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DEMAND-SIDE MANAGEMENT IN POLAND:
PART 2: PILOT PROJECT DESIGN

Final Report

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ABSTRACT

This report presents the results of work sponsored by the Bureau for Europe of the United States Agency for International Development (USAID). Through a bilateral program, USAID has been providing assistance to the Government of Poland under the Eastern Europe Regional Energy Efficiency Project. One of the project's tasks included the design of a demand-side management (DSM) pilot project in Poland, which is the topic of this part (Part 2) of the report. The DSM pilot project design was undertaken with Zaklad Energetyczny Gliwice (Z.E. Gliwice), the largest electric distribution company in Poland (serving 15% of the country's load), located in the industrial heartland of Upper Silesia in southern Poland.

The primary objective of this task was to design a pilot industrial DSM project for Z.E. Gliwice. Alternative delivery mechanisms were explored through focus groups with the utility, its customers, and vendors of DSM products and services that would participate in project implementation. A secondary objective was to help develop capabilities at Z.E. Gliwice to understand how its customers use electricity, a critical component in DSM program design and evaluation. To support the design of a load research element in the pilot project, spot monitoring of Z.E. Gliwice's customers' facilities was conducted using end-use power monitors. This report presents results on the following topics.

Seven of the most successful industrial DSM programs in the United States and Canada are described. Common traits that contributed to program success are identified. The concept of a pilot project is presented and the general objectives that a pilot seeks to accomplish are described. The rationale for the specific pilot project recommended for implementation by Z.E. Gliwice is then presented, based on the lessons learned from North American experience, and responsive to the barriers, risks and uncertainties that currently confront the Polish economy and utility sector. The results of the DSM assessment of Part 1 of this report are summarized, focusing exclusively on the industrial sector, the target of this pilot project.

The specifications for the DSM pilot project are presented. These include the project content and features, the role of financial incentives, a marketing strategy, concurrent market research activities, field delivery and implementation, verification and impact evaluation, and cost recovery and regulatory incentives. The end-use load research element of the DSM pilot project is presented, starting with a discussion of the purpose and goal of utility load research. The methodology, sampling plan, equipment configuration, and data collection and analysis protocols for the end-use load research element of the pilot project are defined. Part 2 of the report concludes with a summary of the practical issues associated with the implementation of the DSM pilot project. The prospective participants are described, as are possible sources of funding. An illustrative budget and schedule for the implementation of the pilot project are also provided.

ACRONYMS

ACEEE	American Council for an Energy-Efficient Economy
ASD	adjustable speed drive
CFL	compact fluorescent lamp
CHP	combined heat and power
C&I	commercial and industrial
CSC	cost of conserved capacity
CSE	cost of conserved energy
DSM	demand-side management
EPRI	Electric Power Research Institute
ERA	Energy Regulatory Agency
ESCO	energy service company
FEWE	Polish Foundation for Energy Efficiency - Fundacja na Rzecz Efeletywnego Wykorzystania Energii
GDP	gross domestic product
GOP	Government of Poland
HVAC	heating, ventilation, and air conditioning
I&C	interruptible and curtailable
IRP	integrated resource planning
MDB	multilateral development bank
OECD	Organization for Economic Cooperation and Development
PPGC	Polish Power Grid Company - Polskei Sieci Elektroenergotyczne
RFP	request for proposals
SPEC	Warsaw District Heating Company
T&D	transmission and distribution
TOU	time of use
TRC	total resource cost
USAID	United States Agency for International Development
WB	World Bank

SKRÓTY

ACEEE	American Council for an Energy-Efficient Economy Amerykańska Rada ds. Gospodarki Efektywnie Wykorzystującej Energię
ASD	adjustable speed drive napęd o regulowanej predkości
CFL	compact fluorescent lamp kompaktowa lampa jarzeniowa
CHP	combined heat and power produkcja enegii cieplnej i elektrycznej w skojarzeniu
C&I	commercial and industrial dotyczący lokali niemieszkalnych i przemysłu
CSC	cost of conserved capacity koszt zaoszczędzonej mocy
CSE	cost of conserved energy koszt zaoszczędzonej energii
DSM	demand-side management sterowanie popytem
EPRI	Electric Power Research Institute Instytut Badawczy Elektroenergetyki
ERA	Energy Regulatory Agency Agencja Regulacyjna Energetyki
ESCO	energy service company energetyczna firma usługowa
FEWE	Polish Foundation for Energy Efficiency Fundacja na Rzecz Efektywnego Wykorzystania Energii
GDP	gross domestic product produkt krajowy brutto
GOP	Government of Poland Rząd Polski
HVAC	heating, ventilation and air conditioning ogrzewanie, wentylacja i klimatyzacja
I&C	interruptible and curtailable podlegający przerwom i ograniczeniu dostaw
IRP	integrated resource planning zintegrowane planowanie źródeł
MDB	multilateral development bank wielostronny bank rozwoju

OECD	Organization for Economic Cooperation and Development Organizacja na Rzecz Współpracy i Rozwoju Gospodarczego
PPGC	Polish Power Grid Company Polskie Sieci Elektroenergetyczne S.A.
RFP	request for proposals zaproszenie do składania ofert
SPEC	Warsaw District Heating Company Stołeczne Przedsiębiorstwo Energetyki Cieplnej
T&D	transmission and distribution przesył i rozdział
TOU	time of use pora zużycia energii
TRC	total resource cost całkowity koszt źródła
USAID	United States Agency for International Development Agencja Stanów Zjednoczonych ds. Rozwoju Międzynarodowego
WB	World Bank Bank Światowy

EXECUTIVE SUMMARY

PROJECT BACKGROUND AND OBJECTIVES

This report presents the results of work sponsored by the Bureau for Europe of the United States Agency for International Development (USAID). Through a bilateral program, USAID has been providing assistance to the Government of Poland (GOP) under the Eastern Europe Regional Energy Efficiency Project. One of the project's tasks included the design of a demand-side management (DSM) pilot project in Poland, which is the topic of this part of the report.

Part 1 of this report presented the results of an assessment of the potential for DSM in Poland. A number of electric end-use efficiency measures were screened for cost-effectiveness and then combined into candidate DSM programs. These programs were defined to realistically develop the achievable DSM resource at the national level in Poland over the short-term (six years). This assessment was done to be consistent with the appraisal of multilateral development bank credits that may become available to Poland in that time frame for power sector investments. Part 1 also identified some of the regulatory and institutional policy issues that need to be addressed in Poland to establish an integrated resource planning framework conducive to the implementation of DSM.

While the identification of demand-side resources and the implementation of a regulatory framework form a necessary foundation for the subsequent development of DSM, further information on customer response to DSM, training of Polish utility staff, and technical proof of concept are all required if widespread implementation is to take place. A pilot DSM project can address these issues while providing 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.

One purpose of the DSM assessment was to identify sectors and end-uses where pilot projects would be most appropriate in Poland. The industrial sector was identified in Part 1 as offering both the greatest achievable savings potential as well as the most cost-effective programs. Therefore, the industrial sector was determined to be the primary candidate for a DSM pilot project. This part of the report presents the design of such a pilot industrial DSM project suitable for financial support from multilateral development banks.

The DSM pilot project design task was undertaken in work with Zaklad Energetyczny Gliwice (Z.E. Gliwice), the largest electric distribution company in Poland, serving 15

percent of the country's load. It is located in the industrial heartland of Upper Silesia in southern Poland.

The primary objective of this task was to design a pilot industrial DSM project for Z.E. Gliwice that would include incentives to ensure participation by utility customers, a marketing approach to solicit such participation, and an evaluation plan. Alternative delivery mechanisms were explored through focus groups with the utility, its customers, and vendors of DSM products and services that would participate in project implementation.

A secondary objective was to help develop capabilities at Z.E. Gliwice to understand how its customers use electricity, a critical component in DSM program design and evaluation. An end-use load research element was designed as part of the DSM pilot project to include an analytical framework and load monitoring plan. To support the design of the load research element, spot monitoring of Z.E. Gliwice's customers' facilities was conducted during the project using end-use power monitors.

SCOPE OF THE DSM PILOT PROJECT DESIGN

Chapter 2 of this part of the report begins by presenting some North American experience with industrial DSM programs. Seven of the most successful programs in the United States and Canada are described. Common traits that contributed to program success are identified. The chapter concludes with a summary of recommended steps that may be appropriate for the implementation of a pilot industrial DSM project in Poland, drawing on the lessons learned from North America.

Chapter 3 presents the concept of a pilot project. The general objectives that a pilot seeks to accomplish are described. The rationale for the specific pilot project recommended for implementation by Z.E. Gliwice is then presented. This rationale is responsive to the barriers, risks and uncertainties that currently confront the Polish economy and utility sector.

Chapter 4 summarizes the results of the DSM assessment of Part 1 of this report, focusing exclusively on the industrial sector. The characteristics of electricity consumption in Poland's industrial sector are presented. The costs and savings of candidate DSM measures are presented as well as the results of the screening of those measures for cost-effectiveness, resulting in a DSM supply curve for the industrial sector. The measures are then aggregated into generic industrial DSM programs that serve as the basis for the industrial DSM pilot project presented here.

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Chapter 5 presents the specifications for the DSM pilot project. These include the project content and features, the role of financial incentives, a marketing strategy, concurrent market research activities, field delivery and implementation, verification and impact evaluation, and cost recovery and regulatory incentives.

Chapter 6 presents the end-use load research element of the DSM pilot project, starting with a discussion of the purpose and goal of utility load research. The spot monitoring work conducted for this project is described, including a presentation of some of the interesting results from the end-use monitoring of six sites during the project. The methodology, sampling plan, equipment configuration, and data collection and analysis protocols for the end-use load research element of the pilot project are defined.

Chapter 7 concludes with a summary of the practical issues associated with the implementation of the DSM pilot project. The prospective participants are described, as are possible sources of funding. An illustrative budget and schedule for the implementation of the pilot project are also provided.

The proposed project is a pilot, as much an experimental tool as a serious effort to acquire DSM resources. It is experimental in that it would test methods for marketing, interacting with customers, providing financial incentives, organizing personnel, managing information flows and record keeping, and acquiring cost-effective electric resources at Z.E. Gliwice. The information gathered during DSM pilot project implementation would be extremely valuable, for it could be used to help design the full-scale implementation of the DSM program in which larger amounts of resources would be committed. It could also be valuable as the first implementation of a utility DSM effort offering financial incentives in Poland, and one of the first in all Europe.

NORTH AMERICAN EXPERIENCE WITH INDUSTRIAL DSM PROGRAMS

The American Council for an Energy-Efficient Economy recently analyzed North American experience to date with industrial demand-side management (DSM). The Council conducted a survey of utilities and prepared a database of industrial DSM programs. More than eighty utilities and third-party organizations were interviewed. The study focused on incentive-based industrial DSM programs, such as that being proposed in this pilot project, and excluded load management-only and information-only programs (including technical assistance programs). The primary measures of program success adopted for the study were high participation rates and/or high electricity savings as a percent of 1989 industrial electricity sales, at levelized costs below the avoided costs of most utilities.

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A total of 12 "successful" programs were identified in the database. The average annual savings as a percent of 1989 industrial sales for these "successful" programs are 1.1 percent, the average annual participation rate is 9 percent of eligible customers, and the levelized utility cost is $0.014/kWh saved. The successful programs have therefore achieved roughly six times the savings and two times the participation of the average program in the database, at lower cost. Seven of these successful programs are described in the report in order to provide some models as to how an industrial DSM pilot project could be implemented in Poland. They are:

- Bonneville Power Administration's Aluminum Smelter Conservation/Modernization Program
- Bonneville Power Administration's Energy Savings Plan
- Boston Edison's Energy Efficiency Partnership Program
- British Columbia Hydro's Power Smart: Efficient Compressed Air Systems Program
- Central Maine Power's Power Partners Program
- Puget Power's Industrial Conservation Incentive Program
- Wisconsin Electric's Smart Money for Business Program.

There are several traits that appear among these relatively successful programs (programs with above-average participation and savings). Outlined below are some of the primary features that appear to distinguish more successful programs from less successful programs, that may be appropriate in considering an industrial DSM pilot project in Poland:

- **Addressing Customer Concerns**. Addressing customer concerns is particularly important when it comes to industrial firms. To date, industries have been skeptical about the quality and intent of utility DSM programs.
- **Marketing Techniques**. The marketing techniques employed by the utility can make the crucial difference between an industrial program's success and failure.
- **Program Flexibility**. Generally, the more program flexibility the utility offers to the industrial customer, the more successful the utility has been in recruiting participants.

A custom program is inherently more flexible than a prescriptive program and is therefore generally attractive to industrial customers.

- **Financial Incentives**. Customer financial incentives are offered by all the programs in the database. A few programs offer the option of low-to-no-interest loans instead of or in addition to a cash rebate. Generally, the programs offering larger financial incentives have above-average participation and savings.

- **Program Analysis and Evaluation**. Two-thirds of the utilities offering the successful programs in the database have performed extensive market research of their industrial customer base and/or have performed impact and process evaluations.

CONCEPT OF A PILOT PROJECT

A pilot project provides the opportunity to test a new concept on a small scale. This approach controls for much of the technical and economic risk and uncertainty usually associated with undertaking any new enterprise. Demand-side management as a utility program activity is certainly a new concept in Poland and should therefore be amenable to the test of proof-of-concept that a pilot project provides.

Objectives of the Proposed Pilot Project

Specifically, the pilot project will seek to:

- Demonstrate the feasibility of several energy and capacity saving technologies in Poland through *programmatic DSM* as it is now widely practiced throughout North America. The pilot is *not* necessarily intended as a technology demonstration, although the technical and economic feasibility of certain technologies will be confirmed.

- Provide a better understanding of electricity end-use in the industrial sector and produce (through audits and energy analyses) equipment inventories, process flow characterizations, and a base of market research information. These activities will have continuing value well beyond the life of the pilot project and will serve as the foundation for an ongoing program of systematic industrial load and market research.

- Help define and test the current capabilities of manufacturers, distributors, vendors, equipment specifiers, and architect-engineer specialists to support DSM on an expanded scale. Further, the pilot project will provide technical support and funding to expand existing capability, develop new expertise, and build bridges to U.S. and other foreign purveyors of DSM technology by establishing formal affiliate relationships with Polish enterprises.

- Demonstrate the capability of a Polish utility to deliver and manage a DSM program, including program marketing, project management, information flows and records keeping, project evaluation, and program evaluation.

- Test numerous program design features and encourage experimentation to help guide the design of a full-scale program. The design features to be tested include marketing approaches, financial incentive arrangements, savings verification procedures, technologies and technology packages selected for assistance, and program procedures.

- Give new insights into how Polish industrial decision-makers evaluate investments in energy efficiency in terms of alterative uses of capital, and the influence of size, market position, growth prospects, private versus public ownership, and other factors on investment criteria, expectations and the quantification of risks and rewards.

- Allow Z.E. Gliwice to work with its industrial customers and other prominent institutions and organizations such as the Polish Power Grid Company, the Polish Academy of Sciences, the Polish Foundation for Energy Efficiency, and the Ministry of Industry and Trade to catalyze a public-private partnership for implementing electric efficiency throughout Poland and help instill the notion of DSM as a valuable, stable resource for Poland's energy future.

Rationale for the Proposed Project

There are numerous reasons why the pilot DSM project proposed in this volume was selected. The key reasons are identified and briefly discussed below.

- The program reflects program experience in North America.

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- The program is flexible enough to deal with an industry undergoing tremendous change.
- The program is focused on the industrial sector because that is where most electricity is consumed, and that is where most of the potential electricity savings can be realized.
- The program relies on custom designed projects because most Polish industrial companies tend to be relatively large; projects are thus likely to be large, which lend themselves to custom design.
- An industrial program will help revitalize Polish industry.
- The program emphasizes financial assistance to help overcome the critical shortage of capital for improvement projects.
- The program operates within a set of guiding principles, sufficiently broad to allow program managers to use their knowledge of local companies, problems, and situations to steer the program around problems.

Barriers, Risks, and Uncertainties

There are many barriers, risks, and uncertainties associated with launching North American-style DSM programs in Poland. Successfully marketing and implementing DSM in Poland will require the development of new skills, new organizational structures, new laws and regulations, new businesses, and whole new industries. The size of this task alone is a large barrier to DSM. But the interest and willingness to overcome such a large barrier appear to be present in Poland. Z.E. Gliwice, the PPGC, and other regional distribution companies seem to be genuinely interested in undertaking this task.

Much of the information presented below on barriers, risks, and uncertainties was gathered from a series of six focus groups held over the period December 1992 through March 1993. Two focus groups were made up of industrial customers, one of residential customers, one of equipment vendors, one of commercial customers, and one of Z.E. Gliwice staff.

Severe Shortage of Capital to Make DSM Improvements. Most Polish utility customers lack the capital to make conservation and load management improvements. Or, if

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they do have the capital, competing investment priorities sharply restrict the amount of capital made available for such energy projects.

Comfort and Trust of Z.E. Gliwice. The recent severe economic downturn in Poland has claimed many casualties, including many relations between debtors and creditors. Many companies found themselves unable to pay their electric bills, and consequently ran up large debts with their electric utility. Z.E. Gliwice did not escape this problem. The tensions created by unpaid bills have deteriorated relations between Z.E. Gliwice and some customers.

Price of Energy-Efficient Equipment. A number of focus group participants identified the high prices for energy-efficient equipment as a significant barrier to DSM investments. They explained that equipment buyers are extremely sensitive to first price: they choose the lowest-priced piece of equipment even when they know that the more efficient, but more expensive, piece will be much cheaper to operate.

Companies May Go Out of Business After DSM Investments are Made. For the difficult 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 utility-sponsored DSM programs.

Baseline Energy Use and Load Data May be Difficult to Obtain. For the type of DSM program proposed in this document, it is important to obtain reliable data on energy use and load profiles before DSM measures are installed.

Utility Cost Recovery and Lost Revenues. As with most electric utilities in the world (including most in North America), expenditures on DSM programs in Poland may result in costs that are not fully recovered in utility rates, as well as revenues lost as a result of lower electricity sales. This issue is discussed in Part 1 of this report as one of the fundamental regulatory policy issues that must be addressed in establishing an integrated resource planning framework in Poland. However, in addition to being a national policy issue, it is also a practical one that Z.E. Gliwice must resolve in the implementation of the DSM pilot project. For this reason, the topic of cost recovery and regulatory incentives is treated separately as an element of project design and is described more fully in Chapter 5.

Employee Pay Tied to Electricity Sales. A portion of each employee's pay at Z.E. Gliwice is tied to the company's electrical sales. This practice is apparently conventional throughout the Polish electric utility industry. Like the issue of utility profitability being tied

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to electricity sales, and perhaps even more so, this presents a substantial barrier to successful DSM program implementation.

Document Management/Lack of Computerization. Implementing a DSM program presents significant challenges for managing a large volume of documents. Because of the very low level of computerization within Z.E. Gliwice, much financial and energy use data are still recorded and compiled by hand. If this practice is employed for implementing DSM, the program will be made unnecessarily difficult to administer.

Lack of Marketing Experience. A successful DSM program requires good marketing. Even North American utilities that have had many years of marketing experience often have trouble marketing their programs. Marketing is a new concept for Polish utilities and Z.E. Gliwice.

OVERVIEW OF THE INDUSTRIAL SECTOR

The industrial sector is the largest energy consuming sector in Poland. In 1991, this sector accounted for electricity sales of 51,052 GWh, or 53 percent of total domestic sales. Although the composition of industrial demand may change, reflecting broader economic trends and the decline of large, primary industries, Poland's industrial sector will likely maintain its predominance in terms of electricity consumption.

The key characteristics of Poland's industrial consumers include the following:

- As of late 1992, state-owned industry accounted for 76 percent of Poland's industrial output. These large enterprises often are not provided the incentives necessary to encourage their participation in DSM programs.

- Electricity typically accounts for between 1 percent and 5 percent of total production costs, and averages around 3 percent. In the current economic environment, many firms are preoccupied with basic survival and may not have the interest or resources to pursue electricity savings.

- There is little tradition of energy saving in Polish industry; the previous economic system focused on production maximization and not optimization.

- Industrial representatives frequently claim that the greatest energy savings potential lies in automated monitoring and control of industrial operations.

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- Large, usually state-owned industries seem to be suspicious of utilities, or at best feel they have little to offer in terms of energy saving assistance. Smaller industries, on the other hand, appear more willing to work with utilities on reducing energy consumption.

- Despite their different perceptions on the role of the utility, both large and small industries feel that if utilities were to promote DSM, their assistance should encompass both technical and financial support.

Industrial DSM Measures

Because of the diversity of process loads, the lack of detailed information about these loads in Poland, and the difficulty of replicating process measures on a widespread basis, process measures were not considered in the assessment. Instead, the analysis focused on lighting and motors, although some of the measures selected address overall industrial electricity use. Industrial lighting and motors alone account for 80 percent of industrial demand, or 42 percent of total domestic consumption, in Poland.

In Part 1 of this report, the DSM assessment for Poland, a number of industrial DSM measures were identified as likely candidates for implementation in Poland. Although all of the measures are technically feasible, programs should be built only around measures shown to be economically cost-effective. Part 1 of this report describes how the cost of saved energy and cost of saved demand can be derived and compared to avoided energy and capacity costs to determine whether a particular measure would be a good candidate around which to develop a program. The results of this screening analysis are presented in Chapter 4 of this volume along with the physical energy and demand savings that would be expected from those measures if they were applied to all existing installations. An industrial energy conservation supply curve is presented which graphically represents these results, by showing the cost of saved energy as a function of energy savings.

Design and Assessment of Industrial DSM Programs

The DSM measures must be packaged with marketing, implementation, and evaluation mechanisms to facilitate widespread adoption of the measures and maximize the potential contribution of this resource. Drawing upon industrial DSM experience in Canada and the United States, preliminary programs were built up around each of these measures. The resulting programs are described in Chapter 4 of this volume.

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The individual programs were subsequently aggregated by end-use technology: motor efficiency, motor drives (including ASDs and high-efficiency drive applications), motor downsizing, operations optimization and maintenance, lighting, and innovative rates. Fixed administrative overhead costs were included in these aggregated programs. Some of the key characteristics of these programs, such as participation rates, variable administrative costs, and expected impacts, are presented in Chapter 4.

The benefit-cost ratios for these programs were calculated. All of the candidate industrial programs appear cost-effective, with benefit-cost ratios ranging from 1.12 to 8.83 for the Total Resource Cost Test, and from 1.76 to 8.91 for the Societal Test. The sensitivity analysis carried out in Part 1 confirmed the cost-effectiveness of these programs over a wide range of participation rates and administrative costs. The industrial programs, particularly the motors programs, were among the most cost-effective of all programs considered.

Part 1 also indicated that the industrial sector ranks highest among all sectors in terms of DSM potential. Cost-effective industrial DSM programs could realistically save 962 GWh per year (worth $58 million at current industrial rates) and 407 MW cumulative capacity additions and rehabilitation by the year 2000. The physical contribution of these programs towards power system requirements is shown in Chapter 4.

The level of utility investment required to achieve these benefits will depend upon the regulatory framework and tariff structure ultimately adopted in Poland. This analysis cannot, therefore, determine the utility financing necessary to implement this program. However, the results conclusively show that:

- Industrial DSM programs that can be implemented in the near term represent a significant power sector resource.
- These programs are highly cost-effective in economic terms.
- Regulations should be developed that ensure that investment decisions subsequently made by both utilities and consumers will coincide with optimal investments identified from an economic perspective, i.e., that least-cost options should be the most profitable for all parties.
- Industrial pilot DSM projects can provide the experience and technical proof of concept necessary for implementing full-scale programs in Poland, can help to more accurately assess DSM costs and benefits based on actual field

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experience, and can help provide a better perspective on regulatory design by taking into account actual consumer response to programs.

- Industrial DSM pilot projects would be appropriate candidates for financing from multilateral development banks.

Given that industrial DSM programs are both the most cost-effective and the largest contributor to achievable DSM savings, industrial pilot projects would lead to the most rapid realization of substantial DSM benefits. The rest of this volume proposes an industrial DSM pilot program that would serve as a bridge towards the full realization of demand-side resources in Poland.

PILOT PROJECT DESIGN SPECIFICATION

The preliminary specifications for the industrial DSM pilot project proposed in this report are presented. As such, "blueprints" for the practical implementation of the pilot project in Poland are provided. While every effort has been taken to provide as much detail as possible, a more complete project design should be undertaken just prior to project implementation. While these specifications can be used as a guideline, the current status of utility regulation and the economy in Poland should be considered at the actual start of the project.

Project Content and Features

The proposed DSM pilot project will have these basic features:

- Z.E. Gliwice will solicit proposals from industrial customers for assistance in implementing DSM projects.

- Z.E. Gliwice will depend primarily upon direct, person-to-person marketing of the project.

- Project eligibility requirements will be simple.

- Project proposal guidelines and forms will be distributed to interested and eligible customers.

- Interested and eligible customers will submit project proposals for DSM projects.

- Z.E. Gliwice and participating customers will negotiate a project and financial assistance package consistent with a set of project policies and principles.

- Proposed DSM projects may include, but will not necessarily be limited to, use of the following technologies which were identified as cost-effective in Chapter 4: high-efficiency motors, motor downsizing, drive applications, process maintenance, process optimization, and high-efficiency lighting. Cogeneration may be considered an eligible project measure to the extent that it complements DSM and is designed to moderate load and not to operate as an independent power project.

- Financial assistance will be offered to customers for approved DSM projects based on energy and demand savings or project cost. However, financial assistance will not exceed 50 percent of total project cost, or DSM resource acquisition rates per kW or KWh saved set at the present value of 50 percent of avoided costs.

- Participating customers must enter into a standard agreement with Z.E. Gliwice for approved projects; the agreement will include provisions for inspection, verification, confidentiality of information, participation in project evaluation efforts, and other items.

- All equipment installed under the project must be inspected and determined to have been installed correctly before the payment will be made. However, on a case-by-case, negotiated basis, partial payments can be made prior to equipment installation if Z.E. Gliwice determines that it is necessary to acquire cost-effective DSM resources.

- Financial assistance will be available for energy audits.

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Financial Incentives

Chapter 5 discusses the range of financial incentives that Z.E. Gliwice could offer its customers under the pilot project. The recommended option is one that combines "variable rebate" and "shared savings" approaches.

Variable Rebates. The Puget Power DSM project mentioned in Chapter 2 utilizes a variant of the variable-rebate approach. That is, as measures are identified through the audit process, standard algorithms or engineering relationships are applied to value the DSM savings they produce. However, site-specific information is used regarding operating hours and other customer data unique to the host factory or building in which the measure would be installed.

Thus, two different customers installing the same measure at the same cost could receive different financial incentives because the nature of the operation at one facility creates more avoided cost benefits for the utility.

Typically, pilot projects offer the customer a "menu" of options in terms of quantity, make and model of units to be installed, and the corresponding payment the utility is prepared to make for each line item on the menu. Often, the proposed amount represents the full incremental cost for a replacement measure or the full capital and installed cost for a retrofit measure.

In some cases, the customer makes some up-front contribution and through the process of negotiation is urged to adopt as many of the menu items as possible. Variable incentive approaches tie "compensation" to "value produced" not "action taken," and permit customers to negotiate for DSM benefits much as they would for any other commodity or service that is intrinsic to their line of business.

"Shared Savings" Approaches. Many utilities use energy service companies (ESCOs), or "performance contractors," which sell energy efficiency projects through shared savings. That is, customers repay the ESCOs' investment from their energy bill savings. In general, compensation arrangements under an efficiency-related performance contract take one of the following three generic forms:

- *Shared Savings.* In this arrangement, the ESCO typically finances, installs and (usually) operates energy-efficient equipment on the customer's premises. The customer pays nothing for the installation, which remains the property of the ESCO. The ESCO assumes all the risk, draws all the tax benefits (if any),

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and may sell (as in the option above) the system to the customer at the end of the contract for its fair market value. In return, the customer pays the ESCO a monthly leasing fee for the equipment and continues to pay its electricity and other fuel bills.

- *Guaranteed Energy Expenses*. In this form of contract, the customer pays the ESCO a flat amount each month for all the energy needs covered in the contract. If the actual energy costs are less than that amount, the ESCO keeps the difference. If the actual bills are greater than the flat fee, the ESCO must pay the difference.

For several reasons, using ESCOs in DSM program delivery encourages customers in some way to share in the cost of the pilot project's activities:

- Customers need to understand that by implementing DSM, Z.E. Gliwice is acquiring a resource on their behalf that is less expensive than conventional supply-side resources. Moreover, it is one that can have both end-use productivity and environmental benefits. However, customers are expected to (and do) pay for all resources -- supply and demand side -- that utilities or other service providers acquire for their benefit.

- Z.E. Gliwice wants the customer to be a partner in this enterprise and does not want to foster the notion that DSM is a return to subsidized electricity pricing.

- North American DSM experience with savings persistence offers convincing anecdotal evidence that savings remain more stable when the customer has some vested financial stake at risk.

- At some point in the not-too-distant future, a viable ESCO community may develop in Poland. Thus, it may be useful to at least introduce early on, the notion of financing efficiency out of shared cost savings. The DSM pilot project may assist in the development of an ESCO industry.

Marketing Strategy

To ensure a maximum level of communication and awareness building, the pilot project will be announced and promoted through multiple media to all prospective participants in Z.E. Gliwice's service territory. This would begin through the preparation of prospect lists

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developed by the Z.E. Gliwice regional staff. The lists would segment facilities by industry sector and size (either production or electricity usage as an indicator of savings potential), and perhaps other firm-specific or operational attributes, data permitting.

Concurrent Market Research

There were several issues in need of further market research that were identified in the focus groups organized for this project. They are listed and briefly discussed below.

Extent of Technical Assistance Needed. Many of the focus group participants expressed the opinion that technical assistance for DSM measures was not a high priority. This view was especially prevalent among the large industrial companies, which tend to have a sufficient number of well-trained staff capable of identifying DSM opportunities in their facilities.

Whether Product-Specific Rebates Would Be Useful. The DSM project proposed here does not recommend offering a fixed rebate for certain types of DSM equipment and measures. Such rebates are common in North American DSM projects. Further market research should be done on whether adding a fixed rebate to the variable rebate approach proposed here would substantially increase project participation levels or offer any other important project benefits.

Explore Methods to Overcome Mistrust of the Utility. The focus groups revealed that some customers might be reluctant to cooperate with Z.E. Gliwice, partly because they are angry that their electricity bills are so high, and partly because they believe the utility must have some ulterior motive for seeking to enter and analyze customer facilities (i.e., knowing that the utility makes more profit when it sells more electricity, these customers don't believe the utility is serious about helping them reduce their consumption of electricity).

Explore How Public Facilities Might Require Different Marketing Approaches than Private Enterprises. Publicly owned and funded facilities face many more constraints to participating in a DSM project, especially with regard to their financial contributions to the project. For example, they may be prohibited from shifting funds from an energy account to a capital improvement account for DSM improvements.

Other Concurrent Research. The implementation of the pilot DSM project might be viewed as a large market research effort. It will provide valuable information on what does

and does not work for persuading customers to participate in the project. Accordingly, the project should be implemented with market information collection in mind.

Field Delivery and Implementation

Contractor-Arranged Installation. Under this approach, Z.E. Gliwice would be responsible for the oversight of all facets of the equipment specification, procurement, installation and testing of the measures the customer adopts as a result of the audit recommendations. To accomplish this, Z.E. Gliwice will manage a process which will be implemented by paid contractors, such as ESCOs.

To choose the best vendors of services and equipment, Z.E. Gliwice should conduct a competitive procurement as follows:

Step 1. At the time the pilot project's initial workshop is held, a separate workshop should be held for prospective implementation contractors, consultants and trade allies. Trade allies are corollary organizations involved in DSM implementation, e.g., distributors and dealers of energy-efficient products.

Step 2. Interested parties would be requested to submit a statement of qualifications along with technical and credit references demonstrating their technical competence and conformance to sound business practices. Z.E. Gliwice would accept national certification of ESCOs and auditors as evidence of qualifications.

Step 3. The submission would also include a set of hourly billing rates for different skill levels and technical specialties. Where a contractor's staff would have to be augmented with new hires, it must submit a hiring plan outlining its testing and qualification procedures. Preference would be given to firms that have the majority of needed staff already on their payrolls.

Step 4. A competitive scoring of bidders would result in the selection and award of contracts. The contracts would be structured as "basic ordering agreements" wherein guaranteed labor rates and standard time allowances for performing certain on-site functions could be quoted in the technical and financial proposal submitted to Z.E. Gliwice.

Development of Equipment, Installation and Testing Specifications. The implementation contractors would develop comprehensive equipment specifications, based on energy audits, that combine:

- requirements adapted from manufacturers' equipment specifications and installation instructions
- prevailing building and safety codes
- union work rules (if any)
- any customer-imposed conditions regarding the conduct of installation activities on-site.

These specifications should be codified by activity type (e.g., new motor installations). Part of each specification would be time standards that could be used to estimate the person-hours and cost to perform most unit functions.

Quality Assurance, Control and Inspection. Z.E. Gliwice would have oversight of the field activities and the performance criteria and quality assurance/quality control (QA/QC) standards established to monitor those field activities. For example, consider the activity "installation of new high-efficiency motors." As a performance criterion, Z.E. Gliwice may establish that no customer should wait more than 90 days from the date of its approved application in response to Z.E. Gliwice's proposal for the installation of new equipment at its facility.

Equipment Procurement. It is anticipated that Z.E. Gliwice will review and approve the procurement (including competitive cost quotations) of all equipment needed in the various projects. It is further anticipated that this equipment would be obtained by the implementation contractors from a mix of domestic and foreign suppliers, and that in the latter instance, any import duties, taxes or other customs fees would be waived.

Customer-Arranged Installations. In most cases, industrial customers will select and contract directly with implementation contractors that Z.E. Gliwice qualifies as participating in the project. It is reasonable to assume that some firms may have long-standing relationships with certain consultants or companies and that they would want to maintain those relationships. Z.E. Gliwice will review their qualifications for acceptance into the program consistent with the competitive bidding process described above.

Disbursement of Incentives. Z.E. Gliwice would provide financial incentives directly to the customer, which would in turn be responsible for paying all contractors and suppliers.

Any DSM costs in excess of those provided through Z.E. Gliwice's financial incentives would be the responsibility of the customer.

Equipment Salvage and Disposal Issues. All replaced equipment should be removed by the implementation contractor and certified to Z.E. Gliwice for salvage or other permanent disposal. It does little good to allow the customer to retain units as "spares" or resell them directly to other firms or intermediaries, as these inefficient units could simply be re-installed elsewhere in Poland. To the extent that any equipment has tangible salvage value, this implied amount can be factored into Z.E. Gliwice's financial incentives to the customer.

Customer Responsibilities. It is recommended that Z.E. Gliwice make customer arranged installation the primary delivery mechanism. In cases where the customer wishes to deviate from this procedure, a special waiver must be granted by Z.E. Gliwice. The customer would assume full liability for managing the process so that it ultimately passes Z.E. Gliwice's inspection requirements. Any carrying costs or other financial overhead associated with delays, remedial work, or other contractor disputes would become the customer's problem.

Training of ESCOs. Through the competitive solicitation process described above, Z.E. Gliwice may determine that there are an insufficient number of ESCOs that are qualified to perform the required energy audits and equipment specification and installation tasks. If this is the case, the DSM pilot project may have to include an ESCO training component. This activity could be coordinated with national efforts to certify qualified ESCOs and other energy engineering firms, and could be sponsored by special funding from bilateral assistance programs.

Consideration of Unsolicited Proposals. It is expected that the field delivery and implementation approach described above will provide a systematic and orderly process for hiring ESCOs and developing DSM projects at Z.E. Gliwice's customer facilities. However, there may be unusual circumstances in which unsolicited proposals are submitted to Z.E. Gliwice outside of the normal process. Z.E. Gliwice should retain flexibility to consider such unsolicited proposals, to the extent that they conform to the required audit standards, respond to the general technical opportunities targeted by the pilot project, and meet selection criteria (e.g., for experience and qualifications).

Verification and Impact Evaluation

Verifying the savings that result from the pilot is essential to:

- show participating customers that measurable energy and demand savings have actually occurred
- prove the viability and cost-effectiveness of a utility-operated, industrial DSM project in Poland
- provide a basis for estimating the impact of a subsequent full-scale project.

Customized facility-specific analyses should be performed to deal with the high-impact, unique building/plant treatments encompassing multiple end-uses and interactive effects that are likely to be observed. This will require that Z.E. Gliwice, their contractors, and the customer work together to establish an accurate reference baseline to measure the pilot's impacts.

It is expected that Z.E. Gliwice's evaluation approach would incorporate end-use metering as part of its impact estimation procedure. The approach would integrate engineering algorithms, simulation models, and statistical regression methods. It would also be necessary to devise combined approaches for aggregating impacts at sampled facilities to produce project-wide estimates, and for enhancing measurement accuracy and precision.

Here, as with all DSM impact estimations, the challenge is to compare: 1) *actual* consumption in treated end-uses *subsequent* to the intervention with 2) estimates of consumption that *would have occurred* in those end-uses absent the intervention. Thus, the savings impact *cannot* be directly *measured*, only *estimated*, since 2) is a non-observable event.

The accuracy of this estimation process is a function of:

- *precision level* as represented by a tolerance band within which one believes the impact to be measured is contained
- *confidence level* as represented by the probability with which one believes the impact of interest is actually contained in that specified tolerance band.

A "verification protocol" is simply an action plan outlining, step-by-step, how the reference baseline is to be established, what impacts are to be quantified from that baseline, and for what time periods. It describes the role of metering, engineering and statistical methods in producing these impact estimates. It also specifies the environment within which verification takes place and what other activity flows need to be metered (e.g., production rates, temperatures, fluid flows). This will produce not only a "snapshot" estimate of current savings but also insight into longer-term issues of savings persistence.

Process and Market Evaluations

A successful pilot can reasonably be expected to attract 30-50 participants over an 18-month period. Thus, the *types and patterns* of participation (or non-participation) may be as important as the absolute level of pilot enrollment. For example, Z.E. Gliwice will need to address the following questions:

- Is there a conspicuous absence of participation within one or more important industry sectors?
- Is plant or company size an important determinant of participation?
- Are there differences in the degree of project interest between domestic and foreign-owned firms?
- Have there been any examples of successfully leveraging multi-facility ownership by a single corporate entity?
- What features of the pilot appear to be most attractive to participants? The greatest obstacle to acceptance? Can these be easily modified?

Once these factors are sorted out, it should be possible to extrapolate the probable overall, full-scale program participation by the entire industrial sector.

DSM Cost Recovery and Regulatory Incentives

Z.E. Gliwice and the other utility companies in Poland face a number of unique challenges associated with the post-communist transition to a restructured market economy. However, the utility sector in Poland shares a major feature with most of the utilities in the rest of the

world when it comes to demand-side management: every kWh that the utility sells increases revenues and every kWh that the utility does not sell decreases revenues. In this sense, it doesn't really matter if Z.E. Gliwice is still a state-owned enterprise or if it becomes a privatized joint-stock company, as currently planned. In either case, under current tariff regulation, reduced sales (whether from DSM, declining industrial production, or simply mild weather) will result in reduced revenues which is bad for the fiscal health of the company. Therefore, a powerful disincentive exists for Z.E. Gliwice to implement a pilot DSM project or to participate in the future to implement an aggressive full-scale DSM project.

This problem, not unique to Z.E. Gliwice, goes to the heart of the evolving legal and regulatory framework of Poland's utility sector. For this reason, the problem was presented in Part 1 of this report as a national institutional policy issue: the legal and regulatory framework under which the power sector operates in Poland should ensure that integrated resource planning (IRP) is the most profitable plan for the utility as well as the least-cost plan for its customers and society at large. To the extent that DSM is a least-cost electric resource, a mechanism must exist to not only remove the powerful disincentive for DSM, but to also provide the utility with a positive incentive to implement DSM. In Part 1 two key mechanisms were described: 1) recovery by the distribution companies of DSM costs through electric rates; and 2) ability of the distribution companies to earn financial incentives to implement DSM.

Pilot Project Implementation of Regulatory Incentives

In considering implementation of any DSM project in Poland, even a pilot project, it seems clear that some DSM incentive mechanism is needed to obtain the enthusiastic support for the enterprise by the host utility. Assuming acceptance of that assertion, the only question remains: Which mechanism and how should it be implemented? This question has not been easily answered in the United States where a number of different mechanisms and combinations thereof have been implemented in various regulatory jurisdictions.

The recommendation which follows represents an attempt to balance the need of Z.E. Gliwice to have the basic disincentive for DSM removed while recognizing the state of flux of the institutional environment and the difficult conditions of the economy. For example, it seems unreasonable to reward Z.E. Gliwice with a positive incentive when so many other enterprises are struggling in the difficult economic circumstances of the post-communist transition.

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The recommended approach focuses on the recovery of DSM costs and revenue losses as the available mechanisms. With these two, at least Z.E. Gliwice will be indifferent to the impact of DSM on its revenues, even if it does not receive a reward for implementing DSM. This approach also seems reasonable in a pilot project context, in which the basic risk of doing something new is compensated while avoiding the possibility of windfall gains from unanticipated outcomes.

Having settled on recovery of DSM costs and revenue losses, the question remains: how to provide for their recovery? The answer lies in the two cashflow streams that Z.E. Gliwice handles in its operations: 1) the transfer tariffs it pays to PPGC for power from the grid; and 2) the retail tariffs it collects from its customers. Following is a discussion of how each approach might work in practice:

DSM Incentives in Transfer Tariffs. Z.E. Gliwice currently purchases the majority of the power it distributes from the PPGC, the operator of the transmission system (a smaller portion of power is purchased directly from local generators in its service territory). PPGC charges wholesale rates for the bulk power in transfer tariffs which are currently regulated by the Ministry of Industry and Trade (this arrangement may change in the future if an Energy Regulatory Agency (ERA) is established with authority over all utility rate setting). The DSM project costs and revenue losses could be calculated and then deducted from the transfer prices that Z.E. Gliwice pays to PPGC.

The rationale for this approach would be that PPGC would be operating under an obligation to acquire and dispatch the least-cost electric resources available throughout the Polish power system (including power from generators and DSM from distribution companies) to meet the system load. To the extent that the DSM resources offered by Z.E. Gliwice represent relatively low-cost resources compared to available supply-side resources, the entire system would benefit. The cost to PPGC of allowing Z.E. Gliwice to recover its DSM costs and revenue losses would be added to the transfer tariffs charged to all PPGC customers and thus, would be borne by all ratepayers throughout the country.

The transfer tariff approach to providing DSM incentives would also work well for the distribution of credits obtained by Poland from multilateral development banks for power sector investments. Under the presumption that PPGC is the single national entity receiving MDB loans, it could disperse the loan proceeds for DSM investments through credits on transfer tariffs to the distribution companies. The loans could either be repaid from the national cashflow from PPGC's sales of power to the distribution companies or from individual distribution companies, out of the resource savings they obtain from the DSM savings occurring in their customers' facilities.

DSM Incentives in Retail Tariffs. Z.E. Gliwice sells the power it distributes to its customers and collects revenues through retail tariffs currently regulated by the Ministry of Finance (an arrangement that could also change with the creation of the ERA). The DSM project costs and revenue losses could be calculated and then added to the rates Z.E. Gliwice charges its customers.

The rationale for this approach would be that Z.E. Gliwice would be operating under an obligation to acquire and distribute the least-cost electric resources available to it (including power from PPGC and its generators as well as DSM from its customers) to meet its local load. To the extent that the DSM resources offered by its customers represent relatively low-cost resources compared to available supply-side resources, Z.E. Gliwice would benefit. The cost to its customers of allowing Z.E. Gliwice to recover its DSM costs and revenue losses would be added to the retail tariffs charged to all Z.E. Gliwice customers and thus, would be borne by all ratepayers throughout its service territory.

Details and Variations on the Theme

The discussion above is but a rough sketch that poses the two approaches as independent choices. Following is a discussion of some details and nuances which might accompany the implementation of either approach.

Shared Savings. In both cases above, the total benefit discussed is that available to Z.E. Gliwice in terms of its recovery of DSM costs and revenue losses. There is another benefit which accrues automatically to PPGC which is the total resource savings it obtains from not having to acquire and provide the power that is avoided by the DSM happening in Z.E. Gliwice's customers' facilities. On the one hand, it would be easy to allow PPGC to retain those resource savings and recognize them as an inducement to PPGC to go along with whichever scheme. On the other hand, it would be possible to calculate those resource savings and then share them through some split (e.g., 50:50) between PPGC and Z.E. Gliwice (as a credit on transfer tariffs). This approach would essentially introduce a positive incentive to Z.E. Gliwice into the equation. Z.E. Gliwice could similarly pass through a share of the resource savings to its customers (as a credit on retail tariffs). In one jurisdiction in the U.S. which employs this approach (New York), the resource savings include the environmental externality costs avoided by the DSM, which adds an extra dimension to the equation. While this approach may be more equitable, it would certainly add complexity to the arrangement and might not be warranted.

Combination Approach. The two approaches to providing DSM incentives described above need not be mutually exclusive. A system could be devised in which a combination of the two approaches could operate.

Importance of Tracking Systems and Impact Evaluation. The two DSM incentive approaches presented here would require rigorous tracking of project costs and the savings achieved by the project which would be the basis for determining revenue losses. Both of these processes are described in the DSM pilot project design.

All-Source Competitive Bidding. The two methods mentioned above provide Z.E. Gliwice with a guaranteed recovery of its DSM costs and revenue losses. This is probably appropriate in the short term to overcome resistance to a new idea, especially for the implementation of a pilot project. However, a more market-based mechanism can be envisioned in the use of the transfer tariffs as the vector for providing DSM incentives: an all-source competitive bidding system, involving both supply and demand-side resources. In this approach, PPGC would hold an annual auction for essentially the baseload portion of system load. Generators and independent power producers would bid an amount and price to supply power to PPGC and distribution companies, ESCOs and large customers would bid an amount and price to supply DSM resources. PPGC would rank order the bids on an integrated resource planning basis (taking price and nonprice factors, e.g., reliability, into consideration) and then contract for the least-cost resources. For DSM resources which are contracted, PPGC would pay over the year through the transfer tariffs. To the extent that the winning price that a distribution company bids is greater than or equal to its DSM costs and revenue losses, the approach yields essentially the same outcome as the more deterministic approach proposed above.

Cost to Non-Participants. In both approaches proposed above, all ratepayers end up footing the bill for the DSM investments. In the transfer tariff case, the DSM costs and revenue losses are spread across the entire Polish ratebase which would probably mean they would be relatively insignificant. In the retail tariff case, the costs are spread across the ratebase of Z.E. Gliwice, which could cause a more noticeable impact on bills. In either case, an argument can be made that ratepayers who do not participate in making DSM investments will suffer bill increases.

Practical Implementation Issues. Finally, the question arises regarding how to implement either one of these schemes in practice within the context of the industrial DSM pilot project proposed in this report. In either case, agreements would have to be reached among participating parties. These parties would be Z.E. Gliwice, PPGC, and the Ministry of Industry and Trade (or ERA) for the transfer tariff approach and Z.E. Gliwice and the

Ministry of Finance (or ERA) for the retail tariff approach. In either case, the agreements should include an obligation for Z.E. Gliwice to keep records associated with the DSM costs and revenue losses resulting from the pilot project activities. If necessary, to reduce the institutional risk of doing something new, "two sets of books" could be kept, showing how tariffs would have been calculated normally versus how they are calculated with the DSM incentive. Part of the pilot project evaluation would then be a comparison of the two accounts to document both the rate impacts of DSM on the system as well as the extent to which Z.E. Gliwice was "made whole" through the process. The results could then be extrapolated to the national level to judge the impact of full-scale DSM projects on Poland's utility sector.

END-USE LOAD RESEARCH ELEMENT

This industrial DSM pilot project contains an end-use load research element as an integral component of project design. End-use load research is an important complement to the demand-side management activities undertaken by utilities. By understanding how its customers use electricity in their facilities, utilities can more accurately gauge the DSM resource potential available to them. Load research also plays an important role in impact evaluation, through which the actual costs and savings of DSM are accurately determined. Finally, the establishment of a load research staff or department at a utility can go a long way toward increasing the level of customer service, as utility staff interact with their customers and learn more about their needs for energy services. This last point is especially relevant in Poland, where utilities are realizing the need to change their market outlook, from a strong tradition as commodity vendors to one of energy service providers.

Background and Rationale

The Load Research Element is intended to furnish an assessment of the potential DSM resources in Z.E. Gliwice's service territory, which will ultimately help the utility to provide market-oriented services that are more responsive to its customers' needs. Z.E. Gliwice staff will also be trained so that they can extend the program to full-scale implementation in the future.

Although load research will be conducted on industrial, commercial, and residential customers, the focus of the pilot project will be the industrial sector, which accounts for the major portion of the company's electricity demand. Between 2 to 5 percent of Z.E. Gliwice's peak load (52 to 130 MW) will be analyzed by the load research element. The

program's primary sources of data, which will be used to evaluate the potential impacts of DSM measures, will be:

whole-premises data (kW and kWh)
end-use data measured by monitoring instruments
billing data from selected customer groups
survey data collected from a wide range of customers.

The load research element incorporates in its design the load research experience of several U.S. utility companies, as well as the field experience gained from the spot monitoring activities in Z.E. Gliwice's service territory. It was also designed with sufficient flexibility to overcome many of the constraints faced by Poland's residential, commercial, and industrial sectors during the country's transition to a market-oriented economy.

Spot Monitoring Program

The spot monitoring program was undertaken between March and June 1993 as a quick, in-field trial to test U.S. load monitoring equipment under Polish conditions, to introduce the concept of demand-side management to local utility personnel, and to gauge the reactions and responses of the customers who were monitored. It also helped to define the most suitable and cost-effective instruments, seminars and training, and venues for vendor participation in the pilot load research element. Last, and most important, this program allowed for the collection of load profiles on several end-uses. The results of the spot monitoring program are reported in Chapter 6.

Load Research Objectives

In support of the DSM pilot project, the objectives of the pilot load research element are to:

- conduct a practical customer survey that will serve as a basis for selecting the sample population for end-use load research
- extract and analyze information from the monthly billing data of 100 large customers in the service territory of Z.E. Gliwice
- estimate the electric load characteristics of the major market segments within the territory of Z.E. Gliwice

- carry out the load monitoring program to collect and examine the actual end-use and whole-premise load records before and after the DSM measures are implemented

- develop the capabilities of Z.E. Gliwice staff to understand how electricity is used by the company's customers, and to conduct a cost/benefit analysis within the framework of local conditions.

PROJECT ADMINISTRATION, FUNDING, BUDGET AND SCHEDULE

This final issue of the industrial DSM pilot project design for Poland details some of the practical administrative issues of project implementation. The overall project structure is presented which indicates the various organizations that would be involved in project implementation and their respective roles and relationships. Following that is a proposed schedule and budget, which includes an indication of possible sources of funding for the pilot project. The chapter concludes with a discussion of the tracking system requirements for record keeping and data management.

Organization

It is assumed that Z.E. Gliwice would be the central management and administrative lead in the development and implementation of the DSM pilot project. Other key participants would be an expert international DSM consulting firm to support Z.E. Gliwice, the implementation contractors and consultants (perhaps a half dozen or more individuals, firms, and ESCOs specializing in audits, engineering analysis, end-use metering and installation), and an advisory committee composed of invited representatives from PPGC, FEWE, the Polish Institute of Power Engineering, and other interested agencies and parties such as equipment vendors, engineering firms, business and professional associations, university faculty, and non-profit groups. The relationships among these entities are depicted in Chapter 7.

Schedule

Chapter 7 outlines the anticipated schedule of activities over the 18-month period planned for the pilot project. This time table is ambitious but achievable if Z.E. Gliwice and the international DSM consultant coordinate closely from the beginning of the program. In

particular, the first month or two will be critical in ensuring the effort can avoid delays that could unduly prolong audits, equipment procurement and field work later in the pilot project.

Funding and Budget

Chapter 7 summarizes the estimated budget for the pilot project with the ranges of costs ($5.8 million to $8.3 million) for each of the 14 activity areas. It also shows the lead, support and advisory roles for each of the parties cooperating in the pilot project effort. Exhibit S-1 shows the estimated budget, by task, including indications of the responsible parties for task implementation.

Although these budget estimates are quite preliminary, they do reflect the general magnitude of costs believed to be required for each activity. The equipment procurement costs are predicated on a pilot project that can attract 30-50 participants whose typical size would be in the range of 0.5-2.5 MW and whose average expected savings would fall in the range of 4-8 percent of current electricity consumption.

Overall, the pilot project would seek to capture 2-4 percent of the available industrial DSM savings potential outlined in Part 1 of this report. The estimated capital outlays roughly correspond to the net present value of a mix of measures whose annualized life cycle cost would average about 2.5 cents per kWh saved, and which collectively would achieve the targeted capture rate of 2-4 percent of available potential. This indirect estimation approach is necessitated by the inability to precisely determine in advance the mix of measures to be installed.

It is important to take note the source of capital expenditures in the budget summary. As indicated, multilateral development banks (e.g., the World Bank, the European Bank for Reconstruction and Development) are expected to underwrite the substantial front-end investment in capital equipment to be procured and installed during the pilot project. However, there are other important sources of funding for training, technical assistance, and other non-capital costs.

These other sources of DSM pilot project financing include:

- **Existing MDB Loan Pools**. For example, the World Bank has an existing loan available in Poland for industrial efficiency improvements that could be tapped for project-specific financing.

Exhibit S-1
Estimated Budget Summary

Activity	Cost Range ($1,000 US)		Responsible Party(ies)		
	Low	High	Lead	Support	Advisory
1	25	35	G	D	C
2	10	15	G	D	-
3	15	25	G	D	C
4	5	10	G	D	-
5	10	15	G	D	-
6	275	350	I	G	D
7	75	125	G	D	-
8	20	25	D	G	C
9	4,800	6,930	I	G	D
10	325	450	I	G	D
11	60	90	I	G	D
12	75	100	D	G	C
13	25	40	D	G	C
14	35	50	D	G	C
TOTAL	**5,755**	**8,260**			

Key To Activities

1. Administrative start-up
2. Market segmentation and prospect recruiting and qualification
3. Pilot announcement, mailings and visits
4. Implementation contractor RFQ
5. RFQ screening and contractor selection
6. Audits and engineering analysis
7. Technical and financial proposals
8. Development of performance tracking system, installation specifications and QA/QC protocols
9. Equipment procurement
10. Project installation and on-site work
11. Pre-installation/post-installation end-use metering and monitoring
12. Impact evaluation
13. Process and market evaluation
14. Analysis of full-scale program options and potential

Key To Responsible Parties

C = Advisory committee (PFGC, FEWE, PIPE, other interested parties)
D = International DSM Consultant
G = Z.E. Gliwice
I = Implementation contractors

- **The Polish Energy Conservation Foundation.** This organization is a unit of the Polish Development Bank which was set up to provide systematic access to private financing in Poland for energy efficiency improvements.

- **Energy Service Companies.** Most ESCOs provide project financing as part of the package of services they offer to clients.

- **Industrial Customers.** As defined under the design of this DSM pilot project, the participating industrial customers would be required to finance a major portion of capital improvements at their facilities.

- **Other Sources.** These could include the Government of Poland, PPGC, and donor agencies (e.g., USAID, the European Union's PHARE program, and the U.K. Know-How Fund).

Performance Tracking, Financial Management, and Records Control

It is recommended that Z.E. Gliwice implement a PC-based, computerized tracking system to facilitate both financial management and records control as well to effect near real-time monitoring of field activities and project management.

In addition, the information contained in the system will be useful for estimating savings impacts and for performing a variance analysis of expected versus actual performance. This feature will serve as an "early warning" indicator that corrective action may be necessary to prevent the pilot project from straying off course as problems surface.

STRESZCZENIE

INFORMACJE WSTĘPNE I CELE PROGRAMU

Niniejszy raport przedstawia rezultaty prac sponsorowanych przez Biuro Europy Agencji Stanów Zjednoczonych ds. Rozwoju Międzynarodowego (USAID). USAID udziela pomocy Rządowi Polski w ramach Regionalnego Programu Efektywnego Wykorzystania Energii w Europie Wschodniej. Jednym z zadań tego programu było opracowanie pilotowego programu sterowania popytem (DSM) w Polsce, co stanowi przedmiot tej części raportu.

W Części 1 niniejszego raportu przedstawiona została ocena potencjału DSM w Polsce. Zbadano szereg środków efektywnego finalnego zużycia energii elektrycznej pod względem ich efektywności kosztowej, a następnie włączono je w potencjalne programy DSM. Programy te zostały tak sformułowane, by objąć realnie osiągalne zasoby w zakresie DSM na poziomie całego kraju w perspektywie krótkoterminowej (sześć lat). Taka ocena została dokonana w sposób spójny z oszacowaniem kredytów z wielostronnego banku rozwoju, które mogą zostać przyznane Polsce w okresie, na który przewidziane są inwestycje w sektorze elektroenergetycznym. W Części 1 zasygnalizowano również niektóre zagadnienia z zakresu przepisów regulacyjnych i polityki instytucjonalnej, które muszą zostać rozwiązane w Polsce, jeśli ma zostać stworzony zintegrowany plan rozwoju źródeł prowadzący do wdrożenia DSM.

Określenie zasobów po stronie popytu oraz wdrożenie ram regulacyjnych stanowią podstawę dla późniejszego opracowania DSM; jednak jeśli DSM ma zostać wdrożony na szeroką skalę, to konieczne stanie się zbieranie informacji na temat reakcji odbiorców na DSM, szkolenie personelu polskich przedsiębiorstw energetycznych oraz wykazanie słuszności założeń technicznych. Pilotowy program DSM może objąć wszystkie te zagadnienia dając jednocześnie okazję do sprawdzenia, czy proponowane programy działają tak, jak się tego oczekiwało. Dzięki takiemu pilotowemu programowi można również uzyskać dodatkowe informacje, które pozwolą zmniejszyć ilość niewiadomych co do wpływu programów DSM oraz usprawnić ich wdrażanie.

Jednym z celów oceny DSM było określenie sektorów i rodzajów finalnego zużycia energii elektrycznej, w których programy pilotowe byłyby najbardziej odpowiednie w Polsce. Przemysł został uznany w Części 1 jako sektor oferujący zarówno największy osiągalny potencjał oszczędności, jak i najbardziej efektywne kosztowo programy. Z tego powodu właśnie sektor przemysłowy został wybrany jako główny kandydat do przeprowadzenia pilotowego programu DSM. Niniejsza część raportu przedstawia plan takiego pilotowego programu DSM dla przemysłu, mającego szansę na uzyskanie finansowego wsparcia ze strony wielostronnych banków rozwoju.

Zadanie opracowania planu pilotowego programu DSM zostało podjęte wspólnie z Zakładem Energetycznym Gliwice (Z.E. Gliwice), największym przedsiębiorstwem rozdziału energii elektrycznej w Polsce, obsługującym 15 procent obciążenia w kraju. Zakład ten leży w samym centrum przemysłowym Górnego Śląska, na południu Polski.

Głównym celem tego zadania było opracowanie planu pilotowego programu DSM dla Z.E. Gliwice, obejmującego elementy zachęcające odbiorców do uczestnictwa w programie, marketing propagujący uczestnictwo oraz plan ewaluacji. W trakcie spotkań w grupach dyskusyjnych z przedstawicielami Zakładu, jego odbiorców oraz dostawców urządzeń i usług z zakresu DSM, którzy uczestniczyliby we wdrażaniu programu, rozważano alternatywne mechanizmy dostarczenia programu.

Drugim co do znaczenia celem była pomoc w wypracowaniu w Z.E. Gliwice umiejętności zrozumienia jak odbiorcy Zakładu zużywają energię elektryczną. Zrozumienie takie jest krytycznym składnikiem planowania i oceny programu DSM. Jedną z części pilotowego programu DSM stanowił również element badania obciążenia finalnego związany z działaniami analitycznymi i planem monitorowania obciążenia. Aby ułatwić opracowanie tego elementu, w trakcie realizacji przedsięwzięcia dokonano rejestracji poboru mocy przez urządzenia u wybranych odbiorców Z.E. Gliwice. Pomiarów dokonano przy wykorzystaniu przyrządów rejestrujących finalny pobór mocy.

ZAKRES PILOTOWEGO PROGRAMU DSM

Rozdział 2 tej części raportu zaczyna się od przedstawienia wybranych doświadczeń północnoamerykańskich w zakresie przemysłowych programów DSM. Opisane zostało siedem najbardziej udanych programów ze Stanów Zjednoczonych i Kanady. Zidentyfikowano wspólne cechy tych programów, które przyczyniły się do ich sukcesu. Rozdział 2 kończy się podsumowaniem zalecanych kroków, które - jak może wynikać z doświadczeń nabytych w Ameryce Północnej - mogą być odpowiednie dla wdrożenia pilotowego przemysłowego programu DSM w Polsce.

W Rozdziale 3 przedstawiona została koncepcja programu pilotowego. Omówione są ogólne cele jakie postawiono przed programem pilotowym. Następnie podane jest uzasadnienie konkretnego programu pilotowego zalecanego do wdrożenia przez Z.E. Gliwice. Uzasadnienie to uwzględnia ograniczenia, ryzyka i elementy niepewności, jakich doświadcza obecnie cała polska gospodarka i przedsiębiorstwa elektroenergetyczne.

Rozdział 4 zawiera podsumowanie wyników oceny DSM z Części 1 niniejszego raportu, koncentrując się wyłącznie na sektorze przemysłowym. Przedstawiona jest charakterystyka

zużycia energii elektrycznej w sektorze przemysłowym w Polsce, koszty i oszczędności potencjalnych środków DSM oraz wyniki badania tych środków pod względem efektywności kosztowej, co dało krzywą podaży DSM dla sektora przemysłowego. Poszczególne środki zebrano następnie w ogólne przemysłowe programy DSM stanowiące podstawę dla przedstawionego tutaj pilotowego programu DSM dla przemysłu.

W rozdziale 5 przedstawiona jest specyfikacja pilotowego programu DSM. Obejmuje ona zawartość i cechy programu, rolę bodźców finansowych, strategię marketingu, równolegle prowadzone badanie rynku, dostawę urządzeń i wdrażanie, weryfikację i ocenę wpływu programu oraz zachęty z zakresu przepisów regulacyjnych i pokrycia kosztów.

Rozdział 6 prezentuje jeden z elementów pilotowego programu DSM, jakim jest badanie obciążenia w wybranych kategoriach finalnego zużycia energii. Rozdział rozpoczyna się od omówienia przyczyn, dla których dokonuje się badania obciążenia, oraz jego celów. Następnie opisane jest rejestrowanie obciążeń przeprowadzone dla celów tego programu, z uwzględnieniem niektórych interesujących wyników rejestracji obciążenia w sześciu miejscach, w których dokonano pomiarów. Rozdział kończy się przedstawieniem metodologii, planu badań wyrywkowych, konfiguracji urządzeń, zbierania danych oraz protokołów analiz dla badania obciążenia finalnego w ramach programu pilotowego.

Rozdział 7, ostatni, zawiera podsumowanie praktycznych zagadnień związanych z wdrażaniem pilotowego programu DSM. Opisani są w nim potencjalni uczestnicy, jak również możliwe źródła finansowania. Przedstawiony jest także budżet i harmonogram wdrażania programu pilotowego.

Proponowany program pilotowy jest tyle przedsięwzięciem eksperymentalnym, co poważną próbą pozyskania źródeł po stronie popytu. Jest to przedsięwzięcie eksperymentalne w tym sensie, że wypróbowałoby ono metody marketingu, współdziałania z odbiorcami, proponowania zachęt finansowych, organizacji personelu, kierowania przepływem informacji i przechowywania danych oraz pozyskiwania kosztowo efektywnych źródeł w Z.E. Gliwice. Informacje zebrane w trakcie wdrażania pilotowego programu DSM byłyby niezwykle cenne, gdyż mogłyby zostać wykorzystane do opracowania programu DSM na pełną skalę, w który zaangażowano by dużo więcej środków. Byłyby one również cenne jako pierwsza w Polsce i jedna z pierwszych w Europie próba wdrożenia przez przedsiębiorstwo elektroenergetyczne programu DSM oferującego zachęty finansowe.

DOŚWIADCZENIA NABYTE W AMERYCE PÓŁNOCNEJ W ZAKRESIE PROGRAMÓW DSM W PRZEMYŚLE

Amerykańska Rada ds. Gospodarki Efektywnie Wykorzystującej Energię dokonała ostatnio analizy doświadczeń nabytych dotychczas w Ameryce Północnej w zakresie sterowania popytem (DSM) w przemyśle. Rada przeprowadziła badania przedsiębiorstw energetycznych i stworzyła bazę danych o przemysłowych programach DSM. Zbadano ponad osiemdziesiąt przedsiębiorstw energetycznych i firm niezależnych. W badaniu tym skoncentrowano się na przemysłowych programach DSM opartych na bodźcach i zachętach, czyli takich, jakim jest proponowany tutaj program pilotowy, a wykluczono programy polegające jedynie na sterowaniu obciążeniem lub pozyskiwaniu informacji (łącznie z programami pomocy technicznej). Głównymi miernikami sukcesu programów przyjętymi w tym badaniu były: wysoki wskaźnik uczestnictwa i/lub duże oszczędności energii elektrycznej wyrażone jako procent sprzedaży energii elektrycznej dla przemysłu w roku 1989, po kosztach uśrednionych niższych od kosztów unikniętych większości przedsiębiorstw energetycznych.

W bazie danych jako "udane" określono w sumie 12 programów. Średnie roczne oszczędności dla tych "udanych" programów, wyrażone jako procent sprzedaży energii elektrycznej dla przemysłu w roku 1989, wynoszą 1,1 procent, średnie roczne uczestnictwo to 9 procent kwalifikujących się odbiorców, a uśredniony koszt przedsiębiorstwa energetycznego wynosi 0,014 USD na zaoszczędzoną kilowatogodzinę. Z danych tych wynika, że udane programy osiągnęły około sześć razy większe oszczędności i dwukrotnie większą liczbę uczestników niż przeciętny program z bazy danych, przy niższych kosztach. W niniejszym raporcie przedstawione zostało siedem z tych udanych programów, tak by dać pewne wyobrażenie o tym, jak pilotowy program DSM dla przemysłu mógłby zostać wdrożony w Polsce. Oto one:

- Program konserwacji i modernizacji pieca do wytapiania aluminium w przedsiębiorstwie Bonneville Power Administration
- Plan oszczędności energii dla przedsiębiorstwa Bonneville Power Administration
- Partnerski program efektywnego wykorzystania energii w przedsiębiorstwie Boston Edison
- Program wprowadzenia wydajnych układów sprężonego powietrza w przedsiębiorstwie British Columbia Hydro
- Partnerski program przedsiębiorstwa Central Maine Power

- Program zachęt do oszczędzania energii w przemyśle opracowany przez przedsiębiorstwo Puget Power

- Program "Smart Money for Business" w przedsiębiorstwie Wisconsin Electric.

Powyższe stosunkowo udane programy (wykazujące wyższe niż przeciętnie poziomy uczestnictwa i oszczędności) mają kilka wspólnych cech. Poniżej przedstawione są główne cechy, które - jak się wydaje - odróżniają programy bardziej udane od mniej udanych. Cechy te mogą być odpowiednie przy rozważaniu pilotowego programu DSM dla przemysłu w Polsce:

- **Zwracanie uwagi na sprawy nurtujące odbiorców.** Zwracanie uwagi na sprawy nurtujące odbiorców ma szczególne znaczenie w przypadku firm przemysłowych. Jak dotychczas, w przemyśle panował sceptycyzm co do jakości i celów programów DSM realizowanych przez przedsiębiorstwa energetyczne.

- **Techniki marketingu.** Techniki marketingu zastosowane przez przedsiębiorstwo energetyczne mogą w sposób zasadniczy decydować o sukcesie lub porażce programu DSM dla przemysłu.

- **Elastyczność programu.** Ogólnie mówiąc, im większą elastyczność proponuje przedsiębiorstwo energetyczne swoim odbiorcom przemysłowym, tym wilcej uczestników udaje się mu pozyskać. Program przygotowany indywidualnie jest z natury rzeczy bardziej elastyczny niż program z góry zaplanowany i dlatego jest zwykle chętniej przyjmowany przez odbiorców przemysłowych.

- **Zachęty finansowe.** Zachęty finansowe dla odbiorców są oferowane we wszystkich programach ujętych w bazie danych. Kilka programów proponuje możliwość zaciągnięcia pożyczki o niskim lub zerowym oprocentowaniu zamiast lub oprócz rabatów gotówkowych. Ogólnie mówiąc, programy oferujące większe zachęty finansowe charakteryzują się wyższymi poziomami uczestnictwa i oszczędności.

- **Analiza i ocena programu.** Dwie trzecie przedsiębiorstw z bazy danych oferujących udane programy przeprowadziło dokładne badanie rynku swoich odbiorców przemysłowych i/lub dokonało oceny przebiegu i wyników programu.

KONCEPCJA PROGRAMU PILOTOWEGO

Program pilotowy daje możliwość wypróbowania nowej koncepcji na małą skalę. Takie podejście pozwala na znaczne ograniczenie ryzyka i niepewności natury technicznej i ekonomicznej, jakie zwykle towarzyszą podejmowaniu każdego nowego przedsięwzięcia. Sterowanie popytem jako program podejmowany przez przedsiębiorstwo energetyczne jest z pewnością nową koncepcją w Polsce i dlatego powinien zostać poddany testowi na sprawdzenie prawdziwości założeń, jakim jest program pilotowy.

Cele proponowanego programu pilotowego

Konkretne cele programu pilotowego to:

- Wykazanie możliwości wprowadzenia w Polsce kilku technologii oszczędzających energię i moc przez programatyczny DSM, tak jak to jest powszechnie praktykowane w Ameryce Północnej. Program pilotowy nie zawsze jest pomyślany jako pokaz technologii, choć potwierdza on techniczną i ekonomiczną możliwość wprowadzenia niektórych z nich.

- Umożliwienie wyrobienia lepszego obrazu co do sposobów finalnego zużycia energii elektrycznej w sektorze przemysłowym oraz opracowanie (na drodze diagnoz i analiz) spisu urządzeń, charakterystyki przebiegu procesu i podstawowych informacji z zakresu badania rynku. Działania te będą bardzo wartościowe nie tylko podczas trwania programu pilotowego, lecz również długo po jego zakończeniu i będą one stanowić podstawć dla programu systematycznych badań rynku i obciążenia w przemyśle.

- Pomoc w określeniu i przetestowaniu aktualnych możliwości producentów, dystrybutorów, sprzedawców, specjalistów dokonujących specyfikacji urządzeń oraz inżynierów-architektów co do ich udziału w programie DSM na pełną skalę. Ponadto program pilotowy zapewni pomoc techniczną i finansowanie umożliwiające rozszerzenie aktualnych możliwości, wypracowanie nowych umiejętności i tworzenie więzi z dostawcami technologii DSM ze Stanów Zjednoczonych i innych krajów poprzez nawiązanie formalnych związków organizacyjnych z polskimi przedsiębiorstwami.

- Wykazanie, że polskie przedsiębiorstwo energetyczne jest w stanie uruchomić i kierować programem DSM, łącznie z marketingiem, kierowaniem poszczególnymi zadaniami w ramach programu, rejestrowaniem przepływu

informacji, zbieraniem danych oraz oceną poszczególnych zadań i całego programu.

- Przetestowanie szeregu cech programu i zachęcanie do eksperymentowania w celu lepszego zaplanowania programu na pełną skalę. Cechy programu, które mają zostać poddane testowaniu to, między innymi, podejścia marketingowe, układ zachęt finansowych, procedury weryfikacji oszczędności, technologie i pakiety technologii wybrane do pomocy oraz procedury realizacji programu.

- Danie nowego poglądu na sposób w jaki polscy przemysłowi decydenci oceniają inwestycje w oszczędność energii jako alternatywne wykorzystanie kapitału, oraz jak oszacowujć wpływ rozmiaru, pozycji rynkowej, perspektyw rozwoju, kapitału prywatnego przeciwstawionego własności publicznej i innych czynników na kryteria inwestowania, na oczekiwania i na ilościowe wymiary ryzyka i korzyści.

- Umożliwienie Z.E. Gliwice podjęcia współpracy z odbiorcami przemysłowymi i znaczącymi instytucjami i organizacjami, takimi jak Polskie Sieci Elektroenergetyczne S.A., Polska Akademia Nauk, Fundacja na Rzecz Efektywnego Wykorzystania Energii i Ministerstwo Przemysłu i Handlu, w celu zainicjowania prywatno-publicznej współpracy partnerskiej dla promocji oszczdnego wykorzystywania energii w Polsce oraz w celu utrwalenia pojęcia DSM jako wartościowego, stabilnego źródła dla przyszłości energetycznej Polski.

Uzasadnienie proponowanego programu

Istnieje wiele powodów, dla których wybrano pilotowy program DSM proponowany w niniejszym raporcie. Poniżej są podane i krótko omówione najważniejsze z nich:

- Program ten odzwierciedla doświadczenia nabyte w Ameryce Północnej.

- Program ten jest wystarczająco elastyczny, by objąć przemysł, w którym zachodzą olbrzymie zmiany.

- Program ten koncentruje się na sektorze przemysłowym, gdyż w nim właśnie zużywa się najwięcej energii elektrycznej i w nim można potencjalnie osiągnąć największe oszczędności.

- Program opiera się na zadaniach przygotowywanych indywidualnie, ponieważ większość polskich przedsiębiorstw przemysłowych to firmy duże; stąd i poszczególne zadania będą raczej obszerne, co prowadzi do wyboru opracowań indywidualnych.

- Program dla przemysłu pomoże ożywić polski przemysł.

- Program kładzie szczególny nacisk na pomoc finansową, aby pomóc w uporaniu się z niedoborem kapitału na przedsięwzięcia udoskonalające.

- Program opiera się na zestawie wytycznych, które są wystarczająco ogólne, by pozwolić osobom kierującym programem na wykorzystanie ich własnej znajomości lokalnych firm, problemów i sytuacji w celu omijania trudności.

Ograniczenia, ryzyko i elementy niepewności

Uruchomienie w Polsce programów DSM w stylu północnoamerykańskim jest związane z wieloma ograniczeniami, ryzykiem i elementami niepewności. Udany marketing i wdrożenie DSM w Polsce będą wiązać się z koniecznością wypracowania nowych umiejętności, nowych struktur organizacyjnych, nowych przepisów i praw, nowych rodzajów firm, oraz całych nowych dziedzin działalności gospodarczej. Sam rozmiar tego zadania jest już wielką barierą dla DSM. Lecz wydaje się, że w Polsce jest zainteresowanie i chęć pokonania tak wielkiej bariery. PSE SA, Z.E. Gliwice i inne zakłady energetyczne wydają się być autentycznie zainteresowane podjęciem tego zadania.

Większość podanych poniżej informacji na temat barier, ryzyka i elementów niepewności zostało zebranych podczas serii sześciu spotkań w grupach dyskusyjnych. Spotkania te odbyły się w okresie od grudnia 1992 do marca 1993 roku. W dwóch grupach dyskusyjnych wzięli udział przedstawiciele odbiorców przemysłowych, w jednej przedstawiciele odbiorców z gospodarstw domowych, w jednej dostawcy urządzeń, w jednej odbiorcy z lokali niemieszkalnych i w jednej przedstawiciele personelu Z.E. Gliwice.

Poważny niedobór kapitału na dokonanie udoskonaleń związanych z DSM. Większość odbiorców polskich przedsiębiorstw energetycznych nie ma środków finansowych na dokonanie udoskonaleń z zakresu oszczędzania energii i sterowania obciążeniem. Lub - jeśli nawet mają środki finansowe - inne priorytety inwestycyjne drastycznie ograniczają ilość środków przeznaczonych na takie cele.

Pewność i zaufanie ze strony Z.E. Gliwice. Niedawne poważne załamanie gospodarki w Polsce pociągnęło za sobą wiele przykrych konsekwencji, jak na przykład pogorszenie stosunków między dłużnikami i wierzycielami. Wiele firm nie jest w stanie płacić rachunków za energię elektryczną, przez co ich dług w stosunku do obsługującego ich zakładu energetycznego urósł do poważnych rozmiarów. Z.E. Gliwice nie uniknął tego problemu. Napięcia wywołane przez nie zapłacone rachunki pogorszyły stosunki pomiędzy Z.E. Gliwice a niektórymi odbiorcami.

Cena urządzeń wydajnie wykorzystujących energiń elektryczną. Wielu uczestników spotkań w grupach dyskusyjnych wskazało na wysokie ceny urządzeń wydajnie wykorzystujących energię elektryczną jako poważną barierę dla inwestycji w DSM. Wyjaśniali oni, że nabywcy urządzeń są niezwykle wrażliwi na cenę płaconą najpierw: wybierają urządzenie najtańsze nawet jeśli wiedzą, że urządzenie bardziej wydajne - lecz i droższe - będzie dużo tańsze w eksploatacji.

Firmy mogą przestać istnieć po dokonaniu inwestycji w DSM. Trudne warunki ekonomiczne w Polsce powodują, że wiele przedsiębiorstw przemysłowych i usługowych jest zamykanych, niekiedy na stałe. Sytuacja ta stanowi wielką trudność dla udanego wdrożenia programów DSM sponsorowanych przez przedsiębiorstwo energetyczne.

Może być trudno uzyskać dane na temat obciążenia i zużycia energii przed wprowadzeniem DSM. Dla takiego typu programu DSM, jaki proponowany jest w niniejszym raporcie, ważne jest uzyskanie wiarygodnych danych na temat profilu zużycia energii i obciążenia przed wprowadzeniem DSM.

Pokrycie kosztów przedsiębiorstwa energetycznego i utracone przychody. Podobnie jak w przypadku większości przedsiębiorstw energetycznych na świecie (także w Ameryce Północnej), wydatki na programy DSM w Polsce mogą zostać nie w pełni pokryte w stawkach na energię elektryczną, jak również może dojść do utraty przychodów wynikającej ze spadku sprzedaży energii. Sprawa ta jest omawiana w Części 1 niniejszego raportu jako jedno z fundamentalnych zagadnień polityki regulacyjnej, którym należy się zająć przy tworzeniu ram zintegrowanego planu rozwoju źródeł w Polsce. Nie jest to jednak tylko zagadnienie polityki ogólnokrajowej; jest to również problem praktyczny, z którym musi sobie poradzić Z.E. Gliwice przy wdrażaniu pilotowego programu DSM. Z tego powodu zagadnienia pokrycia kosztów i zachęt zawartych w przepisach są potraktowane oddzielnie jako element planu przedsięwzięcia i omówione dokładniej w Rozdziale 5.

Pensja pracowników powiązana ze sprzedażą energii elektrycznej. Pewna część pensji każdego pracownika Z.E. Gliwice jest powiązana z ilością energii elektrycznej sprzedanej przez zakład. Praktyka ta wydaje sie być powszechną we wszystkich przedsiębiorstwach

energetycznych w Polsce. Podobnie jak powiązanie zysków zakładu z ilością sprzedanej energii elektrycznej, tak i ta sprawa stanowi podobną - jeśli nie większą - barierę dla udanego wdrożenia programu DSM.

Zarządzanie dokumentacją/brak komputeryzacji. Wdrażanie programu DSM wiąże się ze znaczną trudnością, jaką jest zarządzanie dużą ilością dokumentów. Z powodu bardzo niskiego poziomu komputeryzacji w Z.E. Gliwice duża ilość danych z zakresu finansów i zużycia energii elektrycznej jest nadal rejestrowana i zestawiana ręcznie. Jeśli ta metoda zostanie zastosowana przy wdrażaniu DSM, zarządzanie programem stanie się niepotrzebnie utrudnione.

Brak doświadczenia z zakresu marketingu. Udany program DSM wymaga dobrego marketingu. Nawet przedsiębiorstwa energetyczne z Ameryki Północnej, które mają wiele lat doświadczenia w tym zakresie, często miewaja kłopoty z marketingiem swoich programów. Marketing to nowe pojęcie dla polskich przedsiębiorstw energetycznych i Z.E. Gliwice.

PRZEGLĄD SEKTORA PRZEMYSŁOWEGO

Przemysł jest sektorem zużywającym najwięcej energii elektrycznej w Polsce. W roku 1991 na ten sektor przypadło 51.052 GWh sprzedanej energii elektrycznej, czyli 53 procent energii sprzedanej w kraju. Choć rodzaj zapotrzebowania na energię w przemyśle może się zmienić, odzwierciedlając bardziej ogólne trendy ekonomiczne i spadek ilości dużych zakładów przemysłu ciężkiego, polski sektor przemysłowy prawdopodobnie utrzyma swą dominację jeśli chodzi o zużycie energii elektrycznej.

Najważniejsze cechy charakteryzujące odbiorców przemysłowych w Polsce to między innymi:

- Według danych z końca 1992 roku, przemysł państwowy dawał 76 procent produkcji przemysłowej w Polsce. Tym wielkim przedsiębiorstwom często nie daje się żadnych motywacji do uczestniczenia w programach DSM.

- Energia elektryczna stanowi zwykle między 1 a 5 procent całkowitych kosztów produkcji, przy czym średnio wynosi 3 procent. W obecnych warunkach ekonomicznych wiele firm walczy o przetrwanie i może nie być zainteresowane lub nie mieć środków na dążenie do oszczędzania energii.

- W polskim przemyśle raczej nie ma tradycji oszczędzania energii. Poprzedni system ekonomiczny koncentrował się na maksymalizacji a nie optymalizacji przemysłu.

- Przedstawiciele zakładów przemysłowych czesto twierdzą, że największe potencjalne oszczędności energii tkwią w zautomatyzowanym monitorowaniu i kontroli procesów przemysłowych.

- Duże, zwykle państwowe zakłady przemysłowe wydają się być podejrzliwe wobec zakładów energetycznych, lub przynajmniej uważają, że mają one mało do zaoferowania w zakresie pomocy w oszczędzaniu energii. Z drugiej strony, mniejsze zakłady przemysłowe wyrażają większą chęć współpracy z zakładami energetycznymi w zakresie zmniejszenia zużycia energii.

- Mimo różnic w rozumieniu roli zakładu energetycznego istniejących między dużymi a małymi przedsiębiorstwami przemysłowymi, zarówno duże jak i małe przedsiębiorstwa są zdania, że jeśli zakłady energetyczne miałyby promować DSM, to ich zaangażowanie powinno obejmować pomoc zarówno techniczną, jak i finansową.

Środki DSM w przemyśle

Z powodu różnorodności obciążeń w różnych procesach przemysłowych, braku szczegółowych informacji na temat tych obciążeń w Polsce oraz trudności powielenia środków w procesach przemysłowych na szeroką skalę, środki takie nie były brane pod uwagę w ocenie. W analizie skoncentrowano się natomiast na oświetleniu i silnikach, choć niektóre z wybranych środków dotyczą ogólnego zużycia energii elektrycznej w przemśle. Samo oświetlenie i silniki to 80 procent zapotrzebowania w przemyśle lub 42 procent całkowitego krajowego zużycia energii elektrycznej w Polsce.

W Części 1 niniejszego raportu, zawierającej ocenę DSM dla Polski, podano szereg środków DSM dla przemysłu, które uznano za potencjalnie możliwe do wdrożenia w Polsce. Choć wszystkie środki są technicznie wykonalne, programy powinny być budowane wokół środków, których efektywność kosztowa została wykazana. Część 1 raportu opisuje w jaki sposób wyliczyć koszt zaoszczędzonej energii i koszt zaoszczędzonej mocy oraz jak porównać te koszty z kosztami unikniętymi energii i mocy w celu określenia, czy konkretny środek byłby dobrym kandydatem, wokół którego można by było budować program. Rezultaty tej analizy zostały przedstawione w Rozdziale 4 tej części raportu wraz z fizycznymi ilościami zaoszczędzonej energii i mocy, których oczekiwano by od tych środków, jeśli zostałyby one zastosowane we wszystkich istniejących urządzeniach. Przedstawiona jest tam również krzywa oszczędności energii w przemyśle, która graficznie obrazuje te wyniki, pokazując koszt zaoszczędzonej energii jako funkcję oszczędności energii.

Projekt i ocena programów DSM dla przemysłu

Środki DSM muszą być połączone z mechanizmami marketingu, wdrażania i oceny, tak by ułatwić ich powszechne zastosowanie i zmaksymalizować potencjalny wkład danego środka. Bazując na doświadczeniach w zakresie przemysłowego DSM nabytych w Kanadzie i Stanach Zjednoczonych, wstępne programy zbudowano wokół każdego z tych środków. Wynikające z tego programy zostały opisane w Rozdziale 4 tej części raportu.

Poszczególne programy zostały następnie zgrupowane według technologii finalnego zużycia energii elektrycznej: wydajne silniki, napędy silnikowe (łącznie z napędami o regulowanej prędkości), zmniejszanie mocy silników, optymalizacja produkcji, konserwacja urządzeń, oświetlenie oraz innowacyjne stawki. Do tych zgrupowanych programów włączono stałe administracyjne koszty ogólne. Niektóre dane charakteryzujące te programy, takie jak stopień uczestnictwa, zmienne koszty administracyjne i oczekiwane rezultaty, zostały przedstawione w Rozdziale 4.

Obliczono współczynnik korzyści do kosztów dla tych programów. Wszystkie zakwalifikowane programy przemysłowe są efektywne pod względem kosztów, a ich współczynniki korzyści do kosztów wahają się od 1,12 do 8,83 w przypadku Testu Całkowitych Kosztów Źródła oraz od 1,76 do 8,91 w przypadku Testu Społecznego. Analiza wrażliwości przeprowadzona w Części 1 potwierdziła efektywność kosztową tych programów przy szerokim zakresie poziomów uczestnictwa i kosztów administracyjnych. Programy przemysłowe, szczególnie te dotyczące silników, należały do programów najbardziej efektywnych kosztowo z wszystkich branych pod uwagę.

W Części 1 wskazano również, że sektor przemysłowy zajmuje pierwsze miejsce pod względem potencjału DSM. Kosztowo efektywne programy DSM dla przemysłu mogłyby realnie zaoszczędzić 962 GWh rocznie (co przy aktualnych stawkach dla przemysłu odpowiada kwocie 58 milionów USD) i w sumie 407 MW nowych i zmodernizowanych mocy do roku 2000. Fizyczny wkład tych programów w wymagania systemu elektroenergetycznego został przedstawiony w Rozdziale 4.

Poziom inwestycji ze strony przedsiębiorstwa energetycznego wymaganych dla osiągnięcia takich korzyści będzie zależeć od przepisów regulacyjnych i struktury taryf przyjętych ostatecznie w Polsce. Analiza ta nie może więc określić finansowania ze strony przedsiębiorstwa energetycznego koniecznego do wdrożenia tego programu. Wyniki wskazują jednak wyraźnie, że:

- Programy DSM dla przemysłu, które mogą zostać wdrożone w niedalekiej przyszłości, stanowią znaczne źródło dla sektora energetycznego.

- Programy te są bardzo efektywne kosztowo pod względem ekonomicznym.

- Należy opracować przepisy regulacyjne, które zapewnią, że decyzje inwestycyjne podjęte zarówno przez przedsiębiorstwa energetyczne, jak i odbiorców będą inwestycjami optymalnymi z perspektywy ekonomicznej, to znaczy, że rozwiązania o najniższych kosztach powinny być najbardziej korzystne dla wszystkich stron.

- Pilotowe programy DSM dla przemysłu mogą pozwolić na zdobycie doświadczenia i na techniczne wykazanie prawdziwości założeń konieczne dla wdrożenia w Polsce programów na szeroką skalę. Programy te pomogą bardziej precyzyjnie określić koszty i korzyści programów DSM (dzięki faktycznemu doświadczeniu nabytemu "w terenie") oraz mogą dać lepsze spojrzenie na układ przepisów regulacyjnych, biorąc pod uwagę rzeczywistą reakcję odbiorców na programy.

- Pilotowe programy DSM dla przemysłu byłyby odpowiednimi kandydatami do finansowania ze strony wielostronnych banków rozwoju.

Biorąc pod uwagę, że programy DSM dla przemysłu są najbardziej efektywne pod względem kosztów i mają największy wkład w osiągalne oszczędności wynikające z DSM, pilotowe programy dla przemysłu prowadziłyby do najszybszego osiągnięcia znaczących korzyści związanych z DSM. W pozostałej części niniejszego opracowania zaproponowany został pilotowy program DSM dla przemysłu, który stanowiłby pomost do pełnego wykorzystania zasobów po stronie popytu w Polsce.

SPECYFIKACJA PROGRAMU PILOTOWEGO

W niniejszym raporcie przedstawiona jest wstępna specyfikacja proponowanego pilotowego programu DSM dla przemysłu, która w istocie stanowi projekt praktycznego wdrożenia takiego programu w Polsce. Choć poczyniono wszelkie wysiłki w celu podania jak największej ilości szczegółów, bezpośrednio przed wdrożeniem programu powinien zostać wykonany bardziej szczegółowy projekt. Specyfikację tę można traktować jako zbiór wytycznych, jednak przy rzeczywistym rozpoczęciu programu należy uwzględnić aktualny stan przepisów regulujących działania przedsiębiorstw energetycznych i stan całej gospodarki w Polsce.

Zawartość i cechy programu

Proponowany pilotowy program DSM będzie posiadać następujące podstawe cechy:

- Z.E. Gliwice będzie się starać uzyskać od odbiorców przemysłowych propozycje pomocy we wdrażaniu programów DSM.

- Z.E. Gliwice będzie polegać głównie na bezpośrednim, osobistym marketingu programu.

- Wymagania kwalifikacyjne do programu będą proste.

- Zarys i forma proponowanego programu zostaną przedstawione zainteresowanym i kwalifikującym się odbiorcom.

- Zainteresowani i kwalifikujący się odbiorcy złożą propozycje do programu DSM.

- Z.E. Gliwice i uczestniczący odbiorcy wynegocjują program i pakiet pomocy finansowej odpowiadający ogólnym zasadom programu.

- Proponowane zadania w ramach programu DSM mogą obejmować wykorzystanie następujących technologii, które w Rozdziale 4 zostały określone jako efektywne kosztowo: silniki o wysokiej wydajności, zmniejszanie mocy silników, zastosowanie napędów, konserwacja urządzeń, optymalizacja procesów przemysłowych i wysoce wydajne oświetlenie (program nie musi się jednak ograniczać do tych technologii). Produkcja energii elektrycznej i cieplnej w skojarzeniu może również zostać rozważona jako kwalifikujący się środek, o ile stanowi ona dopełnienie dla DSM i jest zaplanowana w celu obniżenia obciążenia a nie w celu funkcjonowania jako niezależne przedsięwzięcie energetyczne.

- Pomoc finansowa zostanie zaoferowana odbiorcom z zatwierdzonymi programami DSM w oparciu o oszczędności energii i mocy lub koszt programu. Pomoc finansowa nie będzie jednak przekraczać 50 procent całkowitych kosztów programu lub kosztów pozyskania źródeł DSM wyrażonych na zaoszczędzony kilowat lub kilowatogodzinę, których wartość bieżąca stanowi 50 procent kosztów unikniętych.

- Odbiorcy uczestniczący w programie muszą zawrzeć standardową umowę z Z.E. Gliwice na realizację zatwierdzonego programu. Umowa ta będzie

zawierać zapisy dotyczące kontroli, weryfikacji, poufności informacji, udziału w próbach oceny programu i innych spraw.

- Zanim zostanie dokonana płatność, wszelkie urządzenia zainstalowane w ramach programu muszą zostać poddane inspekcji określającej czy zostały one zainstalowane prawidłowo. Jednak w indywidualnych przypadkach, negocjowanych pojedynczo, będzie można dokonać częściowych płatności przed zainstalowaniem urządzeń, jeśli Z.E. Gliwice uzna, że jest konieczne nabycie kosztowo efektywnych źródeł DSM.

- Będzie możliwa pomoc finansowa na analizę zużycia energii w zakładzie (diagnozę danego zakładu pod względem ilości zużywanej energii i rodzaju wskazanych usprawnień z zakresu DSM).

Zachęty finansowe

W Rozdziale 5 omówiony jest zakres zachęt finansowych, jakie Z.E. Gliwice mógłby zaproponować odbiorcom w ramach programu pilotowego. Zalecane rozwiązanie łączy w sobie dwa podejścia: "zmiennych rabatów" i "wspólnych oszczędności".

Zmienne rabaty. Przy realizacji programu DSM w przedsiębiorstwie Puget Power, wspomnianym w Rozdziale 2, wykorzystano podejście zmiennych rabatów. Oznacza ono, że przy identyfikacji środków DSM podczas analizy zużycia energii w danym zakładzie stosuje się standardowe algorytmy lub zależności techniczne dla przypisania wartości oszczędnościom uzyskanym dzięki tym środkom. Wykorzystuje się jednak także i informacje charakterystyczne dla konkretnego miejsca, takie jak godziny pracy urządzeń oraz inne dane specyficzne dla określonego odbiorcy, jego zakładu lub budynku, gdzie zainstalowany byłby dany środek.

W ten sposób, dwóch różnych odbiorców instalujących ten sam środek po tym samym koszcie mogłoby otrzymać różne zachęty finansowe, gdyż natura funkcjonowania jednego zakładu może dawać przedsiębiorstwu energetycznemu więcej korzyści wypływających z kosztów unikniętych.

Zwykle programy pilotowe oferują odbiorcy "menu" opcji co do ilości, marki i modelu instalowanych urządzeń oraz odpowiednią płatność jaką przedsiębiorstwo energetyczne jest gotowe dokonać za każdą pozycję na menu. Często proponowana kwota jest równa pełnym kosztom przyrostowym nowego urządzenia lub pełnym kosztom kapitałowym związanym z instalacją zmodernizowanego urządzenia.

W niektórych przypadkach odbiorca dokonuje częściowego wkładu z góry i w trakcie negocjacji jest zachęcany do przyjęcia jak największej ilości pozycji z menu. Podejście zmiennych zachęt wiąże "wynagrodzenie" z "wytworzoną wartością", a nie "podjętym działaniem" i pozwala odbiorcom negocjować korzyści wynikające z DSM w taki sam sposób, w jaki robiliby to w przypadku każdego innego towaru lub usługi związanej z ich branżą.

Podejście "wspólnych oszczędności". Wiele przedsiębiorstw energetycznych wykorzystuje firmy usługowe energetyki (energy service companies), zwane też "wykonawcami eksploatacyjnymi" (performance contractors), które sprzedają programy oszczędzania energii poprzez udział w oszczędnościach. W takiej sytuacji odbiorcy spłacają inwestycje dokonane przez takie firmy usługowe z oszczędności uzyskanych na energii elektrycznej. Zwykle sposób wynagrodzenia określony w umowie na realizację tego typu zadania przyjmuje jedną z trzech następujących ogólnych form:

- *Wspólne oszczędności.* Przy takim układzie firma usługowa zwykle finansuje, instaluje u odbiorcy i (zazwyczaj) obsługuje urządzenia efektywnie wykorzystujące energię.. Odbiorca nie płaci nic za instalację urządzeń, które pozostają własnością firmy usługowej. Firma ta przyjmuje na siebie całe ryzyko, odciąga ewentualne ulgi podatkowe i po wygaśnięciu kontraktu może sprzedać odbiorcy swój system za jego uczciwą wartość rynkową. W zamian za to odbiorca płaci firmie miesięczną opłatę leasingową i nadal płaci rachunki za energię elektryczną i inne paliwa.

- *Gwarantowane wydatki na energię.* Przy tego typu kontrakcie odbiorca płaci firmie usługowej stałą miesięczną opłatę za energię elektryczną zużywaną przez urządzenia ujęte w kontrakcie. Jeśli rzeczywiste koszty energii będą niższe niż ta opłata, firma usługowa zatrzymuje różnicę. Jeśli natomiast rzeczywiste rachunki będą wyższe niż stała opłata, firma usługowa będzie musiała dopłacić różnicę.

Z kilku względów wykorzystywanie firm usługowych energetyki do realizacji programów DSM w pewien sposób zachęca odbiorców do uczestniczenia w kosztach programu pilotowego:

- Odbiorcy muszą rozumieć, że poprzez wdrażanie DSM Z.E. Gliwice pozyskuje po ich stronie źródło, które jest mniej kosztowne niż konwencjonalne źródła po stronie podaży. Ponadto jest to źródło mogące mieć korzyści dla produktywności i dla środowiska. Od odbiorców oczekuje się jednak, by płacili za wszystkie źródła - zarówno po stronie podaży, jak i popytu - zdobywane dla nich przez przedsiębiorstwa energetyczne lub innych dostawców usług.

- Z.E. Gliwice chce, by odbiorcy byli partnerami w tym przedsięwzięciu i nie chciałby, by utrwalił się pogląd, że DSM jest powrotem do dotowania energii elektrycznej.

- Północnoamerykańskie doświadczenia z zakresu DSM dotyczące utrzymywania się oszczędności dowodzą w sposób przekonywający, że oszczędności są bardziej stałe, gdy odbiorca postawił na szali pewne ryzyko finansowe.

- W niedalekiej przyszłości w Polsce może wytworzyć się grupa aktywnych firm usługowych energetyki. Z tego powodu może okazać się korzystne chociaż wprowadzenie pojęcia finansowania efektywnego zużycia energii ze wspólnych oszczędności. Pilotowy program DSM może pomóc w tworzeniu nowej branży, jaką byłyby firmy usługowe energetyki.

Strategia marketingu

W celu zapewnienia maksymalnego poziomu komunikacji i budowania świadomości u wszystkich potencjalnych uczestników, program pilotowy będzie ogłaszany i promowany w różnych środkach społecznego przekazu na obszarze obsługiwanym przez Z.E. Gliwice. Rozpocznie się to od przygotowania listy potencjalnych uczestników przez rejonowych pracowników Z.E. Gliwice. Na listach tych zakłady przemysłowe zostałyby zgrupowane według sektora przemysłowego i wielkości zakładu (wskaźnikiem potencjału oszczędności byłaby albo wielkość produkcji albo poziom zużycia energii elektrycznej), a być może również według innych cech charakteryzujących zakłady, zależnie od dostępności danych.

Równoległe badanie rynku

W trakcie spotkań grup dyskusyjnych zorganizowanych w ramach tego programu wskazano na kilka zagadnień, które wymagają dalszych badań rynkowych. Poniżej są one wyliczone i krótko omówione:

Zakres wymaganej pomocy technicznej. Wielu uczestników spotkań w grupach dyskusyjnych wyraziło opinię, że pomoc techniczna dla programu DSM nie stanowi najważniejszego priorytetu. Opinia ta przeważała szczególnie wśród przedstawicieli dużych przedsiębiorstw przemysłowych, które zwykle posiadają wystarczającą liczbę dobrze wyszkolonych pracowników potrafiących określić możliwości w zakresie DSM w swoich zakładach.

Czy rabaty powiązane ściśle z konkretnym produktem byłyby pożyteczne. Program DSM proponowany tutaj nie zaleca proponowania stałego rabatu dla pewnego typu urządzeń i środków DSM. Rabaty takie są powszechnie stosowane w programach DSM realizowanych w Ameryce Północnej. Należałoby przeprowadzić dalsze badania rynku w celu określenia, czy dodanie stałego rabatu do proponowanych tutaj rabatów zmiennych w sposób istotny zmieniłoby poziomy uczestnictwa w programie lub dało inne znaczące korzyści.

Zbadać sposoby przełamania nieufności wobec zakładu energetycznego. Spotkania w grupach dyskusyjnych wykazały, że niektórzy odbiorcy mogą niechętnie odnosić się do współpracy z Z.E. Gliwice, częściowo z powodu niezadowolenia z wysokości rachunków za energię elektryczną, a częściowo dlatego, że sądzą, iż zakład energetyczny musi mieć jakiś ukryty powód, jeśli pragnie wejść na teren przedsiębiorstwa przemysłowego i dokonywać analiz (tzn. odbiorcy ci nie wierzą, że zakład energetyczny poważnie mowi o pomaganiu im w ograniczeniu zużycia energii elektrycznej wiedząc, że zakład zwiększa zyski sprzedając więcej energii).

Zbadać czy przedsiębiorstwa państwowe mogą wymagać innego podejścia marketingowego niż firmy prywatne. Przedsiębiorstwa będące własnością publiczną i finansowane ze środków publicznych doświadczają wielu więcej ograniczeń jeśli chodzi o ich udział w programach DSM, szczególnie pod względem ich wkładu finansowego w program. Na przykład może im być nie wolno przenosić funduszy przeznaczonych na energię elektryczną na konto modernizacji kapitałowych w celu dokonania udoskonaleń wymaganych przez DSM.

Inne równoczesne badania. Na wdrażenie pilotowego programu DSM można patrzeć jako na wielkie przedsięwzięcie z zakresu badania rynku. Da ono cenne informacje na temat tego co jest a co nie jest skuteczne w zachęcaniu odbiorców do udziału w programie. Z drugiej strony, program również powinien być wdrażany z myślą o zbieraniu informacji o rynku.

Dostarczenie urządzeń i wdrożenie

Montaż organizowany przez wykonawców. Przy takim podejściu Z.E. Gliwice byłby odpowiedzialny za nadzór nad wszystkimi aspektami specyfikacji urządzeń, nad pozyskaniem, instalacją i testowaniem środków przyjętych przez odbiorcę w wyniku zaleceń. Aby to zrealizować, Z.E. Gliwice będzie kierować procesem wdrażanym przez płatnych wykonawców, takich jak firmy usługowe energetyki.

W celu wybrania najlepszego dostawcy usług i urządzeń Z.E. Gliwice powinien przeprowadzić konkurs ofert, który przebiegałby następująco:

Etap 1. W czasie przeprowadzania wstępnych warsztatów na temat programu pilotowego powinno odbyć się oddzielne spotkanie warsztatowe w celu wyłonienia potencjalnych wykonawców, konsultantów i firm współpracujących. Firmy współpracujące to te, które pośrednio uczestniczą we wdrażaniu DSM, np. dystrybutorzy i sprzedawcy urządzeń efektywnie wykorzystujących energię.

Etap 2. Zainteresowane strony zostałyby poproszone o przedłożenie potwierdzenia kwalifikacji wraz z referencjami technicznymi i kredytowymi wykazującymi ich techniczne kompetencje i przestrzeganie zasad uczciwej gry rynkowej. Z.E. Gliwice przyjmowałby krajowe certyfikaty uzyskane przez firmy usługowe energetyki i firmy przeprowadzające analizę zużycia energii jako świadectwo kwalifikacji.

Etap 3. Zainteresowane strony przedłożyłyby również zestawienie stawek godzinowych dla pracowników o różnych poziomach kwalifikacji i wykształcenia technicznego. W przypadku, gdy wykonawca musiałby zatrudnić dodatkowych pracowników, byłby zobowiązany do przedstawienia planu ich przyjmowania z podaniem ogólnych metod sprawdzania kwalifikacji. Preferowane byłyby firmy zatrudniające już większość potrzebnego personelu.

Etap 4. Konkurencyjna ocena oferentów pozwoliłaby na wybranie najlepszych ofert i przyznanie kontraktów. Kontrakty miałyby strukturę "podstawowych umów zlecających", które przewidywałyby możliwość przedstawienia gwarantowanych stawek wynagrodzenia za robociznę i standardowych norm czasowych na wykonanie niektórych prac w ofercie technicznej i finansowej przedłożonej Z.E. Gliwice.

Opracowanie specyfikacji urządzeń, montażu i testowania. Wykonawcy, na podstawie analizy zużycia energii, opracowaliby wszechstronną specyfikację urządzeń łączącą w sobie:

- wymagania określone przez producenta w specyfikacji urządzeń i instrukcji montażu
- aktualnie obowiązujące normy budowlane i bezpieczeństwa
- ewentualne przepisy związków zawodowych
- wszelkie warunki narzucone przez odbiorcę w zakresie przeprowadzenia montażu na swoim terenie.

Specyfikacja ta powinna być skodyfikowana według typu czynności (np. montaż nowego silnika). Część każdej specyfikacji stanowiłyby normy czasowe, które mogłyby zostać wykorzystane do oszacowania ilości roboczogodzin i kosztu wykonania większości jednostkowych prac.

Zapewnienie jakości, kontrola i inspekcja. Z.E. Gliwice sprawowałby nadzór nad pracami w terenie wykorzystując kryteria realizacji zadań oraz normy zapewnienia i kontroli jakości stworzone w celu monitorowania takich zadań. Na przykład w przypadku zadania o nazwie: "montaż nowych silników efektywnie wykorzystujących energię" Z.E. Gliwice może uznać za kryterium realizacji zadania, że żaden odbiorca nie powinien czekać dłużej niż 90 dni od daty zatwierdzenia wniosku złożonego w odpowiedzi na ofertę Z.E. Gliwice na montaż nowego urządzenia w swoim zakładzie.

Nabycie urządzeń. Przewiduje się, że Z.E. Gliwice będzie rozpatrywać i zatwierdzać procesy nabywania wszelkich urządzeń potrzebnych w różnych programach (łącznie z konkurencyjnymi ofertami kosztowymi). Zakłada się również, że urządzenia te byłyby sprowadzane przez wykonawców od firm krajowych i zagranicznych, oraz że w tym ostatnim przypadku odstąpiono by od pobierania wszelkich ceł importowych, podatków lub innych opłat celnych.

Montaż organizowany przez odbiorcę. W większości przypadków odbiorcy przemysłowi sami wybiorą i podpiszą umowy z wykonawcami zatwierdzonymi przez Z.E. Gliwice do udziału w programie. Z praktycznego punktu widzenia można założyć, że niektóre firmy mogą od wielu lat mieć związki z konsultantami lub innymi firmami i że będą zainteresowane utrzymaniem tych związków. Z.E. Gliwice dokona przeglądu ich kwalifikacji do udziału w programie na zasadach konkursu ofert przedstawionego powyżej.

Wypłata zachęt finansowych. Z.E. Gliwice wypłacałby zachęty finansowe bezpośrednio odbiorcom, którzy z kolei byliby odpowiedzialni za opłacenie wykonawców i dostawców. Odpowiedzialność za wszelkie koszty programów DSM przewyższające sumy wypłacone przez Z.E. Gliwice w formie zachęty finansowej spoczywałaby na odbiorcy.

Zagadnienie odzysku i usuwania urządzeń. Wszelkie zastąpione urządzenia powinny zostać usunięte przez wykonawcę i uzyskać zatwierdzenie od Z.E. Gliwice na odzysk lub trwałe usunięcie. Nie ma większego sensu wyrażanie zgody na to, by odbiorca zatrzymał stare urządzenia jako "zapas" lub odsprzedał je bezpośrednio innym firmom lub pośrednikom, gdyż takie mało wydajne urządzenia mogłyby po prostu zostać zamontowane gdzie indziej w Polsce.

Zakres odpowiedzialności odbiorców. Zaleca się, by Z.E. Gliwice uczynił montaż organizowany przez odbiorcę głównym sposobem wdrażania programów. W przypadkach, w których odbiorca chciałby odejść od takiej procedury, musiałby on uzyskać specjalne zwolnienie

od Z.E. Gliwice. Odbiorca ponosiłby wówczas pełną odpowiedzialność za kierowanie procesem, tak by sprostać wymaganiom inspekcyjnym określonym przez Z.E. Gliwice. Wszelkie dodatkowe koszty obciążające lub ogólne koszty finansowe związane z opóźnieniami, pracami naprawczymi lub sporami z wykonawcami byłyby problemem odbiorcy.

Szkolenie firm usługowych energetyki. Po dokonaniu opisanego powyżej konkursu ofert Z.E. Gliwice może dojść do wniosku, że istnieje niewystarczająca liczba firm usługowych energetyki kwalifikujących się do przeprowadzenia wymaganych analiz zużycia energii oraz dokonania specyfikacji i montażu urządzeń. Jeśli tak będzie, pilotowy program DSM być może będzie musiał objąć również składnik szkolenia firm usługowych. Działania te mogłyby zostać skoordynowane z ogólnokrajowym licencjonowaniem usługowych firm energetyki i innych firm inżynieryjnych związanych z energetyką, a mogłyby być sponsorowane przez specjalny fundusz z programów wzajemnej pomocy.

Uwzględnianie rozwiązań nie proponowanych przez Z.E. Gliwice. Oczekuje się, że przedstawiona powyżej metoda dostarczania urządzeń i wdrażania programu zapewni systematyczny i uporządkowany proces zawierania umów z firmami usługowymi energetyki i rozwijania programów u odbiorców Z.E. Gliwice. Mogą jednak zaistnieć okoliczności, w których Z.E. Gliwice otrzyma propozycje rozwiązań nie proponowanych wcześniej przez siebie, składane nie na drodze normalnego procesu. Z.E Gliwice powinien zachować elastyczność w uwzględnianiu takich propozycji, o ile odpowiadają one wymaganym standardom analiz zużycia energii, są w zgodzie z ogólnymi technicznymi celami projektu pilotowego i odpowiadają kryteriom wyboru (np. pod względem doświadczenia i kwalifikacji).

Weryfikacja i ocena wpływu programu.

Weryfikacja oszczędności uzyskanych w wyniku programu pilotowego jest niezbędna dla:

- pokazania odbiorcom uczestniczącym w programie, że rzeczywiście dało się uzyskać wymierne oszczędności energii i mocy
- wykazania zasadności i efektywności kosztowej przemysłowego programu DSM w Polsce prowadzonego przez przedsiębiorstwo energetyczne
- stworzenia podstawy dla oszacowania wpływu późniejszego, ogólnokrajowego programu.

Należy przeprowadzić indywidualne analizy poszczególnych zakładów przemysłowych, by uwzględnić specyfikę środków DSM mogących mieć zastosowanie w tych zakładach, w których

występują różnorodne rodzaje finalnego zużycia energii i może dochodzić do ich wzajemnego oddziaływania. Dlatego konieczne będzie, by Z.E. Gliwice, jego wykonawcy i odbiorca współpracowali w celu dokładnego określenia linii bazowej jako odnośnika dla pomiaru wpływu programu pilotowego.

Oczekuje się, że ocena wpływu programu przeprowadzana przez Z.E. Gliwice będzie obejmować pomiary finalnego zużycia energii na urządzeniach jako część procedury oszacowania wpływu. Ocena ta łączyłaby algorytmy techniczne, modele symulacyjne i statystyczne metody regresji. Konieczne byłoby również opracowanie wspólnych metod oceny sumujących wpływy w wybranych, pojedynczych zakładach w celu uzyskania szacunków dla całego programu oraz zwiększenia dokładności i precyzji pomiarów.

Podobnie jak w przypadku każdego szacunku co do wpływu przedsięwzięć z zakresu DSM, tak i tutaj pewną trudność stanowi porównanie: 1) faktycznego finalnego zużycia energii w badanych urządzeniach po wprowadzeniu usprawnień z 2) szacunkowym zużyciem jakie miałoby miejsce w tych urządzeniach bez wprowadzenia usprawnień. Dlatego wpływ programów na oszczędności nie może zostać bezpośrednio zmierzony, lecz jedynie oszacowany, gdyż 2) jest zdarzeniem, którego nie da się zaobserwować.

Dokładność takiego procesu oceny jest funkcją:

- *poziomu precyzji* wyrażonego jako zakres tolerancji, w którym - jak się uważa - mieści się mierzony wpływ

- *poziomu pewno£ci* wyrażonego jako prawdopodobieństwo, z którym uważa się, że dany wpływ rzeczywiście mieści się w takim zakresie tolerancji.

"Protokół weryfikacji" to nic innego jak plan działania określający krok po kroku sposób ustalania linii bazowej będącej odnośnikiem, rodzaje wpływów określanych ilościowo w odniesieniu to takiej linii bazowej oraz okres przez jaki będzie się tego dokonywać. Protokół opisuje rolę metod pomiarowych, inżynieryjnych i statystycznych w uzyskiwaniu takich szacunkowych wpływów. Określa on również środowisko, w jakim ma zostać dokonana weryfikacja i jakie inne czynniki działalności mają być mierzone (np. poziomy produkcji, temperatura, przepływy cieczy). Dzięki temu uzyska się nie tylko "chwilowy" szacunek aktualnych oszczędności, lecz również wgląd w bardziej długoterminowe zagadnienia utrzymywania się oszczędności.

Oceny procesu i rynku

Można realnie oczekiwać, że w udanym programie pilotowym weźmie udział 30-50 odbiorców przez okres 18 miesięcy. A zatem typy i rodzaje uczestnictwa (bądź braku uczestnictwa) mogą być równie ważne jak bezwzględna liczba uczestników programu pilotowego. Na przykład, Z.E. Gliwice będzie musiał spróbować znaleźć odpowiedź na następujące pytania:

- Czy daje się zauważyć wyraźny brak uczestnictwa w jednej lub więcej gałęzi przemysłu?
- Czy wielkość firmy lub zakładu jest ważnym czynnikiem decydującym o uczestnictwie?
- Czy są różnice w zainteresowaniu programem pomiędzy firmami krajowymi a zagranicznymi?
- Czy istnieją przykłady udanego przejęcia kilku zakładów przez jedną firmę?
- Które cechy programu pilotowego zdają się być najbardziej atrakcyjne dla uczestników? Które stanowią największą przeszkodę dla przyjęcia programu? Czy cechy te można łatwo zmodyfikować?

Po uporządkowaniu tych czynników powinno być możliwe dokonanie ekstrapolacji prawdopodobnego ogólnego uczestnictwa w całym sektorze przemysłowym w programie na pełną skalę.

Pokrycie kosztów DSM i zachęty finansowe

Z.E. Gliwice i inne przedsiębiorstwa energetyczne w Polsce stoją przed jedynym w swoim rodzaju wyzwaniem, jakim jest przejście od systemu komunistycznego do zrestrukturyzowanej gospodarki rynkowej. Jednakże jeśli chodzi o sterowanie popytem, przedsiębiorstwa energetyczne w Polsce posiadają jedną wspólną cechę z większością podobnych firm z innych części świata: każda kilowatogodzina sprzedana przez przedsiębiorstwo zwiększa dochody, a każda kilowatogodzina nie sprzedana przez przedsiębiorstwo zmniejsza dochody. W tym sensie właściwie nie ma znaczenia, czy Z.E. Gliwice będzie nadal przedsiębiorstwem państwowym, czy też stanie się sprywatyzowaną spółką akcyjną, jak to jest obecnie planowane. W obydwu przypadkach, przy aktualnie obowiązujących przepisach taryfowych zmniejszenie sprzedaży (czy to przez DSM, spadającą produkcję w przemyśle, czy po prostu łagodną pogodę) będzie powodować zmniejszenie dochodów, co będzie mieć zły wpływ na finansową pozycję firmy. Dla Z.E. Gliwice istnieje bardzo mocny hamulec dla wdrażania pilotowego programu DSM lub dla przyszłego uczestnictwa we wdrażaniu agresywnego programu DSM na pełną skalę.

Problem ten, dotyczący nie tylko Z.E. Gliwice, wiążc się z samym sednem tworzących się ram prawnych i regulacyjnych dla sektora energetycznego w Polsce. Z tego powodu sprawa ta została przedstawiona w Części 1 niniejszego raportu jako zagadnienie ogólnokrajowej polityki instytucjonalnej: przepisy prawne i regulacyjne kierujące funkcjonowaniem sektora energetycznego w Polsce powinny zapewnić, by zintegrowany plan rozwoju źródeł był najbardziej opłacalnym planem dla przedsiębiorstwa energetycznego a zarazem planem opartym o najniższe koszty dla odbiorców i społeczeństwa jako całości. Jeśli DSM okaże się najtańszym źródłem energii elektrycznej, to musi istnieć mechanizm, który nie tylko zniesie potężny hamulec dla wprowadzania DSM, lecz da przedsiębiorstwu energetycznemu pozytywną zachętę do wdrażania DSM. W Części 1 opisano dwa kluczowe mechanizmy: 1) pokrycie przez zakład energetyczny kosztów DSM w stawkach na energię elektryczną, oraz 2) zdolność zakładów energetycznych do wypracowywania bodźców finansowych dla wdrażania DSM.

Wprowadzanie zachęt regulacyjnych w programie pilotowym

Przy rozważaniu wprowadzenia w Polsce jakiegokolwiek programu DSM, także programu pilotowego, wydaje się oczywistym, że aby uzyskać entuzjastyczne poparcie przedsięwzięcia ze strony angażującego się przedsiębiorstwa energetycznego, potrzebny jest pewien mechanizm zachęty. Jeśli założyć przyjęcie takiego stwierdzenia, jedyne pytanie brzmi: Jaki mechanizm i jak należy go wprowadzić? Na pytanie to nie znaleziono łatwej odpowiedzi w Stanach Zjednoczonych, gdzie - w zależności od lokalnych przepisów regulacyjnych - wprowadzono cały szereg różnych mechanizmów lub ich kombinacji.

Przedstawione poniżej zalecenie stanowi próbę uwzględnienia potrzeby Z.E. Gliwice uzyskania zniesienia podstawowej przeszkody dla DSM przy jednoczesnym wzięciu pod uwagę stanu ciągłych zmian w środowisku instytucjonalnym i trudnej sytuacji gospodarki. Na przykład, wydaje się nieuzasadnionym przydzielanie Z.E. Gliwice zachęt w sytuacji, gdy tak wiele innych przedsiębiorstw walczy w trudnych warunkach ekonomicznych stworzonych przez post-komunistyczne przemiany.

Zalecane podejście koncentruje się na pokryciu kosztów DSM i utraconych przychodów jako dostępnych mechanizmach. Po ich zastosowaniu Z.E. Gliwice przynajmniej będzie obojętny na wpływ DSM na swoje przychody, nawet jeśli nie otrzyma nagrody za wdrożenie DSM. Podejście to wydaje się być rozsądne także w kontekście programu pilotowego, w którym zniwelowane jest ryzyko związane z podjęciem się czegoś nowego, a jednocześnie uniknięta jest możliwość niespodziewanych korzyści z nieoczekiwanego rozwoju wydarzeń.

Po uzgodnieniu, że konieczne jest pokrycie kosztów DSM i utraconych przychodów, pozostaje nadal pytanie: Jak zapewnić to pokrycie? Odpowiedź tkwi w dwóch strumieniach gotówki, z

którymi ma do czynienia Z.E. Gliwice w swej działalności: 1) ceny hurtowe, jakie Z.E. Gliwice płaci PSE S.A. za energię elektryczną z sieci, oraz 2) ceny detaliczne, jakie zakład pobiera od odbiorców. Poniżej przedstawiony jest sposób, w jaki każde z tych podejść mogłoby funkcjonować w praktyce:

Zachęty do wprowadzania DSM zawarte w taryfach hurtowych. Z.E. Gliwice zakupuje obecnie większość sprzedawanej przez siebie energii od PSE S.A., firmy zarządzającej systemem przesyłowym (niewielka część energii jest kupowana bezpośrednio od lokalnych wytwórców leżących na terenie obsługiwanym przez zakład). PSE S.A. pobiera stawki hurtowe za energię regulowane obecnie przez Ministerstwo Przemysłu i Handlu (układ ten może się zmienić w przyszłości, jeśli stworzona zostanie Agencja Regulacyjna Energetyki regulująca wszelkie stawki w sektorze energetycznym). Możliwe byłoby obliczenie kosztów programu DSM i utraconych przychodów, a następnie odjęcie ich od cen hurtowych jakie Z.E. Gliwice płaci PSE S.A.

Podejście to miałoby rację bytu wówczas, gdy PSE S.A. byłyby zobowiązane do zakupu i uruchomienia najtańszych źródeł dostępnych w całym polskim systemie elektroenergetycznym (łącznie z energią od wytwórców i źródłami DSM od zakładów energetycznych) w celu pokrycia zapotrzebowania w systemie. Jeśli źródła DSM oferowane przez Z.E. Gliwice miałyby stosunkowo niskie koszty w porównaniu z dostępnymi źródłami po stronie podaży, cały system odnosiłby korzyści. Koszt PSE S.A. związany z pozwoleniem Z.E. Gliwice na pokrycie swoich kosztów związanych z DSM i utraconych przychodów zostałby doliczony do cen hurtowych pobieranych od wszystkich odbiorców PSE S.A. i w ten sposób obciążałby on wszystkich płacących za energię elektryczną w całym kraju.

Zawarcie zachęt do wprowadzania DSM w cenach hurtowych miałoby również korzyści dla rozdziału kredytów uzyskanych przez Polskę z wielostronnych banków rozwoju na inwestycje w elektroenergetyce. Zakładając, że PSE S.A. będzie jedyną organizacją w kraju otrzymującą pożyczki z banków rozwoju, mogłaby ona przekazywać je na inwestycje w DSM zapisując je na konto należności z zakładów energetycznych. Pożyczki mogłyby być spłacone albo z gotówki uzyskanej przez PSE S.A. ze sprzedaży energii i mocy do zakładów energetycznych w całym kraju albo przez poszczególne zakłady energetyczne z oszczędności na źródłach jakie zakłady uzyskują w wyniku wprowadzenia DSM u swoich odbiorców.

Zachęty do wprowadzania DSM zawarte w taryfach detalicznych. Z.E. Gliwice sprzedaje energię rozdzielaną do swoich odbiorców i uzyskuje przychód według taryf detalicznych regulowanych obecnie przez Ministerstwo Finansów (również i ten układ może się zmienić po powołaniu Agencji Regulacyjnej Energetyki). Możliwe byłoby obliczenie kosztów programu DSM i utraconych przychodów, a następnie dodanie ich do stawek pobieranych przez Z.E. Gliwice od odbiorców.

Podejście to miałoby rację bytu wówczas, gdy Z.E. Gliwice byłby zobowiązany do zakupu i uruchomienia najtańszych źródeł dostępnych na swoim terenie (łącznie z energią od PSE S.A. i jej wytwórców, jak również źródłami DSM u odbiorców) w celu pokrycia swego lokalnego zapotrzebowania. Jeśli źródła DSM oferowane przez odbiorców miałyby stosunkowo niskie koszty w porównaniu z dostępnymi źródłami po stronie podaży, Z.E. Gliwice odnosiłby korzyści. Koszt ponoszony przez odbiorców związany z pozwoleniem Z.E. Gliwice na pokrycie swoich kosztów DSM i utraconych przychodów zostałby doliczony do cen detalicznych pobieranych od wszystkich odbiorców Z.E. Gliwice i w ten sposób obciążałby on wszystkich płacących za energię elektryczną na całym terenie obsługiwanym przez zakład.

Szczegóły i zagadnienia pokrewne

Powyższy opis tylko w ogólnych zarysach przedstawia dwa powyższe podejścia jako niezależne rozwiązania. Poniżej podane są niektóre szczegóły i niuanse mogące towarzyszyć realizacji obydwu rozwiązań.

Wspólne oszczędności. W obydwu powyższych przypadkach omawiana jest tylko korzyść dla Z.E. Gliwice, tzn. pokrycie kosztów zakładu związanych z wprowadzeniem DSM i utraconym przychodem. Jest jeszcze jedna korzyść, którą automatycznie uzyskuje PSE S.A., jaką jest oszczędność źródeł uzyskana z faktu, że PSE S.A. nie musi zakupić i dostarczyć energii unikniętej dzięki DSM wprowadzonemu u odbiorcy Z.E. Gliwice. Z drugiej strony, łatwo byłoby zezwolić PSE S.A. na zatrzymanie tych oszczędności na źródłach i uznać je za zachętę dla PSE S.A. do zaakceptowania któregokolwiek z powyższych rozwiązań. Można byłoby jednak również obliczyć takie oszczędności na źródłach i podzielić je w pewnych proporcjach (np. 50:50) pomiędzy PSE S.A. a Z.E. Gliwice (poprzez zapisanie ich na konto należności z zakładu). Takie podejście wprowadziłoby do równania pozytywny bodziec dla Z.E. Gliwice. Z.E. Gliwice mógłby w podobny sposób przekazać część, oszczędności swoim odbiorcom (w postaci obniżenia taryf detalicznych). W jednym z rejonów USA, w którym przyjęto takie rozwiązanie (Nowy Jork), oszczędności na zasobach obejmują również zewnętrzne koszty środowiskowe uniknięte dzięki DSM, co dodaje kolejny wymiar do równania. Choć podejście to jest być może bardziej sprawiedliwe, z pewnością spowodowałoby ono, że cały układ byłby bardziej złożony i mógłby nie być gwarantowany.

Podejście łączone. Opisane powyżej dwa sposoby zachęcania do wprowadzania DSM nie muszą się wzajemnie wykluczać. Można byłoby opracować system, w którym obydwa sposoby zostałyby połączone.

Znaczenie systemów monitorowania i oceny wpływu programu. Obydwa przedstawione sposoby zachęcania do wprowadzania DSM wymagałyby rygorystycznego monitorowania

kosztów programu i uzyskanych dzięki niemu oszczędności, co stanowiłoby podstawę dla określenia utraconych przychodów. Obydwa te procesy zostały opisane w projekcie pilotowego programu DSM.

Konkurencyjne oferty ze wszystkich źródeł. Obydwie przedstawione powyżej metody dają Z.E. Gliwice gwarancję pokrycia kosztów poniesionych na DSM i utraconych przychodów. Rozwiązanie takie jest prawdopodobnie słuszne w krótszej perspektywie, gdyż dzięki temu pokonuje się opór wobec nowego rozwiązania, szczególnie w przypadku wdrażania programu pilotowego. Jednakże bardziej wolnorynkowym mechanizmem jaki można by było sobie wyobrazić, byłoby wykorzystanie taryf hurtowych jako wektora dającego zachęty do wprowadzania DSM: system konkurencyjnych ofert ze wszystkich źródeł, obejmujący źródła zarówno po stronie podaży jak i popytu. Przy takim podejściu PSE S.A. rozpisywałyby każdego roku konkurs na (w zasadzie) tylko podstawową część obciążenia systemowego. Wytwórcy składaliby oferty cenowe i ilościowe na dostawę energii i mocy do PSE S.A., a zakłady energetyczne składałyby oferty cenowe i ilościowe na dostawę źródeł DSM. W PSE S.A. dokonano by uszeregowania ofert w oparciu o zintegrowany plan rozwoju źródeł (biorąc pod uwagę zarówno cenę, jak i inne czynniki, np. niezawodność), a następnie zakontraktowano by źródła o najniższych kosztach. Za zakontraktowane źródła DSM PSE S.A. płaciłyby przez cały rok w taryfach hurtowych. Jeżeli wybrana cena zaoferowana przez zakład energetyczny byłaby wyższa lub równa kosztom poniesionym przez ten zakład na DSM i kosztom utraconych przychodów, podejście to daje w zasadzie takie same wyniki jak bardziej deterministyczne podejście zaproponowane wcześniej.

Koszt dla nie uczestniczących. W obydwu podejściach proponowanych powyżej wszyscy płacący za energię elektryczną pokrywają koszty inwestycji w DSM. W przypadku taryf hurtowych koszty DSM i utraconych przychodów są rozłożone na wszystkich płatników w Polsce, co prawdopodobnie oznaczałoby, że koszty te raczej nie byłyby odczuwalne. Natomiast w przypadku taryf detalicznych koszty są rozłożone na wszystkich płacących za energię na terenie obsługiwanym przez Z.E. Gliwice, co mogłoby mieć bardziej widoczny wpływ na rachunki. W obydwu przypadkach można podnieść argument, że płatnicy nie uczestniczący w inwestycjach DSM zostaną obciążeni podniesionymi rachunkami.

Praktyczne zagadnienia związane z wdrażaniem. Na koniec pojawia się pytanie o praktyczny sposób wdrożenia któregokolwiek z powyższych rozwiązań w kontekście proponowanego tutaj pilotowego programu DSM dla przemysłu. W każdym przypadku musiałyby zostać zawarte umowy między uczestniczącymi stronami. Te strony to Z.E. Gliwice, PSE S.A. i Ministerstwo Przemysłu i Handlu (lub Agencja Regulacyjna Energetyki) w przypadku podejścia taryf hurtowych oraz Z.E. Gliwice i Ministerstwo Finansów (lub Agencja Regulacyjna Energetyki) w przypadku podejścia taryf detalicznych. W obydwu przypadkach umowa powinna zawierać zobowiązanie Z.E. Gliwice do rejestrowania kosztów związanych z

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programem DSM i utraconymi przychodami. W razie konieczności, w celu ograniczenia instytucjonalnego ryzyka związanego z podjęciem się nowego zadania, można by było prowadzić "dwa zestawy ksiąg", jeden wykazujący jak taryfy byłyby obliczane normalnie, a drugi jak one są obliczane z zachętą do wprowadzania DSM. Częścią oceny programu pilotowego byłoby następnie porównanie obydwu rachunków w celu udokumentowania zarówno wpływu DSM na system w zakresie stawek, jak również czy Z.E. Gliwice odzyskał wszelkie nakłady i pokrył wszelkie koszty poniesione w procesie. Rezultaty mogłyby następnie zostać poddane ekstrapolacji do poziomu całego kraju w celu określenia wpływu programów DSM realizowanych na pełną skalę na polski sektor elektroenergetyczny.

ELEMENT BADANIA FINALNEGO OBCIĄŻENIA

Przedstawiony tu pilotowy program DSM dla przemysłu zawiera element badania finalnego obciążenia jako integralny składnik projektu programu. Badanie obciążenia finalnego stanowi ważne dopełnienie działań w zakresie sterowania popytem podejmowanych przez przedsiębiorstwa energetyczne. Dzięki zrozumieniu jak odbiorcy używają energię elektryczną w swoich zakładach, przedsiębiorstwa energetyczne mogą dokładniej wskazać potencjał źródeł dostępnych dla nich. Badanie obciążenia odgrywa również ważną rolę przy ocenie wpływu programów, dzięki której dokładnie określa się rzeczywiste koszty i oszczędności wynikłe z DSM. Wreszcie, stworzenie w przedsiębiorstwie energetycznym grupy pracowników lub działu zajmującego się badaniem obciążenia może znacznie przyczynić się do podniesienia poziomu obsługi odbiorców, w miarę jak pracownicy przedsiębiorstwa kontaktują się z odbiorcami i dowiadują się o ich potrzebach w zakresie usług elektroenergetycznych. Ten ostatni punkt ma szczególne znaczenia w Polsce, gdzie przedsiębiorstwa energetyczne zaczynają sobie zdawać sprawę z potrzeby zmiany spojrzenia na rynek: już nie z pozycji sprzedawcy towaru, jak to zawsze było w zwyczaju, lecz z pozycji firmy świadczącej usługę energetyczną.

Informacje wstępne i uzasadnienie

Element badania obciążenia ma na celu ocenę potencjału źródeł DSM na terenie obsługiwanym przez Z.E. Gliwice, co w dalszej perspektywie pomoże zakładowi w świadczeniu usług zorientowanych na rynek i bardziej odpowiadających potrzebom odbiorców. Pracownicy Z.E. Gliwice będą również szkoleni, tak by w przyszłości mogli rozwinąć program na pełną skalę.

Choć badanie obciążenia będzie prowadzone u odbiorców przemysłowych, w lokalach niemieszkalnych i w gospodarstwach domowych, program pilotowy będzie koncentrować się na sektorze przemysłowym, który stanowi główną część zapotrzebowania na energię elektryczną z Z.E. Gliwice. Badaniu poddane zostanie 2 do 5 procent szczytowego obciążenia Z.E. Gliwice

(52 do 130 MW). Głównymi źródłami danych wykorzystywanych do oceny potencjalnego wpływu środków DSM będą:

dane na temat całego zakładu przemysłowego (kW i kWh)
dane na temat zużycia finalnego mierzonego przy pomocy urządzeń pomiarowych
dane na temat rachunków za energię elektryczną z wybranych grup odbiorców
dane z ankiet zebrane od szerokiego spektrum odbiorców.

Element badania obciążenia obejmuje doświadczenia nabyte w tym zakresie przez kilka przedsiębiorstw energetycznych z USA, jak również doświadczenia z pomiarów punktowych prowadzonych u odbiorców Z.E. Gliwice. Element ten został tak zaplanowany, by być odpowiednio elastyczny w celu pokonania wielu ograniczeń, jakie stoją przed sektorem przemysłowym, odbiorcami z lokali niemieszkalnych i gospodarstw domowych w okresie przechodzenia kraju do gospodarki rynkowej.

Program pomiarów punktowych

Program pomiarów punktowych został przeprowadzony w okresie od marca do czerwca 1993 roku jako szybka, praktyczna próba amerykańskich urządzeń do pomiaru obciążenia w polskich warunkach. Celem tego programu było również przybliżenie pojęcia sterowania popytem pracownikom zakładu energetycznego oraz sprawdzenie reakcji odbiorców, u których dokonywano pomiarów. Program pomógł w określeniu najbardziej odpowiednich i efektywnych kosztowo instrumentów, seminariów, szkolenia i miejsc uczestnictwa dostawców urządzeń w pilotowym programie badania obciążenia. Co najważniejsze jednak, program ten pozwolił zabrać profile obciążenia z kilku rodzajów finalnego zużycia energii. Wyniki programu pomiarów punktowych zostały omówione w Rozdziale 6.

Cele badania obciążenia

Wspierając pilotowy program DSM, badanie obciążenia ma następujące cele:

- przeprowadzić praktyczną analizę odbiorców służącą za podstawę wyboru odbiorców reprezentatywnych dla badania obciążenia finalnego
- wydobyć i przeanalizować informacje z rachunków za energię elektryczną u 100 dużych odbiorców obsługiwanych przez Z.E. Gliwice

- oszacować charakterystykę obciążenia głównych segmentów rynku w rejonie obsługiwanym przez Z.E. Gliwice
- przeprowadzić program pomiarów obciążenia w celu zebrania i zbadania rzeczywistego obciążenia finalnego na urządzeniach i w całym zakładzie przed i po wprowadzeniu DSM
- pomóc pracownikom Z.E. Gliwice w zrozumieniu sposobów zużywania energii elektrycznej przez odbiorców zakładu oraz przeprowadzić analizę kosztów i korzyści w ramach lokalnych uwarunkowań.

ADMINISTROWANIE PROGRAMEM, FINANSOWANIE, BUDŻET I HARMONOGRAM

Ostatnie zagadnienie związane z pilotowym programem DSM dla przemysłu opracowanym dla Polski dotyczy niektórych praktycznych spraw administracyjnych. W części tej przedstawiona jest ogólna struktura programu i wskazane są różne organizacje, które byłyby zaangażowane w proces wdrażania programu wraz z podaniem ich roli i wzajemnych związków. Następnie podany jest proponowany harmonogram i budżet, który zawiera wskazanie możliwych źródeł finansowania programu pilotowego. Rozdział kończy się opisaniem wymagań w zakresie systemu monitorującego gromadzenie i zarządzanie danymi.

Organizacja

Zakłada się, że Z.E. Gliwice będzie pełnić centralną rolę w zarządzaniu i administrowaniu pilotowym programem DSM, zarówno w fazie jego przygotowania, jak i wdrażania. Innymi kluczowymi uczestnikami byłyby: fachowa międzynarodowa firma konsultingowa specjalizująca się w DSM, która wspierałaby Z.E. Gliwice, wykonawcy i konsultanci realizujący wdrażanie programu (około sześciu lub więcej osób, przedsiębiorstw i firm usługowych energetyki specjalizujących się w analizach zużycia energii, analizach technicznych, pomiarach zużycia finalnego i instalacji urządzeń) oraz komitet doradczy składający się z zaproszonych przedstawicieli PSE S.A., FEWE, Instytutu Energetyki i innych zainteresowanych agencji i stron, takich jak dostawcy urządzeń, firmy inżynieryjne, stowarzyszenia gospodarcze i zawodowe, wydziały wyższych uczelni i grupy non-profit. Wzajemne związki między tymi uczestnikami są przedstawione schematycznie w Rozdziale 7.

Harmonogram

W Rozdziale 7 nakreślono oczekiwany harmonogram działań w okresie 18 miesięcy przewidzianych na program pilotowy. Harmonogram ten jest ambitny lecz osiągalny, jeśli tylko Z.E. Gliwice i międzynarodowa firma konsultingowa będą ściśle koordynować działania od samego początku programu. Szczególnie pierwszy miesiąc lub dwa będą mieć kluczowe znaczenie dla zapewnienia, by nie było niepotrzebnych opóźnień w analizie zużycia energii, nabywaniu urządzeń i pracach terenowych w dalszej części programu pilotowego.

Finansowanie i budżet

W Rozdziale 7 podsumowano szacunkowy budżet programu pilotowego podając zakresy kosztów (5,8 do 8,3 miliona USD) dla każdego z 14 rodzajów zadań. W rozdziale tym przedstawione są także role poszczególnych stron biorących udział w programie pilotowym, od roli wiodącej, przez wspierającą do doradczej. Schemat S-1 ilustruje szacunkowy budżet w rozbiciu na zadania, z jednoczesnym wskazaniem stron odpowiedzialnych za wdrożenie poszczególnych zadań.

Choć szacunki te są dość wstępne, to odzwierciedlają one jednak ogólną wielkość kosztów uważanych za potrzebne dla realizacji każdego z zadań. Koszty zakupu urządzeń zostały podane dla programu pilotowego obejmującego 30-50 uczestników, których wielkość będzie mieścić się w zakresie od 0,5 do 2,5 MW, i których przeciętne oczekiwane oszczędności będą wynosić od 4 do 8 procent obecnego zużycia energii elektrycznej.

W sumie program pilotowy dążyłby do objęcia 2-4 procent dostępnego potencjału oszczędności w zakresie przemysłowego DSM przedstawionego w Części 1 niniejszego raportu. Szacunkowe nakłady kapitałowe w przybliżeniu odpowiadają wartości bieżącej netto grupy środków, których uśredniony koszt z całego okresu ich żywotności wynosiłby około 2,5 centa na zaoszczędzoną kilowatogodzinę na rok, i które w sumie osiągnęśyby docelowe 2-4 procent dostępnego potencjału. Takie podejście szacunku pośredniego jest wymuszone brakiem możliwości precyzyjnego określenia z góry jakie środki zostaną zainstalowane.

Ważne jest, by w podsumowaniu budżetu określić źródła finansowania wydatków kapitałowych. Tak jak to zostało wskazane, oczekuje się, że jeden z międzynarodowych banków rozwoju udostępni fundusze na znaczną część inwestycji kapitałowych przeznaczonych w pierwszej fazie programu na zakup i zamontowanie urządzeń dla programu pilotowego. Inne możliwe źródła finansowania szkolenia, pomocy technicznej i innych kosztów niekapitałowych to Rząd Polski, PSE S.A. i dwustronne agencje rozwoju, jak np. USAID.

Monitorowanie realizacji programu, zarządzanie finansowe i kontrola danych

Zaleca się, by Z.E. Gliwice zainstalował komputerowy system na bazie komputerów osobistych ułatwiający zarówno zarządzanie finansowe, jak i kontrolę danych oraz wprowadzający monitorowanie czynności w terenie i kierowanie zadaniami prawie w czasie rzeczywistym.

Ponadto, informacje zawarte w systemie będą przydatne do oszacowania oszczędności i przeprowadzenia analizy wariancyjnej oczekiwanego i rzeczywistego przebiegu procesu. Taka możliwość pełniłaby rolę "wczesnego ostrzegania" o ewentualnej konieczności wprowadzenia korekt w celu zapobieżenia zejściu programu pilotowego z wyznaczonych torów w przypadku pojawienia się problemów.

Schemat S-1
Podsumowanie szacunkowego budżetu

Zadanie	Granice kosztów (tys. USD)		Odpowiedzialna strona(y)		
	Dolna	Górna	Przewodzi	Pomaga	Doradza
1	25	35	G	D	C
2	10	15	G	D	-
3	15	25	G	D	C
4	5	10	G	D	-
5	10	15	G	D	-
6	275	350	I	G	D
7	75	125	G	D	-
8	20	25	D	G	C
9	4.800	6.930	I	G	D
10	325	450	I	G	D
11	60	90	I	G	D
12	75	100	D	G	C
13	25	40	D	G	C
14	35	50	D	G	C
RAZEM	**5.755**	**8.260**			

Klucz do zadań

1. Uruchomienie administracyjne
2. Segmentacja rynku oraz pozyskiwanie i kwalifikowanie ewentualnych uczestników
3. Ogłoszenie programu pilotowego, rozsyłanie informacji i wizyty
4. Zaproszenie do składania ofert na wykonanie
5. Przegląd ofert i wybór wykonawcy
6. Analizy zużycia energii elektrycznej i analizy techniczne
7. Propozycje techniczne i finansowe
8. Przygotowanie systemu monitorowania realizacji programu, specyfikacja montażu i protokoły kontroli jakości
9. Zakup urządzeń
10. Montaż urządzeń i prace na miejscu
11. Pomiary i monitorowanie zużycia finalnego przed i po zamontowaniu urządzeń
12. Ocena wpływu programu
13. Ocena procesu i rynku
14. Analiza opcji i potencjału w programie na pełną skalę

Klucz do odpowiedzialnych stron

C = Komitet doradczy (PSE S.A., FEWE, IE, inne zainteresowane strony)
D = Międzynarodowy konsultant DSM
G = Z.E. Gliwice
I = wykonawcy wdrażający program

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CHAPTER 1: INTRODUCTION

This report presents the results of work sponsored by the Bureau for Europe of the United States Agency for International Development (USAID). Through a bilateral program, USAID has been providing assistance to the Government of Poland (GOP) under the Eastern Europe Regional Energy Efficiency Project. One of the project's tasks included the design of a demand-side management (DSM) pilot project in Poland, which is the topic of this part of the report.

Part 1 of this report presents a definition and description of demand-side management and the results of a national assessment of the potential for DSM in Poland. A number of electric end-use efficiency measures were screened for cost-effectiveness and then combined into candidate DSM programs. These programs were defined to realistically develop the achievable DSM resource at the national level in Poland over the short-term (six years). This assessment was done to be consistent with the appraisal of multilateral development bank credits that may become available to Poland in that time frame for power sector investments. Part 1 also identifies some of the regulatory and institutional policy issues that need to be addressed in Poland to establish an integrated resource planning (IRP) framework conducive to the implementation of DSM. The basic concepts of IRP are defined and described.

While the identification of demand-side resources and the implementation of a regulatory framework form a necessary foundation for the subsequent development of DSM, further information on customer response to DSM, training of Polish utility staff, and technical proof of concept are all required if widespread implementation is to take place. The impacts of DSM programs are difficult to assess prior to implementation because of the many factors that influence program effectiveness. A pilot DSM project can accomplish these objectives while providing 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.

One purpose of the DSM assessment was to identify sectors and end-uses where pilot projects would be most appropriate in Poland. The industrial sector was identified in Part 1 as offering both the greatest achievable savings potential as well as the most cost-effective programs. Therefore, the industrial sector was determined to be the primary candidate for a DSM pilot project. This part of the report presents the design of such a pilot industrial DSM project suitable for financial support from multilateral development banks.

The DSM pilot project design task was undertaken in work with Zaklad Energetyczny Gliwice (Z.E. Gliwice), the largest electric distribution company in Poland, serving 15 percent of the country's load. It is located in the industrial heartland of Upper Silesia in southern Poland.

The primary objective of this task was to design a pilot industrial DSM project for Z.E. Gliwice that would include incentives to ensure participation by utility customers, a marketing approach to solicit such participation, and an evaluation plan. Alternative delivery mechanisms were explored through focus groups with the utility, its customers, and vendors of DSM products and services that would participate in project implementation.

A secondary objective was to help develop capabilities at Z.E. Gliwice to understand how its customers use electricity, a critical component in DSM program design and evaluation. An end-use load research element was designed as part of the DSM pilot project to include an analytical framework and load monitoring plan. To support the design of the load research element, spot monitoring of Z.E. Gliwice's customers' facilities was conducted during the project using end-use power monitors.

Chapter 2 of this part of the report begins by presenting some North American experience with industrial DSM programs. Seven of the most successful programs in the United States and Canada are described. Common traits that contributed to program success are identified. The chapter concludes with a summary of recommended steps that may be appropriate for the implementation of a pilot industrial DSM project in Poland, drawing on the lessons learned from North America.

Chapter 3 presents the concept of a pilot project. The general objectives that a pilot seeks to accomplish are described. The rationale for the specific pilot project recommended for implementation by Z.E. Gliwice is then presented. This rationale is responsive to the barriers, risks and uncertainties that currently confront the Polish economy and utility sector.

Chapter 4 summarizes the results of the DSM assessment of Part 1 of this report, focusing exclusively on the industrial sector. The characteristics of electricity consumption in Poland's industrial sector are presented. The costs and savings of candidate DSM measures are presented as well as the results of the screening of those measures for cost-effectiveness, resulting in a DSM supply curve for the industrial sector. The measures are then aggregated into generic industrial DSM programs that serve as the basis for the industrial DSM pilot project presented here.

Chapter 5 presents the specifications for the DSM pilot project. These include the project content and features, the role of financial incentives, a marketing strategy, concurrent market research activities, field delivery and implementation, verification and impact evaluation, and cost recovery and regulatory incentives.

Chapter 6 presents the end-use load research element of the DSM pilot project, starting with a discussion of the purpose and goal of utility load research. The spot monitoring work conducted for this project is described, including a presentation of some of the interesting results from the end-use monitoring of six sites during the project. The methodology, sampling plan, equipment configuration, and data collection and analysis protocols for the end-use load research element of the pilot project are defined.

Chapter 7 concludes with a summary of the practical issues associated with the implementation of the DSM pilot project. The prospective participants are described, as are possible sources of funding. An illustrative budget and schedule for the implementation of the pilot project are also provided.

The proposed project is a pilot, as much an experimental tool as a serious effort to acquire DSM resources. It is experimental in that it would test methods for marketing, interacting with customers, providing financial incentives, organizing personnel, managing information flows and record keeping, and acquiring cost-effective electric resources at Z.E. Gliwice. The information gathered during DSM pilot project implementation would be extremely valuable, for it could be used to help design the full-scale implementation of the DSM program in which larger amounts of resources would be committed. It could also be valuable as the first implementation of a utility DSM effort offering financial incentives in Poland, and one of the first in all Europe.

CHAPTER 2: NORTH AMERICAN EXPERIENCE WITH INDUSTRIAL DSM PROGRAMS

The American Council for an Energy-Efficient Economy recently analyzed North American experience to date with industrial demand-side management (DSM). The Council conducted a survey of utilities and prepared a database of industrial DSM programs. More than eighty utilities and third-party organizations were interviewed. The study focused on incentive-based industrial DSM programs, such as that being proposed in this pilot program, and excluded load management-only and information-only programs (including technical assistance programs).

The primary measures of program success adopted for the study were high participation rates and/or high electricity savings as a percent of 1989 industrial electricity sales, at levelized costs below the avoided costs of most utilities.

There are a number of important caveats associated with the data. Perhaps most important, there is much variation in the quality of the industrial program data and the methods different utilities use to track data. Additionally, for about one-third of the programs analyzed, the energy savings results are highly approximate because, for many of the joint commercial and industrial (C&I) programs, a formal delineation of industrial versus commercial savings has not been performed. Other key issues include the fact that the number of participants, free riders, indirect costs, and customer costs are frequently not tracked.

The study resulted in the compilation of a database on 31 incentive-based, energy-saving industrial DSM programs offered by 17 utilities. The average industrial program for which quantitative results were available (based on average database values and excluding remote outliers) has been offered for four years, has annually saved 0.2 percent of a utility's industrial 1989 electricity sales, has a 4 percent participation rate, and has a levelized utility cost of US $0.019/kWh saved.

A total of 12 "successful" programs were identified in the database. These programs met one or more of the following four criteria and cost the utility no more than $0.045/kWh saved: 1) annual participation rate of at least 8 percent, 2) annual savings as a percent of 1989 industrial sales of at least 0.5 percent, 3) cumulative participation rate of at least 12 percent, and/or 4) cumulative savings as a percent of industrial sales of at least 0.7 percent. The average annual savings as a percent of 1989 industrial sales for these "successful" programs are 1.1 percent, the average annual participation rate is 9 percent, and the levelized

utility cost is $0.014/kWh saved. The successful programs have therefore achieved roughly six times the savings and two times the participation of the average program in the database, at lower cost.

2.1 EXAMPLES OF "SUCCESSFUL" PROGRAMS

Bonneville Power Administration's Aluminum Smelter Conservation/Modernization Program

Bonneville Power Administration (BPA), a federal wholesaler of electricity in the northwest United States, has been administering its Aluminum Smelter Conservation/ Modernization (Con/Mod) Program since 1987. The original purpose of this program was to retain load through improving the energy efficiency of the aluminum smelters in the region. The ten primary smelters in BPA's service territory purchase approximately one-third of BPA's power, or roughly 15 percent of the total electricity used in the region (sold by BPA and other utilities).

The program was introduced at a time when BPA had an electricity surplus and when the aluminum industry was just emerging from one of the longest economic slumps in recent history. Two plants had closed in the region, and there was the threat of more closures in the near future. The most vulnerable plants were of World War II vintage. Aluminum production is highly electricity-intensive; electricity purchases are responsible for approximately 25 percent of this industry's production costs. The short-term objective of the Con/Mod Program was designed to encourage the region's ten primary aluminum smelters to make additional investments in plant modernization so that they could become economically viable in the highly competitive world aluminum market. The long-term objective of the program from BPA's perspective was to purchase low-cost power from the smelters through efficiency improvements.

All of the primary aluminum smelters participated in the planning and design of the program. Initial measurements of the baseline efficiency of the smelters, in kWh per pound of aluminum produced, were made in 1987. Since then, the smelters have reported their electricity use per pound to BPA on a quarterly basis. The incentive payment to the smelters is linked to improvements in this baseline efficiency and equals $0.005/kWh (1987$) saved over a ten-year period, or roughly one-third of the costs of efficiency improvements. Although the deadline for completing the modernization projects was mid-1991, BPA will continue making incentive payments to the smelters over the life of the measures. The customers are under no obligation to explain to the utility how they reduce their electricity

consumption due to proprietary concerns. According to utility staff, as a result of this stipulation and the fact that many of the smelters need to make some of the improvements in order to survive, the financial incentive offered to the customer is fairly small.

Since the start of the program, Con/Mod has achieved electricity savings of 4.1 percent of total industrial sales[1] and a 100 percent participation rate. Although BPA has not estimated the free-ridership of this program, its staff notes that some of the measures would have been installed regardless of the program due to the smelters' need to remain competitive and electricity's high contribution to total aluminum production costs. The levelized cost to the utility has been $0.006/kWh saved. According to the utility, the low cost of the program is partly due to the minimal administrative requirements of the program, since the smelters do not allow utility staff to enter their facilities. The smelters keep all the recorded data and report results to BPA.

BPA suspects that some smelters have made "real" energy savings as a result of the program, and others have made less genuine savings, meaning that the methods for reducing the kWh usage per unit of aluminum produced were not necessarily due to pure energy-efficiency improvements, but rather to more questionable methods. For example, the amount of savings achieved in the smelter projects depended on the assumed baseline efficiency, which was negotiated jointly by BPA and the smelters.

Since the program was initiated during an economic slump in the U.S. aluminum industry, the efficiency of many of the smelters was lower than normal when baseline efficiencies were calculated, according to utility staff. Soon after the program began, the industry began to recover as aluminum prices escalated. Smelters resumed their "normal" operations, the efficiencies of the plants improved, and BPA has reason to believe that the resulting reductions in kWh per pound of aluminum were claimed as savings under the Con/Mod Program. Although BPA notes that this suspicion cannot been proven, staff noted that the utility has seen only 50 percent of the savings "paid for" through this program, and increases in aluminum production do not fully account for the discrepancy. "Real" energy savings generally came from installing process control measures and measures controlling the magnetic field of the pot within which aluminum is produced.

The program has been deemed successful by the utility, although there has been some concern about free riders and the fact that in late 1990 one of the ten smelters shut down.

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[1] Industrial electricity sales included in these calculations are both sales directly from BPA to the smelters and sales made by BPA's utility customers to their respective industrial customers.

No official impact evaluation of the program has been performed because the aluminum smelters will not allow BPA into their facilities.

BPA's Energy Savings Plan

BPA's Energy Savings Plan (ESP) was initiated in early 1988 as a custom pilot program to promote energy efficiency in industries. According to utility staff, for the first 18 months of the program, participation was disappointing. As a result, when BPA redesigned the program to a full-scale version in mid-1990, it decentralized the program and altered the marketing techniques. Whereas the earlier version of ESP was designed and administered only by BPA, the revised program gives administering control to the utilities who distribute BPA's power in order to reduce the paperwork and increase the flexibility of the program. The new version brings together vendors, contractors, utility customers, industrial customers, and others to help plan, design, and participate in the on-going evaluation of the new program structure. As part of this evaluation, these parties contribute to the annual modification of a list of flexible "program principles" that the administering utilities use as the basis for designing their own version of ESP. BPA staff noted that flexible program principles were chosen over program rules in order to give the individual utilities the ability to design the program around the needs of their particular industrial customers. The on-going revision of the principles allows BPA to incorporate lessons learned and changing conditions into the program design in a timely manner.

The utilities administering the program generally negotiate incentives with industrial participants based on the individual customer's needs; other benefits, such as changes in labor requirements and/or non-electric savings, are taken into account. On average, however, the customer receives -- upon completion of a project -- $0.15/kWh saved in the first year or 80 percent of the project costs, whichever is smaller. It was noted that as long as a project's payback can be reduced to less than three years, most industrial firms are interested in participating. Because, as with most industrial DSM programs, the customer receives a financial incentive *after* installing a project, the largest barrier to participation is the difficulty industrial firms face when trying to locate the capital for initially financing a project.

Increased emphasis has been placed on equipment vendors since the re-design of ESP in mid-1990. Utility marketing staff attend trade shows and offer vendor seminars in order to educate vendors on how ESP works and on effective methods for marketing their products by marketing the ESP. Vendors have since played a central role in "selling" the program to

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industrial customers, and BPA staff cite this as largely contributing to the increased success of the program in attracting participants and savings.

The past 1½ years of the program have seen a four-fold increase in the number of participants compared to the first 1½ years. If industrial electricity sales to primary aluminum smelters are excluded (since they are not eligible for the program and account for 95 percent of BPA electricity sales to industrial customers), the 1991 savings as a percent of industrial sales were 2.2 percent. The 1991 participation rate was 4 percent. Cumulative savings as a percent of sales are 5.5 percent and the cumulative participation rate is 12 percent. ESP's low levelized utility cost of $0.005/kWh saved indicates its cost-effectiveness.

Boston Edison's Energy Efficiency Partnership Program

The Energy Efficiency Partnership Program, offered by Boston Edison since 1990, provides commercial and industrial customers incentives to install energy-efficient measures in new and existing facilities. Incentives for customers constructing new facilities, or extensively renovating existing facilities, cover the incremental cost of efficient equipment. Incentives for retrofit measures generally buy down the payback period to one year, with the typical incentive covering approximately 80 percent of an industrial project's total costs. The retrofit incentives are received by the participant in quarterly payments over a two-year period, contingent upon the verification of savings through end-use metering of a sample of installations within a facility.

If a participant wishes to receive an energy audit, two choices are available: either the customer can receive a free "mini" audit which covers lighting and motor systems, or the customer can receive a more comprehensive audit which the customer pays for up-front. The participant will be reimbursed a portion or all of the comprehensive audit costs depending on the percentage of recommendations that are adopted.

According to the utility, few new construction projects have been completed. Little direct marketing of the program has been done; the program is marketed via word-of-mouth. The utility generally tells industrial customers interested in the retrofit portion of the program that by participating in the program, their electricity bill can be reduced by 20 percent on average.

The program has seen an annual participation rate of 7 percent and cumulative savings as a percent of sales of 0.7 percent (cumulative participation and annual savings were not

available). The estimated levelized program cost is $0.035/kWh. One industry expert who has followed the Energy Efficiency Partnership noted that the program has been successful in acquiring process-related savings. Participation has been somewhat hindered by the fact that customers must finance the retrofits themselves; payments from the utility are received slowly over time and are given only if certain levels of savings are achieved. In an attempt to address these concerns, the utility is currently re-designing the way incentives are paid.

British Columbia Hydro's Power Smart: Efficient Compressed Air Systems Program

British Columbia Hydro (BC Hydro) has estimated that up to 50 percent of the energy used in an industrial compressed air system can be lost through leaks. These losses are particularly great in pulp and paper mills, whose facilities often occupy acres of land and have an extensive network of distribution piping. In its Efficient Compressed Air Systems Program, BC Hydro performs free leak tests on the compressed air systems of its industrial customers, targeting pulp and paper customers. The test identifies the general location of leaks, estimates how much they are costing the customer, and suggests a leak reduction target (generally down to 15 percent leakage of air volume). Either the customer repairs its own leaks (generally at very low cost) and the utility performs a follow-up leakage test three to six months later, or -- if the customer agrees to do quarterly leak testing for 2½ years -- the customer and the utility split the cost of leak testing equipment. If the leak reduction targets are being met, the utility will refund the customer's payment for the leak testing unit.

The program reached 27 percent of the eligible customers in 1991 alone and 60 percent since the program's inception 2½ years ago. Electricity savings as a percent of industrial sales were 0.07 percent in 1991 and 0.15 percent cumulatively. The levelized utility cost is $0.005/kWh saved. Some of the reasons for the program's success in recruiting participants were noted by the program manager: 1) the utility set an internal mandate to achieve 100 percent participation over a three-year time span, 2) an extensive marketing effort was made, including seminars and computer software packages, and 3) little time and effort are required by the customer to participate in the program.

Central Maine Power's (CMP) Power Partners Program

CMP's Power Partners Program is an all-source bidding program in which C&I customers or energy service companies (ESCOs) submit energy management project bids in response to RFPs issued by the utility for specific blocks of power. The applicants propose a payment level for a projected amount of electricity savings. Although bids have not been solicited for

almost three years due to adequate power availability, savings from existing projects are still coming in, including savings from industrial projects. Measures often installed in the industrial projects include process-related improvements and lighting retrofits. Incentive payments are made over the lifetime of the measures, with the sum of the payments made over the years generally covering more than 100 percent of the initial project costs. To date, ESCOs have generally managed the industrial projects in the program.

As of early 1992, the industrial projects within this bidding program have saved the equivalent of 1.2 percent of CMP's industrial electricity sales. Approximately 7 percent of CMP's industrial customers are involved in the Power Partners Program. The levelized utility cost is $0.030/kWh saved. This cost takes into account all savings and costs accrued through 1991, and does not include future savings and costs since these were not available from the utility (projects typically receive payments for 15 years). Thus, the program is a cost-effective resource for CMP, even though the utility payment may be large compared to the initial cost of the efficiency projects. The utility monitors all projects within this program to determine if the savings are persisting over time. CMP staff noted the program's flexibility as a key component contributing to its success. No estimates of the free ridership for this program have been made.

Puget Power's Industrial Conservation Incentive Program

Puget Power, located in Washington State, has administered its Industrial Conservation Incentive Program since 1981. Utility staff work with program participants and consultants to perform analyses of entire industrial systems, identify where the electricity savings and greatest overall customer benefits lie, oversee project bidding, assist in project design, and perform savings verification tests. Seminars on commonly-applied measures, such as adjustable-speed drives (ASDs) or compressed air-related measures, are available to customers. Energy audits are performed by utility staff as well as consultants chosen by either the utility or the customer. Three- to five-year plans are developed with participants to coordinate which measures will be installed and when. Initially, although the program was open to all industrial customers, Puget targeted its marketing toward the 100 largest industrial customers. In the last few years they have begun to market to small- and medium-sized customers as well. The customer incentive usually covers approximately 75 percent of materials and installation costs of a project. Puget staff noted that due to the intensive labor requirements of this program, the availability of staff to broadly market the program is limited. The program is marketed simply by word-of-mouth.

The utility divides the measures performed into three categories: process, HVAC, and lighting. According to the program manager, 80 percent of the measures performed are in the process category, which includes pumping, motor/ASD, compressed air, and refrigeration-related measures as well as other site-specific measures. Of these, pumping, motor/ASD, and compressed air-related measures are the most commonly installed process measures.

The utility performs savings verification on every project one year after project completion, including metering and monitoring installed equipment. In addition, for some of the projects, the utility will return to the facility in later years to see if the equipment is still on-line. Although the utility has not yet formally estimated the number of free riders in the program, a preliminary draft evaluation by a consultant indicates that approximately 10 to 20 percent of the program's participants may be free riders.

The program achieved a participation rate of 1 percent in 1991 and 5 percent cumulatively. According to the utility, low electric rates reduced the participation in the earlier years. The electricity savings as a percent of industrial sales were 0.7 percent in 1991 and 2.0 percent since the beginning of the program. The savings have increased by a factor of four over the past three years. For 1992 and beyond, the utility has a goal of saving 1 percent of industrial sales annually through this program. The levelized utility cost in 1991 was $0.026/kWh saved.

The utility attributes the program's success to a number of factors, including the following: 1) the program is part of a package of energy services, and is marketed as such (industrial customers generally do not want to be part of a *program*, according to the utility, but would rather receive *energy services*), 2) contractors involved in the projects generally have extensive technical expertise in the participating industries, and 3) the audits and recommendations target process-related improvements.

Wisconsin Electric's Smart Money for Business Program

Wisconsin Electric's (WEPCo) C&I Smart Money for Business Program is a combination custom and prescriptive program offering commercial and industrial customers zero-to-low interest loans or cash rebates for installing qualifying energy-efficient measures. Special incentives are also provided to encourage energy-efficient design and new construction. Prescriptive rebates are available for lighting, HVAC, energy management controls, and refrigeration measures. Custom incentives are available for motor and process-related improvements and are negotiated with the customer on a case-by-case basis (even prescriptive

rebates are sometimes negotiated). According to the program manager, this keeps program costs down since the lowest required incentive is generally offered. Between 20-50 percent of a custom project's total costs are typically covered by the incentive. If a project requires a feasibility study, WEPCo will pay up to 50 percent of the costs of a comprehensive audit.

After administering the program for over three years and studying the managerial structure of its industrial customers, WEPCo refined its marketing approach to reflect what had been learned. A two-pronged strategy is now taken: utility engineers communicate with and market the program to process-level plant personnel, such as plant engineers and maintenance operators. Simultaneously, utility account executives interact with and market the program to industrial vice presidents. Generally, smaller projects can be handled by the process-level employees, whereas larger projects must be dealt with at a senior management level.

Over the past five years, almost half of all WEPCo's industrial customers have received rebates or loans through the Smart Money Program. The majority of participants have focused on prescriptive measures, with approximately 70-80 percent of rebates being prescriptive. More than half of the industrial energy savings have been due to lighting measures, while process-oriented measures are responsible for approximately 30 percent of the savings. The program manager noted that it has taken time to gain the trust of the industrial customers with regard to DSM, especially in moving from lighting and HVAC measures to process measures. According to the utility, industrial customers have shown great concern and caution in altering their processes.

The industrial portion of Smart Money for Business experienced a 12 percent participation rate in 1991 and a 49 percent participation rate since the start of the program. Electricity savings as a percent of industrial electricity sales were 0.4 percent for projects installed in 1991, and 2.5 percent for projects implemented since the program began. The levelized utility cost is $0.021/kWh saved. The program manager noted that the program's success in recruiting a large proportion of the eligible industrial customer base and acquiring significant savings as a percent of sales is primarily due to the utility's focus on understanding the customer's perspective, making personal one-on-one customer contact, utilizing effective marketing techniques, simplifying the program while still offering a comprehensive package, and securing the technical expertise necessary to do a good job.

The program manager noted that the utility is experimenting with a new component to the program: the utility will arrange contract agreements between customers and ESCOs with technical expertise in particular industries. The utility will assist in an initial audit, but beyond this, the utility will primarily act as a facilitator. The ESCOs will guarantee the savings to the customer and sell the savings back to the utility.

2.2 SUCCESSFUL PROGRAMS: COMMON TRAITS

There are several traits that appear among the relatively successful programs (programs with above-average participation and savings). Outlined below are some of the primary features that appear to distinguish more successful programs from less successful programs.

Addressing Customer Concerns

Addressing customer concerns is particularly important when it comes to industrial firms. To date, industries have been skeptical about the quality and intent of utility DSM programs. A survey conducted in 1991 by the Washington State Energy Office concluded that industries do not generally perceive utilities and government as credible sources of information. This is primarily due to insufficient attention on the part of utilities to the perspective and priorities of industrial customers.

Issues of concern for industries include power quality and reliability, waste minimization and disposal, environmental regulations, and competitiveness. In order to operate successful industrial energy-efficiency programs, it is essential for utilities to understand the relationship of these factors with industrial process energy flows and to design and market programs with such links in mind.

In particular, productivity and environmental concerns are more important to industries than are energy costs. Not only must industrial firms remain competitive in order to survive, they must also comply with a growing number of environmental and health regulations. In addition, many industries want to be viewed as "green." Capital budgeting cycles of industrial firms often reflect these concerns; according to one industrial manager, the first capital expenditures for large industrial firms in the U.S. are generally related to Occupational Safety and Health Administration and environmental regulations, and the second expenditures are usually for new or improved product development. Various utilities with at least five years of industrial DSM experience behind them, such as BC Hydro, Puget Power, and Wisconsin Electric, indicated that they have had to "prove their value to the industrial customer" and that it has been important for them to find ways to increase the productivity and/or reduce the environmental impact of a customer's facility while also reducing energy consumption.

Whereas industrial plant managers may be keen about the idea of improving the efficiency of non-process systems (such as lighting and space heating and cooling), they may be unwilling to change their process due to the perceived high technical and financial risk associated with

process changes. Putting such a risk in the hands of a utility company is often considered an unwise decision.

As a result, a number of utilities, such as United Illuminating, Wisconsin Electric, and Wisconsin Power and Light, allow the industrial participant the option of either performing the energy-efficiency analyses and retrofits themselves, choosing their own vendor and/or engineering contractors to help design and install energy-efficiency measures, or using engineering contractors chosen by the utility for their expertise in particular industries and processes. Wisconsin Power & Light, after administering its C&I Bright Ideas for Business custom program for three years, recently began hiring consultants with specific industrial process experience to perform the detailed industrial energy analyses. According to the utility, hiring the average DSM consultant to assist in detailed industrial process energy audits has not been effective, from either a technical or a marketing standpoint.

Since "time is money" for an industrial customer, an industrial conservation program must be user-friendly to be widely acceptable to a diverse industrial base; it needs to be well-administered and minimize the paperwork, bureaucracy, and customer time requirements often associated with utility programs. One drawback associated with many custom measure programs, as they are currently administered, is the long wait between initial customer enrollment in the program and actual receipt of an incentive payment.

A few industrial DSM program managers noted that it is worthwhile for utilities to follow large industrial customers' capital budgeting cycles closely. The utility should present the program to the customer well in advance of the start of a new cycle (i.e., offer a free audit and indicate the energy-saving opportunities) in order to increase the likelihood for implementation. Planning a marketing approach around the customer's capital appropriations can also shorten the length of time between initial customer contact and final measure implementation. Industries have a limited attention span; if the bureaucratic process drags on too long, their attention tends to shift away from the program and its merits and back to more urgent concerns within their facilities.

Marketing Techniques

The marketing techniques employed by the utility can make the crucial difference between an industrial program's success and failure. Industrial programs cannot be run out of an office. Bill stuffers and other direct mail alone will rarely succeed in marketing a conservation program to the appropriate people in a large industrial facility. The utility needs to make continual personal contact with the customer and target the marketing efforts to the

customer's appropriate decision makers. One utility program manager indicated that utilities often will market their programs through utility staff who have had no previous contact with the industrial customer, whereas elsewhere in the utility -- most likely in the customer relations department -- close relationships have developed over years of interaction. It is worthwhile to utilize existing contacts with industrial customers so that utility staff do not waste time competing with equipment vendors and other salespersons for the attention of the industrial firm.

Some utilities, such as BPA, BC Hydro, and Niagara Mohawk, have focused on trade allies (e.g., motor and ASD manufacturers) for marketing a program. BC Hydro, for example, provides an incentive to equipment vendors equal to 20 percent of the customer rebate. Marketing a program through the use of trade allies not only reduces the administrative costs for the utility, but can also reduce the participant paperwork required. As a program administrator at BC Hydro noted, trade allies and manufacturers can indirectly act as utility marketing staff and thus reduce the utility manpower required to market a program.

Program Flexibility

Generally, the more program flexibility the utility offers to the industrial customer, the more successful the utility has been in recruiting participants. A custom program is inherently more flexible than a prescriptive program and is therefore generally attractive to industrial customers. However, even custom programs can be too rigid for industrial customers, as was demonstrated in the earlier version of BPA's Energy Savings Plan. The failure of the program to recruit participants was partly due to the concrete, restrictive deadlines for submitting project proposals, which had no relationship to the capital budgeting cycles of industrial facilities.

Ultimately, both custom and prescriptive programs can play important roles in securing industrial energy-efficiency improvements. If the two types of programs are offered in conjunction with each other, more customers will most likely be reached and greater savings achieved than if only one type of program is offered. By offering prescriptive rebates for particular measures, utilities can achieve high participation rates and get a large number of customers accustomed to working with the utility. Several utilities have found that success with prescriptive rebates (financial incentives provided for specific DSM technologies) increases customer receptivity to custom rebates for process-related measures.

Financial Incentives

Customer financial incentives are offered by all the programs in the database. A few programs offer the option of low-to-no-interest loans instead of or in addition to a cash rebate. Generally, the programs offering larger financial incentives have above-average participation and savings, such as Commonwealth Electric's Custom Rebate Program. In addition, a few utilities offering relatively successful industrial conservation programs have noted that vendor incentives can streamline and improve the effectiveness of program marketing.

However, as the program manager of BC Hydro's Bonus Partners Program noted, high incentives do not guarantee program success and neither are they always needed. Tailoring a comprehensive range of energy-related services (including DSM) to the needs of the industrial customer may mean that an incentive equaling, for example, 20-50 percent of a project's total cost may be sufficient, rather than 80 percent of a project's total cost.

Program Analysis and Evaluation

Two-thirds of the utilities offering the successful programs in the database have performed extensive market research of their industrial customer base and/or have performed impact and process evaluations. For example, Wisconsin Electric altered its industrial marketing strategy for the Smart Money Program after studying the managerial structure of its industrial customers for over three years. BPA, BC Hydro, Puget Power, Wisconsin Electric, and Wisconsin Power and Light -- all utilities offering successful programs -- have performed process and/or impact evaluations of their programs. These activities provide utilities with a wealth of information on how to improve the design of their programs and thereby increase participation and savings.

2.3 STEPS TO ADVANCE INDUSTRIAL DSM

There are a number of important steps that should be taken by North American utilities to improve the field of industrial DSM. These recommendations are also appropriate for new industrial DSM programs in Poland. They include the following:

1. Utilities should improve industrial DSM program design by addressing customer concerns, improving marketing techniques, focusing on program flexibility, and offering financial incentives.

2. Utilities should improve data tracking methods and program evaluation techniques.

3. There should be improved information exchange among utilities through industrial DSM workshops and an industrial DSM conference.

4. Contiguous electric utilities should coordinate industrial DSM efforts to reduce customer and vendor confusion, and electric and gas utilities should coordinate joint industrial energy audits.

5. Utilities should establish better links with industries by attending industrial energy conferences and coordinating with industrial trade associations and state industrial efficiency programs.

6. Utility industrial DSM staff should receive education and training on industrial process materials and energy flows, the budgeting cycles of different industries, the general perspective of the industrial customer, and the links between improved energy efficiency and increased productivity and reduced environmental emissions.

7. The quality and quantity of data on industrial energy use patterns should be improved.

8. State-of-the-art energy-efficient industrial technologies should be demonstrated and monitored more widely.

CHAPTER 3: CONCEPT OF A PILOT PROJECT

A pilot project provides the opportunity to test a new concept on a small scale. This approach controls for much of the technical and economic risk and uncertainty usually associated with undertaking any new enterprise. Demand-side management as a utility program activity is certainly a new concept in Poland and should therefore be amenable to the test of proof-of-concept that a pilot project provides. In this chapter, the basic objectives of the proposed pilot project are described. The rationale for the specific approach recommended for implementation by Z.E. Gliwice is then presented. This rationale reflects the lessons learned from North American experience with industrial DSM programs presented in Chapter 2 and also adapts to the difficult circumstances that currently confront the Polish economy and utility sector. The chapter concludes with a discussion of these barriers, risks, and uncertainties in Poland.

3.1 OBJECTIVES OF PROPOSED PILOT PROJECT

Specifically, the pilot project will seek to:

- Demonstrate the feasibility of several energy and capacity saving technologies in Poland of *programmatic DSM* as it is now widely practiced elsewhere throughout North America. The pilot is *not* intended as a technology demonstration, although the technical and economic feasibility of certain technologies will be confirmed.

- Provide a better understanding of electricity end-use in the industrial sector and produce (through audits and energy analyses) equipment inventories, process flow characterizations, and a base of market research information. These activities will have continuing value well beyond the life of the pilot and will serve as the foundation for an ongoing program of systematic industrial load and market research.

- Help define and test the current capabilities of manufacturers, distributors, vendors, equipment specifiers, and architect-engineer specialists to support DSM on an expanded scale. Further, the pilot will provide technical support and funding to expand existing capability, develop new expertise, and build bridges to U.S. and other foreign purveyors of DSM technology by establishing formal affiliate relationships with Polish enterprises.

- Demonstrate the capability of a Polish utility to deliver and manage a DSM program, including program marketing, project management, information flows and records keeping, project evaluation, and program evaluation.

- Test numerous program design features and encourage experimentation to help guide the design of a full-scale program. The design features to be tested include marketing approaches, financial incentive arrangements, savings verification procedures, technologies and technology packages selected for assistance, and program procedures.

- Give new insights into how Polish industrial decision-makers evaluate investments in energy efficiency vis-a-vis alterative uses of capital, and the influence of size, market position, growth prospects, private versus public ownership, and other factors on investment criteria, expectations and the quantification of risk-reward.

- Allow Z.E. Gliwice to work with its industrial customers and other prominent institutions and organizations such as the Polish Power Grid Company, the Polish Academy of Sciences, the Polish Foundation for Energy Efficiency, and the Ministry of Industry and Trade to catalyze a public-private partnership for implementing electric efficiency throughout Poland and help instill the notion of DSM as a valuable, stable resource for Poland's energy future.

3.2 RATIONALE FOR PROPOSED PROJECT

There are numerous reasons why the pilot DSM project proposed in this volume was selected. The key reasons are identified and briefly discussed below.

- ***The program reflects program experience in North America.*** To take advantage of the more than ten years of industrial DSM program experience in North America, the proposed project incorporates many features from the most successful North American programs.

  - The program is highly flexible. It is designed to allow a broad array of project types and meet varying customer needs. Customers and Z.E. Gliwice can negotiate special arrangements for project installation and financing to overcome barriers and minimize problems.

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- The program allows customers to design their own projects. Customers can use their own staff and select their own contractors to develop projects. This allows customers to steer around problems that a more rigid, utility-controlled project might encounter.

- The program uses direct marketing. Program experience in North America has shown that industrial programs operate best when they are marketed through person-to-person contact using existing personal relationships with customers, and when possible, top-level management.

- The program offers substantial financial incentives to program participants. North American experience indicates that higher levels of financial assistance are important for obtaining high levels of customer participation. The level of financial assistance offered in this program should be sufficient to attract participation from an industrial sector even as troubled as Poland's.

- ***The program is flexible enough to deal with an industry undergoing tremendous change.*** To say that Polish industry is faced with difficulty in making its transition from state ownership to private ownership is an understatement. It is very difficult to foresee many of the special problems being encountered in this transition. Therefore, a flexible program that allows program mangers to steer around these problems when they are encountered is preferable.

- ***The program is focused on the industrial sector because that is where most electricity is consumed, and that is where most of the potential electricity savings can be realized.*** Roughly 53 percent of the electricity consumed in Poland is consumed in the industrial sector. Fifty-five percent of the cost-effective energy savings and 73 percent of the cost-effective demand savings identified in the DSM assessment are in the industrial sector. It makes sense to focus the first program in a sector with the highest potential.

- ***The program relies on custom designed projects because most Polish industrial companies tend to be relatively large; projects are thus likely to be large, for which custom programs are appropriate.*** Custom programs are best suited to relatively large projects in which the extra staff time required for their implementation can be justified. And custom designed programs can better optimize systems for energy and capacity savings.

- *An industrial program will help revitalize Polish industry.* With Polish industry undergoing such a difficult transition, for the sake of the national economy and the welfare of the Polish people, it is important that Polish industry be given assistance in becoming more efficient and more competitive.

- *The program emphasizes financial assistance to help overcome the critical shortage of capital for improvement projects.* The focus groups clearly identified lack of capital as the key barrier to investments that improve energy efficiency. Representatives of many companies said that their staff had identified several investments that could reduce electricity consumption, but lack of capital prevented them from making the investments. Some said their capital shortage is so severe that their companies won't invest in any project with a payback of more than one year.

  While capital availability is not nearly as large a barrier for North American industrial companies, it nonetheless is a very significant barrier -- so significant that a decade of program experience has taught DSM program managers that making substantial financial assistance available to DSM program participants is essential to a successful program. A North American-style DSM program with heavy emphasis on financial assistance thus appears to be appropriate and promising for application in Poland.

- *The program operates within a set of guiding principles, sufficiently broad to allow program managers to use their knowledge of local companies, problems, and situations to steer the program around problems.* If this program, which is being proposed by non-Polish experts, were based on a rigid set of procedures and rules, as is common in North America, it would be highly likely that these procedures and rules would conflict with a number of local customs, capabilities, or situations. The program is therefore designed to take maximum advantage of local knowledge. A set of broad principles is recommended to guide the program. Program managers are encouraged to experiment, and find the best ways to implement the program consistent with these principles.

3.3 BARRIERS, RISKS, AND UNCERTAINTIES

There are many barriers, risks, and uncertainties associated with launching North American-style DSM programs in Poland. After all, it has taken more than a decade for these programs to evolve in North America, where many mis-steps were taken and well intentioned but ineffective programs were initiated. When the first DSM efforts were started in North America, U.S. utilities had to completely change the way they related and marketed to their

customers; Polish utilities will have to do the same. (Z.E. Gliwice has already recognized this fact. Soon after attending his first seminar on integrated resource planning, the director established his company's first marketing department.)

Successfully marketing and implementing DSM in Poland will require the development of new skills, new organizational structures, new laws and regulations, new businesses, and whole new industries. The size of this task alone is a large barrier to DSM. But the interest and willingness to overcome such a large barrier appear to be present in Poland. Z.E. Gliwice, the PSE, and other regional distribution companies seem to be genuinely interested in undertaking this task.

There are more specific barriers, risks, and uncertainties that have been identified in this project, and warrant discussion here. Many other exist, as with the new application of DSM in any electric utility, but the emphasis here is on those that are particularly relevant to applying DSM in Poland.

Much of the information presented below was gathered from a series of six focus groups held over the period December 1992 through March 1993. These focus groups were sponsored by RCG/Hagler Bailly, and organized and run by the Polish Foundation for Energy Efficiency (FEWE). Two focus groups were made up of industrial customers, one of residential, one of equipment vendors, one of commercial customers, and one of Z.E. Gliwice staff.

Severe Shortage of Capital to Make DSM Improvements

The majority of North American DSM programs are justified largely on the basis that utility customers lack the capital to make conservation and load management improvements. Or, if they do have the capital, competing investment priorities sharply restrict the amount of capital made available for such energy projects.

To say the same situation exists in Poland is an understatement. Most of Poland's industry faces severe capital shortages. The investment needs in aged, out-of-date industrial facilities are enormous, as are the pressures just to stay viable. The focus groups revealed that it is common for Polish companies to forego investments with simple paybacks of greater than one year. Participant after participant in the focus groups identified lack of capital as the primary barrier to installing DSM measures. Many of the participants have identified improvements they would like to make, but cannot make them because they lack capital.

Clearly, financial assistance for DSM customers will have to be a central component in any DSM program initiated in Poland.

Comfort and Trust of Z.E. Gliwice

The recent severe economic downturn in Poland has claimed many casualties, including many relations between debtors and creditors. Many companies found themselves unable to pay their electric bills, and consequently ran up large debts with their electric utility. Z.E. Gliwice did not escape this problem. The tensions created by unpaid bills have deteriorated relations between Z.E. Gliwice and some customers, and now, Z.E. Gliwice may have difficulty persuading these customers to participate in a DSM program. Some focus group participants said they would not allow any employees of Z.E. Gliwice on their property for the purposes of investigating potential DSM projects.

Much of this mistrust might be overcome once there is a better understanding of Z.E. Gliwice's motivation and rationale for implementing a DSM program. Some of their customers simply do not believe that a company in the business of profiting from the sale of electricity would have a sincere interest in helping them reduce their electricity bill.

Perhaps the best way around this barrier is to avoid these customers in the pilot stage of implementing DSM. Once they have had a chance to learn more about the rationale for DSM and to observe how their industrial neighbors have benefitted from participating, they may choose to participate.

Price of Energy-Efficient Equipment

A number of focus group participants identified the high prices for energy-efficient equipment as a significant barrier to DSM investments. They explained that equipment buyers are extremely sensitive to first price: they choose the lowest-priced piece of equipment even when they know that the more efficient, but more expensive, piece will be much cheaper to operate.

This price relationship between efficient and inefficient equipment is even more pronounced with energy-efficient, foreign-made equipment. The participants said that even if they recognized superior efficiency and technology in the foreign-made equipment, they would buy whatever had the lowest price.

One solution to this problem is for the utility to defray part of the cost of DSM measures by providing financial incentives to its customers. Such incentives can be viewed as electric resource costs that the utility incurs and recovers from all customers in electric rates, much as the utility incurs and recovers costs for power purchased from generators or the transmission grid.

In the service territory of Z.E. Gliwice, another opportunity will become available soon, associated with efficient lighting products. The International Finance Corporation, a unit of the World Bank that finances private sector enterprises, has agreed to award a grant to the Philips Lighting Company, specifically to reduce the wholesale cost of compact fluorescent lamps (CFLs) in Poland. These lamps will be sold out of Z.E. Gliwice's retail storefront in downtown Gliwice. The project supports the mission of the Global Environment Facility to mitigate global climate change. This activity will give Z.E. Gliwice the means to subsidize the high first cost of CFLs to its customers, including industrial facilities, and is a good example of how this barrier can be overcome.

Companies May Go Out of Business After DSM Investments are Made

Except in bidding-based DSM programs, 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 is offered the same kind of financial incentives in DSM programs as a financially strong company. 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 difficult 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 utility-sponsored DSM programs. Special precautions will probably have to be taken to avoid a high rate of loss or non-performance of DSM investments.

Simple financial reviews of companies applying to participate in the DSM program probably won't be adequate. Many of these companies will have had very limited exposure to the free market, which makes projections of future financial performance difficult to estimate.

To protect its investments, Z.E. Gliwice may have to require agreements with program participants that would allow the recovery and removal of equipment financed by the DSM

program. The low cost of labor (for equipment retrieval) relative to the high cost of new equipment could make this a practical and cost-effective means of reducing this risk.

Baseline Energy Use and Load Data May be Difficult to Obtain

In the type of DSM program proposed in this document, it is important to obtain reliable data on energy use and load profiles before DSM measures are installed. These data help DSM program managers to estimate potential program savings, which can be used for negotiating customer financial assistance and evaluating the program. If program managers do not have reliable information on a customer's baseline energy use, they run the risk of offering financial assistance for phantom energy savings.

This problem could be acute in Poland, where substantial changes in economic activity have greatly affected production levels and patterns. For example, a factory making an energy-intensive product with batch processing, such as steel making, would experience an increase in energy-intensity per unit of product as its production level fell. If a DSM program manager were to negotiate financial assistance for measures that reduce this energy intensity, the subsequent reductions in energy intensity may be primarily the result of rising production levels, not the DSM measures, yet the utility might be obligated to pay for the savings.

Utility Cost Recovery and Lost Revenues

As with most electric utilities in the world (including most in North America), expenditures on DSM programs in Poland may result in costs that are not fully recovered in utility rates, as well as revenues lost as a result of lower electricity sales. This issue is discussed in Chapter 5 of Part 1 of this report as one of the fundamental regulatory policy issues that must be addressed in establishing an integrated resource planning framework in Poland. However, in addition to being a national policy issue, it is also a practical one that Z.E. Gliwice must resolve in the implementation of the DSM pilot project. For this reason, the topic of cost recovery and regulatory incentives is treated separately as an element of project design and is described more fully in Section 5.8 of Part 2 of this report.

Employee Pay Tied to Electricity Sales

A portion of each employee's pay at Z.E. Gliwice is tied to the company's electrical sales. This practice is apparently conventional throughout the Polish electric utility industry. Like

the issue of utility profitability being tied to electricity sales, and perhaps even more so, this presents a substantial barrier to successful DSM program implementation. Why would an employee strive to make a program succeed if the effect is a reduction in his pay? It is strongly recommended that Z.E. Gliwice restructure its employee compensation approach to eliminate this DSM disincentive.

Document Management/Lack of Computerization

Implementing a DSM program presents significant challenges for managing a large volume of documents. Among the documents and computer files that will have to be written, guided through the organization, and filed for occasional retrieval are:

- promotional materials
- application guidelines
- project applications
- application reviews
- project agreements
- project completion reports
- project impact evaluations
- customer interview reports
- incentive payment records.

This is just a partial list. When added to the many other documents that will be required to manage the program, they present a major documents management challenge.

Because of the very low level of computerization within Z.E. Gliwice, much financial and energy use data are still recorded and compiled by hand. If this practice is employed for implementing DSM, the program will be made unnecessarily difficult to administer. It is recommended that part of the budget for implementing the pilot DSM program be devoted to the purchase of computers and software for better document and records management.

Lack of Marketing Experience

A successful DSM program requires good marketing. Even North American utilities that have had many years of marketing experience often have trouble marketing their programs.

Marketing is a new concept for Polish utilities and Z.E. Gliwice. (Nonetheless, it is very impressive that Z.E. Gliwice immediately recognized the importance of marketing by establishing a marketing department soon after its director heard a presentation on marketing at an integrated resource planning conference.) Given the small amount of experience Z.E. Gliwice has had with marketing, it is expected that they will require assistance in developing and implementing a marketing plan for this pilot program.

CHAPTER 4: OVERVIEW OF THE INDUSTRIAL SECTOR

The industrial sector is the largest energy consuming sector in Poland. In 1991, this sector accounted for electricity sales of 51,052 GWh, or 53 percent of total domestic sales. Although the composition of industrial demand may change, reflecting broader economic trends and the decline of large, primary industries, Poland's industrial sector will likely maintain its predominance in terms of electricity consumption.

The analysis presented in Part 1 of this report assumes that 70 percent of electricity consumption in Polish industry is attributable to motors, 20 percent to process measures (e.g., electrolysis, heating), and 10 percent to lighting. The seasonal load shapes for these end-uses are shown in Exhibit 1.

The key characteristics of Poland's industrial consumers include the following:

- As of late 1992, state-owned industry accounted for 76 percent of Poland's industrial output. These large enterprises often are not provided the incentives necessary to encourage their participation in DSM programs.

- Electricity typically accounts for between 1 percent and 5 percent of total production costs, and averages around 3 percent. In the current economic environment, many firms are preoccupied with basic survival and may not have the interest or resources to pursue electricity savings.

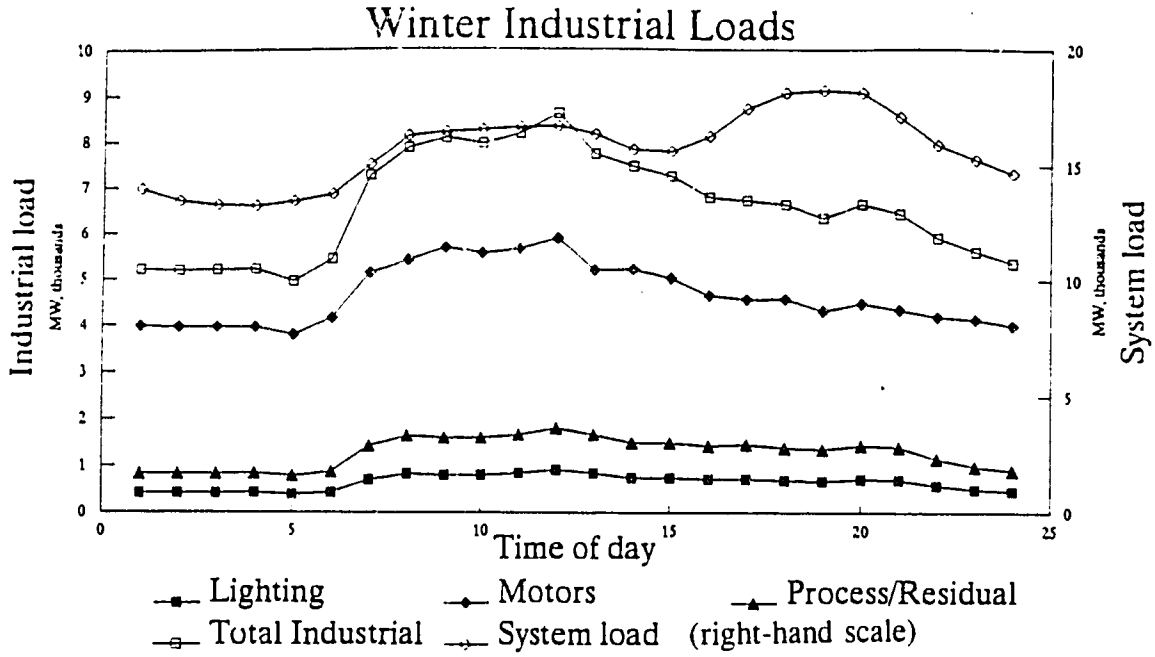
- There is little tradition of energy saving in Polish industry; the previous economic system focused on production maximization and not optimization.

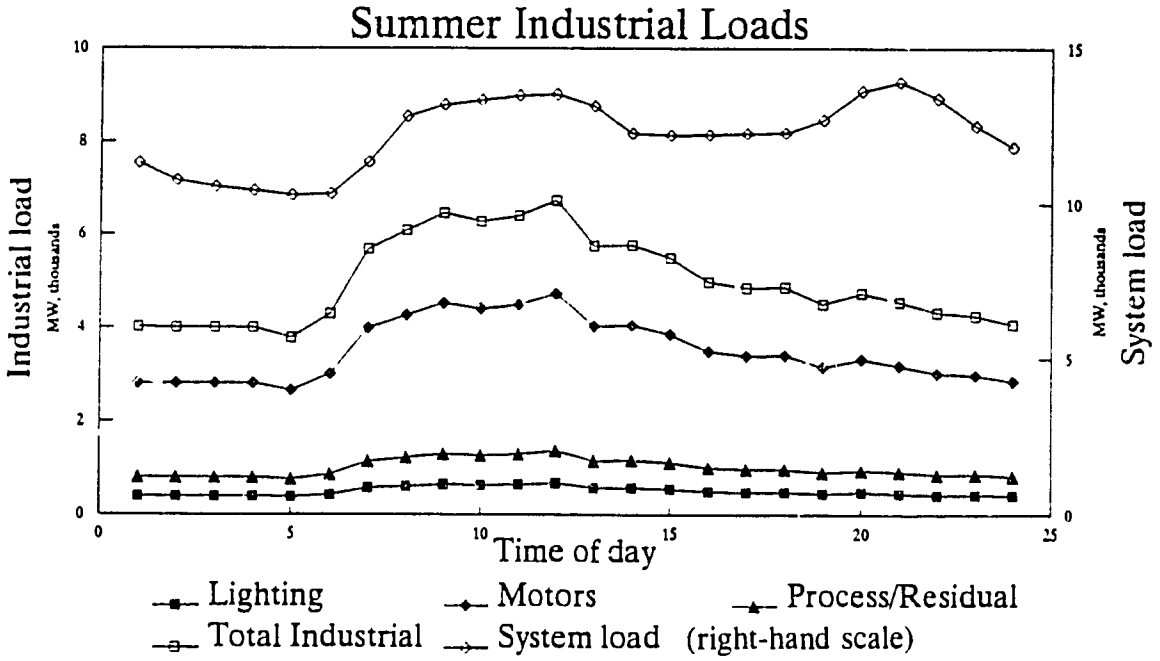
- Industrial representatives frequently claim that the greatest energy savings potential lies in automated monitoring and control of industrial operations.

- Large, usually state-owned industries seem to be suspicious of utilities, or at best feel they have little to offer in terms of energy saving assistance. Smaller industries, on the other hand, appear more willing to work with utilities on reducing energy consumption.

- Despite their different perceptions on the role of the utility, both large and small industries feel that if utilities were to promote DSM, their assistance should encompass both technical and financial support.

Exhibit 1
Industrial End-Use Load Shapes, Winter and Summer





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4.1 INDUSTRIAL DSM MEASURES

Because of the diversity of process loads, the lack of detailed information about these loads in Poland, and the difficulty of replicating process measures on a widespread basis, process measures were not considered in the assessment. Instead, the analysis focused on lighting and motors, although some of the measures selected address overall industrial electricity use. Industrial lighting and motors alone account for 80 percent of industrial demand, or 42 percent of total domestic consumption, in Poland.

Industrial Motors

Given the widespread use of motors (especially large motors) in Polish industry, motor measures can provide substantial energy savings. There are four principal ways in which motor performance can be improved:

- *Efficiency improvements.* Motors can be manufactured with improved cooling fan designs to reduce windage losses; larger cross sections, thinner laminates, and special steel alloys for stators and rotors to reduce magnetic losses; better ball bearings to reduce friction losses; and larger gauge conductors to reduce I^2R losses.

- *Improved control.* Standard induction AC motors operate at essentially fixed speeds, even though loads vary in many motor applications. A variety of technologies can be used to better match motor speed with load. Electronic adjustable speed drives (ASDs) have emerged as one of the most flexible technologies for motor control. ASDs typically use AC-DC-AC inverters to vary the frequency of AC supplied to the motor, and thereby vary motor speed.

- *Motor downsizing.* Many motors are installed with capacities far in excess of that required by the load. Underloaded motors operate at lower efficiency than at full load. FEWE estimates that about 30 percent of motors in Poland are oversized.

- *High-efficiency drive applications.* By improving the efficiency of rotating equipment, such as pumps and compressors, overall drive system energy consumption can be reduced. Better controls, seals, bearings, and belt and lubrication systems can contribute to high application efficiency. In addition, there is often room for selecting better pump and compressor technologies to match user needs.

A total of 19 motor measures were identified, including 12 for motor efficiency improvements and 1 for motor downsizing. Measures for improved control (principally ASDs) and high-efficiency drive applications were combined into 6 drive measures.

Motor efficiency and drive measures were defined for both high- and low-use motors in the small (3.5 kW), medium (17.5 kW) and large (120 kW) classes described in Chapter 3 of Part 1 of this report. Drive measures were considered on a retrofit basis only, whereas efficiency measures were defined for both replacement upon retirement and replacement upon rewind (according to FEWE, motors are typically rewound in Poland about five times before they are replaced).

Average consumption values for both the measures and the standard equipment are based on experience in the United States with motors of similar sizes. The potential energy savings per motor may not be much greater in Poland. This is because over the years, U.S. motors became less efficient due to lower electricity costs and competitive market forces that reduced capital costs. In the former planned economies of Eastern Europe, these market forces did not exist and motors retained higher relative efficiency (e.g., through the use of larger-diameter conductors and magnets). The motor downsizing program assumes that existing motors are switched among enterprises, or within individual enterprises, to yield better utilization of total motor capacity and to avoid additional expenditures on the purchase of new motors.

Industrial Lighting

The industrial sector has the widest range of lighting technologies, including incandescent, fluorescent, and mercury vapor. Other lighting types are found in the sector, but are not considered as candidates for DSM measures because they are already sufficiently efficient or there are limited technical opportunities for exchanging them.

Eight fluorescent lighting measures were considered, which are virtually identical to those put forward for the commercial sector. These measures entail the replacement or retrofit installation of efficient core-coil ballasts or T-8 systems in place of standard high-use or low-use lamps. Measures are also proposed to retrofit mercury vapor lights with high-pressure sodium, and to retrofit high-wattage incandescents with metal halide lamps. Mercury vapor lights are typically used for lighting large exterior areas such as service yards, factories, and warehouses. They generally offer the lowest efficacy of all high-intensity discharge lamps. High-pressure sodium lights have been developed for similar applications, and offer far higher efficacy, but emit a yellowish light that may not be acceptable in some applications.

Incandescent (including quartz) lamps are available in sizes up to 1,000 W. Some of these lamps may be used in large-area lighting applications where color rendering is more important. Metal halide lamps can approach the color rendering of incandescent lamps, and do so with much higher efficacy.

Other Industrial Measures

Four other measures are considered for the industrial sector: production monitoring and optimization, industrial facility maintenance, interruptible rates, and time-of-use (TOU) rates. Although the Tariff Study proposes specific TOU rates, this analysis concentrates on the potential load impacts of those rates.

As part of A.I.D.'s Emergency Energy Program for Eastern and Central Europe, energy audits were conducted of industrial facilities in 8 countries, including Poland. The audited firms represented a comprehensive cross-section of industries and covered all forms of energy, including electricity. These audits identified two principal electricity saving measures:

- *Process optimization measures.* Most industrial facilities in Eastern Europe lack modern instrumentation and monitoring equipment. Many processes are operated solely on the basis of operator experience and without the benefit of real-time information on process status or operating parameters. This is understandable, since the previous economic system valued gross production rather than economic efficiency and optimization; instrumentation that could help optimize processes was an unnecessary expense. Therefore, the first measure involves the installation of low-cost instrumentation, monitoring, and control systems that can be used to optimize production processes using economic criteria. The costs and impacts of this measure are based on the average industrial consumer, which reflects the objective of allowing all industrial enterprises, large and small, to participate in the program and benefit from the measure. The average industrial consumer is characterized by an annual consumption of 1,138 MWh and an average weekday peak demand of 215 kW.

- *Improved maintenance measures.* Similarly, incentives were also previously insufficient to encourage a level of maintenance justified under current economic conditions. The audits revealed that simple maintenance, such as the proper lubrication of motors and machinery, repair of compressor leaks, frequent cleaning of filters and screens, and replacement of door gaskets and curtains, could reduce electricity consumption by 5 percent on average. As with the process optimization

measure, costs have been taken to reflect the large number of smaller companies that would be included in the program to implement these measures.

Rate measures are generally very cost-effective for peak clipping and load shifting. Two rate programs are considered: time-of-use (TOU) tariffs in which consumers pay different electricity rates depending on the time of day or season, and interruptible rates, in which the consumer pays lower rates on the condition that the utility can call up the consumer on short notice and request a reduction in demand of a pre-determined amount for a specified period. The total amount of interruption per year, season, or day can be capped by mutual agreement between the consumer and the utility; failure by the consumer to provide the agreed demand reductions will usually result in financial penalties.

Interruptible rates have not previously been implemented in Poland. It is assumed that this measure would be available to all industrial consumers, so that the costs and impacts of the measures are gauged relative to the average industrial consumer. TOU rates, on the other hand, have been used extensively in Poland on a voluntary basis. However, the Tariff Study has recommended that one of the existing flat rate industrial tariff classes, A11, be converted to a TOU structure. It is therefore assumed that this measure is applied only to consumers in that class, since all other industrial consumers are already within the type of rate structure recommended for that class by the Tariff Study. The average A11 consumer is smaller than the overall industrial average, with annual consumption of 254 MWh and an average weekday peak demand of only 50 kW. What these consumers lack in size they make up in numbers; A11 customers represent approximately 10,000 (22%) of all industrial consumers.

4.2 SCREENING INDUSTRIAL MEASURES

Although all of the above measures are technically feasible, programs should be built only around measures shown to be economically cost-effective. Exhibit 2 summarizes the population, cost, and performance characteristics of the measures described above as well as the standard equipment they are intended to replace. Chapter 3 of Part 1 describes how the cost of saved energy and cost of saved demand can be derived from this information and compared to avoided energy and capacity costs to determine whether a particular measure would be a good candidate around which to develop a program. The results of the screening analysis are presented in Exhibit 3 along with the physical energy and demand savings that would be expected from that measure if it were applied to all existing installations. Exhibit 4 graphically represents these results as an industrial energy conservation supply curve, which shows the cost of saved energy as a function of energy savings.

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Exhibit 2: Characteristics of Conventional End–Uses and Potential DSM Measures in Polish Industry

No.	Measure	Number of eligible installations	Annual hours of operation	Annual consumption of measure, kWh/yr	Annual consump of standard equipment, kWh/y	Cost of standard equipment, $	Labor hrs for standard equipment	Cost of measure, $	Labor hrs for measure	Life of standard equipment, hours or years	Life of measure, hours or years	Power consumption of standard equipment, kW	Power consumption of measure, kW	Coincidence factor (a)
1	Replace 3.5 kW low–use motors with hi–eff motors upon retirement	800,000 (FEWE)	1,800 (FEWE)	5,943 (ACEEE)	6,300 (calc)	150 (FEWE)		203 (ACEEE)		20 (FEWE)	20	3.5 (FEWE)	3 (ACEEE)	0.30
2	Replace 17.5 kW low–use motors with hi–eff motors upon retirement	225,000 (FEWE)	1,800 (FEWE)	30,111 (ACEEE)	31,500 (calc)	500 (FEWE)		675 (ACEEE)		20 (FEWE)	20	17.5 (FEWE)	17 (ACEEE)	0.30
3	Replace 120 kW low–use motors with hi–eff motors upon retirement	20,000 (FEWE)	2,400 (FEWE)	280,167 (ACEEE)	288,000 (calc)	3,480 (ACEEE)		4,680 (ACEEE)		20 (FEWE)	20	120 (FEWE)	117 (ACEEE)	0.30
4	Replace 3.5 kW hi–use motors with hi–eff motors upon retirement	160,000 (FEWE)	5,840 (FEWE)	19,281 (ACEEE)	20,440 (calc)	150 (FEWE)		203 (ACEEE)		20 (FEWE)	20	3.5 (FEWE)	3 (ACEEE)	0.30
5	Replace 17.5 kW hi–use motors with hi–eff motors upon retirement	50,000 (FEWE)	5,840 (FEWE)	97,694 (ACEEE)	102,200 (calc)	500 (FEWE)		675 (ACEEE)		20 (FEWE)	20	17.5 (FEWE)	17 (ACEEE)	0.30
6	Replace 120 kW hi–use motors with hi–eff motors upon retirement	5,000 (FEWE)	5,840 (FEWE)	681,741 (ACEEE)	700,800 (calc)	3,480 (ACEEE)		4,680 (ACEEE)		20 (FEWE)	20	120 (FEWE)	117 (ACEEE)	0.30
7	Replace 3.5 kW low–use motors with hi–eff motors upon rewind	800,000 (FEWE)	2,000 (FEWE)	6,738 (ACEEE)	7,289 (calc)	84 (h)		203 (ACEEE)		20 (FEWE)	20	3.6 (FEWE)	3 (ACEEE)	0.30
8	Replace 17.5 kW low–use motors with hi–eff motors upon rewind	225,000 (FEWE)	2,000 (FEWE)	34,140 (ACEEE)	36,443 (calc)	314 (h)		675 (ACEEE)		20 (FEWE)	20	17.9 (FEWE)	17 (ACEEE)	0.30
9	Replace 120 kW low–use motors with hi–eff motors upon rewind	20,000 (FEWE)	3,000 (FEWE)	357,356 (ACEEE)	374,844 (calc)	2,574 (h)		4,660 (ACEEE)		20 (FEWE)	20	122 (FEWE)	117 (ACEEE)	0.30
10	Replace 3.5 kW hi–use motors with hi–eff motors upon rewind	160,000 (FEWE)	5,840 (FEWE)	19,675 (ACEEE)	21,283 (calc)	84 (h)		203 (ACEEE)		20 (FEWE)	20	3.6 (FEWE)	3 (ACEEE)	0.30
11	Replace 17.5 kW hi–use motors with hi–eff motors upon rewind	50,000 (FEWE)	5,840 (FEWE)	99,688 (ACEEE)	106,414 (calc)	314 (h)		675 (ACEEE)		20 (FEWE)	20	17.9 (FEWE)	17 (ACEEE)	0.30
12	Replace 120 kW hi–use motors with hi–eff motors upon rewind	5,000 (FEWE)	5,840 (FEWE)	695,654 (ACEEE)	729,696 (calc)	2,574 (h)		4,680 (ACEEE)		20 (FEWE)	20	122 (FEWE)	117 (ACEEE)	0.30
13	Drive measure retrofits, 3.5 kW low–use motors	240,000 (FEWE)	1,800 (FEWE)	4,095 (ACEEE)	6,300 (calc)			2700 (ACEEE)	20		15	3.5	3.15	0.30
14	Drive measure retrofits, 17.5 kW low–use motors	67,500 (FEWE)	1,800 (FEWE)	20,475 (ACEEE)	31,500 (calc)			5,800 (ACEEE)	20		15	17.5	15.75	0.30
15	Drive measure retrofits, 120 kW low–use motors	6,000 (FEWE)	2,400 (FEWE)	201,600 (ACEEE)	288,000 (calc)			22,000 (ACEEE)	20		15	120	108	0.30
16	Drive measure retrofits, 3.5 kW hi–use motors	48,000 (FEWE)	5,840 (FEWE)	13,288 (ACEEE)	20,440 (calc)			2700 (ACEEE)	20		15	3.5	3.15	0.30
17	Drive measure retrofits, 17.5 kW hi–use motors	15,000 (FEWE)	5,840 (FEWE)	66,430 (ACEEE)	102,200 (calc)			5,800 (ACEEE)	20		15	17.5	15.75	0.30
18	Drive measure retrofits, 120 kW hi–use motors	1,500 (FEWE)	5,840 (FEWE)	490,560 (ACEEE)	700,800 (calc)			22,000 (ACEEE)	20		15	120	108	0.30
19	Motor downsizing	75,000 (ACEEE) (i)	2,771 (i)	68,545 (ACEEE) (i)	72,153 (i)			1000 (i)			20	26 (i)	24.7 (ACEEE)	0.30

Exhibit 2: Characteristics of Conventional End–Uses and Potential DSM Measures in Polish Industry (cont'd.)

No	Measure	Number of eligible installations	Annual hours of operation	Annual consumption of measure, kWh/yr	Annual consump of standard equipment, kWh/y	Cost of standard equipment, $	Labor hrs for standard equipment	Cost of measure, $	Labor hrs for measure	Life of standard equipment, hours or years	Life of measure, hours or years	Power consumption of standard equipment, kW	Power consumption of measure, kW	Coincidence factor (a)
20	Replace low–use fluorescent ballasts with efficient core–coil ballasts upon retirement	10,000,000 (FEWE)	1,800 (FEWE)	59 (LBL2)	64 (calc)	18 (FEWE)	0.30	23 (LBL2)	0.30	40,000	45,000 (LBL2)	0.036 (d)	0.033 (LBL2)	0.44
21	Replace hi–use fluorescent ballasts with efficient core–coil ballasts upon retirement	5,000,000 (FEWE)	5,840 (FEWE)	510 (LBL2)	555 (calc)	26 (FEWE)	0.30	31 (LBL2)	0.30	40,000	45,000 (LBL2)	0.095 (LBL2)	0.087 (LBL2)	0.44
22	Replace low–use fluorescent lamps & ballasts with T–8 lamps and solid state ballast	10,000,000 (FEWE)	1,800 (FEWE)	44 (LBL2)	64 (calc)	18 (FEWE)	0.30	54 (EPS)	0.30	40,000 (LBL2)	70,000 (LBL2)	0.036 (d)	0.024 (LBL2)	0.44
23	Replace hi–use fluorescent lamps & ballasts with T–8 lamps and solid state ballast	5,000,000 (FEWE)	5,840 (FEWE)	377 (LBL2)	555 (calc)	26 (FEWE)	0.30	62 (EPS)	0.30	40,000 (LBL2)	70,000 (LBL2)	0.095 (LBL2)	0.085 (LBL2)	0.44
24	Retrofit low–use fluorescent ballasts with efficient core–coil ballasts	10,000,000 (FEWE)	1,800 (FEWE)	59 (LBL2)	64 (calc)	18 (FEWE)	0.30	23 (LBL2)	0.30	40,000 (LBL2)	45,000 (LBL2)	0.036 (d)	0.033 (LBL2)	0.44
25	Retrofit hi–use fluorescent ballasts with efficient core–coil ballasts	5,000,000 (FEWE)	5,840 (FEWE)	510 (LBL2)	555 (calc)	26 (FEWE)	0.30	31 (LBL)	0.30	40,000 (LBL2)	45,000 (LBL2)	0.095 (LBL2)	0.087 (LBL2)	0.44
26	Retrofit low–use fluorescent lamps & ballasts with T–8 lamps and solid state ballast	10,000,000 (FEWE)	1,800 (FEWE)	44 (LBL2)	64 (calc)	18 (FEWE)	0.30	54 (EPS)	0.30	40,000 (LBL2)	70,000 (LBL2)	0.036 (d)	0.024 (LBL2)	0.44
27	Retrofit hi–use fluorescent lamps & ballasts with T–8 lamps and solid state ballast	5,000,000 (FEWE)	5,840 (FEWE)	377 (LBL2)	555 (calc)	26 (FEWE)	0.30	62 (EPS)	0.30	40,000 (LBL2)	70,000 (LBL2)	0.095 (LBL2)	0.085 (LBL2)	0.44
28	Retrofit mercury vapor lamps with hi pressure sodium	700,000 (FEWE)	3,650 (FEWE)	339 (calc)	767 (calc)	17 (Grainger)		27 (Grainger)	0.50	20,000 (EPS)	20,000 (EPS)	0.210 (EPS)	0.093 (EPS)	0.44
29	Retrofit high wattage incandescent with metal halide	500,000 (FEWE)	3,650 (FEWE)	339 (calc)	1,095 (calc)	5 (Sylvania)		45 (Sylvania)	0.50	2,500 (Sylvania)	8,000 (Sylvania)	0.300 (Sylvania)	0.093 (Sylvania)	0.44
30	Optimize production processes through process monitoring	44,859 (j)		1,104 (Audits)	1,138 (j)	0		5,000 (k)		10		388 (calc)	365 (calc)	0.32
31	Industrial maintenance	44,859 (j)		1,081 (Audits)	1,138 (j)	0		7,825 (k)		10		388 (calc)	369 (calc)	0.32
32	Interruptible rates	44,859 (j)			1,138 (j)	0		2,500 (l)		15				
33	Time of use rates	10,013 (s)			254 (j)	0		2,500 (l)		15				

Notes & References

(calc)	Value has been calculated from other columns
(FEWE)	Data provided by FEWE specifically to support this assessment. Some of these values have been adjusted to better match actual electricity sales
(EPS)	Electric Power Software Inc., "Technology and Loadshape Information, ver. 1.1", 1992
(LBL2)	Lawrence Berkeley Laboratory, "Technology Assessment: Energy–Efficient Commercial Lighting", 1989
(ACEEE)	American Council for an Energy Efficient Economy, "Energy Efficient Motor Systems", 1992
(Audits)	Values based on a review of 27 industrial audits conducted in Eastern Europe under USAID's Emergency Energy Program for Eastern and Central Europe
(Sylvania)	Sylvania Large Lamp Price Schedule 91–1–1
(Grainger)	Grainger Net Wholesale Catalog, 1992
(a)	Coincidence factors are calculated as total end–use load at system peak hour for the season (see Part 1, Chapter 2) divided by total installed end–use power capacity
(h)	FEWE reported that average rewind costs are about 50% of the cost of a standard motor. The exact proportions used here, which allocate lower percentage costs to smaller motors, is consistent with the FEWE finding, and is based on USAID (Office of Energy and Infrastructure), "Mexico: DSM Assessment", 1993
(i)	Assumes 25% of medium and large motors are candidates for downsizing. Hours of use, energy consumption, and power demand are averages for these motor sizes. Cost based on motor swapping program. This cost includes $300 for installation and $700 to identify participants and arrange motor swapping
(j)	This corresponds to the number and average annual consumption in MWh of industrial customers (see Part 1, Chapter 2)
(k)	Average costs estimated to cover $5,000 purchase of simple energy management systems and/or test equipment, consistent with "Audits" above. Industrial maintenance measure also includes present value of $500/year for additional future maintenance costs
(l)	Costs of meters based on conversation with Cory Pettet, Entergy Inc
(m)	Cost of conserved energy includes the incremental annual cost of the lamps reported in the table, plus the annualized value for the $75 cost of the fixture/ballast
(n)	Cost of conserved energy includes the incremental annual cost of the lamps reported in the table, plus the annualized value for the $140 cost of the fixture/ballast
(s)	This corresponds to the number and average annual consumption in MWh for all customers currently on the A11 tariff

Values without notes or references are assumed

Global Assumptions

Real Discount Rate	12.0%
Drive Measure Applicability	30% of small, medium, and large motors

Exhibit 3: Industrial Electricity Savings Potential by Measure

No.	Measure	Cost of Saved Energy	Current Savings Potential	Cost of Saved Capacity	Current Savin(Potential
1	Replace 3.5 kW low–use motors with hi–eff. motors upon retirement	$0.020 per kWh	286 GWh	$118 per kW	48 MW
2	Replace 17.5 kW low–use motors with hi–eff. motors upon retirement	$0.017 per kWh	312 GWh	$101 per kW	52 MW
3	Replace 120 kW low–use motors with hi–eff. motors upon retirement	$0.021 per kWh	157 GWh	$164 per kW	20 MW
4	Replace 3.5 kW hi–use motors with hi–eff. motors upon retirement	$0.006 per kWh	185 GWh	$118 per kW	10 MW
5	Replace 17.5 kW hi–use motors with hi–eff. motors upon retirement	$0.005 per kWh	225 GWh	$101 per kW	12 MW
6	Replace 120 kW hi–use motors with hi–eff. motors upon retirement	$0.008 per kWh	95 GWh	$164 per kW	5 MW
7	Replace 3.5 kW low–use motors with hi–eff. motors upon rewind	$0.029 per kWh	441 GWh	$196 per kW	65 MW
8	Replace 17.5 kW low–use motors with hi–eff. motors upon rewind	$0.021 per kWh	518 GWh	$143 per kW	76 MW
9	Replace 120 kW low–use motors with hi–eff. motors upon rewind	$0.016 per kWh	350 GWh	$165 per kW	34 MW
10	Replace 3.5 kW hi–use motors with hi–eff. motors upon rewind	$0.010 per kWh	257 GWh	$196 per kW	13 MW
11	Replace 17.5 kW hi–use motors with hi–eff. motors upon rewind	$0.007 per kWh	336 GWh	$143 per kW	17 MW
12	Replace 120 kW hi–use motors with hi–eff. motors upon rewind	$0.008 per kWh	170 GWh	$165 per kW	9 MW
13	Drive measure retrofits, 3.5 kW low–use motors	$0.181 per kWh	529 GWh	$3,809 per kW	25 MW
14	Drive measure retrofits,17.5 kW low–use motors	$0.075 per kWh	744 GWh	$1,573 per kW	35 MW
15	Drive measure retrofits, 120 kW low–use motors	$0.037 per kWh	518 GWh	$898 per kW	22 MW
16	Drive measure retrofits, 3.5 kW hi–use motors	$0.056 per kWh	343 GWh	$3,809 per kW	5 MW
17	Drive measure retrofits,17.5 kW hi–use motors	$0.023 per kWh	537 GWh	$1,573 per kW	8 MW
18	Drive measure retrofits, 120 kW hi–use motors	$0.015 per kWh	315 GWh	$898 per kW	5 MW
19	Motor downsizing	0.037 per kWh	271 GWh	$343 per kW	29 MW

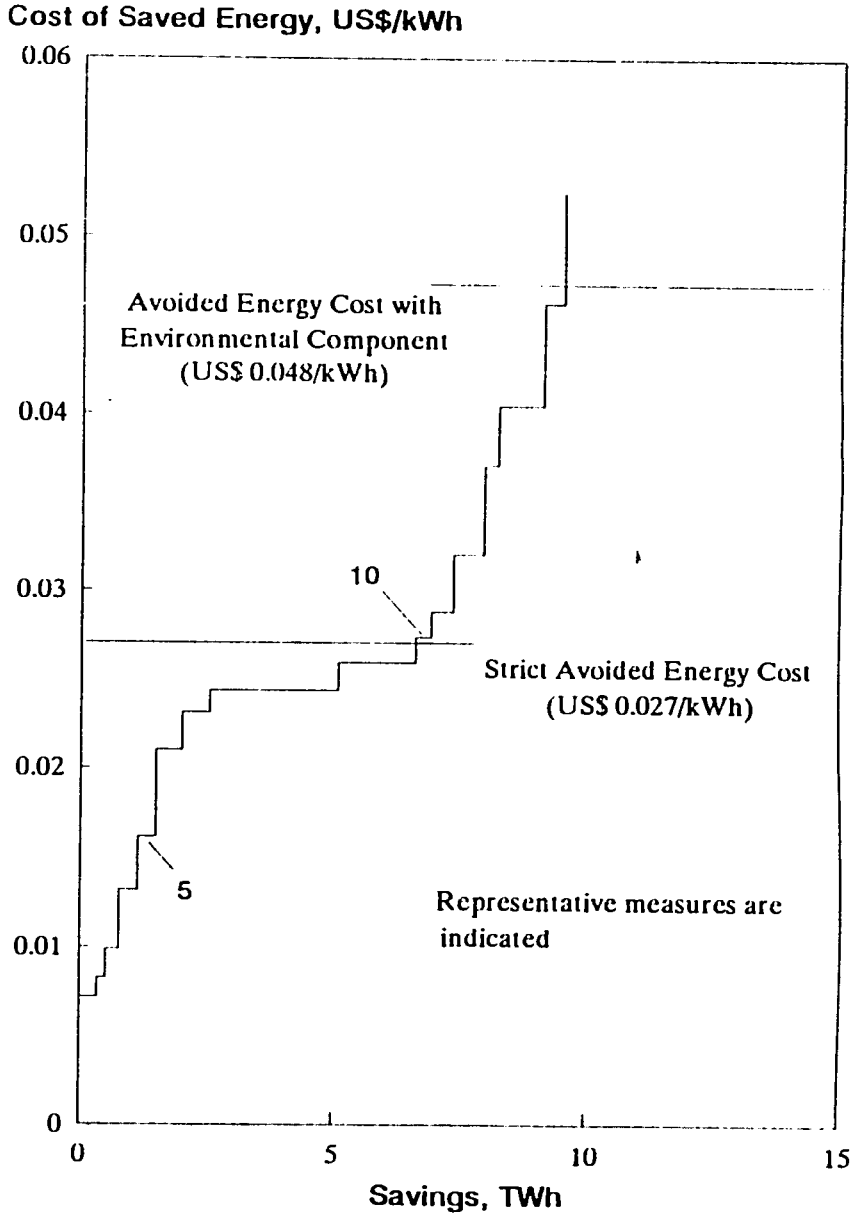
Exhibit 3: Industrial Electricity Savings Potential by Measure (cont'd.)

No.	Measure	Cost of Saved Energy	Current Savings Potential	Cost of Saved Capacity	Current Savings Potential
20	Replace low–use fluorescent ballasts with efficient core–coil ballasts upon retirement	$0.120 per kWh	51 GWh	$492 per kW	13 MW
21	Replace hi–use fluorescent ballasts with efficient core–coil ballasts upon retirement	$0.017 per kWh	222 GWh	$225 per kW	17 MW
22	Replace low–use fluorescent lamps & ballasts with T–8 lamps and solid state ballast	$0.204 per kWh	205 GWh	$836 per kW	50 MW
23	Replace hi–use fluorescent lamps & ballasts with T–8 lamps and solid state ballast	$0.022 per kWh	888 GWh	$289 per kW	67 MW
24	Retrofit low–use fluorescent ballasts with efficient core–coil ballasts	$0.453 per kWh	51 GWh	$1,854 per kW	13 MW
25	Retrofit hi–use fluorescent ballasts with efficient core–coil ballasts	$0.062 per kWh	222 GWh	$829 per kW	17 MW
26	Retrofit low–use fluorescent lamps & ballasts with T–8 lamps and solid state ballast	$0.291 per kWh	205 GWh	$1,192 per kW	50 MW
27	Retrofit hi–use fluorescent lamps & ballasts with T–8 lamps and solid state ballast	$0.040 per kWh	888 GWh	$537 per kW	67 MW
28	Retrofit mercury vapor lamps with hi pressure sodium	$0.027 per kWh	299 GWh	$227 per kW	36 MW
29	Retrofit high wattage incandescent with metal halide	$0.046 per kWh	378 GWh	$383 per kW	46 MW
30	Optimize production processes through process monitoring	$0.026 per kWh	1,531 GWh	$119 per kW	334 MW
31	Industrial maintenance	$0.024 per kWh	2,552 GWh	$223 per kW	278 MW
32	Interruptible rates	NA	NA	NA	NA
33	Time of use rates	NA	NA	NA	NA

Exhibit 4: Industrial Energy Conservation Supply Curve for Poland

Measure	Cost of Saved Energy	Savings
1 Replace 17.5 kW hi-use motors with hi-eff. motors upon rewind	$0.007 per kWh	336 GWh
2 Replace 120 kW hi-use motors with hi-eff. motors upon rewind	$0.008 per kWh	170 GWh
3 Replace 3.5 kW hi-use motors with hi-eff. motors upon rewind	$0.010 per kWh	257 GWh
4 Drive measure retrofits, 120 kW hi-use motors	$0.013 per kWh	368 GWh
5 Replace 120 kW low-use motors with hi-eff. motors upon rewind	$0.016 per kWh	350 GWh
6 Replace 17.5 kW low-use motors with hi-eff. motors upon rewind	$0.021 per kWh	518 GWh
7 Drive measure retrofits, 17.5 kW hi-use motors	$0.023 per kWh	537 GWh
8 Industrial maintenance	$0.024 per kWh	2,552 GWh
9 Optimize production processes through process monitoring	$0.026 per kWh	1,531 GWh
10 Retrofit industrial mercury vapor lights with high pressure sodium	$0.027 per kWh	299 GWh
11 Replace 3.5 kW low-use motors with high efficiency motors upon rewind	$0.029 per kWh	441 GWh
12 Drive measure retrofits, 120 kW low-use motors	$0.032 per kWh	605 GWh
13 Motor downsizing	$0.037 per kWh	271 GWh
14 Retrofit hi-use industrial fluorescent lamps & ballasts with T-8 systems	$0.040 per kWh	888 GWh
15 Retrofit high wattage industrial incandescent lamps with metal halide	$0.046 per kWh	378 GWh
		9501

Industrial rate programs have not been included in this screening analysis.



All of the industrial measures considered here pass the screening analysis except for:

- drive retrofits on 3.5 kW motors and low-use 17.5 kW motors
- all low-use fluorescent lighting measures as well as efficient core-coil retrofits on high-use fluorescent fixtures.

The industrial measures that pass represent 13 of the 20 lowest-cost measures among the 58 considered from all sectors. These measures amount to 9,501 GWh of economically justified savings potential, or nearly 9.9 percent of total domestic electricity sales in 1991. Approximately 1,565 GWh of potential industrial savings are attributable to lighting measures, 3,853 GWh to motor measures (including drive measures), and 4,083 GWh to industrial measures addressing maintenance and the optimization of industrial operations as well as tariffs.

4.3 DESIGN AND ASSESSMENT OF INDUSTRIAL PROGRAMS

These measures must be packaged with marketing, implementation, and evaluation mechanisms to facilitate widespread adoption of the measures and maximize the potential contribution of this resource. Drawing upon industrial DSM experience in Canada and the United States, preliminary programs were built up around each of these measures. The resulting programs are described in Chapter 4 of Part 1.

The individual programs were subsequently aggregated by end-use technology: motor efficiency, motor drives (including ASDs and high-efficiency drive applications), motor downsizing, operations optimization and maintenance, lighting, and rates. Fixed administrative overheads were included in these aggregated programs. Some of the key characteristics of these programs, such as participation rates, administrative costs, and expected impacts, are shown in Exhibit 5.

These programs were assessed in economic terms using the DSM planning model DSManager, an advanced computer package developed by the Electric Power Research Institute (EPRI) in the United States and adapted for use in Poland. Two standard DSM assessment methodologies were used within the model to facilitate the economic (as opposed to financial) evaluation of the candidate programs: the Total Resource Cost (TRC) Test and

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Exhibit 5: Industrial Program Summaries

Industrial Motor Program Summary

	1995	1996	1997	1998	1999	2000
Capital Cost ('000)*	$4,354	$4,354	$8,708	$8,708	$9,809	$9,804
Administrative Cost ('000)	$960	$710	$1,169	$1,169	$1,232	$1 232
New Participants ('000 motors)	29	29	57	57	61	61
Energy Savings (GWh)	39	78	157	235	318	401
Peak Demand Savings (MW)	6	13	25	38	51	64

Cumulative participation over life of program: 6.3% of the entire 1991 population

Industrial Drive Program Summary

	1995	1996	1997	1998	1999	2000
Capital Cost ('000)*	$631	$1,234	$1,865	$2,490	$3,115	$3,115
Administrative Cost ('000)	$511	$272	$284	$295	$306	$306
New Participants (motors)	57	112	169	225	281	281
Energy Savings (GWh)	3	10	20	34	51	68
Peak Demand Savings (MW)	1	2	3	5	8	10

Cumulative participation over life of program: 5% of 1991 industrial customers.

Industrial Motor Downsizing Program Summary

	1995	1996	1997	1998	1999	2000
Capital Cost ('000)*	$17	$37	$50	$67	$84	$84
Administrative Cost ('000)	$361	$172	$184	$195	$206	$206
New Participants (customers)	56	112	168	224	280	280
Energy Savings (GWh)	1	1	2	4	5	7
Peak Demand Savings (MW)	0	0	0	1	1	1

Cumulative participation over life of program: 2.5% of 1991 industrial customers

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Exhibit 5: Industrial Program Summaries (cont'd.)

Industrial Operations Optimization and Maintenance Program

	1995	1996	1997	1998	1999	2000
Capital Cost ('000)*	$945	$1,925	$3,904	$5,018	$5,248	$3,587
Administrative Cost ('000)	$860	$966	$1,686	$2,042	$2,044	$1,326
New Participants (customers)	180	358	718	896	897	538
Energy Savings (GWh)	9	26	60	103	146	171
Peak Demand Savings (MW)	1	4	10	17	24	28

Cumulative participation over life of program: 8% of 1991 industrial customers

Industrial Lighting Program Summary

	1995	1996	1997	1998	1999	2000
Levelized Capital Cost ('000)*	$288	$1,152	$2,303	$3,455	$4,607	$5,758
Administrative Cost ('000)	$542	$725	$916	$916	$916	$916
New Participants ('000 light fixtures)	48	144	192	192	192	192
Energy Savings (GWh)	13	51	103	154	205	256
Peak Demand Savings (MW)	2	9	18	26	35	44

Cumulative participation over life of program: 15.4% of 1991 industrial light fixtures

Industrial Rates Program Summary

	1995	1996	1997	1998	1999	2000
Capital Cost ('000)*	$1,463	$2,925	$4,338	$5,850	$7,313	$7,339
Administrative Cost ('000)	$843	$935	$1,278	$1,620	$1,963	$1,969
New Participants (customers)	685	1,370	2,055	2,740	3,425	3,438
Energy Savings (GWh)	3	9	18	29	44	59
Peak Demand Savings (MW)	13	39	77	129	194	258

* Capital costs incurred by new participants; O&M costs incurred by all current participants.

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the Societal Test. These tests determine the costs and benefits of each program and express the attractiveness of the program in terms of a benefit/cost ratio. The principal difference between the two in the context of this analysis is that the Societal Test includes environmental costs whereas the TRC does not.

The benefit-cost ratios for these programs are summarized in Exhibit 6. All of the candidate industrial programs appear cost-effective, with benefit-cost ratios ranging from 1.12 to 8.83 for the TRC Test, and from 1.76 to 8.91 for the Societal Test. The sensitivity analysis carried out in Part 1 confirmed the cost-effectiveness of these programs over a wide range of participation rates and administrative costs. As shown in Part 1, the industrial programs, particularly the motors programs, were among the most cost-effective of all programs considered.

Chapter 5 of Part 1 also indicated that the industrial sector ranks highest among all sectors in terms of DSM potential. Cost-effective industrial DSM programs could realistically save 962 GWh per year and 407 MW cumulative capacity additions and rehabilitation by the year 2000. The physical contribution of these programs towards power system requirements is shown in Exhibit 7.

The achievable economic benefits of near-term industrial DSM programs are commensurate with the expected physical savings. Exhibit 8 presents a net present value analysis (in economic terms) of the industrial programs developed in the course of the national DSM assessment. These programs yield a net present value of US $105 million, approximately two-thirds of the net present value benefits of the entire DSM program. Industrial programs represent such a large share of the benefits because of the large savings and high benefit-cost ratios associated with each program as well as the persistence of the industrial measures resulting from long technology lifetimes.

The level of utility investment required to achieve these benefits will depend upon the regulatory framework and tariff structure ultimately adopted in Poland. This analysis cannot, therefore, determine the utility financing necessary to implement this program. However, the results conclusively show that:

- Industrial DSM programs that can be implemented in the near term represent a significant power sector resource.

Exhibit 6: Summary of Industrial Assessment Results

	NAME	DESCRIPTION	Benefit/Cost Ratio		Net Benefits ($)		Levelized Cost ($/kWh)		Levelized Cost ($/kW)	
			TRC Test	Societal Cost Test	TRC Test	Societal Cost Test	TRC Test	Societal Cost Test	TRC Test	Societal Cost Test
1	I_PROCSP	Industrial Process – PLAN	1.20	1.88	3,687	16,523	0.0302	0.0302	182.52	182.52
2	I_RATESP	Industrial Rates – PLAN	3.32	3.57	49,561	54,739	0.0849	0.0849	19.35	19.35
3	I_MOTORP	Industrial Motor – PLAN	2.31	3.63	39,562	79,680	0.0156	0.0156	97.02	97.02
4	I_LIGHTP	Industrial Lighting – PLAN	1.44	2.26	12,749	36,404	0.0252	0.0252	146.51	146.51
5	IMTRDWNP	Industrial Motor Downsizing – PLAN	1.17	1.84	172	857	0.0308	0.0308	190.60	190.60
6	IMTRASDP	Industrial Drives – PLAN	1.27	1.99	2,187	8,155	0.0283	0.0283	183.46	183.46
7	I_MTASD4	Ind. Hi–Use Drives – 120 kW	2.73	4.29	1,608	3,060	0.0132	0.0132	88.57	88.57
8	I_LTMH01	Ind. Metal Halide Lighting	1.13	1.78	857	4,954	0.0320	0.0320	186.03	186.03
9	I_LTLB01	Ind. Hi–use Eff. Lamps & Ballasts T–8	1.52	2.38	6,842	18,240	0.0239	0.0239	139.13	139.13
10	I_MTASD1	Ind. Low–Use Drives – 120 kW	1.12	1.76	446	2,838	0.0321	0.0321	211.29	211.29
11	I_MTASD3	Ind. Hi–Use Drives – 17.5 kW	1.51	2.39	1,250	3,373	0.0236	0.0236	146.65	146.65
12	I_PROC01	Ind. Process Monitoring	1.17	1.84	1,221	6,033	0.0309	0.0309	186.71	186.71
13	I_MTEF07	Ind. Hi–use 120 kW Rewind	2.83	4.45	1,359	2,566	0.0127	0.0127	78.69	78.69
14	I_MTEF06	Ind. Hi–use 17.5 kW Rewind	3.78	5.94	4,577	8,143	0.0095	0.0095	58.76	58.76
15	I_MTDWN1	Ind. Motors – Downsizing	1.59	2.50	443	1,128	0.0226	0.0226	140.06	140.06
16	I_MTEFO1	Ind. Low–use 3.5 kW retirement	1.63	2.57	531	1,320	0.0220	0.0220	137.63	137.63
17	I_RTINT1	Ind. Rates – Interruptible Service	8.83	8.91	48,621	49,155	0.2396	0.2396	6.64	6.64
18	I_RTTOU1	Ind. Rates – TOU	1.15	1.48	2,057	6,701	0.0621	0.0621	83.90	83.90
19	I_MTEF03	Ind. Low–use 120 kW Rewind	1.16	1.83	330	1,677	0.0309	0.0309	191.51	191.51
20	I_PROC02	Ind. Process Maintenance	1.34	2.11	3,584	11,608	0.0269	0.0269	162.66	162.66
21	I_MTEF05	Ind. Hi–use 3.5 kW Rewind	2.75	4.33	33,053	62,903	0.0130	0.0130	81.54	81.54
22	I_LTHPS1	Ind. High Pressure Sodium Lighting	1.67	2.61	5,760	13,920	0.0218	0.0218	126.55	126.55
23	I_MTEF02	Ind. Motors 17.5 kW Rewind	1.16	1.83	829	4,189	0.0309	0.0309	190.61	190.61

Programs 1 – 6 are the end–use program aggregations; Programs 7 – 23 are the individual programs.

Exhibit 7
Achievable Energy and Demand Savings in Polish Industry in the Year 2000

Program	Energy Savings (GWh)	Demand Savings (MW)	Energy Savings as a % of Total Savings	Demand Savings as a % of Total Savings	Share of Incremental Energy Growth (1995-2000)	Share of Incremental Demand Growth (1995-2000)
Efficient Motors	401	64	23.1%	11.6%	1.8%	2.0%
Improved Drives	68	10	3.9%	1.8%	0.3%	0.3%
Motor Downsizing	7	1	0.4%	1.3%	0.0%	0.0%
Industrial Process	171	28	9.8%	5.1%	0.8%	0.9%
Industrial Lighting	256	44	14.7%	7.9%	1.2%	1.4%
Industrial Rates	59	258	3.4%	46.6%	0.0%	7.9%
INDUSTRIAL TOTAL	**962**	**407**	**55.4%**	**73.5%**	**4.4%**	**12.5%**

- These programs are highly cost-effective in economic terms.
- Regulations should be developed that ensure that investment decisions subsequently made by both utilities and consumers will coincide with optimal investments identified from an economic perspective, i.e., that least-cost options should be the most profitable for all parties.
- Industrial pilot DSM programs can provide the experience and technical proof of concept necessary for implementing full-scale programs in Poland, can help to more accurately assess DSM costs and benefits based on actual field experience, and can help provide a better perspective on regulatory design by taking into account actual consumer response to programs.

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- Industrial DSM pilot programs would be appropriate candidates for financing from multilateral development banks.

Given that industrial DSM programs are both the most cost-effective and the largest contributor to achievable DSM savings, industrial pilot programs would lead to the most rapid realization of substantial DSM benefits. The rest of this part of the study proposes an industrial DSM pilot program that would serve as a bridge towards the full realization of demand-side resources in Poland.

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EXHIBIT 8: INDUSTRIAL DSM PROGRAM COSTS AND BENEFITS

PROGRAM	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Industrial Motors														
Costs:														
Capital + O&M	$0	$4,354,160	$4,354,160	$8,708,320	$8,708,320	$9,809,010	$9,809,010	$0	$0	$0	$0	$0	$0	$0
Prog Admin	$0	$959,500	$709,500	$1,169,010	$1,169,010	$1,231,540	$1,231,540	$0	$0	$0	$0	$0	$0	$0
Benefits:														
MWh Saved	0	39,139	78,278	156,557	234,835	317,808	400,780	400,780	400,780	400,780	400,780	400,780	400,780	400,780
MW Saved	0	6	13	25	38	51	64	64	64	64	64	64	64	64
Value of MWh Saved	$0	$1,040,390	$2,080,780	$4,161,570	$6,242,350	$8,447,830	$10,653,300	$10,653,300	$10,653,300	$10,653,300	$10,653,300	$10,653,300	$10,653,300	$10,653,300
Value of MW Saved	$0	$100,440	$736,130	$1,472,260	$2,208,400	$2,989,070	$3,769,740	$3,769,740	$3,769,740	$3,769,740	$3,769,740	$3,769,740	$3,769,740	$3,769,740
Drive Measures														
Costs:														
Capital + O&M	$0	$630,800	$1,234,000	$1,864,800	$2,490,000	$3,115,200	$3,115,200	$0	$0	$0	$0	$0	$0	$0
Prog Admin	$0	$511,400	$272,400	$283,800	$295,000	$306,200	$306,200	$0	$0	$0	$0	$0	$0	$0
Benefits:														
MWh Saved	0	3,465	10,144	20,287	33,864	50,874	67,884	67,884	67,884	67,884	67,884	67,884	67,884	67,884
MW Saved	0	1	2	3	5	8	10	10	10	10	10	10	10	10
Value of MWh Saved	$0	$91,000	$266,360	$532,710	$889,230	$1,335,890	$1,782,550	$1,782,550	$1,782,550	$1,782,550	$1,782,550	$1,782,550	$1,782,550	$1,782,550
Value of MW Saved	$0	$8,560	$98,330	$196,680	$324,310	$493,240	$658,170	$658,170	$658,170	$658,170	$658,170	$658,170	$658,170	$658,170
Industrial Motor Downsizing														
Costs:														
Capital + O&M	$0	$16,800	$33,600	$50,400	$67,200	$84,000	$84,000	$0	$0	$0	$0	$0	$0	$0
Prog Admin	$0	$361,200	$172,400	$183,600	$194,800	$206,000	$206,000	$0	$0	$0	$0	$0	$0	$0
Benefits:														
MWh Saved	0	355	1,065	2,129	3,549	5,323	7,098	7,098	7,098	7,098	7,098	7,098	7,098	7,098
MW Saved	0	0	0	0	1	1	1	1	1	1	1	1	1	1
Value of MWh Saved	$0	$9,420	$28,250	$56,490	$94,150	$141,230	$188,310	$188,310	$188,310	$188,310	$188,310	$188,310	$188,310	$188,310
Value of MW Saved	$0	$920	$10,120	$20,250	$33,750	$50,620	$67,500	$67,500	$67,500	$67,500	$67,500	$67,500	$67,500	$67,500
Industrial Operations Improvement														
Costs:														
Capital + O&M	$0	$945,000	$1,924,500	$3,904,000	$5,018,000	$5,24[illegible]	$3,567,000	$897,000	$897,000	$897,000	$897,000	$852,000	$762,500	$583,000
Prog Admin	$0	$860,000	$966,000	$1,686,000	$2,042,000	$2,044,000	$1,326,000	$0	$0	$0	$0	$0	$0	$0
Benefits:														
MWh Saved	0	8,600	25,703	60,006	102,813	145,680	171,383	171,383	171,383	171,383	171,383	162,783	145,980	111,377
MW Saved	0	1	4	10	17	24	28	28	28	28	28	27	24	18
Value of MWh Saved	$0	$228,340	$682,480	$1,593,290	$2,729,900	$3,868,100	$4,550,580	$4,550,580	$4,550,580	$4,550,580	$4,550,580	$4,322,240	$3,868,100	$2,957,290
Value of MW Saved	$0	$22,750	$247,280	$577,280	$989,110	$1,401,500	$1,648,780	$1,648,780	$1,648,780	$1,648,780	$1,648,780	$1,566,040	$1,401,500	$1,071,490
Industrial Lighting														
Costs:														
Capital + O&M	$0	$287,910	$1,151,630	$2,303,260	$3,454,890	$4,606,520	$5,758,150	$5,758,150	$5,758,150	$5,758,150	$5,758,150	$5,758,150	$5,758,150	$5,614,930
Prog Admin	$0	$541,500	$724,500	$916,000	$916,000	$916,000	$916,000	$0	$0	$0	$0	$0	$0	$0
Benefits:														
MWh Saved	0	12,821	51,285	102,570	153,855	205,140	256,425	256,425	256,425	256,425	256,425	256,425	256,425	249,538
MW Saved	0	2	9	18	26	35	44	44	44	44	44	44	44	43
Value of MWh Saved	$0	$341,200	$1,364,790	$2,729,580	$4,094,370	$5,459,150	$6,823,940	$6,823,940	$6,823,940	$6,823,940	$6,823,940	$6,823,940	$6,823,940	$6,640,660
Value of MW Saved	$0	$35,290	$500,370	$1,000,750	$1,501,110	$2,001,480	$2,501,850	$2,501,850	$2,501,850	$2,501,850	$2,501,850	$2,501,850	$2,501,850	$2,434,650
Industrial Rates														
Costs:														
Capital + O&M	$0	$1,462,500	$2,925,000	$4,387,500	$5,850,000	$7,312,500	$7,338,500	$0	$0	$0	$0	$0	$0	$0
Prog Admin	$0	$842,500	$935,000	$1,277,500	$1,620,000	$1,962,500	$1,969,000	$0	$0	$0	$0	$0	$0	$0
Benefits:														
MWh Saved	0	2,941	8,824	17,648	29,414	44,121	58,897	58,897	58,897	58,897	58,897	58,897	58,897	58,897
MW Saved	0	13	39	77	129	194	258	258	258	258	258	258	258	258
Value of MWh Saved	$0	$83,920	$251,750	$503,500	$839,170	$1,258,760	$1,680,290	$1,680,290	$1,680,290	$1,680,290	$1,680,290	$1,680,290	$1,680,290	$1,680,290
Value of MW Saved	$0	$206,610	$2,254,110	$4,508,220	$7,513,700	$11,270,550	$15,030,350	$15,030,350	$15,030,350	$15,030,350	$15,030,350	$15,030,350	$15,030,350	$15,030,350
ALL INDUSTRIAL PROGRAMS														
COSTS:														
Capital + O&M	$0	$7,697,170	$11,622,890	$21,218,280	$25,588,410	$30,174,730	$29,691,860	$6,655,150	$6,655,150	$6,655,150	$6,655,150	$6,610,150	$6,520,650	$6,197,930
Prog Admin	$0	$4,076,100	$3,779,800	$5,515,910	$6,236,810	$6,666,240	$5,954,740	$0	$0	$0	$0	$0	$0	$0
National Overhead*	$555,000	$555,000	$555,000	$555,000	$555,000	$555,000	$555,000	$0	$0	$0	$0	$0	$0	$0
TOTAL COSTS	$555,000	$12,328,270	$15,957,690	$27,289,190	$32,380,220	$37,395,970	$36,201,600	$6,655,150	$6,655,150	$6,655,150	$6,655,150	$6,610,150	$6,520,650	$6,197,930
BENEFITS:														
MWh Saved	0	67,322	175,299	359,198	558,330	768,946	962,467	962,467	962,467	962,467	962,467	953,867	936,764	895,574
MW Saved	0	23	66	134	216	313	407	407	407	407	407	405	402	396
Value of MWh Saved	$0	$1,794,270	$4,674,410	$9,577,140	$14,889,170	$20,510,960	$25,678,970	$25,678,970	$25,678,970	$25,678,970	$25,678,970	$25,450,630	$24,996,490	$23,902,400
Value of MW Saved	$0	$374,570	$3,846,340	$7,775,440	$12,574,380	$18,206,460	$23,676,390	$23,676,390	$23,676,390	$23,676,390	$23,676,390	$23,593,650	$23,429,110	$23,031,900
TOTAL BENEFITS	$0	$2,168,840	$8,520,750	$17,352,580	$27,463,550	$38,717,420	$49,355,360	$49,355,360	$49,355,360	$49,355,360	$49,355,360	$49,044,280	$48,425,600	$46,934,300
TOTAL NET BENEFIT	($555,000)	($10,159,430)	($7,436,940)	($9,936,610)	($4,916,670)	$1,321,450	$13,153,760	$42,700,210	$42,700,210	$42,700,210	$42,700,210	$42,434,130	$41,904,950	$40,736,370

NET PRESENT VALUE: $105,385,385 ECONOMIC IRR: 39.1%

* National overhead costs described in Chapter 4, Year 1 are assumed to be fully absorbed by the industrial programs.

EXHIBIT 8: INDUSTRIAL DSM PROGRAM COSTS AND BENEFITS (cont'd.)

PROGRAM	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Industrial Motors													
Costs:													
Capital + O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Prog Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits:													
MWh Saved	400,780	400,780	400,780	400,780	400,780	400,780	400,780	361,641	322,502	244,224	165,945	82,973	0
MW Saved	64	64	64	64	64	64	64	58	52	39	27	13	0
Value of MWh Saved	$10,653,300	$10,653,300	$10,653,300	$10,653,300	$10,653,300	$10,653,300	$10,653,300	$9,612,910	$8,572,510	$6,491,730	$4,410,940	$2,205,470	$0
Value of MW Saved	$3,769,740	$3,769,740	$3,769,740	$3,769,740	$3,769,740	$3,769,740	$3,769,740	$3,401,670	$3,033,600	$2,297,470	$1,561,350	$780,670	$0
Drive Measures													
Costs:													
Capital + O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Prog Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits:													
MWh Saved	67,884	67,884	64,419	57,741	47,597	34,020	17,010	0	0	0	0	0	0
MW Saved	10	10	10	9	7	5	3	0	0	0	0	0	0
Value of MWh Saved	$1,782,550	$1,782,550	$1,691,560	$1,516,200	$1,249,840	$893,330	$446,660	$0	$0	$0	$0	$0	$0
Value of MW Saved	$658,170	$658,170	$624,570	$559,840	$461,490	$329,860	$164,930	$0	$0	$0	$0	$0	$0
Industrial Motor Downsizin													
Costs:													
Capital + O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Prog Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits:													
MWh Saved	7,098	7,098	7,098	7,098	7,098	7,098	7,098	6,743	6,033	4,969	3,549	1,774	0
MW Saved	1	1	1	1	1	1	1	1	1	1	1	0	0
Value of MWh Saved	$188,310	$188,310	$188,310	$188,310	$188,310	$188,310	$188,310	$178,890	$160,060	$131,810	$94,150	$47,080	$0
Value of MW Saved	$67,500	$67,500	$67,500	$67,500	$67,500	$67,500	$67,500	$64,120	$57,380	$47,250	$33,750	$16,880	$0
Industrial Operations Impro													
Costs:													
Capital + O&M	$359,000	$134,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Prog Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits:													
MWh Saved	68,570	25,703	0	0	0	0	0	0	0	0	0	0	0
MW Saved	11	4	0	0	0	0	0	0	0	0	0	0	0
Value of MWh Saved	$1,820,680	$682,480	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Value of MW Saved	$659,670	$247,280	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Industrial Lighting													
Costs:													
Capital + O&M	$5,185,280	$4,612,410	$4,039,550	$3,466,680	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810
Prog Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits:													
MWh Saved	228,876	201,327	173,778	146,230	118,681	118,681	118,681	118,681	118,681	118,681	118,681	118,681	118,681
MW Saved	39	35	30	25	20	20	20	20	20	20	20	20	20
Value of MWh Saved	$6,090,820	$5,357,690	$4,624,570	$3,891,440	$3,158,320	$3,158,320	$3,158,320	$3,158,320	$3,158,320	$3,158,320	$3,158,320	$3,158,320	$3,158,320
Value of MW Saved	$2,233,070	$1,964,290	$1,695,500	$1,426,720	$1,157,930	$1,157,930	$1,157,930	$1,157,930	$1,157,930	$1,157,930	$1,157,930	$1,157,930	$1,157,930
Industrial Rates													
Costs:													
Capital + O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Prog Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Benefits:													
MWh Saved	58,897	58,897	55,955	50,072	41,248	29,483	14,776	0	0	0	0	0	0
MW Saved	258	258	245	220	181	129	65	0	0	0	0	0	0
Value of MWh Saved	$1,680,290	$1,680,290	$1,596,380	$1,428,540	$1,176,790	$841,120	$421,540	$0	$0	$0	$0	$0	$0
Value of MW Saved	$15,030,350	$15,030,350	$14,278,990	$12,776,250	$10,522,140	$7,516,650	$3,759,800	$0	$0	$0	$0	$0	$0
ALL INDUSTRIAL PRO													
COSTS:													
Capital + O&M	$5,544,280	$4,746,910	$4,039,550	$3,466,680	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810
Prog Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
National Overhead*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL COSTS	$5,544,280	$4,746,910	$4,039,550	$3,466,680	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810	$2,893,810
BENEFITS.													
MWh Saved	832,105	761,690	702,031	661,921	615,404	590,062	558,345	487,065	447,216	367,873	288,175	203,428	118,681
MW Saved	385	273	351	319	274	220	153	80	73	60	48	34	20
Value of MWh Saved	$22,215,950	$20,344,620	$18,754,120	$17,677,790	$16,426,560	$15,734,380	$14,868,130	$12,950,120	$11,890,690	$9,781,860	$7,663,410	$5,410,870	$3,158,320
Value of MW Saved	$22,418,500	$21,737,330	$20,436,300	$18,600,050	$15,978,800	$12,841,680	$8,919,900	$4,623,720	$4,248,910	$3,502,650	$2,753,030	$1,955,480	$1,157,930
TOTAL BENEFITS	$44,634,450	$42,081,950	$39,190,420	$36,277,840	$32,405,360	$28,576,060	$23,788,030	$17,573,840	$16,139,800	$13,284,510	$10,416,440	$7,366,350	$4,316,250
TOTAL NET BENEFIT	$39,090,170	$37,335,040	$35,150,870	$32,811,160	$29,511,550	$25,682,250	$20,894,220	$14,680,030	$13,245,990	$10,390,700	$7,522,630	$4,472,540	$1,422,440

CHAPTER 5: PILOT PROJECT DESIGN SPECIFICATION

This chapter presents preliminary specifications for the industrial DSM pilot project proposed in this report. As such, it provides "blueprints" for the practical implementation of the pilot project in Poland. While every effort has been made to provide as much detail as possible, a more complete project design should be undertaken just prior to project implementation. Although these specifications can be used as a guideline, the current status of utility regulation and the economy in Poland should be considered at the actual start of the project.

These pilot project specifications cover the following topics:

- the project's content and features
- financial incentives for utility customers
- a marketing strategy
- concurrent market research activities
- field delivery and implementation issues
- verification and impact evaluation approaches
- process and market evaluation approaches
- DSM cost recovery and regulatory incentive mechanisms.

5.1 PROJECT CONTENT AND FEATURES

The proposed DSM pilot project will have these basic features:

- Z.E. Gliwice will solicit proposals from industrial customers for assistance in implementing DSM projects.
- Z.E. Gliwice will depend primarily upon direct, person-to-person marketing of the project.

- Project eligibility requirements will be simple.

- Project proposal guidelines and forms will be distributed to interested and eligible customers.

- Interested and eligible customers will submit project proposals for DSM projects.

- Z.E. Gliwice and participating customers will negotiate a project and financial assistance package consistent with a set of project policies and principles.

- Proposed DSM projects may include, but will not necessarily be limited to, use of the following technologies which were identified as cost-effective in Chapter 4: high-efficiency motors, motor downsizing, drive applications, process maintenance, process optimization, and high-efficiency lighting. Cogeneration may be considered an eligible project measure to the extent that it complements DSM and is designed to moderate load and not to operate as an independent power project.

- Financial assistance will be offered to customers for approved DSM projects based on energy and demand savings or project cost. However, financial assistance will not exceed 50 percent of total project cost, or DSM resource acquisition rates per kW or KWh saved set at the present value of 50 percent of avoided costs.

- Participating customers must enter into a standard agreement with Z.E. Gliwice for approved projects; the agreement will include provisions for inspection, verification, confidentiality of information, participation in project evaluation efforts, and other items.

- All equipment installed under the project must be inspected and determined to have been installed correctly before the payment will be made. However, on a case-by-case, negotiated basis, partial payments can be made prior to equipment installation if Z.E. Gliwice determines that it is necessary to acquire cost-effective DSM resources.

- Financial assistance will be available for energy audits.

To maximize project flexibility and to allow project managers to maximize the use of local and customer-specific knowledge, the project will operate under a broad set of principles and policies rather than a set of prescribed procedures. Reviews and critiques of the proposed project may result in the addition of more specific guidelines and procedures, but hopefully, this will be minimized. Below, we describe the basic principles and policies under which the project is intended to operate.

Eligibility

The requirements for participation in the project are:

Funding. Industrial firms receiving money from other sources for the same equipment are not eligible for duplicate funding from the pilot project. However, financing total DSM from multiple sources is strongly encouraged.

Equipment. If equipment is to be upgraded as part of a project, it must first be in operating condition. Equipment off-line for routine maintenance or repair is eligible if an acceptable baseline can be established for determining energy and demand savings. Equipment that has been retired in place is ineligible unless it is under renovation for installation in a new or expanding industrial facility, and if an acceptable baseline for determining energy and demand savings can be established. Project equipment installation may begin *on or after* the effective date of the authorizing agreement. The equipment must function properly within a specified time from the effective date of the agreement.

Eligible Firms. The project is for any industrial manufacturing, processing, or refining facility, and on-site ancillary buildings, located in the service territory of Z.E. Gliwice.

Evaluation. Project proposers must agree to participate in project and project evaluations.

Laws and Regulations. Projects must comply with all local, regional, and national laws and regulations.

Installation. Installation of DSM measures cannot begin before the effective date of a project agreement with Z.E. Gliwice.

Curtailment. Measures that reduce loads through the retirement of equipment rather than through efficiency improvements are not eligible. Acceptable measures provide load reductions without reducing the value of the energy services provided by the building or equipment in which the measures are installed.

Energy Reviews (Walk Throughs and Audits)

Z.E. Gliwice will fund energy reviews to find opportunities for electrical energy and demand savings for industrial firms at the levels shown below. Z.E. Gliwice will approve auditors as qualified to undertake the energy reviews or will accept comparable certification by a nationally recognized organization.

Existing Industrial Facilities. $.01 x industrial facility actual annual energy use (kWh), not to exceed the lesser of the actual cost of the energy review or US $10,000.

Exception to Cap. Energy review payments may occasionally exceed the above caps at the discretion of a designated manager.

Copy. A copy of the energy review must be provided to Z.E. Gliwice.

Budget. Energy reviews funded by the project shall not, in total, exceed 15 percent of the total project operating budget.

Resource Acquisition

Purchase Price. Z.E. Gliwice will make an acquisition payment for energy and demand savings at industrial facilities in an amount not to exceed the lesser of:

- the applicable energy acquisition rate shown below times the annual energy savings, plus the applicable demand acquisition rate (shown below) times the demand savings or
- 50 percent of the project cost.

Acquisition rates will not be revealed to customers, but will be used internally by Z.E. Gliwice to calculate target DSM resource investment costs.

DSM Acquisition Rates		
Project Life (Years)	Energy Rate (US $/kWh)	Demand Rate (US $/kW)
1	0.0140	34
2	0.0263	64
3	0.0372	90
4	0.0467	113
5	0.0551	134
6	0.0625	152
7	0.0690	168
8	0.0747	181
9	0.0797	194
10 or more	0.0842	204

The above acquisition rates are calculated as follows: The energy acquisition rates are equal to the present value of 50 percent of the estimated avoided energy cost used in the DSM assessment (0.5 x 2.7 US cents/kWh). The demand acquisition rates are equal to the present value of 50 percent of the estimated avoided high-voltage capacity costs used in the DSM assessment (0.5 x $67/kW/year). A 12 percent discount rate is used for both the energy and capacity calculations. However, they should be revised in the future based on updated estimates.

Reduced Acquisition Payments. On a case-by-case basis, Z.E. Gliwice may negotiate an acquisition payment less than that specified in the above table. Such flexibility in determining an appropriate negotiated payment is intended to minimize the probability of paying for non-performing investments. If Z.E. Gliwice determines that a customer may not be able to operate the project-funded equipment as intended because of financial problems, Z.E. Gliwice may specify, on a case-by-case basis, the maximum project life they are willing to consider for acquisition payment purposes. For example, if a project is being proposed that has a projected lifetime of ten years, but Z.E. Gliwice determines the project is unlikely to operate for that length of time, they may limit their acquisition payment to a level equal to what would be paid if the project only had a five-year lifetime.

Increased Acquisition Payments. On a case-by-case basis, Z.E. Gliwice may approve payments in excess of 50 percent of project cost. Such flexibility in determining an appropriate negotiated payment is intended to allow the acquisition of cost-effective DSM resources that might not otherwise be available.

Inspections. A project must be inspected and equipment determined to have been installed correctly before an acquisition payment may be made. On a case-by-case basis, and with approval from Z.E. Gliwice, up to 25 percent of the acquisition payment may be made prior to full installation. Such progress payments are intended to allow the acquisition of cost-effective DSM resources that would otherwise not be available.

Payment Methods. Acquisition payments may, at the option of the project proposer, be made on the basis of estimated savings or verified savings. With either option, the project proposer must document the savings. Depending on whether the proposer selects to be paid on the basis of estimated or verified savings, the following conditions apply:

- 100 percent of the agreed upon acquisition rate times the verified savings.
- For estimated energy and demand savings, the project proposer will be paid no less than 75 percent of the agreed upon acquisition rate times the estimated savings. This condition is intended to reduce the reluctance of proposers to use new technology by setting a floor on their acquisition payment.

Furthermore, proposers may choose to be paid in a single lump sum or in multiple payments. Z.E. Gliwice may provide financial incentives to proposers for choosing to be paid with multiple payments, if each payment is tied to successive verifications of savings. This incentive can equal the interest earnings lost by the proposer by choosing multiple payments over a single payment, plus an amount not to exceed 10 percent of what they would receive if they opted for a single lump-sum payment.

Verification. All savings verification methodologies will require Z.E. Gliwice approval. Projects costing less than US $10,000 will not require verification for receipt of payments.

Maintenance. Proposers agree to maintain installed equipment over its stated lifetime to ensure that the expected savings persist. If savings do not persist, Z.E. Gliwice will make a comparable reduction in the resource acquisition price it pays over time to the customer.

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Evaluation

Cooperation Requirements. Project participants will cooperate with Z.E. Gliwice if asked to:

- participate in an evaluation of the project
- maintain and make available all necessary project records for evaluation purposes.

Who Pays. Z.E. Gliwice will pay reasonable evaluation costs incurred by project participants.

Equipment Salvage

Right to Salvage. In all agreements made with project participants, Z.E. Gliwice will retain the right to salvage and remove any equipment fully or partly financed through this project, if the project participant fails to utilize the equipment as intended. This provision is meant to be exercised when the facility or process in which the equipment is used ceases to operate permanently or for an extended period of time. At the time of equipment removal, and to the extent that the project participant contributed to the financing of the equipment, the project participant will be compensated for his share of the fair market value of the salvaged equipment. This provision is intended to reduce the cost of non-performing DSM investments.

Verification

Verification Plan. All proposals to acquire conservation must have an adequate verification plan. The purpose of a verification plan is to ensure that contract terms have been complied with for purposes of payment.

General Verification Standards:

- A verification plan must be sufficient to ensure legal accountability and methodological credibility.

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- The plan must call for maintaining accurate records and data necessary to replicate the verifications for at least three years following project completion.

Performance Verification. Performance verification requires measurement. In some cases where duty cycles of the measure are well known and invariable, and where reduction in load is clear, savings can be pre-determined (e.g., motors that operate continuously or street lighting controlled by photocells).

The verification design must clearly describe an acceptable methodology appropriate for the resource being acquired. An acceptable verification plan will describe the basis of claimed energy or demand savings for payment. It will explicitly address the baseline from which savings are calculated, data requirements, outlier adjustments, analysis algorithms, and methods of determining persistence of savings calculations. The plan will list the non-project factors that are likely to cause variation in energy use and demand, and state the method of addressing them so that they do not mask project performance.

All performance verification plans need to provide a means to independently check the accuracy of savings calculations.

Definitions

Energy review	An analysis of an industrial facility conducted by a qualified individual or firm to identify energy and demand savings opportunities, and to estimate costs and energy savings.
Energy savings	Verifiable or verified electric energy (kilowatt hour) annual savings associated with the project. In the case of existing industrial facilities, savings equal the difference between the measured energy use for a reasonable time period with and without the project. In the case of new and expanding industrial facilities, savings equal the difference between the energy use estimated in the final engineering plans without the project and the measured energy use with the project.
Demand savings	Verifiable or verified electric demand (kilowatt) savings -- during system peak demand -- associated with the project. In the case of existing industrial facilities, savings equal the difference between the measured demand for a reasonable time

period with and without the project. In the case of new and expanding industrial facilities, savings equal the difference between the demand estimated in the final engineering plans without the project and the measured demand with the project.

Industrial facility — Any industrial manufacturing, processing, or refining facility located in the region.

Industrial firm — A person, corporation, or business that owns, operates, or manages an industrial facility.

Project — Any project for the installation of equipment that improves the electrical energy efficiency and/or reduces the peak electric demand of an industrial facility and meets agreement requirements.

Project cost — All customary and reasonable capitalized costs incurred by an industrial firm and Z.E. Gliwice to implement a project, including solely allocated administrative costs; engineering design and planning cost; proposal preparation cost; equipment and equipment installation, removal or abandonment-in-place costs; instrumentation and data collection equipment to verify energy and demand savings; permit and inspection fees; and value-added taxes. Operation and maintenance expense, depreciation, profit (margin), and other typically annual costs are not to be included in project cost.

Proposal — An industrial firm's detailed description of a proposed project, prepared in accordance with Z.E. Gliwice's requirements.

Simple payback — Project cost divided by the value of the annual energy and demand savings associated with the project calculated at Z.E. Gliwice's applicable retail rate in effect as of the effective date of the project agreement. Such calculations are to include demand, energy, and power factor components as applicable.

5.2 FINANCIAL INCENTIVES

This section discusses the range of financial incentives that Z.E. Gliwice could offer its customers under the pilot project. As described below, our recommended option is one that combines "variable rebate" and "shared savings" approaches with the option of loan guarantees and subsidized interest rates for interventions that entail more encompassing process modifications.

"Information-Only" Project Components

Diagnostics and Related Technical Assistance. Information on identifying savings opportunities and the technical assistance needed to seize those opportunities can be very costly for a customer to acquire on its own. Therefore, Z.E. Gliwice's willingness to underwrite the cost of audits and other initial plant diagnostics obviates what could be a significant "transactions cost" for the customer.

The pilot project would offer this service as a requirement for participation and would not position this service as "financial assistance" per se. As mentioned earlier, Z.E. Gliwice could forgive subsequent repayment of the audit if the customer agrees to implement all recommended "no-cost" and "low-cost" measures.

Case Studies. As a condition of participation, it is suggested that the customer agree to allow certain aspects of its participation experience to be used in case studies, which would in turn be used as an inducement for other firms in the same industry to gauge the merits of their own future participation. This can be accomplished in a manner that does not divulge confidential or firm-sensitive information. For example, one can report that measures x, y, and z installed at the ABC steel mill yielded verified savings of 12 percent without revealing proprietary information on, for example, production throughput rates or underlying cost structures. Case studies produced from the pilot project will help diminish the economic and technical risks discussed in Chapter 3.

Training. Training and technical assistance will be provided not only to the customer's in-house staff but also to auditors, installation contractors, and other third-parties involved in the pilot project. Both types of training have an economic value to the customer. The benefits of directly training the customer's staff are self-evident. The second form of training increases the expected value of savings because the installations and process modifications are performed by knowledgeable, competent technicians, thus avoiding adverse disruptions and other unintended mishaps that untrained personnel may create.

Use of Trade Allies. Trade allies are corollary participants in utility DSM programs, e.g., distributors and dealers of energy-efficient products and technologies. To the extent that trade allies become partners in the pilot project, their non-compensated, front-end provision of time, expertise and other technical resources provides a direct benefit for participating customers. Thus, cost-free diagnostics, case studies, training and technical assistance, and the use of trade allies create considerable economic benefit for the prospective participant even if the customer chooses to implement only some or none of the recommended measures beyond the "no-cost" or "low-cost" options identified.

Fixed Rebates

Unit-Savings Based Payments. Although popular in many resource bidding projects, this form of incentive may be ill-suited to Poland's DSM pilot project. Typically, a per-unit (i.e., per kW or per kWh) "bounty" is placed on any action the customer (or third-party on the customer's behalf) chooses to undertake. The bounty is usually time-differentiated (i.e., time-of-day or seasonal differentials) and expressed as a fraction of the utility's avoided cost. As long as the bargained-for savings materialize and can be verified by the utility, the payment is made. Non-performance can sometimes carry a penalty charge (in addition to non-payment) and the burden of justifying cost-effectiveness is usually placed on the customer/bidder.

Measure-Based Payments. Most fixed rebate projects are prescriptive in the sense that they are tagged to the implementation of specific measures. In some cases, the measures are generically described (e.g., "a motor of at least x percent rated efficiency at full load operation"). In other cases, lists of qualifying makes, models and sizes of eligible equipment are provided. The rebate is usually set so that the "typical" participant will achieve what is deemed to be a reasonable payback given estimated "average" cost, performance, and usage profiles for a plant in that industry. The customer must usually show evidence of purchase (e.g., invoice) for the subject measure at a cost greater than the rebate amount in order to receive the rebate. In some cases the rebate is capped at some fraction of the verified purchase price, and the rebate is seldom higher than 80 percent of the utility's estimated avoided costs.

Although it is administratively simple, this approach may also be ill-suited for the Poland DSM pilot project because it does not foster customized or more pervasive interventions, and because no empirical foundation yet exists in Poland to reasonably determine "average participant" characteristics.

Variable Rebates

Site-Specific Determinants of Payment Level. The Puget Power DSM project mentioned in Chapter 2 utilizes a variant of the variable-rebate approach. That is, as measures are identified through the audit process, standard algorithms or engineering relationships are applied to value the DSM savings they produce. However, site-specific information is used regarding operating hours and other customer data unique to the host factory or building in which the measure would be installed.

Thus, two different customers installing the same measure at the same cost could receive different financial incentives because the nature of the operation at one facility creates more avoided cost benefits for the utility.

Structuring the Incentives. Typically, pilot projects offer the customer a "menu" of options in terms of quantity, make and model of units to be installed, and the corresponding payment the utility is prepared to make for each line item on the menu. Often, the proposed amount represents the full incremental cost for a replacement measure or the full capital and installed cost for a retrofit measure.

In some cases, the customer makes some up-front contribution and through the process of negotiation is urged to adopt as many of the menu items as possible. Variable incentive approaches tie "compensation" to "value produced" not "action taken," and permit customers to negotiate for DSM benefits much as they would for any other commodity or service that is intrinsic to their line of business.

"Shared Savings" Approaches

Financing Investment from Cost Savings. Before utility-sponsored DSM programs became popular, many energy service companies (ESCOs), or "performance contractors," sold energy efficiency projects on the notion of shared savings. That is, customers repay the ESCOs' investment from their energy bill savings. In general, compensation arrangements under an efficiency-related performance contract take one of the following three generic forms:

- ***Equipment Installation with Guaranteed Savings.*** In this arrangement, the ESCO installs, maintains and owns the equipment that is placed in the customer's building or factory, and trains the facility's staff in its proper

operation. In return, the customer pays the ESCO a monthly leasing fee for the equipment and continues to pay its electricity and other fuel bills.

Each month the attained savings are computed by comparing a reference baseline cost to the customer's actual energy expenses. If the savings exceed the monthly lease payment, the customer "pockets" the difference and no further payments are made by either party. If, however, the estimated savings are less than the lease payment, part of that month's lease payment is waived by the ESCO to permit the customer to "break even." In extreme cases where energy expenses are actually higher than the baseline, no lease payments are made and the ESCO reimburses the customer for the extra costs incurred.

At the end of some stipulated period (e.g., five years), the customer is offered the option to purchase the equipment at its residual fair market value as determined by contract provisions. Also, if the equipment does not perform as outlined in the lease agreement, then the customer usually has the option to terminate the agreement and the ESCO would then remove the equipment at its own expense.

- ***Shared Savings with Guarantees***. In this arrangement, the ESCO typically finances, installs and (usually) operates energy-efficient equipment on the customer's premises. The customer pays nothing for the installation, which remains the property of the ESCO. The ESCO assumes all the risk, draws all the tax benefits (if any), and may sell (as in the option above) the system to the customer at the end of the contract for its fair market value. Each month, the actual energy use is compared to that presumed likely to have occurred absent the efficiency improvements. This calculation is based on methods and formulae clearly delineated and agreed to in advance by all parties to the contract. The difference between these two amounts represents the measured energy savings (assuming that the installation actually saves energy).

In shared savings contracts, the dollar value of the measured savings is divided by some contractually agreed-upon formula between the customer and the ESCO. In other words, each takes a certain fixed percentage of the energy savings. If there are no savings, the customer simply pays its energy bills and owes the ESCO nothing. However, it is virtually universal practice now for the ESCO to ensure that the customer will at least break even and hence will "issue credits" against payments the customer makes to the ESCO for the amount by which actual energy expenses exceed baseline estimates.

- *Guaranteed Energy Expenses.* In this form of contract, the customer pays the ESCO a flat amount each month for all the energy needs covered in the contract. If the actual energy costs are less than that amount, the ESCO keeps the difference. If the actual bills are greater than the flat fee, the ESCO must pay the difference.

  In all circumstances, the customer's out-of-pocket expense (and hence risk exposure) is guaranteed as a fixed percentage of stipulated monthly baseline energy costs (or alternatively, some constant flat fee equal to a fixed percentage of annualized baseline energy costs over the entire term of the contract converted to a monthly equivalent).

  This form of arrangement is sometimes referred to as a "chauffage" or "total energy services" management. As with the other arrangements discussed, the baseline energy costs are almost always indexed or otherwise adjusted for fuel price escalation, etc.

Determination of Repayment Terms and Units. For several reasons, using ESCOs in DSM program delivery encourages customers in some way to share in the cost of the pilot project's activities:

- Customers need to understand that by implementing DSM, Z.E. Gliwice is acquiring a resource on their behalf that is less expensive than conventional supply-side resources. Moreover, it is one that can have both end-use productivity and environmental benefits. However, customers are expected to (and do) pay for all resources -- supply and demand side -- that utilities or other service providers acquire for their benefit.

- Z.E. Gliwice wants the customer to be a partner in this enterprise and does not want to foster the notion that DSM is a return to subsidized electricity pricing.

- North American DSM experience with savings persistence offers convincing anecdotal evidence that savings remain more stable when the customer has some vested financial stake at risk.

- At some point in the not-too-distant future, a viable ESCO community may develop in Poland. Thus, it may be useful to at least introduce early on, the notion of financing efficiency out of shared cost savings. This DSM pilot project should help establish ESCO capabilities in Poland's private sector.

Comparison of Alternatives

Advantages and Disadvantages. For reasons cited earlier, fixed rebates are probably inappropriate for this pilot project. Further, the economic value of information and diagnostics is already embedded as a project feature. This leaves variable rebates and shared savings.

Recommended Approach. Z.E. Gliwice should combine the variable rebate and shared savings options into an incentive delivered through the formal technical and financial proposal received from each participant following the audit.

5.3 MARKETING STRATEGY

To ensure a maximum level of communication and awareness building, the pilot project will be announced and promoted through multiple media to all prospective participants in Z.E. Gliwice's service territory. This would begin through the preparation of prospect lists developed by the Z.E. Gliwice regional staff. The lists would segment facilities by industry sector and size (either production or electricity usage as an indicator of savings potential), and perhaps other firm-specific or operational attributes, data permitting.

A brochure and formal letter of announcement would be mailed to the entire list, or a stratified sample thereof, along with an invitation to attend a workshop. During the workshop, Z.E. Gliwice and its contractors would outline the purpose and objectives of the pilot project, answer all questions, and solicit interested firms to apply.

"Eligibility" at this point would simply consist of the willingness to comply with all project requirements for information and cooperation, willingness to undertake an audit. and the absence of peculiar operating circumstances (e.g., plant only operates six months of the year) that would bias the ability to extrapolate experience at the subject facility to the larger stratum of plants under which it is classified.

A walk-through analysis (initially paid for by Z.E. Gliwice) would be scheduled to identify all cost-effective opportunities for DSM efficiency improvements. At Z.E. Gliwice's discretion, it could elect to retain outside experts to further analyze more complex applications and/or certain aspects of the process to better understand operating profiles and duty cycles that affect the technical and economic feasibility of certain DSM measures.

5.4 CONCURRENT MARKET RESEARCH

There were several issues in need of further market research that were identified in the focus groups organized for this project. They are listed and briefly discussed below.

Extent of Technical Assistance Needed

Many of the focus group participants expressed the opinion that technical assistance for DSM measures was not a high priority. This view was especially prevalent among the large industrial companies, which tend to have a sufficient number of well-trained staff capable of identifying DSM opportunities in their facilities. Their view may be paraphrased as follows: We know how to reduce energy consumption, just help us with financing to make it possible. Polish industry is dominated by large enterprises, so this may be a widely held view. However, experience elsewhere in post-communist countries indicates significant needs beyond financing, including management improvements.

The DSM project proposed here does not put a great deal of emphasis on providing technical assistance, although we propose it be made available through the project. During the course of implementing the project, project managers may find that the provision of more technical assistance would greatly improve the project. It is recommended that project managers continue to collect information from project participants, project non-participants, and DSM contractors and vendors about the value of offering more technical assistance through the project. Mangers should also seek to identify what kind of technical assistance would be most useful, and learn about the willingness of their customers to pay for this assistance.

Whether Product-Specific Rebates Would Be Useful

The DSM project proposed here does not recommend offering a fixed rebate for certain types of DSM equipment and measures. Such rebates are common in North American DSM projects.

Further market research should be done on whether adding a fixed rebate to the variable rebate approach proposed here would substantially increase project participation levels or offer any other important project benefits.

Explore Methods to Overcome Mistrust of the Utility

The focus groups revealed that some customers might be reluctant to cooperate with Z.E. Gliwice, partly because they are angry that their electricity bills are so high, and partly because they believe the utility must have some ulterior motive for seeking to enter and analyze customer facilities (i.e., knowing that the utility makes more profit when it sells more electricity, these customers don't believe the utility is serious about helping them reduce their consumption of electricity).

The problem appears to be limited to a small number of customers, but if it is not, then Z.E. Gliwice could have great difficulty in marketing DSM services. This problem should be further investigated, and if found to be widespread, market research should be done on methods to help overcome the problem.

Explore How Public Facilities Might Require Different Marketing Approaches than Private Enterprises

Publicly owned and funded facilities face many more constraints to participating in a DSM project, especially with regard to their financial contributions to the project. For example, they may be prohibited from shifting funds from an energy account to a capital improvement account for DSM improvements.

Other Concurrent Research

The implementation of the pilot DSM project might be viewed as a large market research effort. It will provide valuable information on what does and does not work for persuading customers to participate in the project. Accordingly, the project should be implemented with market information collection in mind. For example, Z.E. Gliwice should conduct post-project installation interviews with project customers, equipment vendors, and contractors. These interviews could yield valuable information for designing new marketing efforts. As an alternative to these interviews, Z.E. Gliwice could organize focus groups of the same individuals. Moreover, Z.E. Gliwice could organize advisory committees of vendors, customers, and contractors to help evaluate and improve their marketing efforts.

5.5 FIELD DELIVERY AND IMPLEMENTATION

Contractor-Arranged Installation

Use of Contractors. Under this approach, Z.E. Gliwice would be responsible for the oversight of all facets of the equipment specification, procurement, installation and testing of the measures the customer adopts as a result of the audit recommendations. To accomplish this, Z.E. Gliwice will manage a process which will be implemented by paid contractors, such as ESCOs.

The number of contractors required depends on the expertise available and needed for the DSM technologies and industries likely to be engaged in the pilot project. For example, for the audit portion of the project, Z.E. Gliwice may choose to award personal services contracts to individual engineering consultants with expertise in the industry segments the project is working in. Conversely, it may assign clusters of industries to two or more firms that have successful process experience in those sectors.

For installation, Z.E. Gliwice would probably find it simpler to award contracts to firms with trained teams of technicians dedicated to specific technology/equipment groupings. For instance, one firm may specialize in the "no-cost" measure category, which involves simple, lower-skill-level maintenance, repair and fault detection activities. Another firm may focus on motor replacement, and more technologically complex controls and process retrofit applications.

To choose the best vendors of services and equipment, Z.E. Gliwice should conduct a competitive procurement as follows:

Step 1. At the time the pilot project's initial workshop is held, a separate workshop should be held for prospective implementation contractors, consultants and trade allies. Trade allies are corollary organizations involved in DSM implementation, e.g., distributors and dealers of energy-efficient products.

Step 2. Interested parties would be requested to submit a statement of qualifications along with technical and credit references demonstrating their technical competence and conformance to sound business practices. Z.E. Gliwice would accept national certification of ESCOs and auditors as evidence of qualifications.

Step 3. The submission would also include a set of hourly billing rates for different skill levels and technical specialties. Where a contractor's staff would have to be augmented with new hires, it must submit a hiring plan outlining its testing and qualification procedures. Preference would be given to firms that have the majority of needed staff already on their payrolls.

Step 4. A competitive scoring of bidders would result in the selection and award of contracts. The contracts would be structured as "basic ordering agreements" wherein guaranteed labor rates and standard time allowances for performing certain on-site functions could be quoted in the technical and financial proposal submitted to Z.E. Gliwice.

Development of Equipment, Installation and Testing Specifications. The implementation contractors would develop comprehensive equipment specifications, based on energy audits, that combine:

- requirements adapted from manufacturers' equipment specifications and installation instructions
- prevailing building and safety codes
- union work rules (if any)
- any customer-imposed conditions regarding the conduct of installation activities on-site.

These specifications should be codified by activity type (e.g., new motor installations). Part of each specification would be time standards that could be used to estimate the person-hours and cost to perform most unit functions.

Most contractors work to such specifications and performance standards. Their use fosters fairness in the costing of projects and in determining that the work is acceptable and should be reimbursed. Z.E. Gliwice can probably adapt the needed specifications from those contractors that provide sample specifications from previous projects in which they were engaged.

An important part of these specifications is the development of equipment testing protocols. These protocols would address three areas of equipment performance:

- confirmation that, once installed, the equipment generally conforms to manufacturer specifications and representations regarding: current draw,

voltage and other "nameplate" ratings, and the relative efficiencies of operation under full and various part-load conditions

- assurance that electronic controls and devices (e.g., ASDs) do not degrade power quality by creating harmonic distortions, power surges and other problems

- longer-term monitoring of high-efficiency equipment to determine if voltage fluctuations and power surges following service interruptions have damaged them or shortened their useful installed life. This would be accomplished by periodic site visits to inspect equipment, reconfirm additional metered test readings, and inspect components. The site visits would use non-restrictive testing procedures that do not require removing the equipment from the factory premises or taking it off-line for extended periods of time.

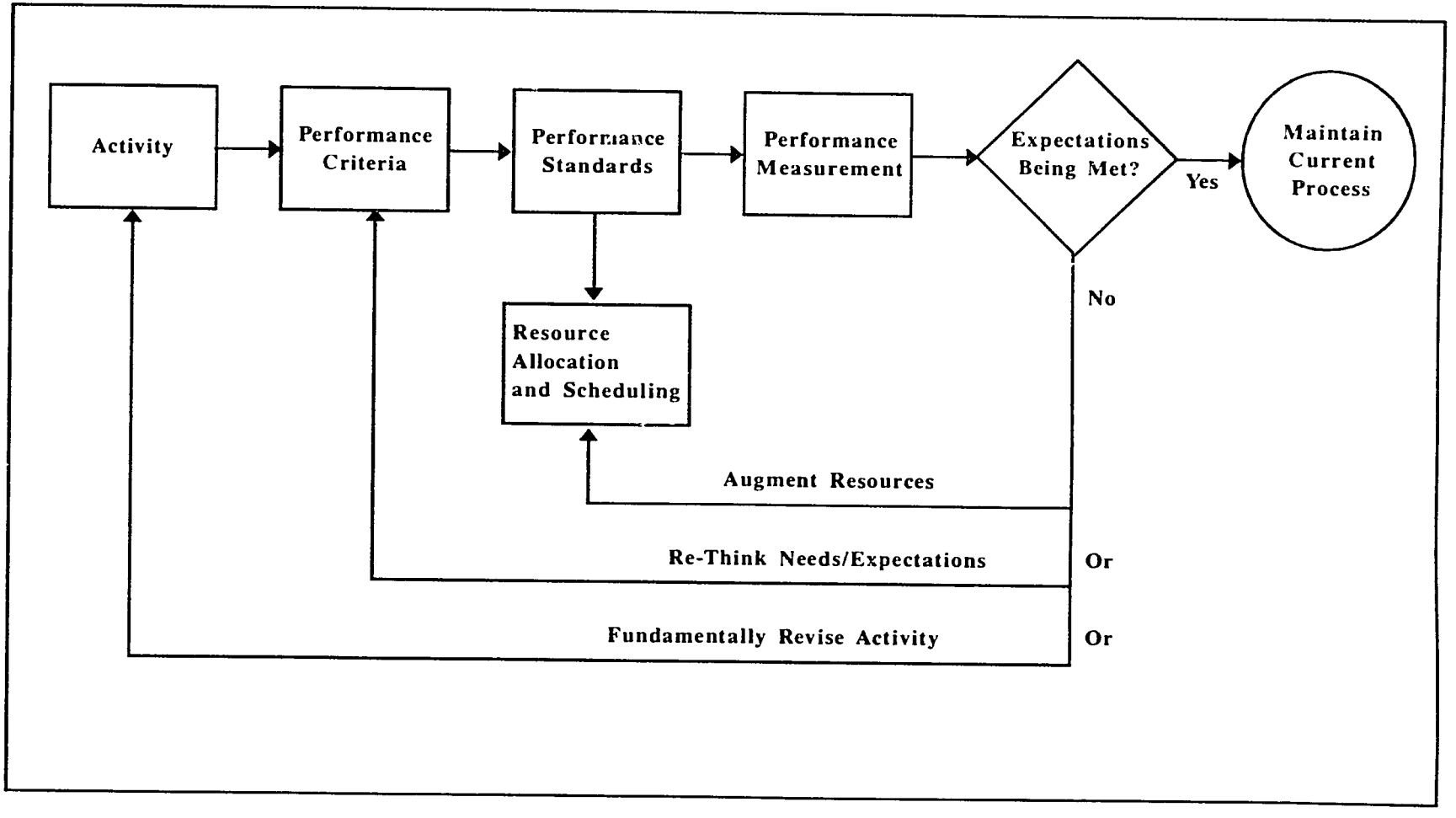
Quality Assurance, Control and Inspection. Z.E. Gliwice would have oversight of the field activities and the performance criteria and quality assurance/quality control (QA/QC) standards established to monitor those field activities (see Exhibit 9). For example, consider the activity "installation of new high-efficiency motors." As a performance criterion, Z.E. Gliwice may establish that no customer should wait more than 90 days from the date of its approved application in response to Z.E. Gliwice's proposal for the installation of new equipment at its facility.

This criterion then gives rise to performance standards (which must be unambiguously measurable) that the implementation contractor is expected to meet. So, for instance, the number of participating customers plus new participants, and the numbers of units each project entails, combine to produce an equivalent average weekly installation rate that the contractor must meet to ensure a customer does not remain in the "service queue" for more than 90 days.

Conformance to this standard can be directly monitored through on-site inspections and the tracking of activity reports and invoices the contractor submits to Z.E. Gliwice. If expectations are not being met, Z.E. Gliwice must take one or more of the remedial actions outlined in the diagram.

It is important that the pilot project test the ability to conduct field operations and logistics in a thoroughly business-like fashion. Because the project will intervene in the day-to-day operations of factories and businesses, mismanagement, delays or faulty workmanship can have severe consequences entailing considerable economic loss to the customer. Strict

Exhibit 9
Developing Performance Standards and QA/QC Requirements



discipline and quality control are absolutely essential to ensure pilot project cost-effectiveness and customer goodwill and confidence.

Chapter 7 discusses the need for Z.E. Gliwice to maintain a formal pilot project performance tracking system to ensure financial and management controls and to facilitate reporting.

Equipment Procurement. It is anticipated that Z.E. Gliwice will review and approve the procurement (including competitive cost quotations) of all equipment needed in the various projects. It is further anticipated that this equipment would be obtained by the implementation contractors from a mix of domestic and foreign suppliers, and that in the latter instance, any import duties, taxes or other customs fees would be waived.

It is an objective of the pilot project to help foster the development of a domestic technology delivery infrastructure including regional and local distribution channels that can rapidly mature to support subsequent full-scale projects. It is reasonable to expect that foreign suppliers interested in both near- and longer-term project opportunities in Poland would seek to establish local distribution and manufacturer representative relationships with Polish enterprises. The pilot project should explicitly encourage these affiliations.

Customer-Arranged Installations

Contractor Eligibility and Certification. In most cases, industrial customers will select and contract directly with implementation contractors that Z.E. Gliwice qualifies as participating in the project. It is reasonable to assume that some firms may have long-standing relationships with certain consultants or companies and that they would want to maintain those relationships. Z.E. Gliwice will review their qualifications for acceptance into the program consistent with the competitive bidding process described above.

Although prior experience would be a criterion on which competing bidders would be scored, there is no guarantee that for either the audit or installation phases of the project, that a particular customer's preferred consultant would be selected.

Despite the confidentiality guarantees Z.E. Gliwice would provide, some customers may be suspicious of allowing individuals or firms on their premises if the customer has not selected them. Liability insurance considerations may also be an issue that makes customer-identified contractors more attractive.

Disbursement of Incentives. Z.E. Gliwice would provide financial incentives directly to the customer, which would in turn be responsible for paying all contractors and suppliers. Any DSM costs in excess of those provided through Z.E. Gliwice's financial incentives would be the responsibility of the customer.

Equipment Salvage and Disposal Issues. All replaced equipment should be removed by the implementation contractor and certified to Z.E. Gliwice for salvage or other permanent disposal. It does little good to allow the customer to retain units as "spares" or resell them directly to other firms or intermediaries, as these inefficient units could simply be re-installed elsewhere in Poland. To the extent that any equipment has tangible salvage value, this implied amount can be factored into Z.E. Gliwice's financial incentives to the customer.

Customer Responsibilities. It is recommended that Z.E. Gliwice make customer-arranged installation the primary delivery mechanism. In cases where the customer wishes to deviate from this procedure, a special waiver must be granted by Z.E. Gliwice. The customer would assume full liability for managing the process so that it ultimately passes Z.E. Gliwice's inspection requirements. Any carrying costs or other financial overhead associated with delays, remedial work, or other contractor disputes would become the customer's problem.

Training of ESCOs. Through the competitive solicitation process described above, Z.E. Gliwice may determine that there are an insufficient number of ESCOs that are qualified to perform the required energy audits and equipment specification and installation tasks. If this is the case, the DSM pilot project may have to include an ESCO training component. This activity could be coordinated with national efforts to certify qualified ESCOs and other energy engineering firms, and could be sponsored by special funding from bilateral assistance programs.

Consideration of Unsolicited Proposals. It is expected that the field delivery and implementation approach described above will provide a systematic and orderly process for hiring ESCOs and developing DSM projects at Z.E. Gliwice's customer facilities. However, there may be unusual circumstances in which unsolicited proposals are submitted to Z.E. Gliwice outside of the normal process. Z.E. Gliwice should retain flexibility to consider such unsolicited proposals, to the extent that they conform to the required audit standards, respond to the general technical opportunities targeted by the pilot project, and meet selection criteria (e.g., for experience and qualifications).

5.6 VERIFICATION AND IMPACT EVALUATION

Verification

Verifying the savings that result from the pilot is essential to:

- show participating customers that measurable energy and demand savings have actually occurred
- prove the viability and cost-effectiveness of a utility-operated, industrial DSM project in Poland
- provide a basis for estimating the impact of a subsequent full-scale project.

The task of generalizing results to a larger population will be complicated because of the small number of participants (probably less than 50 plants), which are likely to exhibit:

- heterogenous process types
- very different (and in some cases, unique) operating profiles and production constraints
- relatively customized applications and, in some cases, process modifications
- significant facility-wide savings in aggregate across all measures installed.

This suggests the need for facility-specific verification protocols because:

- it is not feasible to define meaningful control groups or matched-pair approaches for bill comparisons
- the types of econometric billing data approaches, statistically adjusted engineering estimates, or conditional demand analyses commonly used in other North American DSM project evaluations are not always appropriate because of the limited number of observations in Poland and the need to control for so many concurrent on-site influences.

Accordingly, we propose that customized facility-specific analyses be performed to deal with the high-impact, unique building/plant treatments encompassing multiple end-uses and interactive effects that are likely to be observed. This will require that Z.E. Gliwice, their

contractors, and the customer work together to establish an accurate reference baseline to measure the pilot's impacts.

It is expected that Z.E. Gliwice's evaluation approach would incorporate end-use metering as part of its impact estimation procedure. The approach would integrate engineering algorithms, simulation models, and statistical regression methods. It would also be necessary to devise combined approaches for aggregating impacts at sampled facilities to produce project-wide estimates, and for enhancing measurement accuracy and precision.

Here, as with all DSM impact estimations, the challenge is to compare: 1) *actual* consumption in treated end-uses *subsequent* to the intervention with 2) estimates of consumption that *would have occurred* in those end-uses absent the intervention. Thus, the savings impact *cannot* be directly *measured*, only *estimated*, since 2) is a non-observable event.

The accuracy of this estimation process is a function of:

- *precision level* as represented by a tolerance band within which one believes the impact to be measured is contained

- *confidence level* as represented by the probability with which one believes the impact of interest is actually contained in that specified tolerance band.

A "verification protocol" is simply an action plan outlining, step-by-step, how the reference baseline is to be established, what impacts are to be quantified from that baseline, and for what time periods. It describes the role of metering, engineering and statistical methods in producing these impact estimates. It also specifies the environment within which verification takes place and what other activity flows need to be metered (e.g., production rates, temperatures, fluid flows). This will produce not only a "snapshot" estimate of current savings but also insight into longer-term issues of savings persistence.

As a component of a well-conceived verification protocol, metering dictates monitoring requirements based upon the need to:

- isolate the energy consumption of affected end-uses and/or equipment whose consumption levels, time profiles of usage, duty cycles, and full/part-load performance characteristics are not well-known or understood

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- monitor the flow rates/transaction rates of other physical variables (e.g.. volume of fluids pumped, number of items produced, mass of product cooled) that explain and can be correlated with the quantity of electricity consumed in the treated end-use

- leverage engineering and statistical procedures whose accuracy/precision levels can be greatly enhanced through calibration/regression with metered data.

The way in which metering is used and metering sample sizes are determined is predicated on the levels of precision and confidence desired.

Evaluation seeks to establish a "with project" versus "without project" comparison baseline (see Exhibit 10) and to isolate and quantify the effects of key factors (see Exhibit 11). The project's savings impacts can be estimated even when overall consumption increases (as shown in Exhibit 12).

Referring to times A, B, and C in Exhibit 10, Exhibit 13 describes how combined engineering, metering and statistical approaches can be used by to verify savings by pilot participants.

The "Controlled Experiment" approach is the simplest and most straightforward option, but may be difficult to implement under real factory-floor circumstances. The "Two-Stage Calibration" approach is the most expensive and also involves the logistic difficulty of pre-intervention metering, which may be problematic for some pilot customers.

If the intervention is a *retrofit*, the advantage of the "Two-Stage Calibration" approach is that the engineering model is being calibrated to the same technology that would have remained in place at times A and C. If the intervention is a *replacement*, the "Single-Stage Calibration" approach is preferable since time C almost always represents a technology *other* than that used at times A and B (that is, the technology may be more or less efficient than the technology in place prior to the replacement).

Z.E. Gliwice may wish to hold a one-day workshop for all participating customers to communicate to them how the evaluation will proceed, how sampled results will be transferred to them, and what record keeping, self-reporting and survey-response responsibility they may have.

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Exhibit 10
Verified Savings Attributable to the Program May Only Contribute a Portion of the Overall Change in Billed Consumption

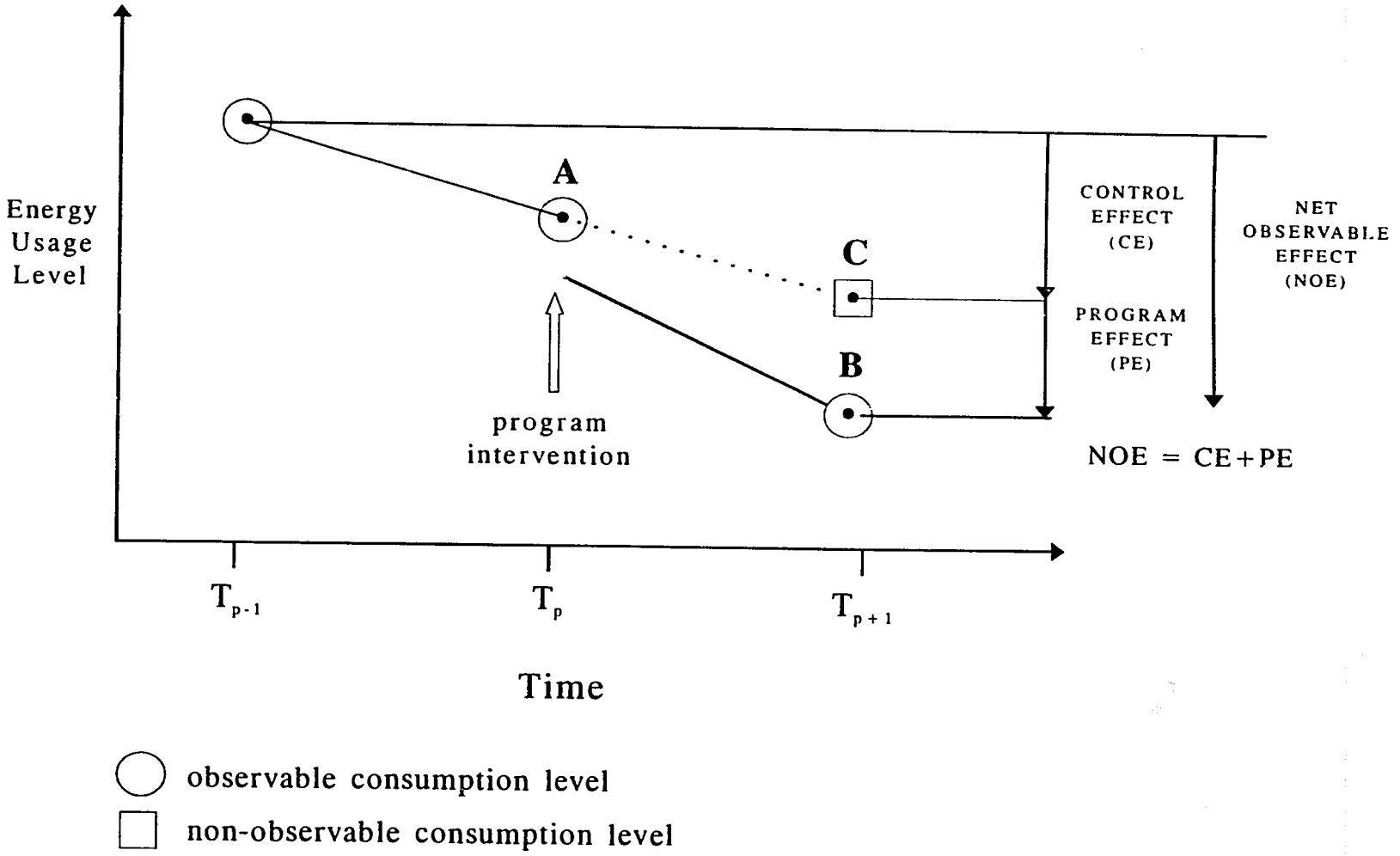
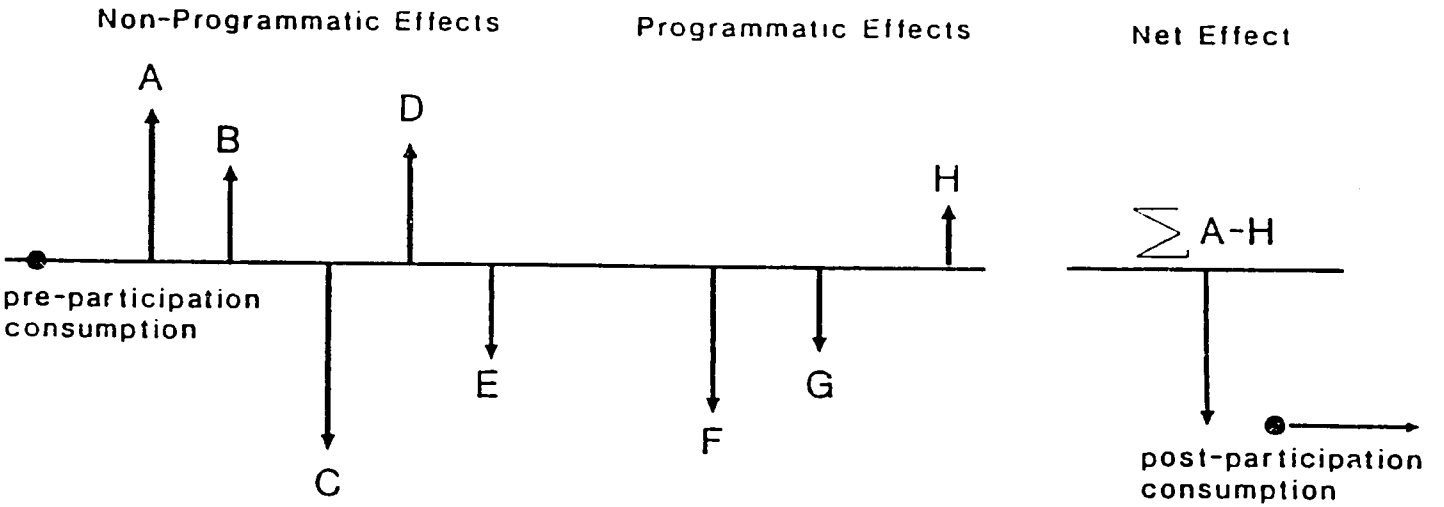


Exhibit 11
Savings Measurement Must Isolate and Quantify the Influence of Programmatic and Non-Programmatic Factors



Effects

- A: illumination of formerly vacant areas for in-process inventory storage
  B: expanded operating hours at night and on weekends
  C: unanticipated 2-week plant shutdown for environmental retrofit
  D: installation of new exterior perimeter lighting
  E: non-program related conservation actions
  F: installation of high-efficiency lamps and ballasts
  G: installation of motion sensors
- H: replacement of lamps in fixtures containing burned out bulbs and using program intervention as an opportunity to increase illumination levels in selected areas of production and warehousing areas

*This effect results in altered service levels requiring special adjustments in the savings computation

Exhibit 12
Measurable Savings Can Be Verified in Some Cases, Even if Facility Consumption Increases After Participation

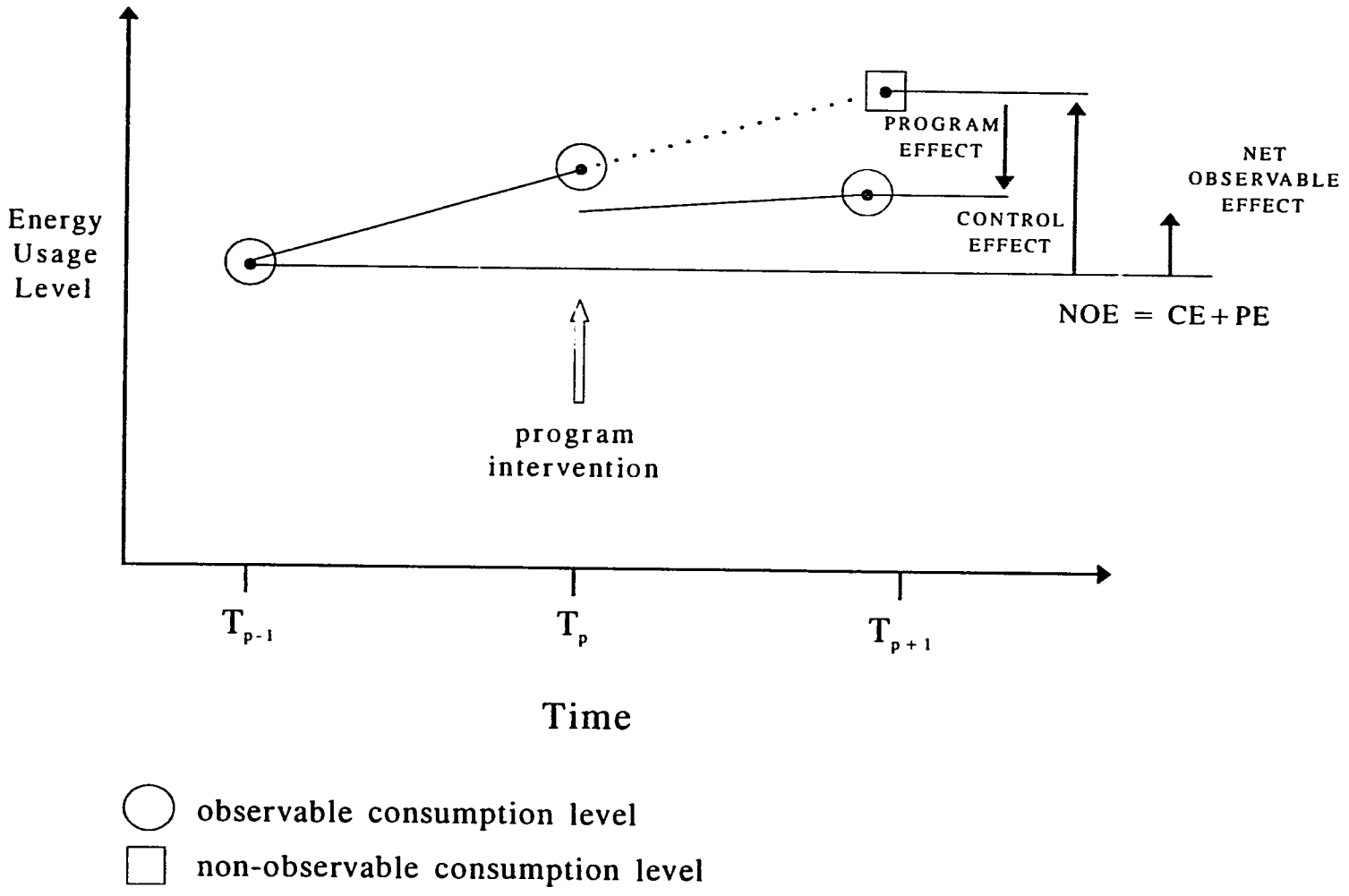


Exhibit 13
Alternative Hybrid Verification Approaches

Approach A: "Controlled Experiment"

- metering is used at times A and B for short intervals, pre- and post-intervention, respectively
- production rates, operating hours, etc. are held constant such that "control effects" wash out and only project-related effects are observed
- savings are computed per unit of activity (per hour of use, per unit produced, etc.) and factored to post-intervention activity levels.

Approach B: "Single-Stage Calibration"

- only post-intervention metering is done (i.e., time B)
- an engineering model is used to predict consumption at time B and this estimate is then compared to metered time B consumption
- an adjustment factor (or relationship) is derived
- the engineering model is used to predict time C and this result is calibrated by the adjustment factor
- savings are estimated by comparing the adjusted time C prediction to metered time B consumption.

Approach C: "Two-Stage Calibration"

- pre- and post-intervention metering is done (i.e., times A and B)
- the engineering model is calibrated using an adjustment factor based on the time A comparison
- time C is projected using the calibrated model
- savings are estimated by comparing the adjusted time C prediction to metered time B consumption.

Unit Savings Impacts

It is important that unit savings impacts be estimated for each type of intervention (e.g., per high-efficiency motor installed, per ASD installed). A distribution and range of impacts can then be developed for each measure, and perhaps further differentiated by industry type if enough observations are obtained within certain industry groupings.

This will help Z.E. Gliwice interpret the likely variability of savings both within and across measure and industry categories, and to decide which estimates are most appropriate to use in projecting full-scale project impacts.

5.7 PROCESS AND MARKET EVALUATIONS

Participation Rate

A successful pilot can only reasonably be expected to attract 30-50 participants over an 18-month period. Thus, the *types and patterns* of participation (or non-participation) may be as important as the absolute level of pilot enrollment. For example, Z.E. Gliwice will need to address the following questions:

- Is there a conspicuous absence of participation within one or more important industry sectors?
- Is plant or company size an important determinant of participation?
- Are there differences in the degree of project interest between domestic and foreign-owned firms?
- Have there been any examples of successfully leveraging multi-facility ownership by a single corporate entity?
- What features of the pilot appear to be most attractive to participants? The greatest obstacle to acceptance? Can these be easily modified?

Once these factors are sorted out, it is possible to extrapolate the probable overall, full-scale project participation by drawing upon the market segmentation information described in Chapter 4.

Cost-Effectiveness and Efficiency of Field Delivery

Apart from the savings impacts, Z.E. Gliwice must be concerned with how effectively it managed the pilot's implementation. Z.E. Gliwice will need answers to the following types of questions:

- What lessons have been learned about competitively procuring, managing and financially controlling the implementation contractors' services?
- What do the quality assurance reports suggest about the technical competence and efficiency with which audits and installations were performed?
- Were procurement lead and lag times as anticipated? If not, why?
- How did the pilot foster the development of local and regional distribution and "technology delivery" capability?
- Were administrative and delivery costs a disproportionate fraction of overall pilot costs relative to initial budget estimates?
- Have Z.E. Gliwice staff acquired valuable experience that could be transferred to pilots or full-scale projects in this and other technology areas?

Customer Perceptions of Satisfaction and Enhanced Service Quality

Through focus groups, personal interviews and follow-up surveys, Z.E. Gliwice should track whether or not customers appear satisfied with the pilot and how these perceptions change 3, 6, 9 months, and a year or more after initial participation. This would reveal the perceptions of customers as their business conditions change and as verification efforts reveal how much savings have actually been realized.

It is also important to determine whether customers perceive an increase in their "service quality." That is, are other dimensions of their operation (e.g., higher reliability, increased throughput, reduced downtime) positively affected, or has DSM served only as a cost-reduction action? These insights can be qualitatively and quantitatively documented in the case studies Z.E. Gliwice would prepare to help promote the full-scale project.

Re-assessment of Full-Scale Project Options

The evaluation results may indicate that little modification of the pilot's features or delivery approaches is needed before full-scale project operation. On the other hand, there may be a need for major "course corrections," or worse, that a full-scale project is simply not advisable.

It is difficult to assess what circumstances may produce any given outcome. However, at each stage of the pilot process, formal contingency plans should be developed. Whether the revealed problems are budgetary, operational or administrative in nature, logical plans will have been thought through in advance to guide further action.

Comprehensive Retrospective Benefit-Cost Analysis

Typically, pilot projects are viewed as research, development and demonstration activities designed to reduce the risks and uncertainty of future project activities. As such, they are not normally subjected to the same stringent retrospective benefit-cost analysis as full-scale projects.

Nonetheless, it would be useful to perform this type of analysis on this project to gain insight into how cost-effective a full-scale project might be. Of course, a pilot project cannot be expected to be as cost-effective as a full-scale project because of one-time startup costs, project learning and training costs, and economies of scale, but this type of analysis could still be very useful in helping to estimate the cost-effectiveness of a full-scale project.

The outcome of this analysis will be important in securing support and funding for full-scale expansion. It will also be instrumental in examining what project features, measures or delivery procedures are necessary to eliminate or modify for the full-scale version of the project.

5.8 DSM COST RECOVERY AND REGULATORY INCENTIVES

Z.E. Gliwice and the other utility companies in Poland face a number of unique challenges associated with the post-communist transition to a restructured market economy. However, the utility sector in Poland shares a major feature with most of the utilities in the rest of the world when it comes to demand-side management: every kWh that the utility sells increases revenues and every kWh that the utility does not sell decreases revenues. In this sense, it

doesn't really matter if Z.E. Gliwice is still a state-owned enterprise or if it becomes a privatized joint-stock company, as currently planned. In either case, under current tariff regulation, reduced sales (whether from DSM, declining industrial production, or simply mild weather) will result in reduced revenues which is bad for the fiscal health of the company. Therefore, a powerful disincentive exists for Z.E. Gliwice to implement a pilot DSM project or to participate in the future to implement an aggressive full-scale DSM program.

This problem, not unique to Z.E. Gliwice, goes to the heart of the evolving legal and regulatory framework of Poland's utility sector. For this reason, the problem was presented in Section 5.2 of Part 1 of this report as a national institutional policy issue: the legal and regulatory framework under which the power sector operates in Poland should ensure that integrated resource planning (IRP) is the most profitable plan for the utility as well as the least-cost plan for its customers and society at large. To the extent that DSM is a least-cost electric resource, a mechanism must exist to not only remove the powerful disincentive for DSM, but to also provide the utility with a positive incentive to implement DSM. In Section 5.2 of Part 1, two mechanisms were described: 1) recovery by the distribution companies of DSM costs through electric rates and 2) the ability of the distribution companies to earn financial incentives to implement DSM.

The day may come when a regulatory framework for IRP exists in Poland, through the possible passage of energy laws, the establishment of energy regulatory authorities, and the subsequent promulgation of regulations governing the operation of the utility sector. However, in anticipation of the implementation of a DSM pilot project, it would be imprudent to wait for such a comprehensive system to evolve at the national level. Therefore, some of the basic principles for removing the utility disincentive for DSM are proposed here as part of the pilot project design. It is proposed that these principles could be implemented on a one-time, experimental basis strictly associated with the pilot project. Then, the outcome could be evaluated for application in a more systematic way at the national level. In a sense, the pilot project would provide the opportunity for not only a technical and programmatic proof-of-concept, but also for an institutional one.

This section first describes what these principles for DSM cost recovery and regulatory incentives are (referred to hereafter as "DSM incentives"). Then, two different mechanisms are proposed that could accomplish essentially the same outcome: 1) the provision of the DSM incentives through the transfer tariffs that the Polish Power Grid Company (PPGC) charges to Z.E. Gliwice and 2) the provision of the DSM incentives through the retail tariffs that Z.E. Gliwice charges its customers.

DSM Incentive Mechanisms

A number of DSM incentive mechanisms have been developed and implemented throughout the United States in the last ten years. These can serve as a starting point for the consideration of comparable mechanisms in Poland. The development and use of DSM incentive mechanisms depend on the specific goals of regulators and the motivations of utilities involved in the process. Therefore, there is no attempt here to define the "best" mechanism, which in most cases will probably be a combination of mechanisms. Following is a brief description of the most common DSM incentive mechanisms.[1]

Recovery of DSM Project Costs. Most participants in the IRP process agree that the recovery of DSM project costs is required in order to obtain the enthusiastic support of utility management to aggressively pursue IRP goals. This view holds that utilities should be able to recover all allowable direct costs to design, implement, and evaluate DSM projects. These costs include the incentives paid to customers (such as rebates) to motivate their participation in the projects, payments to vendors (such as bids by energy service companies) to compensate them for implementing projects, and other project-related expenses such as advertising, labor and administration. Most jurisdictions that have adopted DSM incentive mechanisms typically allow for the recovery of DSM project costs. In most cases, the cost recovery is not inherent in the incentive mechanism but is provided through another complementary process for this purpose such as a surcharge or a deferral mechanism.

Recovery of Lost Revenue. A major disincentive to DSM is the lost revenue (associated with unavoidable fixed costs) from foregone sales of electricity that customers don't buy because of end-use efficiency. Absent the decoupling of revenues from sales (see the following point), utilities should be able to recover the lost revenue on fixed costs. Variable costs (primarily for fuel) are not incurred and are therefore not "lost."

Decoupling Revenues from Sales. Decoupling the direct relationship between a utility's revenues and its sales volume removes the utility's short-run incentive to sell additional electricity. While decoupling eliminates the issue of the recovery of lost revenues from DSM, it also has a much broader impact on utility operations. Decoupling mechanisms make utilities indifferent to sales volume since their revenues are decoupled from sales, then determined administratively. Another approach decouples revenues from sales, but instead of being administratively determined, revenues are then "recoupled" to some other attribute, such as the rate of customer growth which allows the utility to recover a fixed amount of

[1] *Regulatory Incentives for Demand-Side Management*, Steven M. Nadel, Michael W. Reid, and David R. Wolcott, eds. Washington, DC: American Council for an Energy-Efficient Economy, 1992.

revenue per customer. Revenues vary only as the number of customers varies; thus, the utility is indifferent to sales volume and is motivated to serve its customers' energy service needs at the lowest possible cost.

Some regulators believe that decoupling is a fundamental fix to the deficiencies of traditional regulation. However, others do not necessarily see decoupling itself as a panacea because it does not provide a positive incentive to promote DSM (see the following point). Furthermore, since decoupling shifts risk from utilities to ratepayers, it can have the side effect of making utilities indifferent to issues that could raise rates (e.g., cogeneration bypass) or degrade customer service. Utilities have generally been less quick to embrace decoupling because it removes a potential avenue to profitability.

Provision of Positive Incentives. A positive incentive may be required to motivate utility management to overcome the perceived risk of implementing DSM projects. Regulators increasingly agree that utilities should earn increased profits, at least initially, for successfully accomplishing their goals in IRP (e.g., implementing a resource plan with the lowest societal costs) and DSM (e.g., acquiring all cost-effective DSM resources). Among various possible positive incentive mechanisms, there are no inherent differences in the amount of bonus provided. Instead, the value of the incentive depends on several other factors that can be built into any mechanism.

The primary factor is the magnitude of the incentive that regulators allow. Regardless of the mechanism, regulators generally decide what an appropriate incentive amount is for an expected level of utility performance. A second factor is whether thresholds are established that must be exceeded before incentives are earned. Some jurisdictions allow incentives to be earned on the first kWh saved while others require that a threshold amount of savings must be achieved before an incentive begins to accrue (others even provide penalties if savings are particularly low). A third factor is whether caps are established to limit the maximum incentive that can be earned. Caps can keep incentives from becoming excessive, but once the cap is reached, a utility has little incentive to continue pursuing the desired behavior. The final factor is the amount of time over which a bonus is earned. A bonus today is better than a bonus tomorrow, considering both the time value of money and the uncertainties of regulatory continuity.

Pilot Project Implementation of DSM Incentives

In considering the implementation of any DSM project in Poland, even a pilot project, it seems clear that some DSM incentive mechanism is needed to obtain the enthusiastic support

for the enterprise by the host utility. Assuming acceptance of that assertion, only one question remains: Which mechanism and how should it be implemented? This question has not been easily answered in the United States, where a number of different mechanisms and combinations thereof have been implemented in various regulatory jurisdictions.

The recommendation that follows represents an attempt to balance the need of Z.E. Gliwice to have the basic disincentive for DSM removed while recognizing the state of flux of the institutional environment and the difficult conditions of the economy. For example, because of the existing uncertainty regarding the development of government policies for the utility sector, the concept of decoupling seems too radical and comprehensive to implement at this time. In a similar fashion, it seems unreasonable to reward Z.E. Gliwice with a positive incentive when so many other enterprises are struggling in the difficult economic circumstances of the post-communist transition.

Removing decoupling and positive incentives mechanisms leaves the recovery of DSM costs and revenue losses as the available mechanisms. With these two, at least Z.E. Gliwice will be indifferent to the impact of DSM on its revenues, even if it does not receive a reward for implementing DSM. This approach also seems reasonable in a pilot project context, in which the basic risk of doing something new is compensated while avoiding the possibility of windfall gains from unanticipated outcomes.

Having settled on the recovery of DSM costs and revenue losses, the question remains: how to provide for their recovery? The answer lies in the two cashflow streams that Z.E. Gliwice handles in its operations: 1) the transfer tariffs it pays to PPGC for power from the grid and 2) the retail tariffs it collects from its customers. Following is a discussion of how each approach might work in practice:

DSM Incentives in Transfer Tariffs. Z.E. Gliwice currently purchases the majority of the power it distributes from the PPGC, the operator of the transmission system (a smaller portion of power is purchased directly from local generators in its service territory). PPGC charges wholesale rates for the bulk power in transfer tariffs, which are currently regulated by the Ministry of Industry and Trade (this arrangement may change in the future if an Energy Regulatory Agency (ERA) is established with authority over all utility rate setting). The DSM project costs and revenue losses could be calculated and then deducted from the transfer prices that Z.E. Gliwice pays to PPGC.

The rationale for this approach would be that PPGC would be operating under an obligation to acquire and dispatch the least-cost electric resources available throughout the Polish power system (including power from generators and DSM from distribution companies) to meet the

system load. To the extent that the DSM resources offered by Z.E. Gliwice represent relatively low-cost resources compared to available supply-side resources, the entire system would benefit. The cost to PPGC of allowing Z.E. Gliwice to recover its DSM costs and revenue losses would be added to the transfer tariffs charged to all PPGC customers and thus would be borne by all ratepayers throughout the country.

The transfer tariff approach to providing DSM incentives would also work well for the distribution of credits obtained by Poland from multilateral development banks for power sector investments. Under the presumption that PPGC is the single national entity receiving MDB loans, it could disperse the loan proceeds for DSM investments through credits on transfer tariffs to the distribution companies. The loans could either be repaid from the national cashflow from PPGC's sales of power to the distribution companies or from individual distribution companies out of the resource savings they obtain from the DSM savings occurring in their customers' facilities.

DSM Incentives in Retail Tariffs. Z.E. Gliwice sells the power it distributes to its customers and collects revenues through retail tariffs currently regulated by the Ministry of Finance (an arrangement that could also change with the creation of the ERA). The DSM project costs and revenue losses could be calculated and then added to the rates Z.E. Gliwice charges its customers.

The rationale for this approach would be that Z.E. Gliwice would be operating under an obligation to acquire and distribute the least-cost electric resources available to it (including power from PPGC and its generators as well as DSM from its customers) to meet its local load. To the extent that the DSM resources offered by its customers represent relatively low-cost resources compared to available supply-side resources, Z.E. Gliwice would benefit. The cost to its customers of allowing Z.E. Gliwice to recover its DSM costs and revenue losses would be added to the retail tariffs charged to all Z.E. Gliwice customers and thus would be borne by all ratepayers throughout its service territory.

Details and Variations on the Theme

The discussion above is only a rough sketch that poses the two approaches as independent choices. A discussion of some details and nuances that might accompany the implementation of either approach follows.

Shared Savings. In both cases above, the total benefit discussed is that available to Z.E. Gliwice in terms of its recovery of DSM costs and revenue losses. There is another

benefit that accrues automatically to PPGC: the total resource savings it obtains from not having to acquire and provide the power that is avoided by the DSM happening in Z.E. Gliwice's customers' facilities. On the one hand, it would be easy to allow PPGC to retain those resource savings and recognize them as an inducement to PPGC to go along with whichever scheme. On the other hand, it would be possible to calculate those resource savings and then share them through some split (e.g., 50:50) between PPGC and Z.E. Gliwice (as a credit on transfer tariffs). This approach would essentially introduce a positive incentive to Z.E. Gliwice into the equation. Z.E. Gliwice could similarly pass through a share of the resource savings to its customers (as a credit on retail tariffs). In one jurisdiction in the United States that employs this approach (New York), the resource savings include the environmental externality costs avoided by DSM, which adds an extra dimension to the equation. While this approach may be more equitable, it would certainly add complexity to the arrangement and might not be warranted.

Combination Approach. The two approaches to providing DSM incentives described above need not be mutually exclusive. A system could be devised in which a combination of the two approaches could operate. Some recovery of DSM costs and revenue losses could be obtained through the transfer tariffs and some through the retail tariffs. However, while this approach may also be more equitable, it also would add complexity to the arrangement and might not be warranted, especially for a pilot project.

Importance of Tracking Systems and Impact Evaluation. One of the beauties of the decoupling approach to DSM incentives mentioned above is that there is no need to precisely track the DSM costs and revenue losses. Tariffs are determined administratively, independent of sales, through a regulatory process. However, the two DSM incentive approaches presented here would require rigorous tracking of project costs and the savings achieved by the project which would be the basis for determining revenue losses. Both of these processes are described in the DSM pilot project design (tracking systems in Chapter 7 and impact evaluation in Section 5.6.). Both activities can be costly and are subject to some subjectivity and game playing (the utility might be motivated to inflate costs and savings to increase the revenues it would be allowed to recover). Nonetheless, both activities are essential for the conduct of a pilot project in order to document and prove the concept. Therefore, either approach is warranted with the caveat that special attention needs to be paid to the tracking systems and impact evaluations to ensure that they present independent, objective data.

All-Source Competitive Bidding. The two methods mentioned above provide Z.E. Gliwice with a guaranteed recovery of its DSM costs and revenue losses. This is probably appropriate in the short term to overcome resistance to a new idea, especially for the

implementation of a pilot project. However, a more market-based mechanism can be envisioned in the use of the transfer tariffs as the vector for providing DSM incentives: an all-source competitive bidding system, involving both supply and demand-side resources. In this approach, PPGC would hold an annual auction for essentially the baseload portion of system load. Generators and independent power producers would bid an amount and price to supply power to PPGC and distribution companies, ESCOs, and large customers would bid an amount and price to supply DSM resources. PPGC would rank order the bids on an integrated resource planning basis (taking price and non-price factors, e.g., reliability, into consideration) and then contract for the least-cost resources. For DSM resources that are contracted, PPGC would pay over the year through the transfer tariffs. To the extent that the winning price that a distribution company bids is greater than or equal to its DSM costs and revenue losses, the approach yields essentially the same outcome as the more deterministic approach proposed above.

Cost to Non-Participants. In both approaches proposed above, all ratepayers end up footing the bill for the DSM investments. In the transfer tariff case, the DSM costs and revenue losses are spread across the entire Polish ratebase which would probably mean they would be relatively insignificant. In the retail tariff case, the costs are spread across the ratebase of Z.E. Gliwice, which could cause a more noticeable impact on bills. In either case, an argument can be made that ratepayers who do not participate in making DSM investments will suffer bill increases. This argument is partially offset by the fact that all customers will benefit from the total resource savings of DSM, to the extent they are retained by PPGC and Z.E. Gliwice and reflected in overall lower bills for everyone. Nonetheless, this issue has been a problem in the United States where non-participants (especially large industrial customers) complain of paying for DSM in their bills without receiving any benefits.

Two ways of dealing with this problem have evolved which could possibly be applied in Poland to the extent that the issue is raised. One approach (applicable to the retail tariff approach above) would be to recover the costs associated with DSM investments in a particular class of customers from that class. For example, relevant to the industrial DSM pilot project design proposed in this report, Z.E. Gliwice would recover the DSM costs and revenue losses through retail tariffs of only the industrial customers, leaving no impact on residential and commercial bills. Alternatively, the DSM costs could be assessed on the individual customer participating in the project and receiving the DSM benefits. In that case, a "DSM charge," based on the actual investment in a customer's facility, would be assessed on that customer's bill until the total investment cost is recovered. The charge could be proportioned to be less than the savings accruing during any particular period, leaving the

customer with an incentive to participate, in addition to the incentive of obtaining up-front capital from the utility for DSM improvements.

Practical Implementation Issues. Finally, the question arises regarding how to implement either one of these schemes in practice within the context of the industrial DSM pilot project proposed in this report. In either case, agreements would have to be reached among participating parties. These parties would be Z.E. Gliwice, PPGC, and the Ministry of Industry and Trade (or ERA) for the transfer tariff approach and Z.E. Gliwice and the Ministry of Finance (or ERA) for the retail tariff approach. In either case, the agreements should include an obligation for Z.E. Gliwice to keep records associated with the DSM costs and revenue losses resulting from the pilot project activities. If necessary, to reduce the institutional risk of doing something new, "two sets of books" could be kept, showing how tariffs would have been calculated normally versus how they are calculated with the DSM incentive. Part of the pilot project evaluation would then be a comparison of the two accounts to document both the rate impacts of DSM on the system as well as the extent to which Z.E. Gliwice was "made whole" through the process. The results could then be extrapolated to the national level to judge the impact of full-scale DSM projects on Poland's utility sector.

CHAPTER 6: END-USE LOAD RESEARCH ELEMENT

This industrial DSM pilot project contains an end-use load research element as an integral component of project design. End-use load research is an important complement to the demand-side management activities undertaken by utilities. By understanding how its customers use electricity in their facilities, utilities can more accurately gauge the DSM resource potential available to them. Load research also plays an important role in impact evaluation, through which the actual costs and savings of DSM are accurately determined. Finally, the establishment of a load research staff or department at a utility can go a long way toward increasing the level of customer service, as utility staff interact with their customers and learn more about their needs for energy services. This last point is especially relevant in Poland, where utilities are realizing the need to change their market outlook, from a strong tradition as commodity vendors to one of energy service providers.

In the project which led to this report, a mini end-use load research activity (spot monitoring program) was undertaken with Z.E. Gliwice as a preliminary way to introduce the basic concept of load research to the DSM pilot project design process. In this chapter, the activities and results of the spot monitoring program are described. The objectives and methodology of the load research element of the pilot DSM project are then presented. In this sense, load research is defined as a separate pilot project activity because it typically involves different people at the utility whose tasks are performed independently and at different times than the DSM project implementation staff. In fact, this independence is essential for the integrity of the load research results, which in the case of impact evaluation, must be scrupulously objective and impartial. The chapter continues with details about the proposed sampling plan, monitoring equipment, and data collection and processing protocols. It concludes with a discussion of the data analysis activities that will support and complement the DSM pilot project implementation.

First, however, a brief description of the history and process of utility load research in the United States is appropriate to fix the role of this technical discipline within utility operations. Utilities have been conducting load research in the United States for over sixty years. Traditionally, load research provided data needed for cost allocations and the resulting cost-of-service information.[1] Most demand-related costs of production, transmission, and distribution facilities can be allocated to the classes of service based on system peaks, class peaks, or individual customer demands that are determined from load

[1] *Load Research Manual*, Association of Edison Illuminating Companies, Birmingham, Alabama, 1990.

research data. The introduction of time-of-use tariffs expanded most utility load research activities to include analysis of customers' demands during on- and off-peak periods. Load data also played an important role in informing utility load forecasts.

Historically, load research activities focused on the acquisition and analysis of "whole premise" customer data (i.e, billing data). However, recently load research has evolved to include the collection and analysis of customer end-use consumption data. Utilities now face competitive pressures that force them to better understand how their customers use electricity. For example, load data can provide concrete information about the strengths and weaknesses of certain marketing programs. With the advent of DSM programs, the need for good end-use load data has dramatically increased. For example, load research data are necessary to evaluate the cost-effectiveness of DSM programs and their impact on utility operations.

Exhibit 14 shows the activities of a typical load research process. From planning the objectives of load research, a sample design is undertaken, and data are collected, processed, and analyzed. The results are then applied for some evaluation purpose. In the case of this report, load research will be used to evaluate the results of the industrial DSM pilot project.

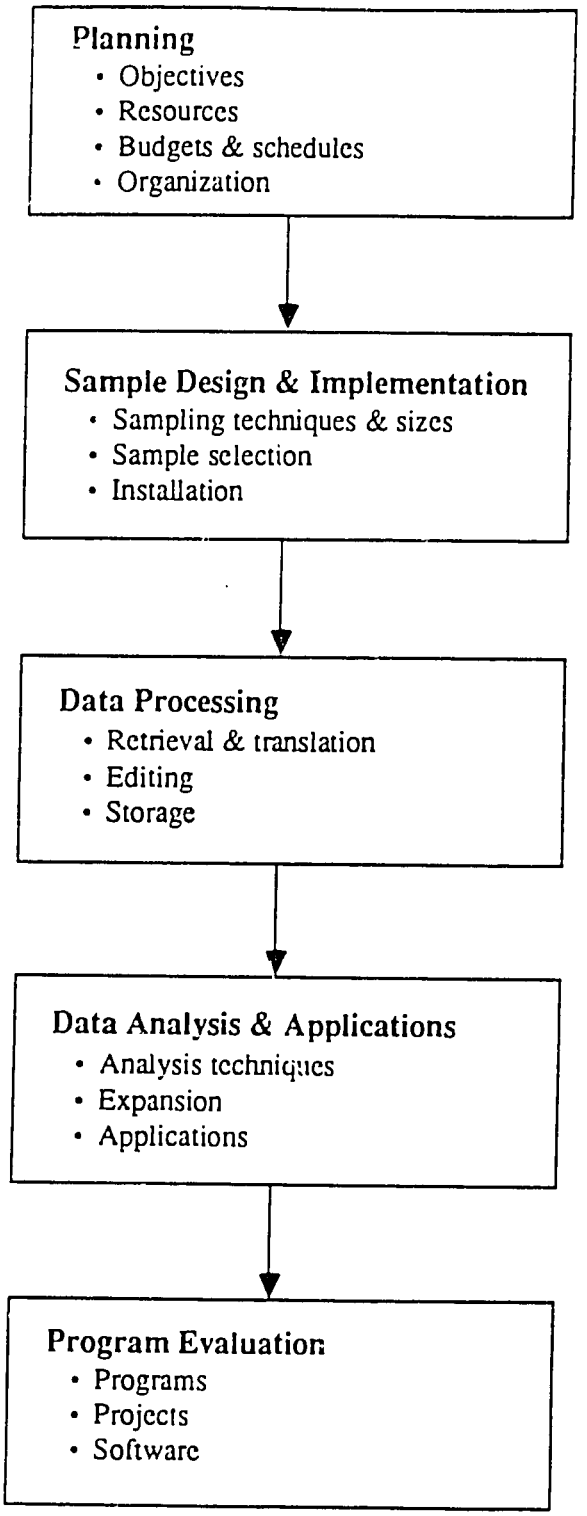
6.1 BACKGROUND AND RATIONALE

The Load Research Element is intended to furnish an assessment of the potential DSM resources in Z.E. Gliwice's service territory, which will ultimately help the utility to provide market-oriented services that are more responsive to its customers' needs. Z.E. Gliwice staff will also be trained so that they can extend the program to full-scale implementation in the future.

Although load research will be conducted on industrial, commercial, and residential customers, the focus of the pilot project will be the industrial sector, which accounts for the major portion of the company's electricity demand. Between 2 to 5 percent of Z.E. Gliwice's peak load (52 to 130 MW) will be analyzed by the load research element. The program's primary sources of data, which will be used to evaluate the potential impacts of DSM measures, will be:

- whole-premises data (kW and kWh)
- end-use data measured by monitoring instruments
- billing data from selected customer groups
- survey data collected from a wide range of customers.

Exhibit 14
The Load Research Process



The load research element incorporates in its design the load research experience of several U.S. utility companies, as well as the field experience gained from the spot monitoring activities in Z.E. Gliwice's service territory. It was also designed with sufficient flexibility to overcome many of the constraints faced by Poland's residential, commercial, and industrial sectors during the country's transition to a market-oriented economy.

6.2 SPOT MONITORING PROGRAM

The spot monitoring program was undertaken between March and June 1993 as a quick, in-field trial to test U.S. load monitoring equipment under Polish conditions, to introduce the concept of demand-side management to local utility personnel, and to gauge the reactions and responses of the customers who were monitored. It also helped to define the most suitable and cost-effective instruments, seminars and training, and venues for vendor participation in the pilot load research element. Last, and most important, this program allowed for the collection of load profiles on several end-uses.

In October 1992, Z.E. Gliwice was selected to help implement the pilot load monitoring program. Several industrial plants were contacted to solicit their cooperation for the first field monitoring trial. From these plants, one steel mill, one coal mine, and one central district heating plant were selected as the sites at which the monitoring program would be tested.

The coal mine represents a class of heavy electricity customers that are served under the high-voltage tariff. Because nearly 20 of Poland's 54 coal mines are in Z.E. Gliwice's service territory, the mining industry represents a major portion of the company's system load. Most of Poland's mining operations operate continuously on weekdays and do not operate on weekends. There is very little seasonal variation in the coal mines' loads.

The steel mill also represents a class of heavy electricity customers served under the high-voltage tariff. Because Z.E. Gliwice's service area contains a high concentration of steel plants, these users account for a major portion of the company's system load. As a result of production cutbacks, some of the steel mill operations in Z.E. Gliwice's territory are candidates for flexible time usage.

The district heating plant represents a customer class that exhibits seasonal variation in demand and usage. These plants are not only electricity consumers but may also generate electricity.

In addition to these three industrial plants, a vocational school and a children's clinic were selected as representative sites in the commercial sector. One unit of flats in a high-rise apartment building and one single-family dwelling were added to represent the residential sector.

By February 1993, site visits had been conducted, and instruments had been procured and delivered to Z.E. Gliwice. Two types of power monitoring equipment were acquired for this project through competitive bidding. For the heavy industrial loads, four Rustrak Ranger power monitors (model RR2-1233A) were purchased from Mark IV Instruments, Inc. The Rustrak data were downloaded to spreadsheets for analysis using its own Pronto software product. For the lighter commercial and residential loads, ten power monitors manufactured by Pacific Science and Technology, Inc. (TOU series) were purchased. Training was provided by the equipment vendors and seminars on instrument installation were held with the help of the technical and marketing department of Z.E. Gliwice.

Z.E. Gliwice followed a tight schedule for the monitoring program, and by late June 1993, the spot monitoring task was completed and reports were submitted. Also, the end-use load profiles were stored on electronic diskettes and the data were organized and presented in both graphic and tabulated form.

For the industrial customers, recordings were made on current, voltage, real and reactive power, and power factor of individual motors or furnaces. In the case of residential and commercial sites, the whole-premise energy consumption (kWh) was recorded, as there were on-off and time-of-day recordings of the lighting circuit, hot water pumps, and refrigeration compressors or fan motors.

Findings by Industrial Site/Sector

Jastrzebie Coal Mine. The fan motor at the main shaft of the Jastrzebie coal mine was a 1.6 MW motor of constant speed and 24 hour continuous operation. The load on the 1.9 MW motor for the No. 2 shaft elevator varied between weekdays and Sunday, at a ratio of almost 3 to 1. Together, these two motors consumed 16 million kWh of electricity in 1992. The cost of this consumption was $535,000.

Huta Baildon Steel Plant. The 10 MW, 15 metric ton capacity electric arc furnace at the Huta Baildon steel mill operates in batch mode at between 25-75 percent load. The furnace's electricity cost was about $56,000 a month, on average. By scheduling a shift in the evening, it is possible for the plant to avoid the high demand charge.

The induction fan motor at the filtering station was on steady operation. The shaft (resistance) furnace and the induction furnace were monitored, but they are not operated on a regular schedule.

The load profile of the electrolysis bath was recorded for five days in March. It showed the variation in load from day to day depending on the demand for hydrogen. Air compressors, the salt bath furnace, and rolling mill motors were monitored as well. Like the fan motors and shaft furnace, there were several units of different sizes that could be used interchangeably. The electric dryer at the welding electrode plant was the only end-use that showed consistent load during the weekdays.

Laziska District Heating Plant. Combustion air fan and induction fan motors, coal crusher motors, feed water pumps, and cooling water pumps were monitored and their load profiles recorded.

Commercial and Residential Sectors. Power usage for household and institutional lighting is not as high as that in the United States. However, there are a vast number of hot water circulation pumps in institutional buildings and high-rise apartments, associated with the district heating system.

Because the security systems in the school and clinic were not as good as those in industrial customer facilities, the monitoring instruments could not be secured for the duration of the spot monitoring. Also, because some of these sites' electrical systems were old, it was often difficult to hook up or attach instruments.

The single-family dwelling monitored had an electric hot water heater, electric stove, water pump and incandescent lighting. The apartment unit monitored did not have any major electric appliances except a refrigerator. Its lighting load appeared to be the major portion of the whole-premise load.

Results

The results of the spot monitoring program confirm the need for and applicability of end-use load research in Poland. The majority of the data gathered will be useful to Z.E. Gliwice, its customers, and potential suppliers of energy-related services and products.

The end-use load data also proved to be very useful in identifying patterns of consumption and indicating potential DSM technologies and practices. The data consist of three primary components:

- utility report
- RUSTRAK power monitor data
- load logger data.

These proved to be the most useful and combine to illustrate the overall profile of consumption for each consumer monitored. These data were used to generate typical load shapes for the residential, commercial, and industrial customers.

The data and analysis were useful in evaluating the following DSM energy efficiency technologies and practices:

- power factor correction
- variable-speed drives
- lighting and controls
- demand controllers
- industrial controls
- high-efficiency refrigerators
- load optimization
- peak load shaving.

The results of this pilot effort clearly indicate the need to expand the end-use monitoring program, and the benefits to the utility and its customers from data analysis. Future end-use load monitoring programs could be improved by better targeting the specific equipment to be monitored, and comparison in advance to billing and consumption data. Following is a description of the data collection results.

Load Data

The results of the spot monitoring program are contained in three primary sources of data:

1. *Utility Report* - Z.E. Gliwice generated a report for each customer included in the program. This report contains a general description of the facility, end-use equipment that was monitored, and a summary of load shapes and billing data. The report was very useful in corroborating the data from the power monitors and load loggers.

2. *RUSTRAK Power Monitor* - Data were collected on many examples of typical end-use equipment, from large industrial motors and process equipment to small household loads. Typical load shapes for commercial and residential consumers can be generated from these data, and load shapes can be generated for selected industrial applications. The data are useful to evaluate opportunities for energy-efficient equipment, load shifting, peak shaving, and energy-efficient practices. Data were compiled for voltages, current, power (active and reactive), and power factor.

3. *Load Loggers* - Data were also collected by load logger instruments, which measure on/off cycles for end-use equipment. Electronic power and current loggers, as well as lighting loggers (photo sensitive) were used. They were found to be sufficient to enable the collection and transmittal of load data into electronic files for further analysis. Data were collected for lighting, motors, and general uses.

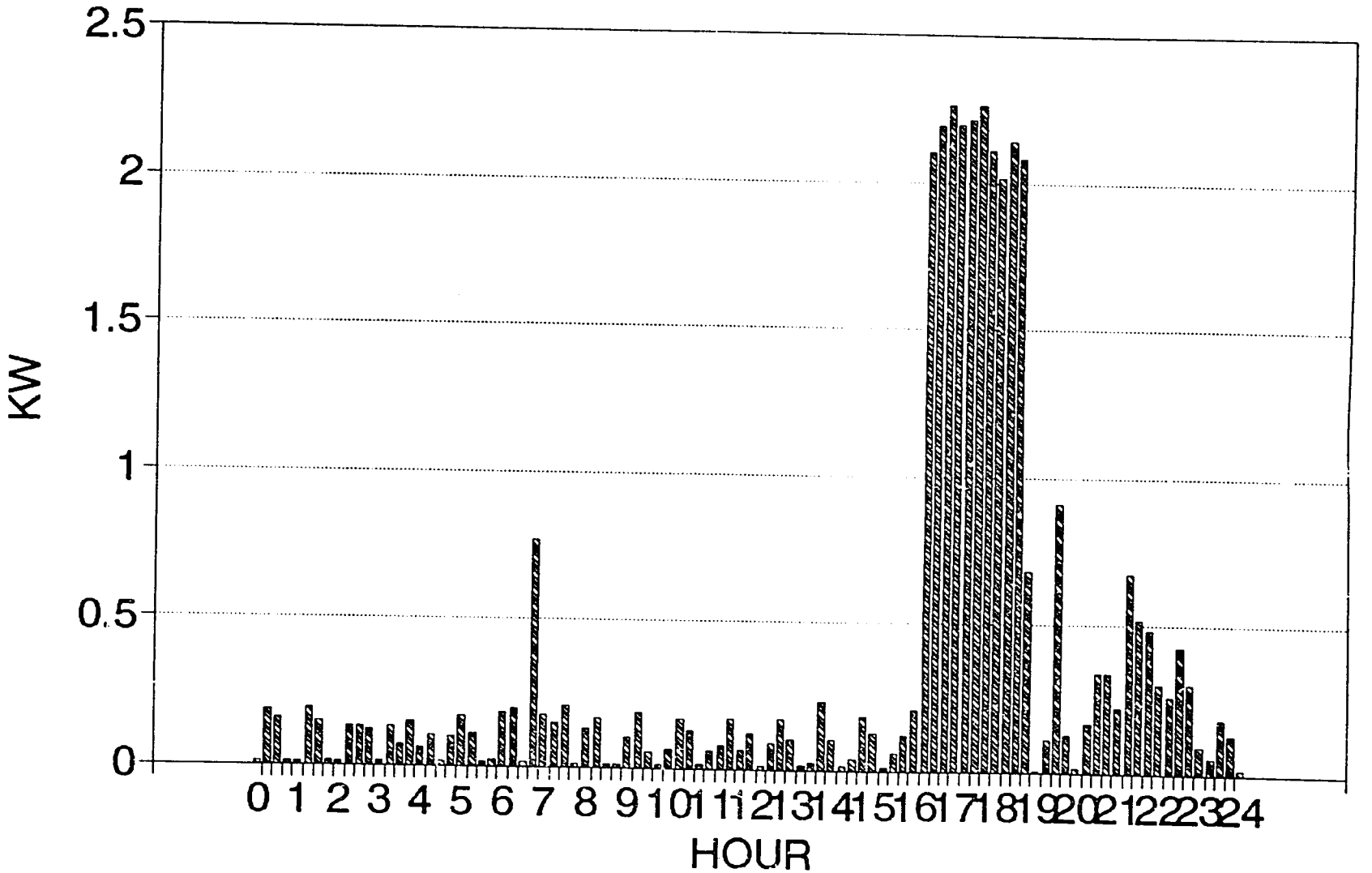
Specific results are contained in the following paragraphs with illustrative load shapes. Most of the monitoring appears to have been well targeted to electrical consumption equipment and systems that could be included in an overall DSM program.

Load Shapes

Typical load shapes were generated for the following consumers:

- *Single-Family Home* - The single-family home exhibited a uniform baseload and peak periods of 6:00 to 7:00 and 16:00 to 22:00. The baseload (0.25 kW) and peak load (2.25 kW) are lower than in the U.S., but the load shape is generally similar. Exhibit 15 illustrates the results for a typical day.

Exhibit 15
Single-Family Home Load Profile
(24 hour, Wednesday, May 12, 1993)



- *School* - The school also exhibited the expected load shape with peak loads occurring from 7:00 to 15:00 and 16:00 to 20:00 for a typical weekday. The weekend load profile was relatively flat. Exhibit 16 illustrates the school load profile.

- *Hospital* - The hospital load profile was predictable, with peak load occurring from 6:00 to 18:00, and the baseload steadily declining from 18:00 to 06:00 for a typical day. The weekend load profile exhibited a smaller peak load, but the shape was consistent. Exhibit 17 illustrates the hospital load profile.

- *Industrial* - The spot monitoring program concentrated on monitoring large end-use equipment, not entire facility loads, at the steel mill, coal mine, and district heating plant. The results were aggregated into facility load shapes that generally conform to overall load shapes. Exhibits 18 through 20 illustrate these load profiles.

DSM Energy-Efficient Technologies

The end-use data clearly identified the applicability of several energy-efficient technologies that could be included in an overall DSM program. These technologies and their applications are summarized as follows:

- *Motor Loading/Power Factor Correction* - Most industrial equipment and commercial facilities exhibited lower than acceptable power factor (cos phi), e.g., the hospital's overall power factor was approximately 0.7 during off-peak periods and 0.8 during peak periods (see Exhibit 21). For industrial equipment, power factors as low as 0.5 were observed (see Exhibit 22). This indicates that there are underloaded motors in operation. A program to replace motors with the correct size would improve cos phi and also improve motor efficiency (reduce kWh). Alternatively, capacitors could be installed to correct cos phi (but no kWh savings would result).

- *Variable Speed Drives* - Exhibit 20 shows that pumping flow from the district heating company is met by shutting down the main pump for several hours per day. It may be possible that the installation of variable speed drives on the pumps could meet flow conditions, using lower energy requirements.

Exhibit 16
School Load Profile
(24 hour, Friday, May 7, 1993)

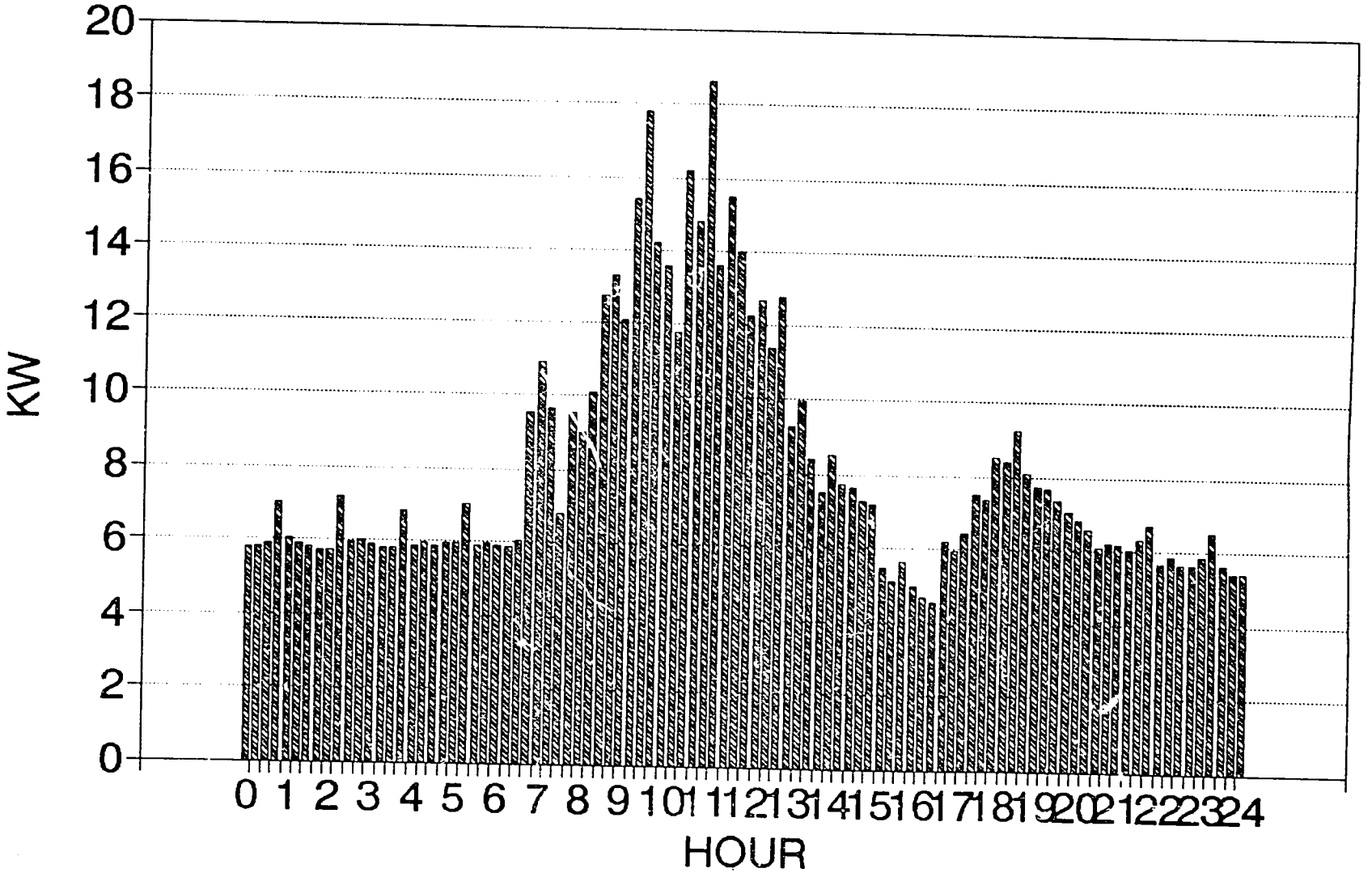


Exhibit 17
Hospital Load Profile
(24 hour, Tuesday, May 4, 1993)

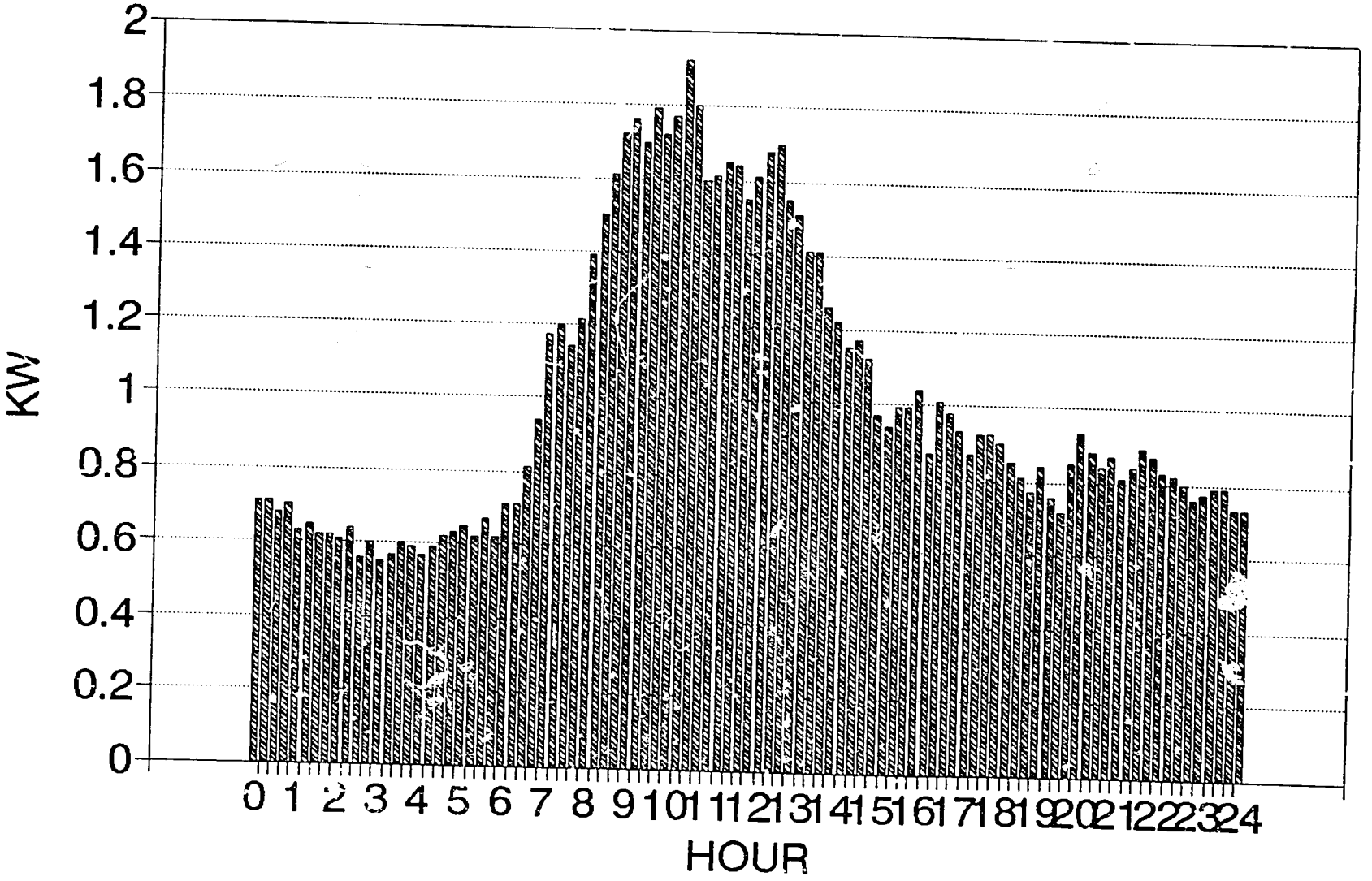
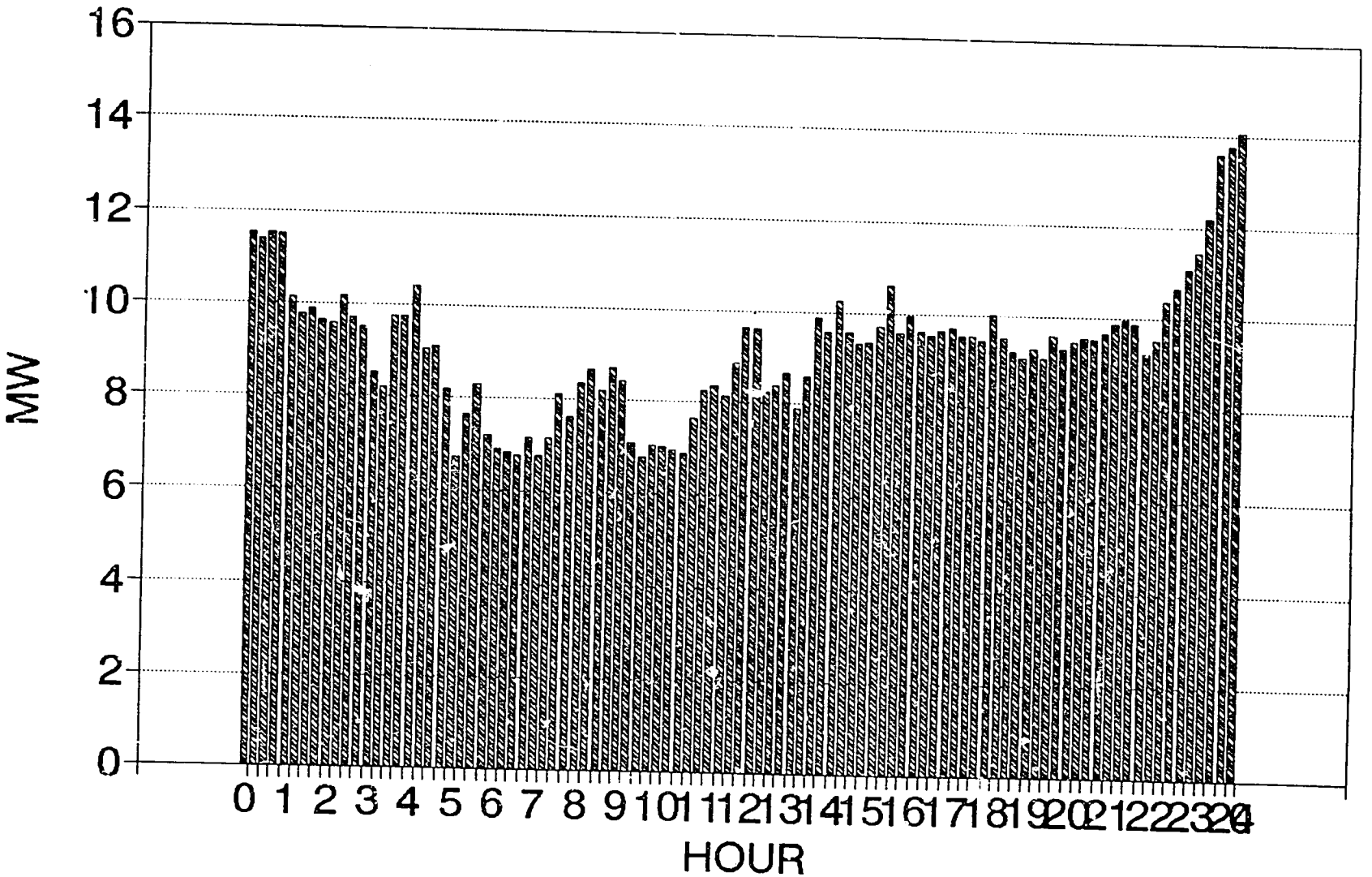


Exhibit 18
Jastrzebie Coal Mine Load Profile
(24 hour, Wednesday, April/May 1993)



184

Exhibit 19
Huta Baildon Steel Mill Load Profile
(24 hour, Monday, March/April/May 1993)

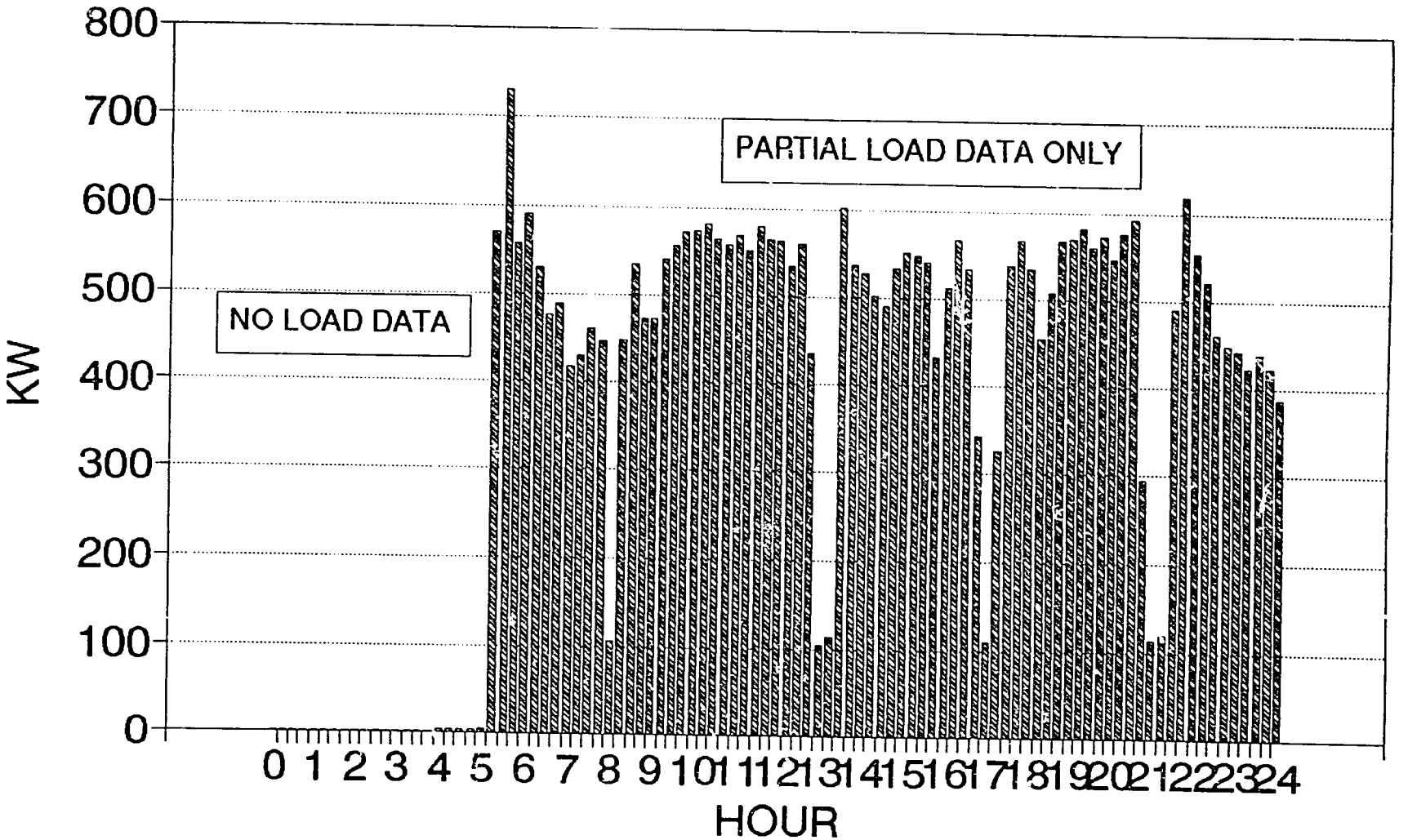


Exhibit 20
Laziska District Heating Plant Load Profile
(24 hour, Wednesday, May/June 1993)

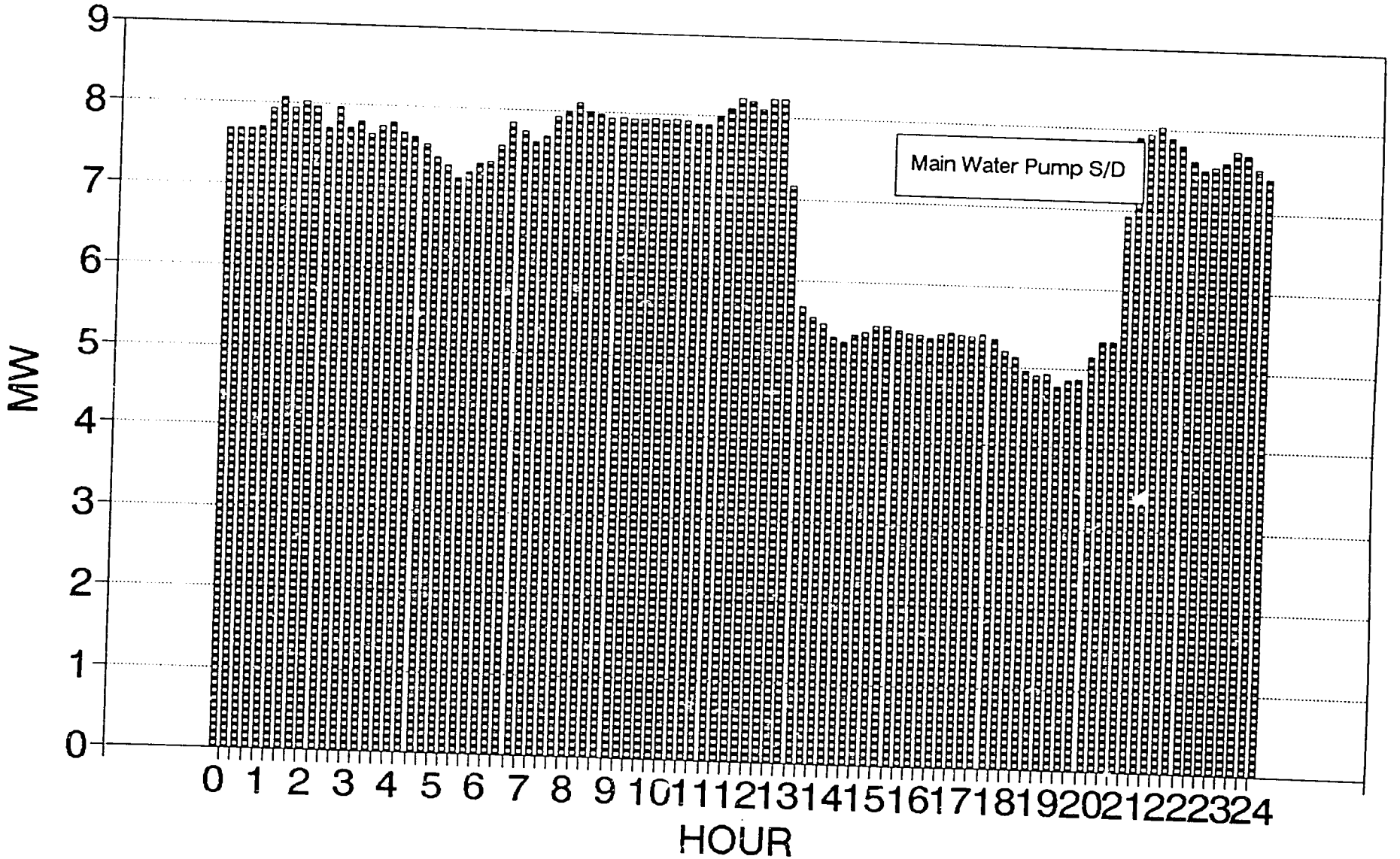
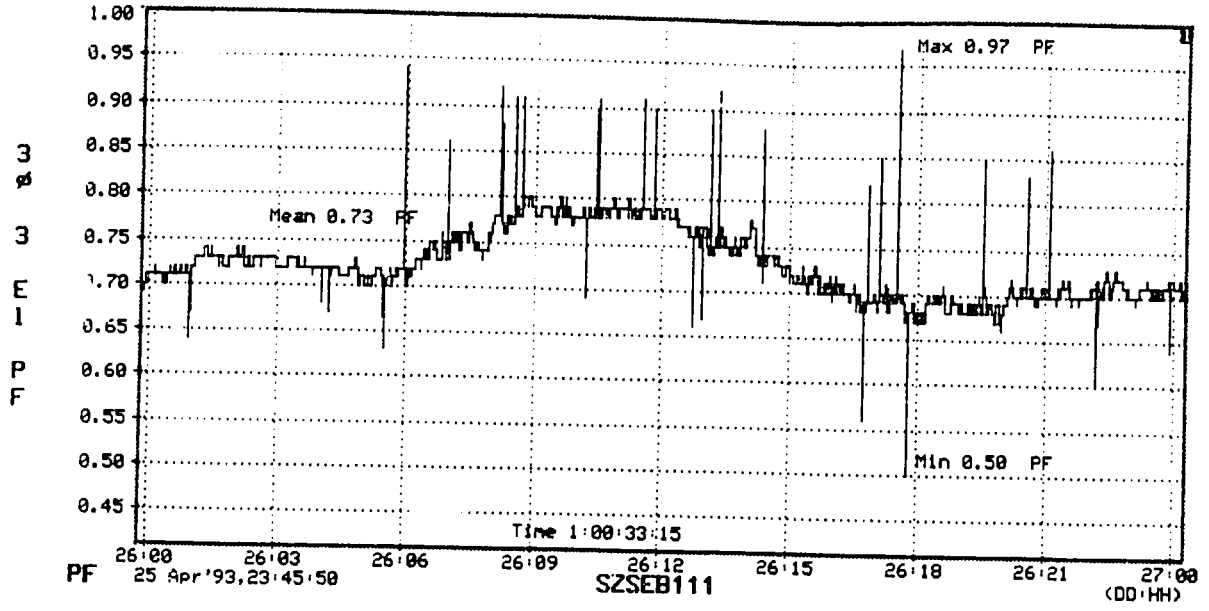
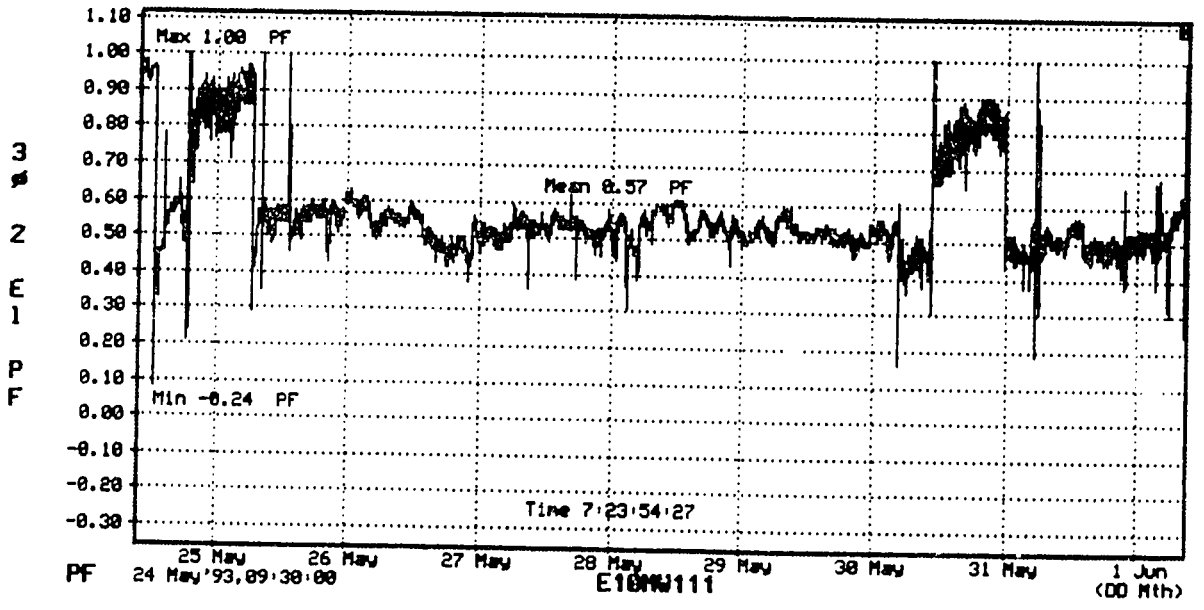


Exhibit 21
Hospital Power Factor



Key:
Graph 1 Trace 1 SZSEB111.DTA Adaptive Average 29 Apr 1993

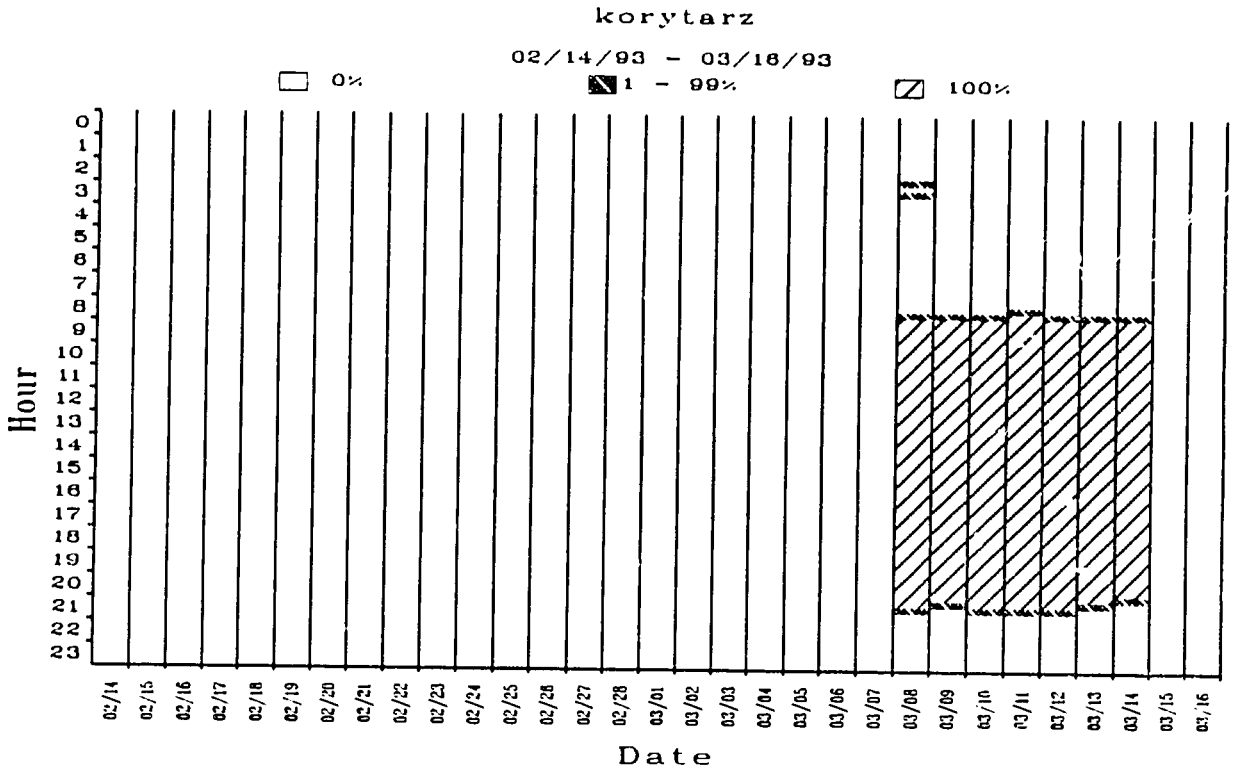
Exhibit 22
Industrial Motor Power Factor



Key:
Graph 1 Trace 1 E10MW111.DTA Adaptive Average 1 Jun 1993

- *Lighting and Controls* - Much of the commercial baseload low power factor can presumably be attributed to fluorescent lighting using conventional ballast and low-efficiency tubes. A program of re-lamping and ballast replacement would improve power factor and decrease load requirements. In addition, the pattern of lighting usage indicates that automated lighting controls could reduce consumption (Exhibit 23).

Exhibit 23
School Hallway Lighting Pattern

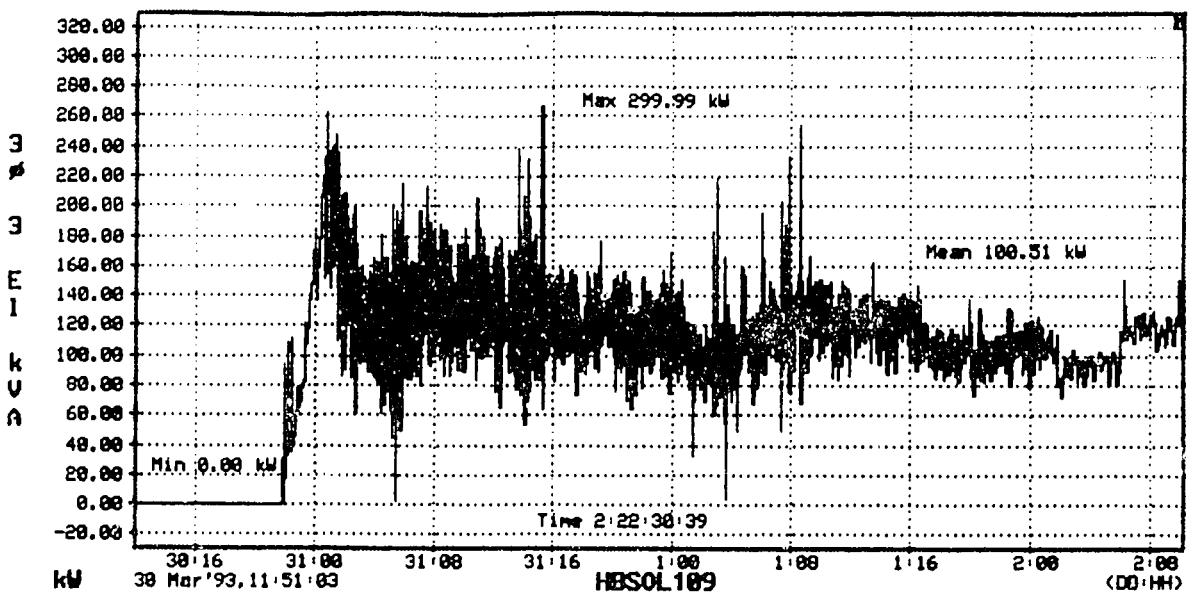


- *Industrial Controls* - Some of the industrial end-use equipment exhibited a pattern of widely fluctuating demand, indicating that existing controllers operate with a very wide deadband. The replacement and installation of

modern digital-based control systems would optimize these operations and also reduce energy consumption (Exhibit 24).

- *Demand Controllers* - The data indicate that some industrial equipment that comprise a production train (i.e., equipment that is dependent on other equipment to form a sequential industrial process) could better be optimized to control equipment operation and stop/starts. A demand controller would optimize this demand and ultimately reduce energy consumption.

Exhibit 24
Industrial Salt Bath Power Profile



Key:
Graph 1 Trace 1 HBSOL109.DTA Adaptive Average 2 Apr 1993

DSM Energy Efficiency Practices

In sorting through the data, several energy efficiency practices were revealed that could be introduced to reduce consumption and peak-load demand:

- *Lighting* - Many of the commercial applications had uniform lighting consumption patterns for all days of the week, and at some odd hours. Utilizing lighting only when necessary would conserve energy.

- *Peak-Load Shaving* - Many of the industrial processes were described as batch processes and the data supported this pattern of consumption. It may be possible to shift these loads to off-peak periods, or use demand controllers.

- *Load Optimization* - Many of the end-users were operating at loads below the rated load of the equipment, and some at higher loads. The report supported this finding by noting reduced industrial outputs at many points in the process. Industrial processes should be well matched with the equipment that make up the process so that equipment operates at near optimum efficiency.

6.3 LOAD RESEARCH OBJECTIVES

In support of the DSM pilot project, the objectives of the pilot load research element are to:

- conduct a practical customer survey that will serve as a basis for selecting the sample population for end-use load research

- extract and analyze information from the monthly billing data of 100 large customers in the service territory of Z.E. Gliwice

- estimate the electric load characteristics of the major market segments within the territory of Z.E. Gliwice

- carry out the load monitoring program to collect and examine the actual end-use and whole-premise load records before and after the DSM measures are implemented

- develop the capabilities of Z.E. Gliwice staff to understand how electricity is used by the company's customers, and to conduct a cost/benefit analysis within the framework of local conditions.

6.4 LOAD RESEARCH METHODOLOGY

Survey

A simple survey was designed to serve as a guide in collecting preliminary information on the customer mix in Z.E. Gliwice's service territory. It is anticipated that the survey will cover the residential, commercial, and industrial sectors. However, the survey will emphasize a wide range of industries to support the DSM pilot project. Z.E. Gliwice's billing data will be used to provide information that will help focus the survey efforts. The results of this survey will help researchers determine a more significant and representative sample population for the load research element.

The survey is divided into two parts:

- *Information sheets*, which are largely concerned with general information on the physical and electric layouts of a site, and information on end-uses, electricity tariffs, whole-premise consumption history and projection, and any recent changes at the site.

- *Monitoring data sheets*, which are largely concerned with the procedure and data format employed when the site is the subject of selected load monitoring.

These data sheets were developed as a result of the spot monitoring program conducted at Z.E. Gliwice, and are included as Appendix A to this report.

Market Analysis

Z.E. Gliwice's monthly billing data will be examined to determine market patterns by total power usage (kWh), peak demand (kW), and tariff class. During this exercise, billing data for 100 or more large industrial customers of Z.E. Gliwice will be analyzed to better understand the load characteristics of this major market segment.

The statistics on usage patterns will be tabulated and transferred from the billing file in the company's customer service department to an electronic file for use on personal computers. The electronic billing data file will then be used to construct a distribution of Z.E. Gliwice's sales among various market segments according to kW, kWh, and tariff class.

From this distribution, a stratification will be adopted to focus on heavy users such as industrial sector companies. The stratification, in turn, will be used to formulate the approach to load research. As an illustration, an estimated distribution, based on the Polish national average, is presented below:

- 55% of electrical energy is used by industrial users
- 18% by residential users
- 11% by commercial users
- 7% by agricultural users
- 7% by transportation users.

The results of the survey and the billing data analysis will be used to plan the rest of the load research element. These results will also inform the implementation of the pilot DSM project.

Market Segmentation

Each of the three sectors to be examined in the load research element (industrial, commercial, and residential) will be segmented to gain a better understanding of specific load characteristics within the sector. Industrial product code, tariff class, annual usage (kWh) and demand level (kW) will be used to segment the industrial sector. The residential sector will be divided by building type (single-family dwellings vs. multi-family high-rise buildings) and end-use. The commercial sector will be segmented by public institutions (e.g., schools, hospitals, community buildings) vs. privately owned buildings (e.g., shops, offices) and by end-use. The flexibility designed into the program will allow the local characteristics of each market segment to be taken into consideration.

6.5 LOAD RESEARCH SAMPLING PLAN

The goal of the sampling plan is to have a simple approach, yet one that yields meaningful results with reasonable statistical reliability. This involves placing limitations on both the sample customer selection and the end-uses to be monitored. The design selected for this

plan segments the population into market sectors, and further sub-divides the sectors according to specific criteria based on end-uses.

Sampling Frame

The sampling frame determines the key characteristics of customers' load profiles. In this regard, the load research element must maintain a close relationship with the pilot DSM project so that it can serve as a basis to project the impacts of DSM measures across the entire customer population. The key variables to be investigated in the sampling are the timing of electricity use and the amount of electricity use per customer group, per end-use group, or per part of a distribution feeder circuit.

For example, the limited exposure to the Z.E. Gliwice service territory gained through the spot monitoring program indicates that lighting is a major end-use of electricity for commercial and residential customers. Air conditioning, either window units or central system (HVAC), is not a significant power load now, nor will it be in the next few years. Electric hot water heaters and electric clothes dryers are not used in most households or commercial establishments. Instead, hot water pumps for space heating and domestic usage are prevalent in commercial and multi-family buildings. Refrigerators and televisions are found in nearly every household. Electric ranges are the main form of cooking in regions where gas lines are absent.

The spot monitoring program results also suggest that the end-use pattern of the industrial sector varies among different industries. This is especially true for heavy industries that have excess capacity or are in the process of being transformed. The load research element will target the major uses of electricity within sectors, and the sampling frame will seek to determine these major end-uses.

Industrial Plan

Since there are many different industrial customers in Z.E. Gliwice's territory, billing data will be used to segment them into groups. Either SIC codes or products/processes can be used as the basis for making the following classifications:

Process Selection

- coal mining
- iron and steelmaking
- non-ferrous metals
- chemical (including refineries)
- stone, clay and glass (including cement)
- metallic products
- textiles and garments
- food processing
- pulp and paper
- district heating
- others.

Because Polish industries are changing quickly and to ensure that the whole-premises load data derived from the billing records represent the most important DSM resources, the sampling plan will use the following criteria for industrial customers:

- An industry group must represent a significant portion of the total industrial demand of Z.E. Gliwice.

- Within an industry group, experience in other countries has shown that there is potential for significant improvement in electric power efficiency and for demand-side management.

- Within an industry group, experience in other countries has shown that there exists the flexibility to shift major load components to off-peak hours.

- The specific site has complete billing records and other key data.

- The specific site has been privatized or is on a list of candidates for privatization.

End-Use Selection

To help assess the DSM resources within a class of the industrial sector in Z.E. Gliwice's service territory, the sampling plan may also group end-uses. Tracking end-uses, such as motors or furnaces, enables their examination across other industries, and allows the

sampling plan to be structured on a statistical basis. On the other hand, the operating mode of each piece of equipment is always dictated by the process requirements, in which the equipment is but one component. In many cases, the industrial processes used are so obsolete and inefficient that the best way to achieve maximum benefits will be to replace the old processes with new and efficient ones.

Based on the survey of industrial customers, statistics will be collected and analyzed on all the motors, furnaces, pumps, compressors, electrolysis baths, and lighting these customers possess to yield a sampling plan on the end-uses mentioned above plus others. Load profiles of the following end-uses should be monitored:

- motors over 500 kW
- motors between 50 kW and 500 kW
- motors of less than 50 kW
- electric furnaces over 1 MW
- electric furnaces between 500 kW and 1 MW
- electric furnaces less than 500 kW
- pumps/compressors of over 500 kW
- pumps/compressors between 50 kW and 500 kW
- pumps/compressors of less than 50 kW
- electrolysis of greater than 500 kW
- electrolysis of less than 500 kW
- lighting.

In addition, these end-uses must meet the following criteria:

- The end-use represents a significant portion of the load in that industry.

- The end-use has the potential for significant improvement in electric power efficiency and the potential to be a large demand-side resource.

- The end-use can be readily monitored, within the budget, for the program.

- End-uses in the same industry group and are also widely used in other industry groups.

Other important factors that must be taken into account in screening the end-uses (e.g., motors) include the age of the motor, its service history, and annual hours of operation. In Poland and other Eastern European countries, large motors have been in service for decades,

and have been rewound several times during their service lives. Each time a motor is rewound, its efficiency is reduced slightly. In the survey, the service history of each motor will be documented to help determine whether the old motor should be replaced with a new one.

Residential Plan

Housing Inventory and Survey

A survey of housing inventory would include square meters of living space, number and ages of occupants, major electricity uses and home appliances, gross family income, and other information that would be helpful in designing the sample program to study the load profiles of typical households. The survey work conducted by FEWE can be useful in providing a basis for the sample selection. The sample must be selected so as to be large enough and diverse enough to provide valid statistics.

End-Use Selection

The Load Research Element should concentrate on:

- lighting
- refrigerators
- electric ranges
- electric water heaters.

Commercial Plan

Commercial Building Inventory and Survey

Statistics and billing data on Poland's commercial customers should be very helpful in designing a load research sampling plan. An inventory study on two categories of commercial buildings will be conducted. The first category comprises schools, hospitals, and institutional and government buildings, which are managed by local governments. The second comprises hotels, office buildings, shops, markets, and restaurants, which are generally managed by private entities. Z.E. Gliwice's billing and customer service

department will serve as the source for obtaining basic whole-premise information on such buildings.

Again, survey sheets designed to extract physical and operational information from these buildings' managers will be important in helping to select a sample that is representative of the entire sector. Since most commercial establishments have a telephone, the survey should be followed by telephone interviews to increase the number of responses.

Commercial Building Distribution

To begin stratifying the groups within this market sector, it will be necessary to construct time-of-day power use distribution curves for commercial buildings. Curves will be constructed for the following building categories:

- hospital and health care facilities
- schools and educational facilities
- municipal and city buildings
- government-owned shops and markets
- hotels and office buildings
- private shops and eateries
- street lighting
- others.

End-Use Selection

The Polish commercial sector has a limited number of end-uses that have potential as DSM resources:

- lighting
- pumps for space heating, hot water, and domestic hot water
- air conditioning systems
- ventilation fans
- commercial coolers and freezers
- electric room/space heaters.

Sample Design

The basic steps in developing a sample design are listed below.

- The population of customers to be represented by the sample and the sample frame must be defined. A sample frame could be all industrial customers with demand over 10 MW, or all residential customers without electric ranges, dryers, dishwashers, or air conditioners, or all commercial customers with 50 percent of their connected load used for lighting.

- The sample frame can also be homogeneous groups that are defined on the basis of a power consumption index, such as kW and/or kWh.

- The size of the impact variable (delta kWh or delta kW) is estimated for the sample frame as a whole or for customer segments.

- For the entire population or for the customer segments, the variance of the impact variable (i.e., savings) must be estimated as well as the variance associated with the ability to measure the variable. This measurement is usually accomplished by examining a customer database, which can be used as a proxy for measure savings.

The population size (which is known), the estimated average impact, and the variance of the impact (which is estimated) provide the basis for calculating the sample size required to meet the desired specified sampling error (e.g., ± 10 percent with a specified level of confidence, e.g., 90 percent).

Z.E. Gliwice's billing data from past years will be used in extracting the information that will serve as a "template" for selecting customers in the sample. These data are critical to the load research element because the experiences in North America may not easily fit Polish conditions and because there is no prior database or other utility experience on which to draw. The flexibility designed into the pilot project will allow it to be adjusted while new data and experience accumulate.

The pilot load research element will sample four types of information:

Customer Survey

Survey sheets for industrial, commercial, and residential customers will be distributed through the customer service department. Follow-up telephone calls will be made to all customers (including residential) to increase the number of responses.

Billing Data Analysis

Billing data on Z.E. Gliwice's customers are kept in the customer service department. Billing data on whole-premise consumption (kWh) and maximum demand (kW, for industrial customers only) will be very valuable in the sample stratification and selection. Our experience in the spot monitoring program suggests that this portion of the sample data should be obtained early in the pilot project.

Strip Chart Recording of Demand over Time

Strip chart recordings of demand at time intervals (15 minutes to half hour) exist for about 50 to 60 industrial sites; these sites are among Z.E. Gliwice's 100 largest industrial customers. These demand records are very important to the pilot load research element. In the spot monitoring program, two 24-hour demand curves were requested for 20 of these industrial sites. Demand curves for more days from all of the sites should be available to the load research element. Such charts can yield the time-of-use patterns of those industrial customers, thus, reducing the cost of the load research program.

Direct Measurements from End-Use Meters

A comparable effort to that undertaken in the spot monitoring program should be included in the load research element. Z.E. Gliwice should evaluate its field experience with the power monitors used for spot monitoring program. If performance has been satisfactory, the use of this equipment could be continued, with additional units purchased if necessary. Z.E. Gliwice may also wish to investigate purchasing additional units of comparable equipment, especially if field performance in the spot monitoring program is found to be lacking.

6.6 LOAD RESEARCH MONITORING EQUIPMENT AND CONFIGURATION

Local Situation and Budget Constraints

Because the conditions facing Z.E. Gliwice are different from those experienced by North American utilities, the wholesale adoption of a U.S. load research program for Poland will not be possible. For instance, it is very difficult to set up a remote monitoring network through Poland's existing telephone facilities because it is very difficult to acquire a telephone line in general and the remote cellular phone network is still under development. Thus, the monitoring system for the pilot load research program should be selected upon such merits as transportability, electronic data storage and data transfer capabilities, and easy and hand-free operation under field conditions.

Also, the idea of using local instruments or components was not adopted in the spot monitoring program because of their less than ideal performance records. It was instead agreed that under the time and budget limits imposed on the project, U.S. hardware would be used for monitoring. It was also decided not to mix and assemble several component items together to make a custom system. This is because it is easier to hold one vendor accountable for the entire system than going through ten different vendors to pinpoint whose components are at fault. Therefore, it is preferable to have U.S. vendors supply packaged hardware that is versatile enough to record the load profiles of a range of end-uses, and that is portable, and can be connected and disconnected to the end-uses with ease. Data storage and data readers are also critical, as most of the installations monitored would not have access to a phone line.

Ideally, it is desirable to include in the research sample customers of all sizes, types and demographic requirements, and who possess at least two or three of the end-uses to be monitored. However, it will always be necessary to screen the customer population further to reduce the number of sampling points to fit the budget or financing available. On-premise billing data are usually used to help eliminate customers with large deviations from the group norm. Based on the spot monitoring experience, the pilot load research element should focus on the 50 to 60 industrial sites that have their demand recording on strip charts.

Field Installation and Training

Field installation of load monitoring equipment will vary slightly from end-use to end-use, but in general, the instruments are quite adaptable at different industrial sites. The key to the success of any field installation is the cooperation extended toward this program by the host

site organization. A training course to familiarize engineers and technicians with the equipment can be incorporated into the program at an early stage with the assistance of instrument vendors. Training was provided by the equipment vendor's staff, and the technical staff of Z.E. Gliwice. Also, some technical people from the industrial, commercial, and residential organizations are now familiar with these instruments through the spot monitoring program.

Data Collection and Processing

On-site collection will be the mode of data gathering for this pilot project. A data recording/downloading device will be provided to the technical staff of Z.E. Gliwice, who will visit each field-installed power logger and extract the load profile data from the field instrument. At Z.E. Gliwice's office, the data will be transferred from the data pack to the PC and hard drive. This mode of data collection was used in the spot monitoring program, and in general, appeared to work effectively. The same mode should be adopted for the pilot project.

Local Utility Involvement

Depending on the degree of involvement from Z.E. Gliwice, regional utility companies can be of much assistance in such areas as data collection, management, and some preliminary analysis. It is the intention of this pilot project to train and help Z.E. Gliwice to do as much as possible in conducting such a program.

All the load profile data will be collected with the help of a PC in Z.E. Gliwice's office, and stored on floppy diskettes. Such data would be analyzed with a PC within the company.

Data validation, checks, compilation and analysis should be conducted at Z.E. Gliwice from time to time, to ensure that no instruments are malfunctioning, to avoid abnormal modes in customer operations, and other unexpected usage patterns. These activities should be coordinated with the site hosts in order to understand their normal or abnormal situations.

Training and Supervision

A fair amount of effort should be budgeted for training the technical and DSM staff of Z.E. Gliwice in conducting such a pilot project. Z.E. Gliwice's early involvement in the

preparation stage is critical to the program's success. Substantial customer cooperation is required, not only for the installation of the monitoring instruments, but also for the pre-sample selection survey responses. Because Z.E. Gliwice has not conducted many such customer surveys in the past, it should work together with the DSM pilot project advisory committee, beginning with composing a trial survey sheet.

The advisors could assume supervisory responsibilities after the initial training period and during the early phase of the field monitoring. Training in the form of custom surveying, survey follow-up, survey results analysis, software seminars, instrument hardware training, data analysis techniques, and data management needs to be well thought out and well prepared. Ideally, the training materials would be focused more on practical aspects than theoretical aspects.

6.7 MONITORING AND DATA ANALYSIS

End-uses should be monitored for at least five to ten duty cycles for non-seasonal applications. The duty cycles of different end-uses may vary quite a bit, as will the operational cycle due to business conditions. It is best to form such a strategy from an understanding of the operation at specific industrial sites. The customer survey or on-site interviews may be useful to achieve this understanding.

A strategy for monitoring batch operations should be carefully thought out to determine the best monitoring schedule. For most industrial end-uses, monitoring should be carried out for at least one week to study the weekday and weekend differences in profiles. Also, some equipment might be running only a few days in a month depending on business demand. Plants that have continuous operation or semi-continuous operation will provide more reliable data. The rule of thumb of one week of monitoring worked very well during the spot monitoring program.

The instrument sets can be moved from site to site to cover as large a sample size as the budget allows. When seasonal variation is an important factor (as it is, for example, with the hot water pumps at a district heating plant), then the monitoring should be done once in-season and once off-season. Again, the on-site interview and customer survey sheets should be useful in determining the situation at each sampling site.

Overall, it appears that one year will be needed to conduct the actual monitoring, in addition to three months of preparation before the monitoring and three months to summarize the results after the monitoring. In all, eighteen months would be necessary to obtain effective

results. This time frame is consistent with that anticipated for the implementation of the DSM pilot project. Of course, such a program is an on-going exercise. There will be intermediate results, and Z.E. Gliwice will want to establish a department to continue monitoring (at a reduced level) after "the project" ends.

Data Editing and Validation

Data editing is divided into two types. The first is housekeeping editing, which is the minor editing that involves adjusting start and stop times, the summation of total kWh consumption over the appropriate period, and the correction of improper IDs, meter multipliers, etc. The second type, load data editing, involves identifying and replacing missing or bad data and correcting data for power outages.

There are several editing procedures to follow, which are considered standard practices in load research data processing:

- Where less than a week of data are missing in a month, the previous week's data will be substituted.
- Where only a few intervals (up to four) are missing, the data are smoothed, i.e., the intervals on either side are averaged and used for each of the missing intervals.
- Where a customer's data are missing for long periods or are absent entirely, that customer's data will not be included the sample analysis.

Validating load data is an audit function that ensures that data entering the master file are consistent. Validation is an important aspect of data collection and sets the stage for any editing that may be necessary.

Both direct and indirect load research data are required for DSM evaluations. Taken together, these data form the basis for drawing conclusions about the impact and process evaluation. Every load research activity should have a data management plan. In addition to identifying how data are to be validated, such a plan should identify how the data are to be initially processed, and whether they are to be stored by sample identification number or end-use, or both.

Data files and analyses should be tracked in a special database. This database should contain the location of the data, when they were collected, when they were processed, and how they were processed. Since the analysis of load research data typically takes much PC time, the analyst will probably want to work with test samples to develop and test software before processing the entire set of records.

Coordination with the DSM Pilot Project

It is essential that the activities of the load research element be closely coordinated with the implementation of the DSM pilot project. End-use load research can provide important data for the impact evaluation of the pilot project (see Section 5.6). Since the pilot project will focus exclusively on the industrial sector, the industrial component of sampling design, data collection, and analysis would obviously be most relevant.

An example of the required coordination would be the deployment of power monitors under the load research element to those industrial sites that are participating in the pilot project. End-use consumption data can be collected before and after the installation of DSM measures as a way to establish baseline consumption and to determine the level of savings resulting from the DSM interventions. Time series data can then be collected periodically at the site to determine the persistence of DSM savings over time.

While emphasizing coordination with the DSM pilot project, the load research element should also be independent. Such a relationship would be essential to preserve the objectivity and integrity of the load research data to the extent that it is used to show the degree of success (or lack thereof) of the pilot project. Independent load research data will also be vital for assisting with the extrapolation of data from the pilot project at Z.E. Gliwice to the national level, in anticipation of the expansion of DSM programs to other distribution companies throughout Poland.

CHAPTER 7: PROGRAM ADMINISTRATION, FUNDING, BUDGET AND SCHEDULE

This final chapter of the industrial DSM pilot project design for Poland details some of the practical administrative issues of project implementation. The overall project structure presented indicates the various organizations that would be involved in project implementation and their respective roles and relationships. Following that is a proposed schedule and budget, which includes an indication of possible sources of funding for the pilot project. The chapter concludes with a discussion of the tracking system requirements for record keeping and data management.

7.1 ORGANIZATION

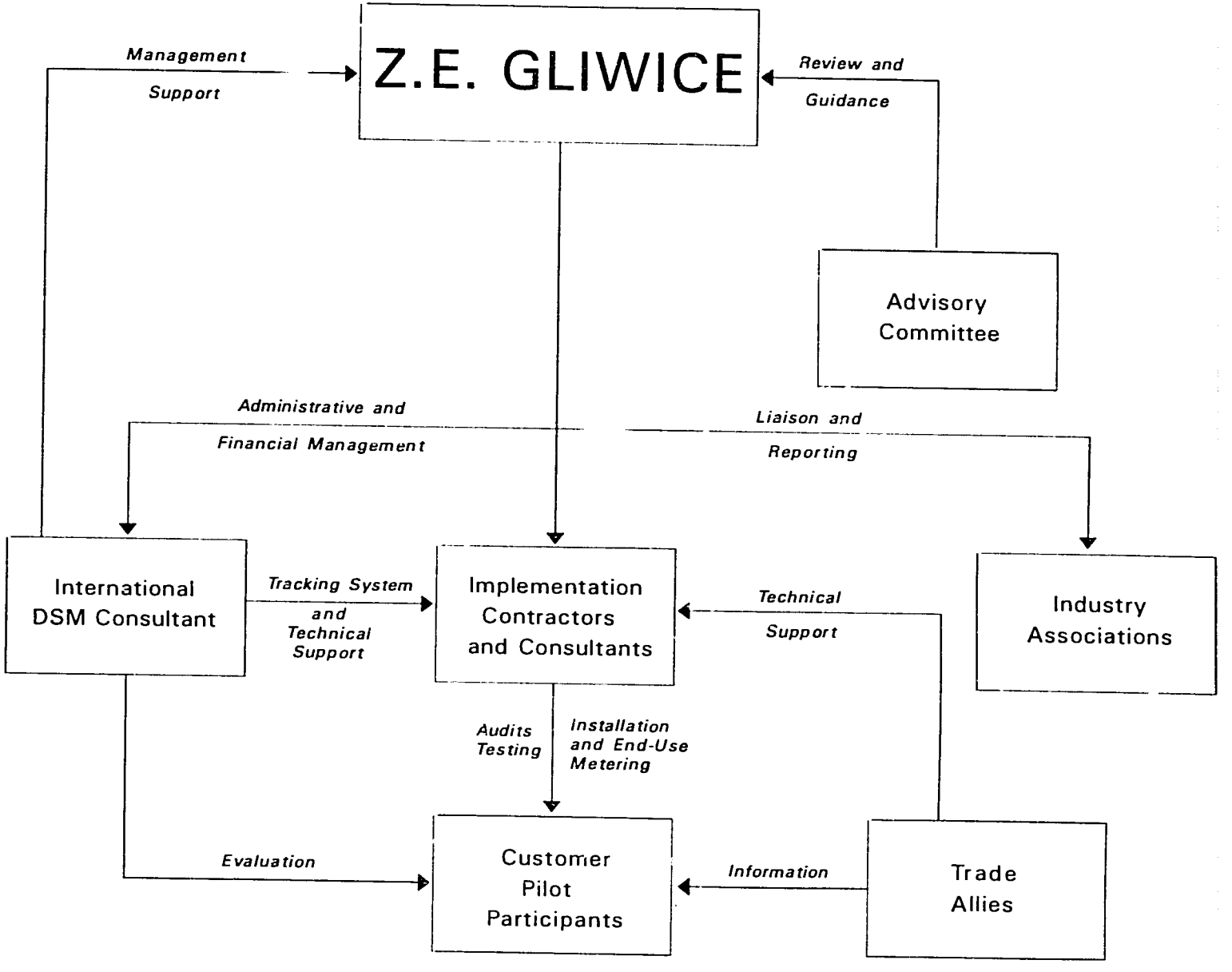
It is assumed that Z.E. Gliwice would be the central management and administrative lead in the development and implementation of the DSM pilot project. Other key participants would be an expert international DSM consulting firm to support Z.E. Gliwice, the implementation contractors and consultants (perhaps a half dozen or more individuals, firms, and ESCOs specializing in audits, engineering analysis, end-use metering and installation), and an advisory committee composed of invited representatives from PPGC, FEWE, the Polish Institute of Power Engineering, and other interested agencies and parties such as equipment vendors, engineering firms, business and professional associations, university faculty, and non-profit groups. The relationships among these entities are depicted in Exhibit 25.

The relationship between Z.E. Gliwice and the various implementation contractors and consultants would be governed directly by the basic ordering agreements and other services contracts Z.E. Gliwice negotiates as a result of its competitive solicitation of bids.

The advisory committee would exercise no direct management or administrative control or oversight. As its title implies, this committee would observe, review and provide advice and guidance to the process. At various stages of the pilot project and in consultation with Z.E. Gliwice, individual organizations on the committee may volunteer (or be requested by Z.E. Gliwice) to provide technical specialists to help support particular aspects of design, implementation or savings verification.

It is assumed that the international DSM consultant would be funded directly by a donor agency (e.g., USAID). Z.E. Gliwice would be designated as the official Polish counterpart agency and direct recipient of the technical and management support the consultant provides.

Exhibit 25
Pilot Project Organization



The international DSM consultant would augment Z.E. Gliwice's staff by providing day-to-day pilot project management and supervision of the various implementation contractors and consultants. It would also facilitate coordination between Z.E. Gliwice and the advisory committee and trade allies.

In addition, the consultant would be responsible for the development, installation and maintenance of the performance tracking system; the technical conduct of the savings impact verifications; and the process and market evaluations of the pilot project. The consultant would also serve as a conduit of technical information and experience to the implementation contractors and consultants.

The international consultant must be sensitive to the pilot project's goal of creating a sustained capability within Z.E. Gliwice to implement DSM in the future without continued dependence on foreign experts. At the same time, the consultant must be involved in all aspects of the pilot project to ensure its success and help guide the other pilot project participants through the potential problems that U.S. and Canadian DSM implementers encountered in their initial stages of program deployment, as described in Chapter 2.

7.2 SCHEDULE

Exhibit 26 outlines the anticipated schedule of activities over the 18-month period planned for the pilot project. This time table is ambitious but achievable if Z.E. Gliwice and the international DSM consultant coordinate closely from the beginning of the program. In particular, the first month or two will be critical in ensuring the effort can avoid delays in that could unduly prolong audit, equipment procurement and field work later in the pilot project.

It is essential that the international DSM consultant's staff be located in Poland to work with Z.E. Gliwice staff in Upper Silesia during the critical first one or two months.

Because this will be a precedent-setting project, it is important that sufficient time be given to evaluating the pilot project and developing a plan and implementation strategy for the full-scale program. The schedule shown in Exhibit 26 allows for these important activities while still permitting new participants to enter the program, even as the evaluation proceeds. Indeed, some installations may not be made until after the pilot project formally "ends." These participants would simply be transferred into the starting pipeline for the full-scale program. This practice is common in many utility-sponsored DSM programs in the United States.

Exhibit 26
Pilot Project Schedule and Milestones

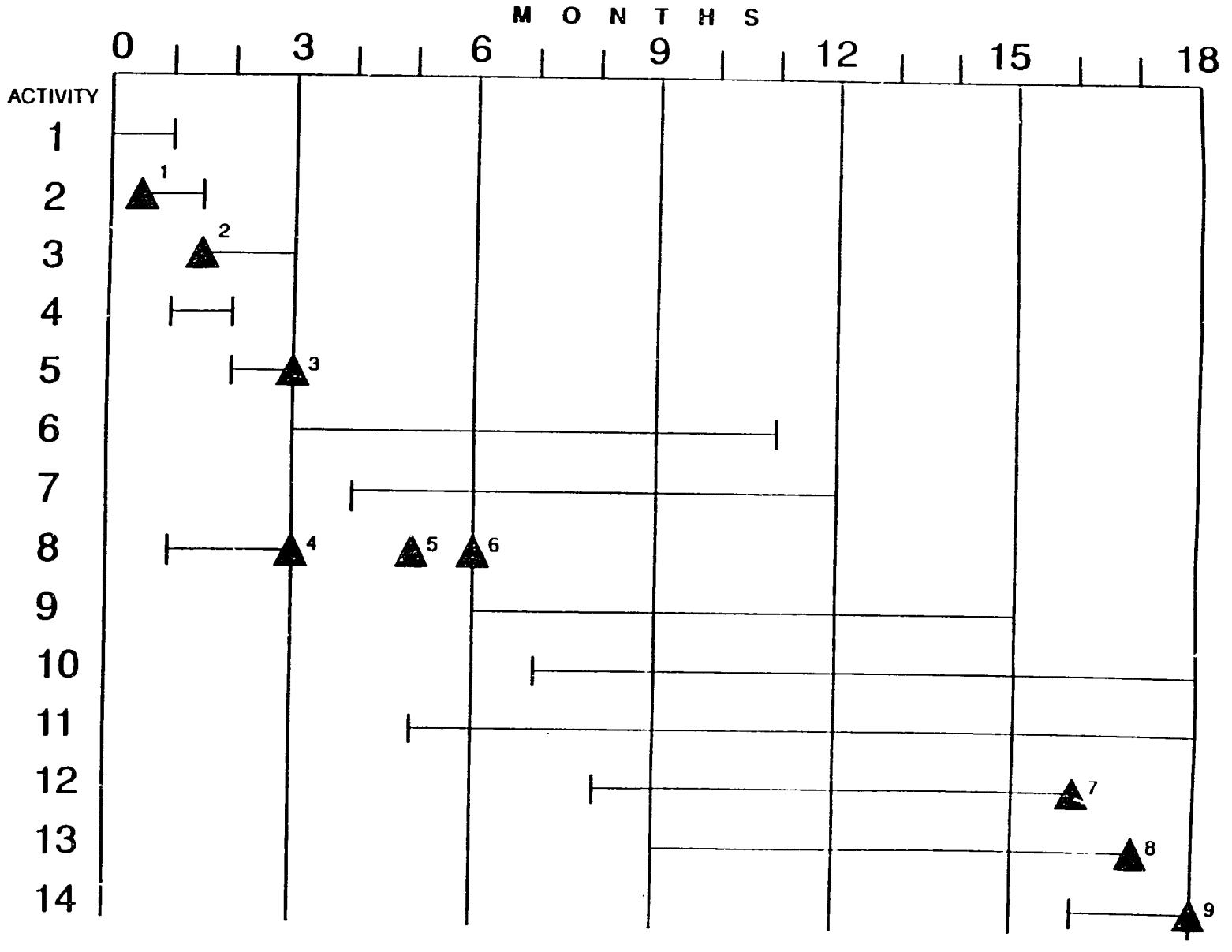


Exhibit 26 (continued)
Pilot Project Schedule and Milestones

Key To Activities

1. Administrative start-up
2. Market segmentation and prospect recruiting and qualification
3. Pilot project announcement, mailings and site visits
4. Implementation contractor request for qualifications (RFQ)
5. RFQ screening and contractor selection
6. Audits and engineering analysis
7. Technical and financial proposals
8. Development of performance tracking system, installation specifications and QA/QC protocols
9. Equipment procurement
10. Project installation and on-site work
11. Pre-installation/post-installation end-use metering and monitoring
12. Impact evaluation
13. Process and market evaluation
14. Analysis of full-scale program options and potential

Key To Milestones

1. Customer workshop
2. Contractor, consultant, trade ally workshop
3. Contractor training and orientation
4. Tracking system initiated
5. Installation specifications completed
6. QA/QC protocols completed
7. Impact verification report
8. Process and market evaluation report
9. Full-scale program plan and implementation strategy

7.3 FUNDING AND BUDGET

Exhibit 27 summarizes the estimated budget for the pilot project with the ranges of costs for each of the 14 activity areas. It also shows the lead, support and advisory roles for each of the parties cooperating in the pilot project effort.

Although these budget estimates are quite preliminary, they do reflect the general magnitude of costs believed to be required for each activity. The equipment procurement costs are predicated on a pilot project that can attract 30-50 participants whose typical size would be in the range of 0.5-2.5 MW and whose average expected savings would fall in the range of 4-8 percent of current electricity consumption.

Overall, the pilot project would seek to capture 2-4 percent of the available industrial DSM savings potential outlined in Part 1 of this report. The estimated capital outlays roughly correspond to the net present value of a mix of measures whose annualized life cycle cost would average about 2.5 cents per kWh saved, and which collectively would achieve the targeted capture rate of 2-4 percent of available potential. This indirect estimation approach is necessitated by the inability to precisely determine in advance the mix of measures to be installed.

It is important to take note of line item 9 in the budget summary. As indicated, multilateral development banks (e.g., the World Bank, the European Bank for Reconstruction and Development) are expected to underwrite the substantial front-end investment in capital equipment to be procured and installed during the pilot project. However, there are other sources of funding for training, technical assistance, and other non-capital costs.

These other sources of DSM pilot project financing include:

- **Existing MDB Loan Pools**. For example, the World Bank has an existing loan available in Poland for industrial efficiency improvements that could be tapped for project-specific financing.

- **The Polish Energy Conservation Foundation.** This organization is a unit of the Polish Development Bank which was set up to provide systematic access to private financing in Poland for energy efficiency improvements.

- **Energy Service Companies**. Most ESCOs provide project financing as part of the package of services they offer to clients.

2.1C

Exhibit 27
Estimated Budget Summary

Activity	Cost Range ($1,000 US)		Responsible Party(ies)		
	Low	High	Lead	Support	Advisory
1	25	35	G	D	C
2	10	15	G	D	-
3	15	25	G	D	C
4	5	10	G	D	-
5	10	15	G	D	-
6	275	350	I	G	D
7	75	125	G	D	-
8	20	25	D	G	C
9	4,800	6,930	I	G	D
10	325	450	I	G	D
11	60	90	I	G	D
12	75	100	D	G	C
13	25	40	D	G	C
14	35	50	D	G	C
TOTAL	**5,755**	**8,260**			

Key To Activities

1. Administrative start-up
2. Market segmentation and prospect recruiting and qualification
3. Pilot announcement. mailings and visits
4. Implementation contractor RFQ
5. RFQ screening and contractor selection
6. Audits and engineering analysis
7. Technical and financial proposals
8. Development of performance tracking system, installation specifications and QA/QC protocols
9. Equipment procurement
10. Project installation and on-site work
11. Pre-installation/post-installation end-use metering and monitoring
12. Impact evaluation
13. Process and market evaluation
14. Analysis of full-scale program options and potential

Key To Responsible Parties

C = Advisory committee (PPGC, FEWE, PIPE, other interested parties)
D = International DSM Consultant
G = Z.E. Gliwice
I = Implementation contractors

- **Industrial Customers.** As defined under the design of this DSM pilot project, the participating industrial customers would be required to finance a major portion of capital improvements at their facilities.

- **Other Sources.** These could include the Government of Poland, PPGC, and donor agencies (e.g., USAID, the European Union's PHARE program, and the U.K. Know-How Fund).

7.4 PERFORMANCE TRACKING, FINANCIAL MANAGEMENT, AND RECORDS CONTROL

It is recommended that Z.E. Gliwice implement a PC-based, computerized tracking system to facilitate both financial management and records control as well to effect near real-time monitoring of field activities and project management.

In addition, the information contained in the system will be useful for estimating savings impacts and for performing a variance analysis of expected versus actual performance. This feature will serve as an "early warning" indicator that corrective action may be necessary to prevent the pilot project from straying off course as problems surface.

Exhibit 28 contains a schematic overview of the most important system features. The international DSM consultant would develop and maintain this system for Z.E. Gliwice throughout this 18-month effort and train Z.E. Gliwice personnel in its use.

The performance tracking system combines both passive documentation and records management features with active resource allocation, scheduling and transactions processing functions:

- The customer profiling and targeting module would allow Z.E. Gliwice to organize information on customers targeted for pilot project participation from its own information and files, billing histories available from its customers, and the process, end-use and savings-related information produced through the market segmentation analysis. This information would be updated as field experience is accumulated.

- The program documentation module would contain customer-specific information on all facilities audits, measures identified and recommended, and technical and financial proposals tendered. It would encompass customers that

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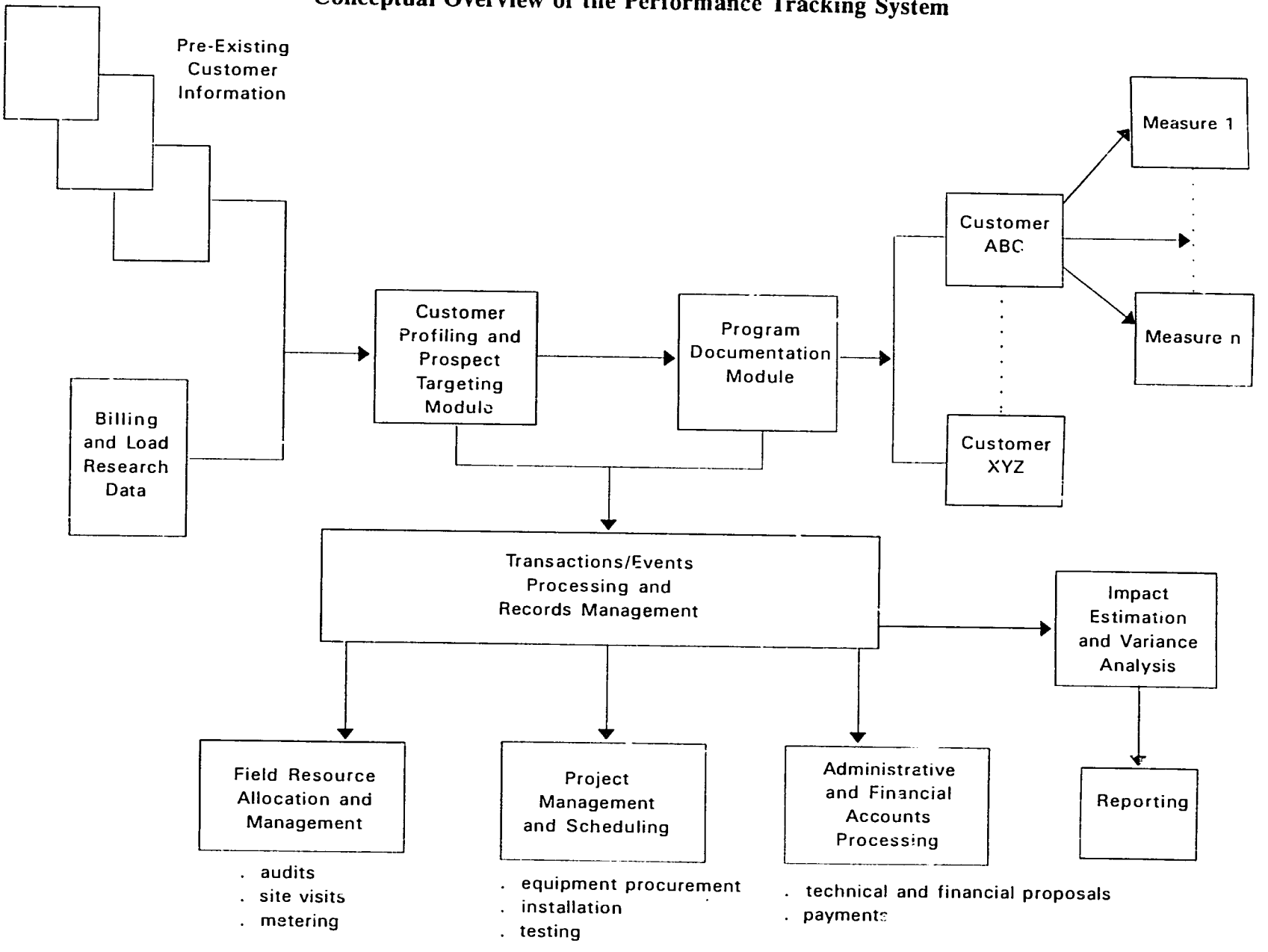
Exhibit 28
Conceptual Overview of the Performance Tracking System



both participate and decline to participate in the pilot project, and all measures identified for both categories of customers, whether adopted or not. In this way, Z.E. Gliwice can examine adoption patterns by sector, end-use and measure type, and begin to "flag" behavior that appears to differ significantly from expectations. This will facilitate "mid-course corrections" to pilot project features or delivery.

- The field resource allocation and management and project management and scheduling modules will help control, schedule and assign contractor and staff resources for pilot project marketing and recruiting, audits, equipment procurement, installations and testing, end-use metering, and the other field activities. The modules are shown separately to indicate that the system is being used as a pro-active tactical tool to manage and control day-to-day operations while simultaneously processing and storing the audit, installation and test report information that results from these activities.

- The administrative and financial accounts processing module will handle all contractor and equipment invoices and accounts payable, cash disbursements and commitments made as part of day-to-day pilot project operations, and the management of the Revolving Efficiency Fund credits and reinvestment.

- The impact and variance analysis and reporting module is intended to provide Z.E. Gliwice, the advisory committee, customers and other stakeholders with monthly and other periodic reports of pilot project activity and a comparison of achieved versus expected accomplishments.

The tracking system will have continuing benefits for the full-scale program.

APPENDIX A

SURVEY AND MONITORING SHEETS

FOR ELECTRIC END-USE LOAD RESEARCH

CONTENTS

APPENDIX A-1: SURVEY SHEETS FOR LARGE COMMERCIAL AND INDUSTRIAL CUSTOMERS

APPENDIX A-2: SURVEY SHEETS FOR SMALL COMMERCIAL AND RESIDENTIAL CUSTOMERS

APPENDIX A-3: MONITORING SHEETS FOR COMMERCIAL AND RESIDENTIAL CUSTOMERS

APPENDIX A-4: MONITORING SHEETS FOR COAL MINES

APPENDIX A-5: SURVEY SHEETS FOR DISTRICT HEATING AND COGENERATION PLANTS

APPENDIX A-6: MONITORING SHEETS FOR DISTRICT HEATING AND COGENERATION PLANTS

APPENDIX A - 1

SURVEY SHEETS

FOR

LARGE COMMERCIAL AND

INDUSTRIAL CUSTOMERS

NOTICE

Your participation in this survey is voluntary, but your cooperation in is very significant for documenting electricity consumption patterns in Poland. At some time in the future, funding from the Polish government and international organizations may become available to implement demand-side management (DSM) and energy efficiency measures. This survey may be helpful in your applying for loans to improve the overall energy efficiency at this location.

Information given here is only for use by Z.E. Gliwice. The individual enterprise data will remain confidential under a signed agreement with Z.E. Gliwice. Only summaries and statistical conclusions on a much broader scope will be used in any reports of this survey.

1. INITIAL CONTACT TO IDENTIFY RESPONDENT

1.1 Name of person in charge of this interview/survey

1.2 Name of enterprise/company/plant

1.3 Address and phone number

1.4 Name of person in contact/interviewed and position/title

1.5 Interview/ contact history

First contact date:

Follow up contact date:

Second follow up date:

Conclusion date:

2. INTRODUCTION TO THE INTERVIEW

2.1 Name of Z.E. Gliwice person conducting such interview/survey

2.2 Means of contact: on site interview

telephone interview

mail contact

customer request

2.3 Purpose of this survey/contact

(a) obtain information for use in forecasting future levels of electricity demand, tariff classification,

(b) better understanding customers' electricity use characteristics,

(c) identify opportunities for energy efficiency improvements, and

(d) quantify the demand side management resources.

3. AREA OF ACTIVITY / CLASSIFICATIONS

3.1 Industrial enterprise

3.1.1 what kind of industry is your enterprise ?

Iron/ steel
Non-ferrous metals
Metal fabrications
Refinery
Chemicals
Mining
Building material: cement/bricks
Timber/Pulp and paper
Textile/garments
Food processing
Motor vehicles/agricultural machinery
Electric power plant
District heating/ cogeneration plant
Other

3.2 Commercial enterprise

3.2.1 what kind of commercial enterprise is yours ?

Office building
Retail store
School/ college
Lodging/hotel
Restaurant
Health care, hospital, nursing home or clinic
Assembly, public or private
Apartment/multi family residences
Governmental building
Warehouse
Other

4. PHYSICAL VARIABLES AND ECONOMIC ACTIVITIES

4.1. Industrial enterprise

4.1.1 Acreage of plant site
4.1.2 number of buildings
4.1.3 building sizes

4.2 Commercial enterprise

4.2.1 number of buildings
4.2.2 size of each building
4.2.3 width by length by height
4.2.4 number of floors
4.2.5 space each floor
4.2.6 number of rooms on each floor
4.2.7 space heating source
4.2.8 building type

5. ENERGY CONSUMPTION PICTURE

5.1 Industrial enterprise

5.1.1 Feed line: how many

5.1.1.1 Voltages
5.1.1.2 Phase

5.1.2 Electric end uses

5.1.2.1	Vent. motors	#	kW	V	Phase	Yrs
5.1.2.2	Pumps	#	kW	V	Phase	Yrs
5.1.2.3	Compressors	#	kW	V	Phase	Yrs
5.1.2.4	Refrigeration	#	kW	V	Phase	Yrs
5.1.2.5	HVAC	#	kW	V	Phase	Yrs
5.1.2.6	Furnaces	#	MW	V	Phase	Yrs
5.1.2.7	Electrolysis	#	MW	V	Phase	Yrs
5.1.2.8	Other	#	MW	V	Phase	Yrs

5.2 Commercial enterprise

5.2.1 SUPPLY MODE

5.2.1.1 VOLTAGE
5.2.1.2 PHASE

5.2.2 ELECTRIC END USES

5.2.2.1	WATER BOILER(S)	#	KW	V	PHASE	YRS
5.2.2.2	WATER HEATER(S)	#	KW	V	PHASE	YRS
5.2.2.3	STOVE(S)	#	KW	V	PHASE	YRS

5.2.2.4 VENTILATION FAN MOTOR(S)

KW	V	PHASE	OPERATION/MODE	YRS	HISTORY

5.2.2.5 REFRIGERATION COMPRESSOR(S)

KW	V	PHASE	OPERATION/MODE	YRS	HISTORY

5.2.2.6 AIR CONDITIONING COMPRESSOR(S)

KW	V	PHASE	OPERATION/MODE	YRS	HISTORY

5.2.2.7 ELECTRIC SPACE HEATER(S)

KW	V	PHASE	OPERATION/MODE

5.2.2.8 SPACE HEATING WATER PUMP(S)

KW	V	PHASE	OPERATION/MODE

5.2.3. LIGHTING USAGE

5.2.3.1	INCANDESCENT	WATTS	#	USAGE/MODE (HI-MD-LW)
5.2.3.2	FLUORESCENT	WATTS	#	USAGE/MODE BALLAST
5.2.3.3	FLUORESCENT/ REFLECTOR(S)	WATTS	#	USAGE/MODE BALLAST
5.2.3.4	MERCURY VAPOR	WATTS	#	USAGE/MODE (HI-MD-LW)
5.2.3.5	H.P. SODIUM	WATTS	#	USAGE/MODE (HI-MD-LW)

5.2.4 WHOLE PREMISE CONSUMPTION

5.2.4.1 CURRENT TARIFF RATE

ON PEAK RATE	ZL/KWH
OFF PEAK RATE	ZL/KWH
DEMAND CHARGE	ZL/KW

5.2.4.2 LAST YEAR RATE

ON PEAK RATE	ZL/KWH
OFF PEAK RATE	ZL/KWH
DEMAND CHARGE	ZL/KW

5.2.4.3 PROJECTED NEXT YEAR RATE

ON PEAK RATE	ZL/KWH
OFF PEAK RATE	ZL/KWH
DEMAND CHARGE	ZL/KW

5.2.4.4 TOTAL CONSUMPTION

BY THE MONTH	KWH	COST(ZL)	AVG ZL/KWH
BY THE WEEK	KWH	COST(ZL)	AVG ZL/KWH
DEMAND (MAX/MIN)	KW	COST(ZL)	AVG ZL/KWH

5.2.4.5 LOAD PATTERN (DAILY)

AM

PM

5.2.4.6 LOAD PATTERN (WEEKLY)

WEEK DAYS	AM	PM
WEEK ENDS		

5.2.4.7 LOAD PATTERN (SEASONALLY)

MONTHS TO MONTHS

5.2.5 MODE OF OPERATION

a. Date of factory commissioning

b. Number of employee: Total: per shift:

c. Change in no of employee: Last year: next yr.:

d. Hours of operation: per day
Days of operation: per week
Weeks of operation: per year

e. Period of plant shut down (turn over)

Winter summer spring/fall

How many days(weeks) in each turn over:

f. Is hot water or steam generated in the plant ?

If yes, how much, kg/hr; for what purpose: space heating

process

If steam, what is the pressure, rate (kg/hr), and usage ?

What fuel is used to generate the hot water/steam ?

Is electricity is also generated in the steam/hot water plant ?

g. What is the current cost of fuel ?

h. What is the current cost of steam/hot water ?

i. What is the tariff of electricity consumed at the plant ?

Demand charge

Contract demand
Maximum demand
Over contract penalty

Usage charge

on peak:
peak time:
off peak:

Is there any demand constraint ?
Intermittent rate
Black out
brown out

j. What is the current level of production compared with last three years: up % or down %

What is the expected level of production in the next two years?
up % or down %

k. Approximately what % of maximum capacity is this plant currently operating at ?

1991	%	1992	%	1993	%	1994	%	1995	%

l. Any significant capital investment made within last (2) years ?

if yes, in what area: production energy efficiency pollution

m. Any significant capital investment to be made in the future ?

if yes, in what area: production energy efficiency pollution

n. Is this enterprise a private company, joint stock company, or governmental company ?

o. What are the primary (major) electricity end uses at this plant, in demand (kW) and in energy (kWh) ?

motors driving fans for ventilation
motors driving pumps
motors driving compressors
motors driving conveyer belts
motors driving crushers or milling machines
motors driving lath and machinery
electric furnaces
arc furnaces
electric dryers
HVAC
refrigeration and freezers
electrochemical process
electric space heaters
electric hot water heaters
lights

p. What types of lights are primarily used at the plant ?

Incandescent
Fluorescent
Compact fluorescent
Mercury vapor
Hi-pressure sodium
Metal halide
Other

o. Can the plant shift its operation schedule among different departments and result in a load shift mode of operation to avoid high contract demand cost ?

6. POTENTIAL IMPROVEMENT IN ENERGY EFFICIENCY

6.1 Motor(s) maintenance and history

6.1.1 list of motor(s)

Name plate information
year made:
manufacturer name:
capacity:
rpm:
motor type
power:
voltage:
current:

function: compressor pump ventilation conveyer etc
mode of operation: continuous hours of operation/day; /week
batch hours of operation/day; /week
service history:

repaired: how many times what was the defects
rewind: how many times by whom/ rotor condition
check: efficiency before and after

submetering: is this motor submetered ?
is the efficiency of this motor checked each time it was repaired ?

6.1.2 Economics

how much would it cost to replace the motor ?
how much improvement in efficiency if the old motor is replaced with a new one ?
what is the simple payback for the replacement ?

if the motor is used in a constant speed pump, how much would it cost to change the motor to a variable speed pump ? new motor: rewind the old motor:
What is the estimated payback in the above case ?

6.2 Lighting

6.2.1 Lighting fixture inventory

Does lighting load represent a significant portion of the total load ?
Are most of the lightings are of incandescent types ?

How much an impact will it have if all lighting fixtures were changed to compact fluorescent lighting ?

At what electricity price level would make such changes an attractive alternative to the business customers ?

7. ENERGY CONSERVATION

7.1 ANY MAJOR ADDITIONS OR REMODELING WITHIN NEXT YEAR

7.2 HAS ANY ENERGY AUDITS BEEN CONDUCTED IN THE PLANT WITHIN THE LAST TWO TO THREE YEARS ?

7.3 ANY ENERGY MANAGEMENT PROGRAM PLANNED AND/OR PRACTICED

7.4 ANY ENERGY EFFICIENCY MEASURES THAT COULD BE IMPLEMENTED AT THIS PLANT ?

If yes, what is the most cost efficient measure, and why ?

7.8 WHAT WOULD BE THE MOST ATTRACTIVE INCENTIVE THE DISTRIBUTION CAN OFFER TO YOU FOR ANY END USE EFFICIENCY IMPROVEMENT ?

8. CONCLUSION SESSION

8.1 PERSON WHO IS TRACKING THE COST OF ELECTRIC ENERGY

8.2 ANY OTHER RELEVANT INFORMATION ON ELECTRIC ENERGY CONSUMPTION

8.3 PERSON SUPPLIES THE INFORMATION: NAME DATE

APPENDIX A - 2

SURVEY SHEETS

FOR

SMALL COMMERCIAL

AND

RESIDENTIAL

CUSTOMERS

NOTICE

Your participation in this survey is voluntary, but your cooperation in is very significant for documenting electricity consumption patterns in Poland. At some time in the future, funding from the Polish government and international organizations may become available to implement demand-side management (DSM) and energy efficiency measures. This survey may be helpful in your applying for loans to improve the overall energy efficiency at this location.

Information given here is only for use by Z.E. Gliwice. The individual enterprise data will remain confidential under a signed agreement with Z.E. Gliwice. Only summaries and statistical conclusions on a much broader scope will be used in any reports of this survey.

1. DATE OF SITE INSTALLATION:

2. SITE NAME AND ADDRESS:

3. OWNER'S NAME

4. PHYSICAL DATA OF BUILDING

   4.1 NO OF STORIES
   4.2 TOTAL VOLUME (M^3)
   4.3 TOTAL AREA (M^2)
   4.4 SPACE HEATING SOURCE
   4.5 BUILDING TYPE: CONCRETE BRICK WOOD /ROOF
   4.6 NUMBER OF ROOMS

5. ELECTRIC USAGE INFORMATION (EXCLUDING LIGHTING)

   5.1 SUPPLY MODE
      5.1.1 VOLTAGE
      5.1.2 PHASE
   5.2 ELECTRIC END USES
      5.2.1 WATER BOILER(S) # KW V PHASE YRS

      5.2.2 WATER HEATER(S) # KW V PHASE YRS

      5.2.3 STOVE(S) # KW V PHASE YRS

      5.2.4 VENTILATION FAN MOTOR(S)

KW V PHASE OPERATION/MODE YRS HISTORY

      5.2.5 REFRIGERATION COMPRESSOR(S)

KW V PHASE OPERATION/MODE YRS HISTORY

INFORMATION SHEET OF COMMERCIAL/RESIDENTIAL SITE

      5.2.6 AIR CONDITIONING COMPRESSOR(S)

KW V PHASE OPERATION/MODE YRS HISTORY

5.2.7 ELECTRIC SPACE HEATER(S)

#	KW	V	PHASE	OPERATION/MODE

5.2.8 WATER PUMP(S)

#	KW	V	PHASE	OPERATION/MODE

6. LIGHTING USAGE

6.1 LIGHT FIXTURE

6.1.1	INCANDESCENT	WATTS	#	USAGE/MODE (HI-MD-LW)
6.1.2	FLUORESCENT	WATTS	#	USAGE/MODE BALLAST
6.1.3	FLUORESCENT/ REFLECTOR(S)	WATTS	#	USAGE/MODE BALLAST
6.1.4	MERCURY VAPOR	WATTS	#	USAGE/MODE (HI-MD-LW)
6.1.5	H.P. SODIUM	WATTS	#	USAGE/MODE (HI-MD-LW)

7. WHOLE PREMISE CONSUMPTION

7.1 CURRENT TARIFF RATE

ON PEAK RATE	ZL/KWH
OFF PEAK RATE	ZL/KWH
DEMAND CHARGE	ZL/KW

7.2 LAST YEAR RATE

ON PEAK RATE	ZL/KWH
OFF PEAK RATE	ZL/KWH
DEMAND CHARGE	ZL/KW

7.3 PROJECTED NEXT YEAR RATE

ON PEAK RATE	ZL/KWH
OFF PEAK RATE	ZL/KWH
DEMAND CHARGE	ZL/KW

7.4 TOTAL CONSUMPTION

BY THE MONTH	KWH	COST(ZL)	AVG ZL/KWH
BY THE WEEK	KWH	COST(ZL)	AVG ZL/KWH
DEMAND (MAX/MIN)	KW	COST(ZL)	AVG ZL/KWH

7.5 LOAD PATTERN (DAILY)

AM

PM

7.6 LOAD PATTERN (WEEKLY)

WEEK DAYS AM PM

WEEK ENDS

7.7 LOAD PATTERN (SEASONALLY)

MONTHS TO MONTHS

8. ANY MAJOR ADDITIONS OR REMODELING WITHIN NEXT YEAR

9. ANY ENERGY MANAGEMENT PROGRAM PLANNED AND/OR PRACTICED

10. PERSON WHO IS TRACKING THE COST OF ELECTRIC ENERGY

11. ANY OTHER RELEVANT INFORMATION ON ELECTRIC ENERGY CONSUMPTION

12. PERSON SUPPLIES THE INFORMATION: NAME DATE

APPENDIX A - 3

MONITORING SHEETS

FOR

COMMERCIAL AND RESIDENTIAL CUSTOMERS

1. ELECTRIC BLUE PRINT OF SITE

2. PHYSICAL AND ELECTRIC LAYOUT OF SITE

3. LIGHTING LOGGER LOCATIONS

3.1 LT LOGGER INSTALLATION POSITION

3.2 LT LOGGER SENSITIVITY ADJUSTMENT

3.3 LT LOGGER DATA CHECK -------- BY NAME _____

DATE _____

3.4 LT LOGGER RESET

LT LOGGER ID	TIME TO START DATA LOGGING
	TIME TO END DATA LOGGING
LT LOGGER ID	TIME TO START DATA LOGGING
	TIME TO END DATA LOGGING
LT LOGGER ID	TIME TO START DATA LOGGING
	TIME TO END DATA LOGGING

3.5 LT LOGGER ROTATIONAL SCHEME

4. MOTOR LOGGER LOCATIONS

4.1 MT LOGGER INSTALLATION POSITION

4.2 MT LOGGER DATA CHECK --------- BY NAME _____

DATE _____

4.3 MT LOGGER RESET

MT LOGGER ID	TIME TO START DATA LOGGING
	TIME TO END DATA LOGGING
MT LOGGER ID	TIME TO START DATA LOGGING
	TIME TO END DATA LOGGING
MT LOGGER ID	TIME TO START DATA LOGGING
	TIME TO END DATA LOGGING

4.4 MT LOGGER ROTATIONAL SCHEME

5. CURRENT LOGGER LOCATIONS

5.1 CT LOGGER INSTALLATION POSITION

5.2 CT LOGGER DATA CHECK --------- BY NAME _____

DATE _____

5.3 CT LOGGER RESET

CT LOGGER ID	TIME TO START DATA LOGGING
	TIME TO END DATA LOGGING
CT LOGGER ID	TIME TO START DATA LOGGING
	TIME TO END DATA LOGGING

5.4 CT LOGGER ROTATIONAL SCHEME

6. WHOLE PREMISE LOAD MONITORING

6.1 POWER LOGGER II LOCATION

6.2 POWER LOGGER DATA CHECK --------- BY NAME _____
POWER LOGGER ID:
DATE _____

6.3 POWER LOGGER RESET

TIME TO START

TIME TO END

7. COMMENTS ON MONITORING INSTRUMENTS/ LOCATIONS/ SCHEDULE/ ETC

APPENDIX A - 4

MONITORING SHEETS

FOR

COAL MINES

1. VENTILATION MOTORS

1.1 IDENTIFICATION AND LOCATION

1.2 TYPE OF MOTORS

1.3 NOMINAL RATING (NAME PLATE INFORMATION)

1.4 WORKING CURRENT

1.5 EXCITER CURRENT

1.6 NOTES AND COMMENTS

2. POWER LOGGER ASSIGNED TO THIS FAN MOTOR

2.1 POWER LOGGER ID

2.2 SYSTEM CONFIGURATION

2.3 PT ADJUSTMENT FACTOR

2.4 SAMPLE RATE AND RECORDING LENGTH

15 MINUTES -------

TOTAL LENGTH ---------

2.5 RECORDING MODE

ADAPTIVE -------

2.6 RECORDS AND DISPLAY CHECKS

BY NAME _____

DATE _____

2.7 TIME AND DATE TO START RECORD

DATE _____ TIME _____

SUBMETER (KWH) READING _____

2.8 TIME AND DATE TO END

DATE _____ TIME _____

SUBMETER (KWH) READING _____

3. PUMP MOTORS

3.1 IDENTIFICATION AND LOCATION

3.2 TYPE OF MOTORS

3.3 NOMINAL RATING (NAME PLATE INFORMATION)

3.4 WORKING CURRENT

3.5 EXCITER CURRENT

3.6 NOTES AND COMMENTS

4. POWER LOGGER ASSIGNED TO THIS PUMP MOTOR

4.1 POWER LOGGER ID

4.2 SYSTEM CONFIGURATION

4.3 PT ADJUSTMENT FACTOR

4.4 SAMPLE RATE AND RECORDING LENGTH

15 MINUTES -------

TOTAL LENGTH ---------

4.5 RECORDING MODE

ADAPTIVE -------

4.6 RECORDS AND DISPLAY CHECKS

BY NAME _____

DATE _____

4.7 TIME AND DATE TO START RECORD

DATE _____ TIME _____

SUBMETER (KWH) READING _____

4.8 TIME AND DATE TO END

DATE _____ TIME _____

SUBMETER (KWH) READING _____

5. SHAFT ELEVATOR MOTORS

5.1 IDENTIFICATION AND LOCATION

5.2 TYPE OF MOTORS

5.3 NOMINAL RATING (NAME PLATE INFORMATION)

5.4 WORKING CURRENT

5.5 EXCITER CURRENT

5.6 NOTES AND COMMENTS

6. POWER LOGGER ASSIGNED TO THIS PUMP MOTOR

6.1 POWER LOGGER ID

6.2 SYSTEM CONFIGURATION

6.3 PT ADJUSTMENT FACTOR

6.4 SAMPLE RATE AND RECORDING LENGTH

15 MINUTES -------

TOTAL LENGTH ---------

6.5 RECORDING MODE

ADAPTIVE -------

6.6 RECORDS AND DISPLAY CHECKS

BY NAME _____

DATE _____

6.7 TIME AND DATE TO START RECORD

DATE _____ TIME _____

SUBMETER (KWH) READING _____

6.8 TIME AND DATE TO END

DATE _____ TIME _____

SUBMETER (KWH) READING _____

7. OTHER MAJOR USE OF ELECTRIC POWER

AIR COMPRESSORS

UNDERGROUND COMBINES

COAL CRUSHING AND SEPARATION

A. WHOLE PREMISE ELECTRIC LOAD CURVE

DURING THE SAME PERIOD OF TIME WHEN POWER LOGGER IS RECORDING THE LOADS OF VARIOUS END USES, IT IS NECESSARY TO HAVE THE FOLLOWING INFORMATION OF THE WHOLE SITE:

A.1 15 MINUTE DEMAND CHARGE STRIP CHART RECORDS

A.2 HOURLY DEMAND CURVE

B. WHOLE PREMISE ELECTRIC ENERGY CONSUMPTION

B.1 ELECTRIC KWH CONSUMPTION RECORDS FOR THE DAYS OF LOAD MONITORING

B.2 MONTHLY BILLING DATA FOR THE PAST 12 MONTHS

C. ELECTRIC TARIFF INFORMATION

C.1 LAST YEAR RATES

C.2 CURRENT YEAR RATES

C.3 NEXT YEAR RATES (PROJECTED)

D. ANY MAJOR CAPITAL IMPROVEMENTS

D.1 LAST TWO YEARS ($)

D.2 CURRENT YEAR ($)

D.3 NEXT YEAR ($)

E. ANY MAJOR VARIATION IN COAL PRODUCTION LEVEL

F. ANY MAJOR VARIATION IN THE NUMBER OF EMPLOYEES

G. PERSON WHO IS IN CHARGE OF THE ELECTRIC POWER COST AND THE EFFICIENCY OF MAJOR ELECTRIC EQUIPMENT:

H. PERSON(S) WHO SUPPLY THE ABOVE INFORMATION:

NAME _____ DATE _____

APPENDIX A - 5

SURVEY SHEETS

FOR

DISTRICT HEATING AND COGENERATION PLANTS

NOTICE

Your participation in this survey is voluntary, but your cooperation in is very significant for documenting electricity consumption patterns in Poland. At some time in the future, funding from the Polish government and international organizations may become available to implement demand-side management (DSM) and energy efficiency measures. This survey may be helpful in your applying for loans to improve the overall energy efficiency at this location.

Information given here is only for use by Z.E. Gliwice. The individual enterprise data will remain confidential under a signed agreement with Z.E. Gliwice. Only summaries and statistical conclusions on a much broader scope will be used in any reports of this survey.

1. ___ MW turbine banks

a. Boiler feedwater pump motors

Quantity	Description	Capacity (kW)
	primary	
	main	

b. Boiler make-up water pump motors

Quantity	Description	Capacity (kW)

c. Coal crusher motors

Quantity	Description	Capacity (kW)

d. Combustion air fan motors

Quantity	Description	Capacity (kW)

e. Boiler exhaust fan motors

Quantity	Description	Capacity (kW)

2. ___ MW turbine banks

a. Boiler feedwater pump motors

Quantity	Description	Capacity (kW)
	primary	
	main	

b. Boiler make-up water pump motors

Quantity	Description	Capacity (kW)

c. Coal crusher motors

Quantity	Description	Capacity (kW)

d. Combustion air fan motors

Quantity	Description	Capacity (kW)

e. Boiler exhaust fan motors

Quantity	Description	Capacity (kW)

3. ___ MW turbine banks

a. Boiler feedwater pump motors

Quantity	Description primary	Capacity (kW)

b. Boiler make-up water pump motors

Quantity	Description	Capacity (kW)

c. Coal crusher motors

Quantity	Description	Capacity (kW)

d. Combustion air fan motors

Quantity	Description	Capacity (kW)

e. Boiler exhaust fan motors

Quantity	Description	Capacity (kW)

4. ___ MW turbine banks

a. Boiler feedwater pump motors

Quantity	Description primary	Capacity (kW)

b. Boiler make-up water pump motors

Quantity	Description	Capacity (kW)

c. Coal crusher motors

Quantity	Description	Capacity (kW)

d. Combustion air fan motors

Quantity	Description	Capacity (kW)

e. Boiler exhaust fan motors

Quantity	Description	Capacity (kW)

5. ___ MW turbine banks

a. Boiler feedwater pump motors

Quantity	Description primary	Capacity (kW)

b. Boiler make-up water pump motors

Quantity	Description	Capacity (kW)

c. Coal crusher motors

Quantity	Description	Capacity (kW)

d. Combustion air fan motors

Quantity	Description	Capacity (kW)

e. Boiler exhaust fan motors

Quantity	Description	Capacity (kW)

6. ___ MW turbine banks

a. Boiler feedwater pump motors

Quantity	Description primary	Capacity (kW)

b. Boiler make-up water pump motors

Quantity	Description	Capacity (kW)

c. Coal crusher motors

Quantity	Description	Capacity (kW)

d. Combustion air fan motors

Quantity	Description	Capacity (kW)

e. Boiler exhaust fan motors

Quantity	Description	Capacity (kW)

7. Cooling tower pumps

Quantity	Description	Capacity (kW)

8. Cooling tower fans

Quantity	Description	Capacity (kW)

9. Pump motors supplying hot water to city

a. Supply pump motors

Quantity	Description	Capacity (kW)

b. Return pump motors

Quantity	Description	Capacity (kW)

10. Other major motor loads (list quantity, size (kW) and application)

- for example, motors conveying coal from storage to boilers.

APPENDIX A - 6

MONITORING SHEETS

FOR

DISTRICT HEATING AND COGENERATION PLANTS

1. INDUCED FAN MOTORS

1.1 IDENTIFICATION AND LOCATION

1.2 TYPE OF MOTORS

1.3 NOMINAL RATING (NAME PLATE INFORMATION)

1.4 WORKING CURRENT

1.5 EXCITER CURRENT

1.6 NOTES AND COMMENTS

2. POWER LOGGER ASSIGNED TO THIS FAN MOTOR

2.1 POWER LOGGER ID

2.2 SYSTEM CONFIGURATION

2.3 PT ADJUSTMENT FACTOR

2.4 SAMPLE RATE AND RECORDING LENGTH

15 MINUTES -------

TOTAL LENGTH ---------

2.5 RECORDING MODE

ADAPTIVE -------

2.6 RECORDS AND DISPLAY CHECKS

BY NAME _____

DATE _____

2.7 TIME AND DATE TO START RECORD

DATE _____ TIME _____

SUBMETER (KWH) READING _____

2.8 TIME AND DATE TO END

DATE _____ TIME _____

SUBMETER (KWH) READING _____

3. HOT WATER PUMP MOTORS

3.1 IDENTIFICATION AND LOCATION

3.2 TYPE OF MOTORS

3.2.1 CONSTANT SPEED/ ADJUSTABLE SPEED

3.3 NOMINAL RATING (NAME PLATE INFORMATION)

3.4 WORKING CURRENT

3.5 EXCITER CURRENT

3.6 NOTES AND COMMENTS

4. POWER LOGGER ASSIGNED TO THIS PUMP MOTOR

4.1 POWER LOGGER ID

4.2 SYSTEM CONFIGURATION

4.3 PT ADJUSTMENT FACTOR

4.4 SAMPLE RATE AND RECORDING LENGTH

15 MINUTES -------

TOTAL LENGTH ---------

4.5 RECORDING MODE

ADAPTIVE -------

4.6 RECORDS AND DISPLAY CHECKS

BY NAME _____

DATE _____

4.7 TIME AND DATE TO START RECORD

DATE _____ TIME _____

SUBMETER (KWH) READING _____

4.8 TIME AND DATE TO END

DATE _____ TIME _____

SUBMETER (KWH) READING _____

5. BOILER FEED WATER PUMP MOTORS

5.1 IDENTIFICATION AND LOCATION

5.2 TYPE OF MOTORS

5.3 NOMINAL RATING (NAME PLATE INFORMATION)

5.4 WORKING CURRENT

5.5 EXCITER CURRENT

5.6 NOTES AND COMMENTS

6. POWER LOGGER ASSIGNED TO THIS PUMP MOTOR

6.1 POWER LOGGER ID

6.2 SYSTEM CONFIGURATION

6.3 PT ADJUSTMENT FACTOR

6.4 SAMPLE RATE AND RECORDING LENGTH

15 MINUTES -------

TOTAL LENGTH ---------

6.5 RECORDING MODE

ADAPTIVE -------

6.6 RECORDS AND DISPLAY CHECKS

BY NAME _____

DATE _____

6.7 TIME AND DATE TO START RECORD

DATE _____ TIME _____

SUBMETER (KWH) READING _____

6.8 TIME AND DATE TO END

DATE _____ TIME _____

SUBMETER (KWH) READING _____

7. OTHER MAJOR USE OF ELECTRIC POWER

COMPRESSORS

COOLING WATER PUMPS

COAL PREPARATION AND CONVEYER

A. WHOLE PREMISE ELECTRIC LOAD CURVE

DURING THE SAME PERIOD OF TIME WHEN POWER LOGGER IS RECORDING THE LOADS OF VARIOUS END USES, IT IS NECESSARY TO HAVE THE FOLLOWING INFORMATION OF THE WHOLE SITE:

A.1 15 MINUTE DEMAND CHARGE STRIP CHART RECORDS

A.2 HOURLY DEMAND CURVE

B. WHOLE PREMISE ELECTRIC ENERGY CONSUMPTION

B.1 ELECTRIC KWH CONSUMPTION RECORDS FOR THE DAYS OF LOAD MONITORING

B.2 MONTHLY BILLING DATA FOR THE PAST 12 MONTHS

C. ELECTRIC TARIFF INFORMATION

C.1 LAST YEAR RATES

C.2 CURRENT YEAR RATES

C.3 NEXT YEAR RATES (PROJECTED)

D. ANY MAJOR CAPITAL IMPROVEMENTS

D.1 LAST TWO YEARS ($)

D.2 CURRENT YEAR ($)

D.3 NEXT YEAR ($)

E. ANY MAJOR VARIATION IN HEAT AND ELECTRIC POWER PRODUCTION LEVEL

E.1 HEAT PRODUCTION

LAST YEAR

THIS YEAR

E.2 ELECTRIC POWER PRODUCTION LEVEL

LAST YEAR

THIS YEAR

F. ANY MAJOR VARIATION IN THE NUMBER OF EMPLOYEES

G. PERSON WHO IS IN CHARGE OF THE ELECTRIC POWER COST AND THE EFFICIENCY OF MAJOR ELECTRIC EQUIPMENT:

H. PERSON(S) WHO SUPPLY THE ABOVE INFORMATION:

NAME _____ DATE _____

I. ANY OTHER COMMENTS RELATED TO POWER CONSUMPTION