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Message from Secretary - Ministry of Power / Director General – Bureau of Energy Efficiency

Enactment of the landmark Energy Conservation Act in August 2001 initiated the energy conservation efforts in different sectors of Indian economy. Institutionalization of the Bureau of Energy Efficiency (BEE) marks the focus of the Ministry of Power (MoP) to promote energy conservation activities in India. BEE, under its mandate under the EC Act, has initiated several activities including certification of energy professionals, promotion of standards and labeling for appliances and equipment, benchmarking of energy consumption among the industrial users, and energy efficiency building codes. Several of the above activities are being implemented through the bilateral technical assistance offered by agencies – most prominently under the agreements with the United States Agency for International Development (USAID). Assistance to BEE under the Energy Conservation and Commercialization initiative is one such joint effort to promote efficiency projects driven by electricity utilities and inception of energy efficiency building codes.

BEE and MOP have worked closely with the ECO II implementation agency – the International Institute for Energy Conservation, a global not-for profit NGO promoting energy efficiency between August 2003 and August 2005. Design of DSM Best Practices Guidebook forms an important part of the implementation of the ECOII initiative. This task complements the efforts under the DSM Implementation tasks and provides additional tool for the participating Indian utilities to understand the nuances of implementation of DSM in different sectors and in different economies. One of the key messages offered by this Guidebook is the benefit of DSM implementation to the electricity utilities. Benefits resulting from the peak-load reduction and reduced energy consumption in both the subsidized and non-subsidized sectors are note-worthy. In the competitive electricity distribution market triggered by the Electricity Act 2003, DSM measures will assist the distribution companies to offer additional services to its consumers and to go closer to them. Utility branding of several products, lighting products in particular, have resulted in price-benefits to the consumers and increased market share of such products with the utility endorsing. It is worth mentioning in at this juncture the proactive steps taken by the Bangalore Electricity Supply Company (BESCOM) in leading the way in the utility-driven DSM by way of successfully completing the pilot phase of the BESCOM Efficient Lighting Program (BELP), again under the Technical Assistance offered under USAID funding and program support by IIEC. Lessons learned from the case studies also reflect on the regulatory support that can be offered by the State Electricity Regulatory Commissions in promoting DSM through tariff signals.

I am pleased to be a part of the launch of this Guidebook and encourage Indian utilities in adopting such measures that would assist in easing out the capacity increase challenges in the Indian power sector.

Message from Director – Energy Environment and Enterprise Group - USAID – India Mission

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Comments made by the attendees of a Focused Group Meeting organized by IIEC in Mumbai on February 25, 2005 to discuss the Draft DSM Guidebook are acknowledged. List of attendees of the meeting held on February 25, 2005 is as follows:

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Executive Summary

The International Institute for Energy Conservation (IIEC) has developed this Guidebook as part of the Energy Conservation and Commercialization initiative (ECO II), a program funded by the United States Agency for International Development (USAID). The purpose of this Guidebook is to facilitate the development, financing and implementation of demand-side management projects in India, by providing documented international DSM case studies and drawing lessons learned from them. This Guidebook introduces the DSM concepts, gives the reader a perspective on the evolving Indian regulatory framework, provides a compendium of case studies from different sectors and countries, presents the lessons learned from the case and presents a proposed generic methodology for implementation of DSM in Indian utilities.

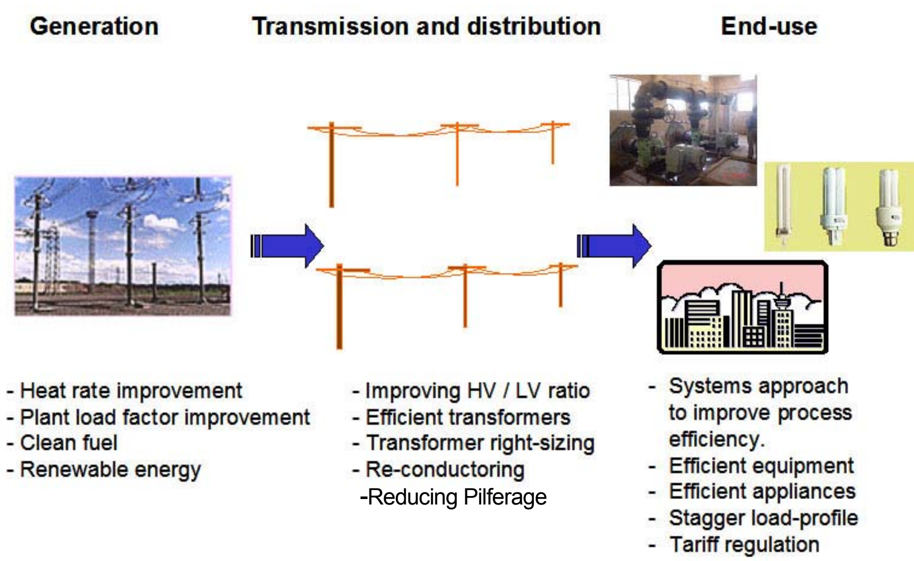
It can be seen from the case studies that, considering the tangible and nontangible benefits to the customers, society and the utilities- the investments made in DSM programs are definitely justified.

Acronyms

ADB	Asian Development Bank
AEC	Ahmedabad Electricity Company (India)
AMC	Ahmedabad Municipal Corporation
BEE	Bureau of Energy Efficiency (India)
BPA	Bonneville Power Administration (United States)
CEA	Central Electricity Authority (India)
CEB	Ceylon Electricity Board (Sri Lanka)
CEPALCO	Cagayan Electric Power And Light Company (Philippines)
CFL	Compact Fluorescent Lamp
CO2	Carbon Dioxide
CONAE	Comision Nacional Para El Ahorro De Energia (Mexican Government Energy-Efficiency Agency)
DOE	Department Of Energy (United States)
DSM	Demand-Side Management
ECA	Energy Conservation Act 2001 (India)
ECF	Energy Conservation Fund
ECO	Energy Conservation and Commercialization Project
EDF	Electricite De France (The French Electricity Agency)
EE	Energy Efficiency
EGAT	Electricity Generating Authority Of Thailand
EMCAT	Energy Management Consultation And Training
ESCO	Energy Services Company
GEB	Gujarat Electricity Board
GEF	Global Environmental Fund
GHG	Greenhouse Gas
GOI	Government Of India
GWh	Gigawatt Hour
HEM	High Efficiency Motors
HP	Horsepower
HPS	High Pressure Sodium Lamps
IFC	International Finance Corporation
IIEC Asia	International Institute for Energy Conservation
IPP	Independent Power Producers
IREDA	Indian Renewable Energy Development Authority
KWh	Kilowatt Hour
LCC	Life Cycle Cost
LPG	Liquefied Petroleum Gas
M & E	Monitoring & Evaluation
MEDA	Maharashtra Energy Development Agency
MNES	Ministry Of Non-Conventional Energy Sources (India)
MOP	Ministry Of Power (India)
MU	Million Units (Electricity)
M & V	Monitoring & Verification
MW	Mega Watt
NGO	Non-Governmental Organization
NPCL	Noida Power Company Limited (India)
NPV	Net Present Value
NYPA	New York Power Administration
PEA	Provincial Electricity Authority (Thailand)
PF	Power Factor
SERC	State Electricity Regulatory Commission
USAID	United States Agency For International Development
WB	The World Bank
WESCO	Western Electricity Supply Company (India)
XIM	Xavier Institute of Management

Chapter 1 Introduction

As in several other developing and developed countries in the world energy conservation activities in India have been on the rise over the last three decades,. Increased energy demand and taxes on power generation is a common feature of electricity markets across the world. The electricity available for end-use is now stressed but several interventions targeted at improving system efficiency are possible. Figure 1.1 highlights some of the system efficiency options available to the electricity utilities in general.



■ Figure 0.1: Efficiency opportunities in power distribution

This Guidebook aims to facilitate the adoption of end-use efficiency measures through Demand Side Management (DSM) approach by utilities in the developing countries, especially in India. One of the activities under the USAID sponsored Energy Conservation and Commercialization (ECO II) initiative, implemented by the International Institute for Energy Conservation (IIEC) is promoting DSM among Indian utilities. This Guidebook is part of the project deliverables. Chapter 2 aims to facilitate the practitioners' appreciation of the concepts and rationale of DSM. Chapter 3 introduces the role of DSM in Indian utility sector while Chapter 4 presents an overview of successful DSM projects from across the world, including international and Indian case studies from residential, commercial, agricultural, industrial and municipal sectors. Key features of the case studies are discussed in Chapter 5, followed by a generic model for structuring and evaluation of DSM programs in the context of Indian utilities in Chapter 6.

Chapter 2 DSM Concepts/Rationale

2.1 Definition and Rationale

Changing electricity markets in the developing and the developed countries face several challenges, largely due to the uncertainties in the load growth, higher investments required in capacity addition, declining fuel sources and its associated environmental costs. Tariff changes due to the changing regulatory stands also affect the ability of utilities to service its customer base. The concept of demand-side management was developed in response to the potential problems of global warming and the need for sustainable development, and the recognition that improved energy efficiency represents the most cost-effective option to reduce the impacts of these problems. Demand-side management (DSM) refers to cooperative activities between the utility and its customers (sometimes with the assistance of third parties such as energy services companies and various trade allies) to implement options for increasing the efficiency of energy utilization, with resulting benefits to the customer, utility, and society as a whole. Benefits of the DSM initiatives are manifold, as described in Table 2.1 below.

■ Table 0.1: DSM Benefits

Customer benefits	Societal benefits	Utility benefits
Satisfy electricity demands	Reduce environmental degradation	Lower cost of service
Reduce / stabilize costs	Conserve resources	Improve operating efficiency, flexibility
Improve value of service	Protect global environment	Reduce capital needs
Maintain/improve lifestyle and productivity	Maximize customer welfare	Improve customer service

The implementation of DSM programs in developing countries is likely to:

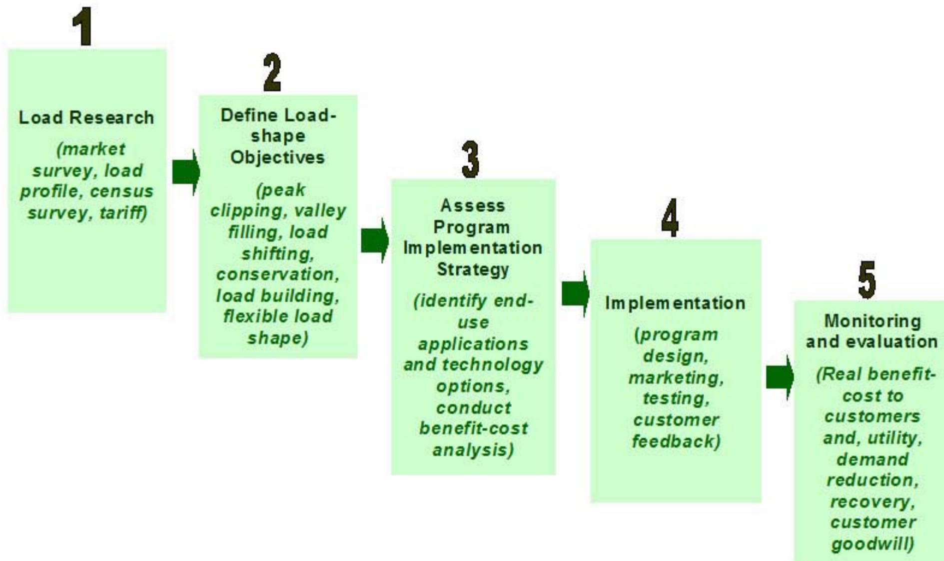
- Improve the efficiency of energy systems
- Reduce financial needs to build new energy facilities (generation)
- Minimize adverse environmental impacts
- Lower the cost of delivered energy to consumers
- Reduce power shortages and power cuts
- Improve the reliability and quality of power supply
- Contribute to local economic development

2.2 DSM Implementation

DSM programs are utility and customer specific. Figure 2.1 describes various steps involved in implementing a DSM program.

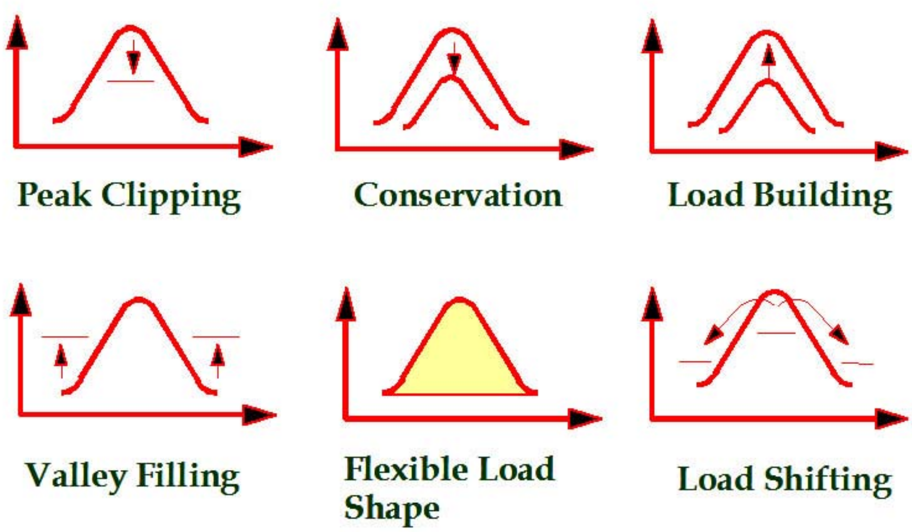
Step 1: Load Research

This stage in the DSM implementation will typically assess the customer base, tariff, load profile on an hourly basis and will identify the sectors contributing to the load shape. This step will also identify the tariff classes in the utility, current recovery from different sectors and current subsidy offered to different sectors.



- Figure 0.2: Steps in typical DSM program

Step 2: Define load-shape objectives
Based on the results of the load research in the utility, DSM engineers will define the load shape objectives for the current situation. Various load-shape objectives - **Peak Clipping** (reduction in the peak demand), **Valley Filling** (increased demand at off-peak), **Load Shifting** (demand shifting to non-peak period), and **Load Building** (increased demand) are possible. These are represented in Figure 2.2.



- Figure 0.3: Load-shape objectives

Specific descriptions of load-shape objectives are shown in Box 2.1.

Box 2.1 Meaning of load-shape objective

- **Peak Clipping** — the reduction of utility load primarily during periods of peak demand
- **Valley-Filling** — the improvement of system load factor by building load in off-peak periods
- **Load Shifting** — the reduction of utility loads during periods of peak demand, while at the same time building load in off-peak periods. Load shifting typically does not substantially alter total electricity sales.
- **Conservation** — the reduction of utility loads, more or less equally, during all or most hours of the day
- **Load Building** — the increase of utility loads, more or less equally, during all or most hours of the day
- provision of a more **Flexible Utility Load Shape** — refers to programs that set up utility options to alter customer energy consumption on an as-needed basis, as in interruptible/ curtailable agreements.

Step 3: Assess program implementation strategies
This step will identify the end-use applications that can be potentially targeted to reduce peak demand, specifically in sectors with higher subsidies. This step will also carry out a detailed benefit-cost analysis for the end-users and the utilities, including analysis on societal as well as environmental benefits.

Step 4: Implementation
Implementation stage will design the program for specific end-use applications, will promote the program to the target audience through marketing approaches such as advertising, bills and inserts, and focused group meetings as in case of the industrial sector.

Step 5: Monitoring and Evaluation
This step will track the program design and implementation and will compare the same with proposed DSM goal set by the utility. A detailed benefit-cost analysis in this case will include identifying the avoided supply cost for the utility vis-à-vis the total program cost for the utilities and benefits to the participants including the reduced bills or incentives to the end-users.

2.3 DSM in Restructured Utility Market

In India, several utilities are on the restructuring path, which makes it important for the Guidebook to discuss possible implementation options. In India and other developing countries, the restructuring of the electricity industry is leading to the creation of new entities and realigning the roles of the industry players (generators, transmission businesses, distribution 'wires' businesses, and retail suppliers) relative to customers. In a restructured market, two distinct types of DSM programs are relevant:

- **Public-policy-based DSM and energy efficiency** — These are DSM and energy efficiency programs carried out to achieve public policy objectives. Such objectives could be: to reduce environmental damage, to increase overall energy system efficiency, to achieve job creation, etc.

- **Business-based DSM and energy efficiency** — These are DSM and energy efficiency programs carried out by energy businesses or their partners to achieve commercial corporate objectives. Examples of objectives for this type of DSM include: to improve the profitability of existing business areas, to improve market positioning, to retain customers, to improve public relations, to increase profitability from new business areas (e.g., new products and services).

2.3.1 Public Policy-Based DSM

This type of DSM initiative needs to target at programs ensuring non-distortion of existing market forces in the electrical industry. Following are some of the implementation mechanisms identified in restructured electricity markets:

- Product labeling: This mechanism involves identifying a product's energy efficiency rating and expected annual energy cost, displayed on the product at the point of purchase. Labeling initiative will in general drive the customer choice towards superior energy efficient products, thereby reducing the energy consumption. This strategy would particularly be applicable to products contributing to the peak demand of a utility, such as the residential lighting.
- "Branding" of energy efficiency — Branding is designed to increase the visibility and credibility of energy efficiency initiatives. A product is branded if it meets the set energy efficiency standards. Branding eventually raises the minimum product efficiencies available in the market.
- Market transformation — Market transformation focuses on intervention in the market to permanently change the decisions that customers make regarding energy efficiency. This intervention can be termed as being a combination of the two mechanisms given above. Market transformation creates a market pull leveraging the policy push targeted at efficiency gains.

The "feebate" — Energy efficiency can also be promoted through direct financial mechanisms such as tax credits or subsidies for efficient technologies and surcharges for inefficient technologies. One form of mechanism, the feebate, offers a rebate for products above a designated efficiency standard and a fee for products below it. While direct financial intervention may offer adequate incentive to promote efficiency, it could also distort markets, which tend to become overly reliant on the incentives.

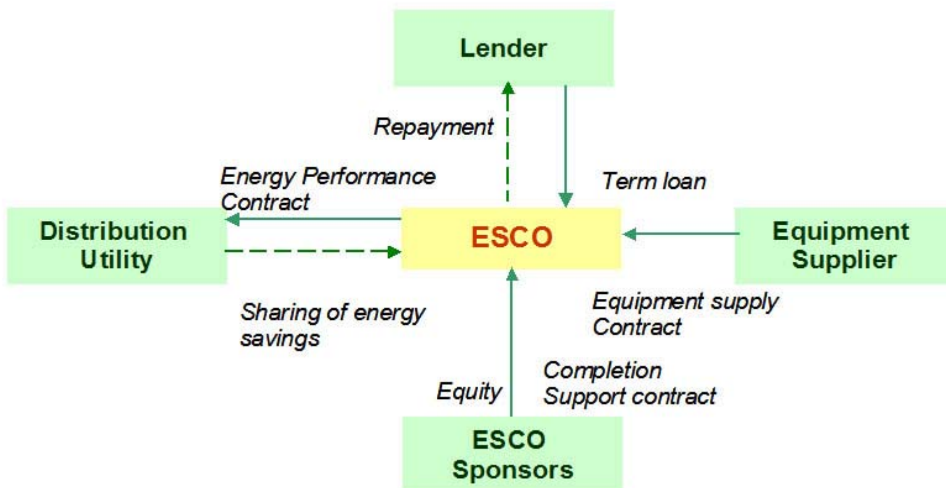
A wide range of funding sources has been used for public policy-based DSM. The most commonly referred to is the "wires charge." This is often levied on all purchases of electricity, regardless of the supplier of that electricity. The use of such a charge can ensure that the funding source for energy efficiency activities does not cause the electricity price of one energy provider (e.g., utility) to be higher or lower (more or less competitive) than that of another energy provider. In short, an energy provider cannot bypass the charge, and it does not favor one provider over another.

Other observed funding mechanisms for public policy based DSM and energy efficiency services include:

- General tax revenues — i.e., the activities are funded from the general tax base so that costs are borne by all fuels (not just electricity), market distortions are minimized and cost accountability assured
- Energy efficiency standards of performance — This is a mechanism where a regulator sets energy savings targets that licensed distributors have to achieve (e.g., as done by the Office of Electric Regulation (Offer) in the franchise market in England & Wales). Standards of performance could be mandatory or voluntary depending on the approach opted by the regulator.
- Customer levy — This involves charging on a per-customer basis, e.g., in England & Wales each franchise customer is charged £1 to fund the activities implemented as part of the standards of performance
- Appliance levy — This involves a charge on specific appliances to fund DSM and energy efficiency activities

2.3.2 Business-based DSM

Since restructuring of electricity markets is fairly new in most countries, there is limited experience with private sector implementation of DSM and energy efficiency activities. Nonetheless some early experience in competitive markets indicates how the markets for business based energy services may evolve. These examples identify the role of energy services companies and a variety of performance guarantee contracting that can be structured. Scope of operations for a typical energy service performance contracting can vary from sector-to sector. For example, in case of the municipal sector projects such as the street lighting or water pumping programs, which are small scale projects requiring lower investments, there is an identified role for the private sector participation. On the other hand, large-scale projects such as the power factor correction programs by the utilities would demand the role of utilities providing the required investments. In business-based DSM and energy efficiency, the most common implementing organization within the electricity business industry is the electricity utility, specifically the electricity retailing business. Another significant group players are the new entrants of unregulated businesses, such as appliance manufacturers and ESCOs, which are often more entrepreneurial, but may have less "brand name" with electricity customers than the electric utility. This is particularly true with smaller customers. Figure 2.3 represents the funds flow in a typical ESCO-implemented DSM contract.



■ Figure 0.4: Typical ESCO Contracting Mechanism

Business based activities are funded based on a commercial rate of return on investment. This usually implies the possibility to attract private capital funding for activities. In addition that are often available part funding by government entities designed to initiate commercially viable DSM and energy efficiency activities.

Funding sources for business based DSM and energy efficiency activities include:

- Private and publicly owned banks — Loans and financing arrangements may be entered into at normal commercial terms
- Internal corporate funding — Utility (or other investors) may invest own funds in developing, implementing and operating the activities on a commercial basis
- Customer funding — Service arrangement contracts may include the possibility for the customer to fund the investment in part or entirely.

The second option mentioned in the funding sources above, is from the investments made by the utilities themselves. In Sri Lanka and Philippines, there are good examples of the DSM being implemented by the utility-initiated ESCOs; "DSMCorp" in Sri Lanka and "CEPALCO" in the Philippines are two examples. In Sri Lanka, the Ceylone Electricity Board (CEB) also promoted a vendor-ESCO, "Lanka Transformers", which promoted leasing of efficient transformers to CEB with goals of reducing line losses.

Chapter 3 DSM in Indian Utilities

3.1 Overview[1]

The Indian power sector has more than tripled its installed capacity, from 30,000 MW in 1981 to over 100,000 MW in 2001. Despite this growth in supply, its power systems are struggling to overcome chronic power shortages and poor power quality. With demand exceeding supply, severe peak (around 18%) and energy (around 10%) shortages continue to plague the sector. Shortages are exacerbated by inefficiencies in power generation, distribution and end-use systems. The inefficiencies in the end-use systems is due to irrational tariffs, technological obsolescence of industrial processes and equipment, lack of awareness, nascent energy services (ESCO) industry, and inadequate policy drivers (such as energy efficiency standards and labeling system, financial incentives) in India.

The elementary problem being faced by the power sector is the poor financial conditions of the State Electricity Boards (SEBs) or successor entities in most states. Over the years, the SEBs have been causing an increasingly larger drain on the State Government budgets, contributing to 10-15% of the state fiscal deficits adversely impacting much needed investments in the social sectors of health and education. The power sector is operating with very low or no returns on the equity and no contribution to future investments from internal resources. This results in inadequate investment in additional generation capacity which is likely to further exacerbate the existing gap between power supply and demand. In 1991, Independent Power Producers (IPP) proposals exceeded 150,000 MW, while as of Jan 2001, just 3,500 MW of IPP power was actually operational.

Even if captive market capacity addition of 1,500-2,000 MW per year is included, a total capacity addition of not more than 6,000 MW a year over the next 4-5 years is expected. This translates into US$6 billion of investments and several million tons of additional pollutants but would still not be close enough to meet the targeted capacity increases of 111,500 MW by 2007. The direct and indirect economic impact of outages resulting from the capacity shortages is enormous. Some of the tangible impacts range from millions of dollars of losses in the industrial sector to over sizing of pumping systems resulting in falling groundwater levels at an alarming rate in the agricultural sector.

Thus, the Indian power sector faces two fundamental and interdependent issues: inferior operational performance leading to poor revenue cash flow, and as a consequence, inadequate capital mobilization for sector expansion. Current approaches do not completely address these issues. Power sector plans focus exclusively on new supply and lately, to an extent, on improving supply efficiency and reducing T&D losses (for instance, the latter through the Accelerated Power Development Program). A major omission is the neglect of demand-side management (DSM) opportunities in India.

There is a clear role and potential for utility driven DSM programs in India. It is estimated that the end-use efficiency improvement potential in industry and building sector alone is of the order of Rs. 10,000 crores and Rs. 2000 crores per year respectively. To capture some of this potential, the Government of India has targeted 15% improvement in energy efficiency by 2007-08. The new Energy Conservation legislation seeks to implement energy efficiency policies that lead to widespread market development through better standards for appliances and equipment, energy efficiency labeling, rational cost-of-service based tariffs, mandatory energy audits, awareness and training, financial and fiscal incentives (eg. 100% accelerated depreciation).

[1] Contributed by Mr. S. Padmanaban & Dr. Ashok Sarkar, Office of Environment, Energy and Enterprise, US Agency for International Development, New Delhi, India.

In this chapter, the importance, benefits and role of DSM in India including the on agricultural sector applications has been discussed.

3.2 What is DSM?

DSM is a concept in which a power utility, such as an vertically integrated SEB or an unbundled distribution utility, manages the demand for power among some or all its customers to meet its current or future needs. DSM is either implemented directly through utility sponsored programs or through market intermediaries like ESCOs. In India, DSM can be achieved through energy efficiency, which is the reduction of kilowatt hours (kWh) of energy consumption or demand load management, which is the reduction of kilowatts (kW) of power demand or the displacement of demand to off-peak times. In the former category are programs such as awareness generation programs, customer or vendor rebates for efficient equipment, etc., while the latter includes time-of-use tariffs, interruptible tariffs, direct load control, etc. Specific types of programs depend on the utility objective: peak clipping, load shifting, strategic conservation or strategic load growth.

Reductions in energy demand and consumption at the end user's premises can free up electricity generation, transmission and distribution capacity at a fraction of the costs required to provide new capacity. The cost of saved energy has been estimated to be as low as 10% of the cost of added capacity for some DSM measures. In addition to avoided and deferred capacity costs, support for energy efficiency at its customers' installations brings a utility into closer contact with its clients, often resulting in better service, and allowing a more efficient future planning process.

In the regime of tariff rationalization following upon the establishment of state regulatory agencies end-use efficiency improvements through DSM at the customer end could mitigate the adverse impact of increased rates on residential, commercial and agricultural customers. At the same time, DSM helps industries to be placed more competitively in increasingly open markets in the age of globalization.

The historic problems of the Indian power sector can be traced to three root issues – unacceptably high T&D losses, large commercial losses due to poor billing, metering, collection and energy theft, and, low end-use efficiency of energy use specifically in agriculture. There is now widespread agreement that restoration of the financial health of the sector can be only enabled by demand side initiatives. To be specific, the electricity distribution area is where the historic problems converge. This convergence is most felt in the agricultural sector where the water-energy nexus is a major root cause for the precarious financial condition of the power sector in India today. Water withdrawal is an energy intensive operation throughout the agricultural sector, with the result that 30-40% of India's power consumption is used for irrigation. The irrigation pumping electricity use is at the heart of the subsidy issue and along with electricity theft and T&D losses, comprise the root cause for the sector's financial dilemma.

The reasons a power utility in India may undertake DSM include: a) demand outstripping the capability to provide supply, particularly peak supply, b) improve the cash flow revenues of the utility, c) improve the quality and reliability of power supply, and d) mitigate the impact of rising tariffs to the subsidised customers. For agricultural sector particularly, utility DSM is highly beneficial because of the subsidized prices and high costs of supply resulting from technical and commercial losses.

3.3 Natural Laws of Financing

The strategic value of DSM and energy efficiency lies in their ability to improve the financial cash flow of Indian utilities. The natural laws of financing require that revenues from electricity sales are used to service debt interest payments and principal due on capital loans. If the flow of revenue is choked on account of commercial and technical losses in distribution and poor end-use efficiency, the ability of the utility to attract private investments towards financing IPPs or other utility services is severely undermined.

Economies are also realized on the capital account. Studies in India and elsewhere on the cost-effectiveness of DSM have reported that it costs between 1/5th to 1/10th to save a megawatt of power as compared to the capital investment needs to generate an equivalent megawatt in a power plant.

3.4 DSM and Power Quality

The link between quality and reliability of power supply and energy efficiency is self evident. The primary casualty on account of indifferent power supply is reduced end-use efficiency. The use of voltage stabilizers, battery powered inverters and robust yet low efficiency irrigation motor-pumpsets point out to the coping strategy employed by urban and rural power consumers at the cost of efficiency. Improvement in quality of power supply is sine qua non to achieving higher end-use efficiency. Quality improvement also has its own positive implications. Anecdotal evidence tells us that consumers are willing to pay higher prices provided there is commensurate improvement in the quality and reliability of power supply.

Example of Energy Accounting

Banglore Electricity Supply Company (BESCOM)
– Remote Automatic Meter Reading System

As the problem of reading meters manually and getting the data back to the billing section for printing and sending by a particular data is manpower intensive and is compounded by human errors, billing delays, scope for malpractices and meter tampering, BESCOM initiated a unique Remote Automatic Meter Reading System.

This system connects existing meters with data communication ports (optical ports) for obtaining billing data, tamper and load survey data and surveillance data at a central Data Management Centre (DMC). The remote connectivity between meters and DMC is done using modems for data transfer.

Major functionalities and features of the system include a web server to connect multiple meters; theft detection alarm, email messaging and permanent recording. A unique feature is automatic shut-off, when exceeding limits, norms or entertaining pilferage and an alarm annunciation to higher authority if action not taken in specified time for any pilferage. The system runs on customizable software with modular structure, expandable, reliable, maintenance free integration with existing billing system, automatic billing and internet based monitoring and control.

This system is used for HT & LT customers having more than 40 HP load, which constitutes about 40-50% of the revenue. The target of this system is to connect 10,000 customer sites of HT and LT customers > 40HP and to cover all 11KV feeder meters. Benefits of the system includes, improvement in quality of service to its high value customers; continuous monitoring, tamper-proofing, online energy audit and reporting; facilitation of load survey and potential enhancement of revenue.

Source: BESCOM Best Practices and Initiatives, September 2004

The improvement in power quality and hence energy efficiency has major socio-political implications. A subject of considerable political sensitivity is that associated with tariff increases for power supply to agriculture and the urban poor. DSM and energy efficiency has the inherent potential to mitigate the rising impact of such politically sensitive tariffs through an integrated program of metering, installation of energy conservation devices and efficient system operation and maintenance.

3.5 Utility Driven DSM in Reforming Utilities

Utility-driven DSM applications in India have been limited largely to non-agricultural sectors. In one of the first DSM programs in India, the Ahmedabad Electricity Company (AEC), a DSM cell was set up in 1994 that has worked with customers to develop load research data, screen alternative energy efficiency measures and implement some of those measures through the involvement of ESCOs. Two ESCOs have worked with AEC to implement efficient lighting and reactive power compensation (through capacitor installations) measures at its HT and LT customers that has led to peak load savings of about 10% thereby reducing the need for expensive imported power in peak load hours. The ESCOs have raised finances from institutions like IREDA and have installed the efficient equipment at customer premises on a guaranted performance basis. The utility, AEC, escrows the savings which are used for loan repayments and ESCO charges.

Similar DSM cells have been established in Tamil Nadu Electricity Board and, more recently, at Jaipur DISCOM, one of the unbundled distribution utilities of the erstwhile Rajasthan State Electricity Board.

As experience from other countries reveal, in India also, the future success of DSM would be driven by the support of regulators. Regulators will have to incorporate provisions that would provide incentives for utilities to promote DSM.

Experience in India and elsewhere indicates that the establishment of a dedicated DSM cell is one of the key to its success. The cell comprises of members who focus on specific functional areas like marketing, data analysis, One of the very first activities of the DSM cell is to develop load research (LR) through metering, consumer surveys, billing data, etc. A proper LR phase leads to the utility load curves that could be disaggregated by sectoral end-uses during different times of the day, month and year. The ultimate objective of the cell is to become an interface with customers, equipment/appliance manufacturers, ESCOs, regulators, and the utility top management.

3.6 DSM in the Agricultural Sector

The agriculture sector in India uses 85% of the available fresh water. However, on-farm irrigation efficiency is only 20-50%. The other 50-80% is wasted . Combining these data indicate that the agricultural sector in India is wasting from about one half of the country's total fresh water supply.

On the energy front there are inefficiencies as well. The agricultural sector, on the average, accounts for about 27% of the total electricity consumption in India. The figure is somewhat higher in the agricultural states like AP, Gujarat, MP, UP, Karnataka, Haryana, etc. where agricultural electricity use is between 35-45%. However from a revenue perspective, the sale of this electricity amounts to no more than 5-10% of the state electricity board's revenues. The reason for this perverse state of financial affairs is the adoption of flat rate pricing for agricultural power. Under this system, when a farmer pays a fixed price per horse power per month for electricity, or what is termed as a flat-rate system, the marginal cost of pumping water is zero. This leads to energy wastages, over pumping and inefficient selection of crops. Moreover flat rate pumping masks the true cost of power to farmers. When unreliability is factored in, most farmers incur costs of Rs. 2-3/unit – more than what typical urban dwellers pay. From a political-economic perspective, the flat rate structure enables the state to give the impression of providing subsidized power to the rural voting population whether or not that population actually receives the intended subsidy.

Example of Community Participation

BESCOM – Gram Vidyut Pratinidhi Scheme
Grama Vidyut Pratinidhi (GVP) is a local person contracted to carry out various activities related to supply of Electricity in Grama Panchayat (GP) areas especially to improve rural revenue collection. The GVP is a person with knowledge of billing and collection and is expected to provide 15 days revenue billing as bank guarantee for the period of engagement.
Responsibilities of a GVP include, meter reading, billing Distribution, revenue collection and depositing collection with the utility. The GVP is also responsible for registering complaints and following them to the utility, facilitating grievance redressal of LT consumers and giving feedback about field realities to the utility on a regular basis.

The incentives offered to the GVP are, a monthly fee of 8% on revenue collection (up to base target fixed) subject to a maximum of Rs.4000/- per month; additional incentive of 8% for the revenue collection exceeding the target and Rs.100/- per installation for regularizing the unauthorized connections. The penalty for under performance is 2% for every shortfall of Rs.10000 below baseline every month.

The pilot scheme commenced in 22 Grama Panchayat in Tiptur and Devanahally talukas during August 2003. At present 980 GVPs are working across BESCOM and have demonstrated a collection rate of more than 130%. Most of the GVPs are exceeding their targets and actual collection in September 2004 was Rs.550lakh, as against the collection target of Rs.440lakh.

Source: BESCOM Best Practices and Initiatives, September 2004

Summing up, the tariff structure and the poor combination of technology and management are responsible for water loss, unsustainable exploitation of ground water and the high energy losses associated with the distribution and end-use of electricity in irrigation water pumping.

3.7 Causes of Energy Loss

Significant energy losses are associated with the distribution of electricity and in the poor selection, installation, maintenance and operation of the electrical motor-pump set system. A careful examination of the causes for such losses reveals that a vicious cycle exists that involves two sub-systems operating in tandem with one another: the electrical distribution system and the water pumping system. This vicious cycle comprises of three sub-cycles: The technology sub cycle, the financial sub-cycle and the socio-economic sub-cycle.
The Technology Sub-cycle: A starting point in the vicious cycle involving the electricity distribution system alone is the poor design and installation of the main distribution LT feeder line (11 kV) followed by overloading of the 11 kV/415 V distribution transformers (DTRs) and long lengths of undersized secondary lines characterized by high line losses and large voltage drops. Farmers typically have no control in power supply decision-making and, thus no control over the quality of supply and on the timing and duration of supply (when and how much depends upon grid supply and demand balances and is decided by the utility in advance and implemented through a rostering schedule).

Example of Feeder Management

BESCOM – Rural Load Management System
Rural Load Management System (RLMS) carries out alternate switching of irrigations loads using Programmable Logic Controllers (PLC). In this popwer supply will be provided as per the policies of the Government for by preparing pre-determined schedule to facilitate alternate switching on/off of a group of Irrigation Pump (IP) set consumers connected to a distribution transformer. The RLM unit consists of PLC, MCCB, MCB and contactors, which is fixed on the LT side of the distribution transformer. Energy meter is also included for proper energy accounting.

Advantages of the system are reduced feeder loading and voltage drop by almost 50%; continuous 3 phase power supply to rural industries load, water supply, domestic and other consumers. No rostering, unbalanced loading, reduced transformer and better power quality is also expected to improve IP consumer satisfaction. Capacity release also facilitates service to additional load, continuous charging of feeder and increased consumption to metered consumers.

The scheme was implemented on a pilot basis on three 11kV feeders feeding from Tavarekere MUSS of Magadi sub-division of Bangalore south taluk. The RLM units were commissioned in February 2004. The comparative day wise peaks for the month of January 2004 (before providing RLM units) and for February 2004 (after providing RLM units) shows a maximum peak load reduction of 80% and an average peak load reduction of 35%. This is remarkable if we consider that the average daily consumption remained the same during that period. Transformer failure over three-months has reduced by 75%. BESCOM has decided to extend this project to all the 14 rural division, covering 250 feeders and 15500 distribution transformers.

Source: BESCOM Best Practices and Initiatives, September 2004

Several consequences arise as a direct result of the poor quality of power. Firstly, frequent motor burn-outs occur causing continual anguish to the farmer and leading to additional costs that they have to bear to get the motor rewound and installed. Secondly, the farmer tends to select robust motors that have thicker armature coil windings and thus can withstand the large current and consequent localized heat generation without coil burn-outs. These motors are characterized by low efficiency and furthermore, to ensure that the flow rate of water pumped out is not reduced due to power voltage conditions, the farmer tends to replace the existing motor with a higher capacity rating. From the farmer's viewpoint a 10 hp motor operating under low voltage conditions is likely to perform as well as a 5 hp motor. It has been the experience that in both Haryana and A.P., farmers use oversized pumpsets to obtain the required discharge.

Compounding the problem of poor power quality is the problem associated with management of load demand by the local distribution sub-station authorities in their desire to maintain system stability. The sub-station personnel follow a prescribed system of power regulation (power curtailment policy) whereby power is rotated among the farmers in two blocks of 4-8 hours per day. This system of power rationing, also known as rostering, causes certain undesirable practices to creep in that further increases system losses and affects power quality, and eventually leads to system failure. A common enough practice is for farmers to keep their motors switches turned on in the hope that whenever the rostering schedule is in effect for a particular block of farmers, water is pumped. Ad-hoc changes in the schedule have altered the farmer to follow such practices which lead to a number of pumps coming together at the same time – a load demand diversity of nearly unity. This in turn causes the 11 kV/415 V DTR to trip; and, in cases where the transformer fuses have been tampered with, and, with the absence of this basic protection, the transformer burns-out. Restoration of power to the farmers connected to the transformer takes several days and sometimes weeks further impacting their financial situation.

Several other scenarios in addition to this basic scenario can also occur. During the evening hours, as darkness enters, village households and rural services (street lighting) are provided power. Since peak power capacity is limited, farmers are discouraged from using their motor-pumpsets, which operate on three-phase supply. This is achieved by “single-phasing” the supply to alternating groups of feeders in rural areas. Cutting off the supply (as simple rostering would result in) prevents all consumers from consuming electricity since the rural feeder serves mixed loads, viz. Pumps on farms, light in homes and streets, etc. Single-phasing involves cutting-off one of three phases so that three-phase pumpsets cannot operate but single-phase lights and appliances in households can.

However, many farmers circumvent single-phasing by installing dummy capacitors that permit them to operate their three-phase pumpsets on two phase supply. In addition to the resulting increase in peak demand, this causes problems for utility in the form of overloading of the phases, harmonic disturbance and lower power factor.

Example of Micro-Privatization

Andhra Pradesh Southern Power Distribution Company Limited (APSPDCL) – Outsourcing in distribution system

The Southern Power Distribution Company of Andhra Pradesh is implementing a micro-privatization initiative, which involves franchising the substations to private parties. The objective of the program is to invite private participation at the 33/11Kv substation level, where the private party takes over the entire O&M and Revenue Cycle Management responsibility. The agency is handed over the substation as well as the feeders and has the option to retain the employees. On an experimental basis, tenders were invited for 16 substations, tenders for 6 sub-stations were finalized and LOA released.

The methodology of the initiative includes giving a monthly target for collections which is equal to the substation input multiplied by the specific revenue of the substation. Bidders are expected to quote the percentage of collection commission they want for achieving the target. A penalty of 2% of the commission for every 1% shortfall in collections is applicable. Bidding agencies will give a minimum collection performance guarantee and also quote for a percentage of incremental collection. The bidder will have to give a Bank Guarantee equal to one month cash collections of the substation.

Benefits of this initiative are, reduction in work force intensity of the power distribution company; sharing of the revenue realization responsibility; creating a locally available and answerable entity enabling quicker complaint redressal and ensuring high quality O&M due to dedicated staff and direct liability.

Source: ‘Outsourcing in Distribution System – Experience of the Southern Power Distribution Co. of AP Ltd.’, from APDRP Best Practices

Table 3.1, below illustrates the rostering schedule typically followed by the utility sub-station staff in Andhra Pradesh.

- Table 0.2: APTRANSCO’s Restrictions on rural Feeders

Time (24 hrs)	0500-1100	1100-1700	1700-2300	2300-0200	0200-0500
Group					
A	3-phase	-	Single-phase	3-phase	

B	-	3-phase	Single-phase	-	3-phase

Financial Sub-Cycle :Combined with the poor quality of power and the resultant impact it has on the performance and efficiency of the farmer's pumpsets, is the financial impact of low crop yields and low incomes, which in turn generates farmer dissatisfaction with the state electricity board and the bureaucracy. Under these conditions, electricity tariff revisions for farmers are politically resisted and payments on electricity bills are postponed, resulting in low cost recovery and the ensuing political pressure by farmers not to pay for a service that is not responsive to their needs.

Low cost recovery, in turn, is linked to under funding of the operations and maintenance of the power delivery systems which, coupled with the poor engineering standards and state of the LT distribution systems, and compounded by the inappropriate structure, policies and staff skills of many SEBs, closes the circle by providing poor quality of supply service. This in turn, sets off a chain-reaction of events of motor burnouts/transformer overloading, etc. that give rise to a host of problems, whose tendency is then to further depress the cost-recovery levels and the cycle goes on. Sub-optimal allocation of resources towards the distribution system places further burden on the already vulnerable system causing deterioration in the quality and reliability of supply.

Socio-Economic Sub-Cycle: Exacerbating the low cost recovery issue are the twin issues of illegal connections and thefts. The former is a direct result of the long waiting periods that farmers have to suffer (upwards of 2-3 years) to obtain sanction for a new pumpset connection and the latter is due to the ease by which unscrupulous elements can tap into the long winding secondary distribution lines. These combined with the near-universal practice of "motor nameplate switching" whereby higher capacity motors have their labels altered to indicate lower ratings. In a flat rate tariff system as is prevalent in Haryana and A.P. and most other Indian states, this further robs the utility of its legitimate revenue.

Example of Community Participation

MSEB – Akshay Prakash Scheme

"Maharashtra State Electricity Board (MSEB) has devised a scheme called "Akshay Prakash" in which several villages are participating to voluntarily regulate their use of electricity, particularly during peak hours. The Maharashtra Rajya Veej Grahak Sanghatana has also taken up a similar scheme called "Swayam Prakash". This effort will elicit the participation of a larger number of villages. These efforts are supported by providing incentives to the participating villages, such as priority in the programmes for energy conservation and feeder separation."

Source: Maharashtra Electricity Regulatory Commission (MERC) press note on, "Load Shedding by MSEB and Proposed Single-phasing scheme", March 4, 2005

Summing up, therefore, the inefficient distribution systems with poor voltage profiles and high distribution losses result in motor burnouts. Low diversity factor caused due to the load shedding in rural areas also results in high rate of distribution transformer burnouts. As a result, customers are dissatisfied with the utility power supply and install higher capacity motors. Since they also have to incur expenditures on account of frequent motor rewindings, their operational expenditures escalate and they are reluctant to pay more to the utility on account of higher capacity motors. This leads to the use of spurious nameplates on agricultural pumpsets and resistance to tariff increases. Customers also resist metering of pumpsets. Utility revenues deteriorate and less resources are available for maintenance and rehabilitation of distribution systems. This results in sub-optimal planning, low quality of works and further forces utility to consider load shedding. Thus, the vicious cycle is completed. Let us now turn to the subject of water use in agriculture, specifically water losses and tariffs.

3.8 Conclusions

A fundamental problem being faced by the power sector is the poor financial conditions of the State Electricity Boards (SEBs) or successor entities in most states. There are economic, environmental and social reasons to promote utility driven DSM as a precursor to the ongoing power sector reforms in India. Although limited experience with DSM in India has proven its importance in the power scenario, there exists an enormous untapped potential. There has been very little application of this innovative concept in the agricultural sector where the benefits are going to be significant.

Chapter 4 Case Studies

4.1 Overview

Several utilities across the world have benefited through DSM initiatives and there are now numerous examples of utility-sponsored DSM. This section presents 19 case studies from different sectors, across the world. These are case studies collated during the course of ECO II initiative. The DSM case studies cover sectors from residential lighting, residential cooking / heating, municipal street-lighting, municipal water pumping, commercial buildings, agricultural efficiency improvement, and industrial. As shown in Table 4.1, these are case studies from Asia, (including India and South East Asia), North and South America and Europe.

The detailed case studies given in Appendix A, are presented using a uniform format, as given below:

Program Summery	➢ Program Overview ➢ Program Objectives/ Goals ➢ Program Implementation & Design Strategy ➢ Program Results ➢ Key Lessons Learned
Utility Characteristics	➢ Utility name ➢ Utility Characteristics ➢ Phase In Restructuring ➢ DSM Initiatives
Program Design	➢ Program Description ➢ Program Goals ➢ Customer/ Market Characteristics ➢ DSM Measures (Technology/ Management) ➢ Types of Incentives ➢ DSM Marketing Strategy ➢ Implementing Organization ➢ Projected Savings
Program Implementation	➢ Program Delivery ➢ Staffing ➢ Customer Participation
Program Monitoring & Evaluation	➢ M & V Objectives ➢ M & V Types ➢ Organization ➢ Data Collection ➢ M & E Period
Program Results	➢ # of Participants by Year ➢ Savings per Year ➢ Cumulative Savings (kW/kWh) ➢ Program Costs
Program Benefits	➢ Benefits to Customers ➢ Benefits to Utility ➢ Other Benefits ➢ Cost of Energy Saved

- Table 0.3: List of case studies

	DSM Sector: Residential	
	Country	Case study title
1	Poland	Polish Efficient Lighting Program- DSM Pilot Project- Poland
2	Thailand	EGAT Compact Fluorescent Lamps Program- Thailand
3	USA	Southern California Edison Low Income Relamping Program – United States
4	Philippines	Cagayan Electric Power and Light Company Compact Fluorescent Lamp (CFL) Program – Philippines
5	Mexico	Illumex- Promoting use of Compact Florescent Lamps- Mexico
6	Sri Lanka	Ceylon Electricity Board Compact Fluorescent Lamp (CFL) Loan Program – Sri Lanka
7	India	GRIDCO / Paradeep Port Trust- LPG Cooking Initiative –India
8	India	Ahmedabad Electric Company- High-Rise Buildings Water Pump Program – India
9	India	BESCOM Efficient Lighting Program –India
	DSM Sector: /Municipal	
	Country	Case study title
10	USA	Seattle City Light Comprehensive Municipal DSM – United States
11	Thailand	Provincial Electricity Authority Street Lighting Program – Thailand
12	Latvia	Tukums Municipal Council Street Lighting Program– Latvia
13	India	Ahmedabad Electric Company Municipal Water Pumping System Efficiency Improvement Program – India
	DSM Sector: Commercial	
	Country	Case study title
14	USA	New York Power Authority High Efficiency Lighting Program – United States
	DSM Sector: Agriculture	
	Country	Case study title
15	USA	Bonneville Power Administration– WaterWise Program– United States
16	India	Noida Power Company Ltd– Agricultural Pump-Set Efficiency Improvement Program – India
	DSM Sector: Industrial	
	Country	Case study title
17	China	Ministry of Electric Power - Beijing Industrial DSM Program– China
18	Philippines	Cagayan Electric Power and Light Company Industrial Demonstration Program – Philippines
19	India	Grid Corporation – Orissa Industrial DSM – India

Chapter 5 Lessons Learnt From Case Studies

As described in the opening chapters in this Guidebook and as planned under the ECO initiative of USAID / BEE, purpose of this manual is to feed in to the evolving DSM programs in India. Table 5.1 describes four sets of specific questions that are used to compare and contrast the case studies and conclusions drawn.

- Table 0.4: Matrix to discuss the case studies

Programs	Peak redn			Program Design						Implementation			M&E		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Residential		☞		☞			☞			☞			☞	☞	
Municipal		☞		☞		☞				☞	☞				☞
Indl/Comm		☞		☞		☞	☞				☞				☞
Agriculture			☞	☞		☞		☞		☞			☞		☞

Peak reduction benefits: **1**: High, **2**: Moderate, **3**: Low
Program Design: **4**: Electricity utility alone, **5**: Electricity + other utility, **6**: Direct customers
Program Design: **7**: Private sector, **8**: Consumer groups, **9**: Public sector
Implementation: **10**: Utility staffing, **11**: Private sector, **12**: Non-utility staffing
M&E: **13**: Engineering estimates, **14**: Surveys, **15**: Actual billing

We discuss the features of the case studies in relation to the above questions in this section.

We analyzed the commonalities of the DSM initiatives presented in this Guidebook, on the basis of four broad factors i.e. peak reduction benefits, program design, implementation and monitoring & evaluation (M&E), as explained in Table 5.1. Important features of the case studies range from the drivers and initiators of the programs, rationale for selecting the DSM program by the utilities, financing the required investments, implementation patterns and most importantly the program sustainability.

In most of the case studies, our analysis shows that the bilateral and multilateral agencies (WB, IFC, GEF) being the initiators and / or financiers. Only in case of the DSM programs in the United States, we find that the initiation is by the utilities themselves without the involvement or handholding of the technical assistance agencies.

In case of Sri Lankan CFL program, however, though the initiation was by the World Bank technical assistance; the implementation and financing the DSM initiative (CFL) was by CEB, which makes this case study a good representative of developing country initiation of efficiency improvement programs!

In all the case studies, DSM programs were selected on the basis of contribution to the system load, potential to reduce the peak demand ensuring beneficial benefit-cost ratios, availability of technical and financial resources, and clearly defined implementation roadmap.

In case of Seattle City Light initiative, the municipal utility identified a comprehensive program to capture benefits of system load reduction, ranging from water pumping, lighting, energy efficient appliances and weatherization.

Most of the programs benefited the customers with reduced costs of premium products (CFLs) through the incentives offered by the utility or the multilateral financing agencies (WB, GEF).

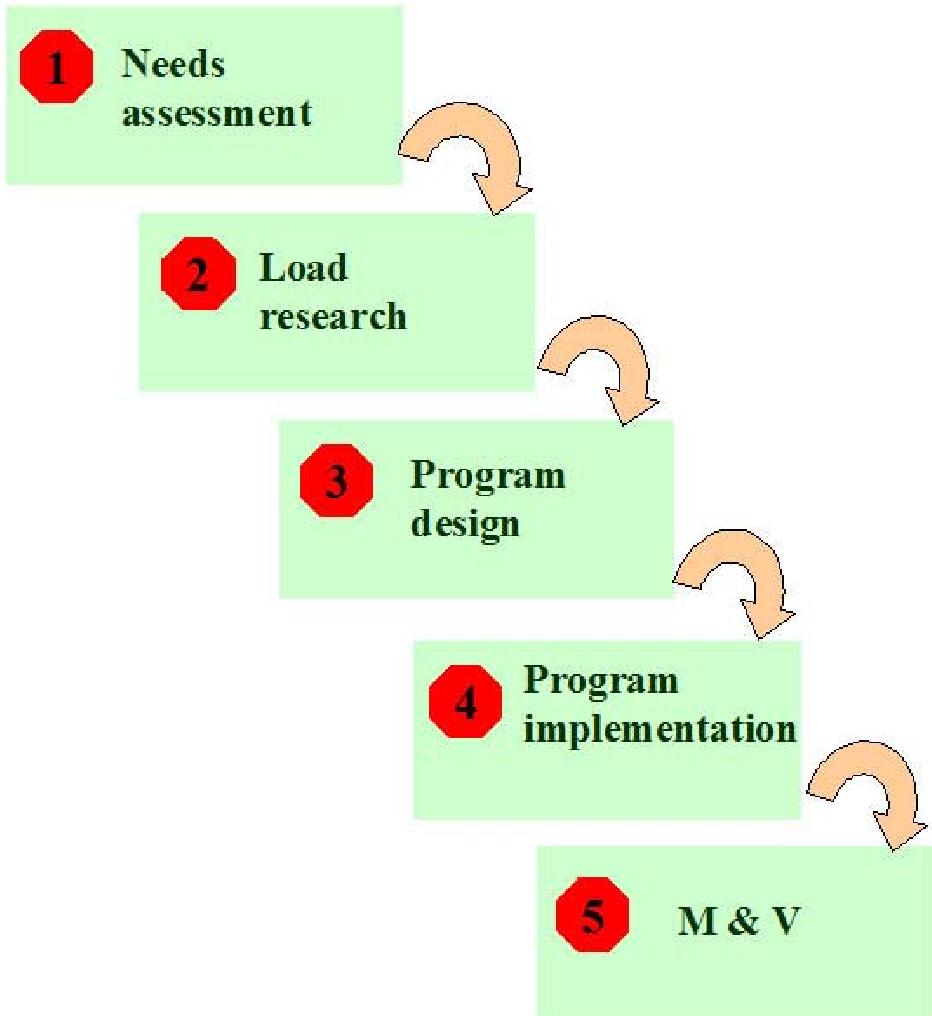
Considering the tangible & nontangible benefits to the customers, society and utilities- the investments made in DSM programs of these case studies are justified.

Implementation of the programs in case of lighting programs was carried out by the utilities themselves. Most of the utilities implementing such initiatives made investments in setting up DSM cells, with specific targets.

Customers' participation, outreach and response to the program designs were key in almost all programs (such as lighting initiatives) targeted at large number of customers. Marketing campaigns using mass media were a common feature of such programs. In case of municipal programs, the electricity utilities worked in close coordination with the water utilities (Ahmedabad, India) and municipal councils (Thailand). Agricultural sector projects however, required a higher level of interface with the consumer groups (farmers' associations) as in case of DSM initiatives in Noida, India and BPA, USA.

Chapter 6 Proposed Implementation Model-DSM In India

Based on the discussion on the Indian electricity reforms process, regulatory environment and the lessons learned from the case studies, we present a six-step DSM implementation model (Figure 6.1). This model draws on the DSM implementation program steps discussed in Figure 2.1.



- Figure 0.5: DSM Implementation Model – India

Steps identified in the above implementation model are explained specifically in the context of Indian DSM initiatives.

Step 1 Needs Assessment
This step is supposed to assess the macro-goals of a typical electrical utility. Typically, for the Indian utilities, the generation mix, allocation of power from the regional grid (supported by the Power Trading Corporation and Power Grid Corporation) is relevant. Also, the cost of the power at the 11 KV feeders and the way in which it compares with the cost of delivery, taking in to account the transmission and distribution losses are important. Peak-demand penalty

levied by the transmission company is also recognized as an important factor. Specifically to India, the tariff regulation and the tariff increase proposals put forth by the utilities need to be captured.

Step 2 Load research
Most of the Indian utilities face the problems of not having enough technical information, especially in the rural sector. Load research program by the Indian utilities needs to assess the current and the future load that needs to be catered. Based on the billing information available, the current data needs to be put in place in the required format. Load research should be linked with specific load shape goals that can potentially save the additional purchase needs for the utility. Inter-sectoral comparison of the data availability and the benefits of the savings in the subsidized sectors need to be reflected in the potential to sell electricity to the sectors that can potentially bring higher profits within the system.

Step 3 Program design
Based on the identified load research goals and assessment of possible reduction of the losses, the programs needs to be designed and targeted at specific sector. Indicator representing the MW or units saved potential of the proposed investments in terms of Rupees is a proposed proxy in analyzing the program merits.

Step 4 Program implementation
This step involves program launch and implementation with the chosen policy and / or business-based implementation plan. In case of Lighting program for example, involvement of the industry association and financing agency was important in order to streamline the funds flow between the involved actors.

Step 5 Monitoring and verification
This stage is expected to feed in to the program assessment by evaluating the program under consideration and also by providing inputs in the macro planning for the utility.

Appendix A: Details of Case Studies

A-1: Residential Sector

POLISH EFFICIENT LIGHTING PROJECT (PELP) – DSM PILOT PROJECT- POLAND

Program Summary	
Program overview:	Promotion of Compact Fluorescent Lamps (CFLs) Pilot project to introduce DSM as a practice and to defer distribution and transmission investments in the Polish electric system CFL subsidy/coupon system used to persuade in selected areas to purchase and install CFLs
Program objectives / goals:	Energy efficiency leading to a reduction in greenhouse gas emissions, peak demand and capacity addition requirement. Program objectives are: To reduce domestic electricity consumption in Poland through promotional and educational campaigns and CFLs subsidized at the manufacturer's end To demonstrate the benefits of reducing the peak load
Program design and implementation strategy:	The program was driven by the three local municipalities with complete support from the electric utilities The cost of the CFLs was subsidized with US$100,000 from the US$5 million PELP project funds
Program results:	Decrease in household electricity consumption (upto 30%) Reduction of the evening peak load by about 15-16% Significant increase in sales of CFLs
Key lessons learned:	The interest of the municipalities as they perceive reduction in electricity consumption a direct benefit to their citizens and promotion of the same as their mandate The investment from GEF, as it recognizes the direct link between generation capacity addition, offset and energy efficiency as directly reducing GHG emissions Electric power distribution companies' reluctance to participate, was based on their belief that a project that would result in reduced electricity sales could not be possibly good for their business The PELP project demonstrated that a subsidy at the manufacturer level can result in dramatic cost savings The short-term subsidy will not help introduce customers to a new project, but could lower costs over the long term by increasing demand Combined with an education and information campaign, consumers can realize the benefits of investing in an energy efficient product in order to reduce electricity bills

Utility Characteristics

Utility Name:	Torun ZE serving city of Chelmo and neighboring area Bialystok ZE serving city of Elk and neighboring area Bielsko Biala serving city of Zywiec and neighboring area The three utilities service a total of 110,000 urban population
Utility characteristic:	Private-owned utility The functions of these utilities include, transmission and distribution of electricity to the respective cities and regions
Phase in restructuring:	Private
DSM initiatives:	DSM is not a part of the main stream operations of the utilities The program was structured as a pilot to promote CFL as DSM measure in the region

Program Design		
Program Description:	Promotional and educational campaigns CFL products subsidized at the manufacturer's level DSM pilot implementation with focus on CFL as an alternative technology to traditional incandescent lighting	
Program Goals:	To increase the sales of CFLs by eliminating the market barrier including consumer resistance To introduce the concept of using DSM (CFLs) to defer distribution and transmission investments in the Polish electric system	
Customer / market characteristics:	The household share in the total energy consumption was for 30-40%, Lighting use in the domestic sector accounted for 14,550,000 MWh or 55% of the total electricity consumption for the sector High Consumer resistance to the adoption of more energy efficient lighting products. Lack of consumer awareness that the replacement of an incandescent lamp by a CFL is a profitable investment despite the relatively high price of the CFL Three selected cities for the DSM pilot have areas with grid capacity already running close to capacity and any increase in demand would require addition in distribution capacity as well, apart from the generation capacity addition. Therefore, any reduction in this load will reflect in the revenues, peak demand and daily loads	
DSM measures (technology / management):	Replacement of incandescent lamps with energy-efficient Compact Fluorescent Lamps (CFLs)	
Types of incentives:	A subsidy was offered to the manufacturers to sell CFLs at wholesale rates. This subsidy was transferred to the customers in the form of discount coupons for purchase of CFLs. The customers benefited by purchasing the CFLs at discount ranging from 25-70% discount from normal retail price	
DSM marketing strategy:	Large scale promotional and public educational campaigns with events at local schools, public places, street fairs, banners, posters, newspaper articles, television stories, mailing from city government, brochures and mobile energy education classroom (called an Energy Bus)	
Implementing organization:	Municipal governments provided the majority involvement and leadership and were directly involved with the promotion and awareness campaigns for the CFL program Distribution companies of three cities and their electric utilities provided the supporting role GEF provided the funds for the design and implementation of the project The utility was directly involved with the sale of the CFLs, promotion of the project and subsidy to the manufacturers Polish Network "Energie Cities" University of Mining and Metallurgy in Krakow	
Projected Savings:	Program Period: June 1995 – June 1998	
	Energy Savings:	519,000 MWh

Program Design		
	Demand Savings:	Reduction of 15% in total electric peak demand

Program Implementation	
Program delivery:	Engineers from the distribution utilities established target areas for intensive CFL promotion and electric load analysis CFLs manufacturers received subsidies in exchange for their agreement to certain negotiated wholesale prices and delivery arrangements Subsidized lamps were made available to the residents of the three cities using discount coupons
Staffing:	Engineers from distribution utilities
Customer participation:	Customers responded positively to the awareness and marketing campaigns undertaken by the program, in fact, within two years of the initiation of the project, 83% of respondents knew of CFLs and 71% of surveyed electronics shops sold CFLs

Program Monitoring and Evaluation	
M&V objectives:	A M&E procedure was evolved to capture load changes. Monitoring was undertaken at different levels, households, grid components (transformers and cables) and sub-system. Monitoring began before the CFL program was initiated and continued through out the project duration Evaluation of utility benefits Evaluation of customers' benefits
M&V types:	Billing analysis Energy audit The measurement criteria included, field data, end use data and substation data
Organization:	Distribution utilities
Data collection:	Measurements of electric power consumption, peak loads, and power quality before and after wide-scale installation of CFLs in selected areas of three cities Data collected from the households included the percentage on time, by hour, for all the major lighting points and the rated electric power for each of these lighting points Estimates of the per-CFL peak lighting load reductions were produced from engineering calculation
M&E period:	Monitoring began before the CFL program was initiated in 1993 and continued throughout the duration of the project in 1997

Program Results	
# of participants by year:	The total population covered in the program area was 110,000 with a sale of almost 2 CFL per person
Savings per year:	Upto 30% decrease in household electricity consumption
Cumulative savings (kW, kWh):	436,000 MWh
Program Costs:	Total program budget of US$5 million, US$1 million used for subsidizing the CFL manufacturers

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's electricity consumption Provided low cost CFLs to customers Avoided cost of upgrading its equipment capacity Avoided CO2 generation of 206,370 tons

ELECTRICITY GENERATING AUTHORITY OF THAILAND (EGAT) – COMPACT FLUORESCENT LAMP (CFL) PROGRAM

Program Summary	
Program overview:	Piloted a scheme on reducing the high first cost through bulk purchase to induce customer adoption of CFL in the residential sector and existing commercial buildings
Program objectives / goals:	To promote efficiency in the utilization of electric energy to be able to meet the desired system load shape To induce customer adoption of CFL technologies, especially in the residential sector and existing commercial buildings To test strategy for reducing first-cost of CFLs through bulk purchase and making them readily available in retail stores
Program design and implementation strategy:	Utility driven program Government and private sector participation – trade allies (lighting vendors and retailers) EGAT purchased CFLs in bulk from three participating importers and suppliers and sold them at lower than market price through participant convenience stores and gas stations. For commercial buildings and factories, the EGAT's DSM Office promoted the use of CFLs through sales to Green Building Program participants. Green Building participants were offered low price CFLs as part of the program conditions, with zero interest charges and various re-payments options
Program results: (2001 to 2002)	Energy Savings – 27,000 MWh (average) Demand Savings – 2.0 MW
Key lessons learned:	TV and newspaper advertisement increased the awareness and created a demand-pull for CFLs Unintended consequence of the program was increased sales of lower price, quality CFLs primarily from China Development and promotion of national labeling and standards for CFLS helps consumers identify and importers minimize imports of lower quality CFLs. Market assessment to accurately establish market size (sales) and share prior to implementation important to estimate changes to identify and address new entrants to the market Subsidizing the price of CFLs and distribution to few pre-selected retailers distorts the market Taxes and duty on imported CFLs must be reduced to make CFLs more price competitive with incandescent lamps

Utility Characteristics	
Utility Name:	Electricity Generating Authority of Thailand (EGAT)
Utility characteristic:	State-owned utility Functions as generator and buyer of nation's power as well as owner of the entire system of power transmission to distributors Produces 15,000 MW of electricity and bought nearly 9,000 MW from small and independent power producers in 2001 – 02 Provider of engineering, maintenance, and energy-related services Mandated to implement DSM programs in the electric power sector
Phase in restructuring:	Own stakes in two generating companies that it spun off

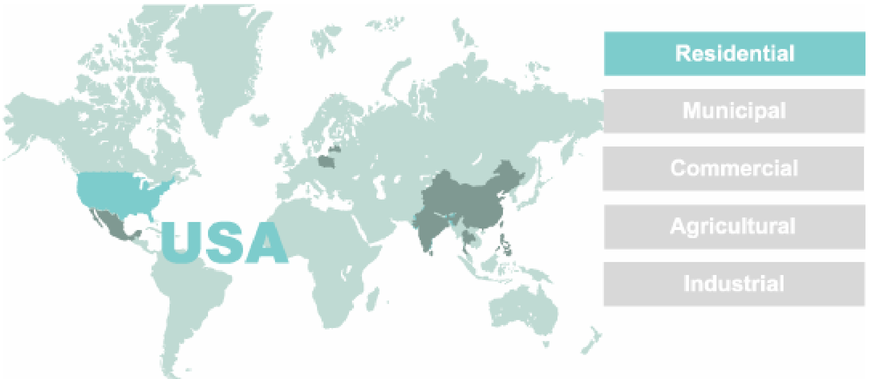
	EGAT to be privatized in an IPO scheduled for 2005	
DSM initiatives: (1993)	To help consumers develop energy conservation attitude. Market transformation programs for consumer appliances Program addressed non-residential customers and load management through the development of time-of-use tariffs and related measures Consumer oriented DSM programs such as: Energy Efficient Fluorescent (Thin Tube) Program Compact fluorescent Lamp (CFL) Program High Efficiency Air Conditioner Program High Efficiency refrigerator Program	
Program Design		
Program Description:	Designed to reduce the first-cost of CFLs by passing along discounts through bulk purchase from participant importers of CFLs with built-in magnetic and electronic ballasts Improving availability of CFLs at selected convenience stores at a subsidized price	
Program Goals:	To accelerate the adoption of CFL technologies by the residential and commercial customers To reduce electricity consumption and demand by residential sector and existing commercial building utility customers To promote the concept of electricity energy efficiency among consumers and importers/suppliers	
Customer / market characteristics:	The lighting usage of the residential sector and existing commercial buildings significantly influences the level and timing of EGAT' s peak demand during weekday and weekend. About 70% of the total CFL imports are sold to the residential customers while the remaining 30% of CFLs are sold to commercial and institutional customers CFL technology accounts for less than 10% of Thailand lighting market	
DSM measures (technology / management):	Replacement of incandescent lamps with energy-efficient CFLs of self ballasted and "screw" type design	
Types of incentives:	CFLs sold at subsidized price were approximately 50% cheaper than the regular market price Purchased lamps from importers by bulk at discounted cost	
DSM marketing strategy:	Increased consumer awareness of the CFL benefits through advertising and promotion on TV and newspaper Appropriate price discounts were established for program lamps and made available at participating convenience stores	
Implementing organization:	EGAT led the public advertising campaigns and served as a moderator between importers and retailers Importers stored CFLs and Retailers ordered CFLs through EGAT	
Projected Savings:	Program Period: 1996 – 1998	
	Energy Savings:	80,770 MWh
	Demand Savings:	6.23 MW
Program Implementation		
Program delivery:	Market evaluation and review undertaken by government and industry associations using available statistics on the size and characteristics of the CFL market in Thailand Suppliers import CFLs for the market ahead of EGAT's initiation of the promotion of CFLs Retailers sell the lamps through a chain of convenience stores throughout Thailand	
Staffing:	EGAT' s DSM Office staff on full-time basis	

Customer participation:	Residential participants were enticed to buy CFL at participating retail store because of the CFL's TV advertising Non-residential participants responded to letters and information sent by EGAT about the program

Program Monitoring and Evaluation	
M&V objectives:	To assess the extent to which the program was achieving the targeted benefit and reductions in greenhouse gas emissions
M&V types:	Billing analysis: to determine peak demand and energy savings, and costs and cost effectiveness of program Survey: to assess market, customers satisfaction, and lamp usage Reports: program progress, records and assumptions
Organization:	Third party consulting subcontractor paid by EGAT
Data collection:	Energy savings values obtained from engineering estimate Daily lamp use obtained from survey of participants Billing analysis intended for Green Building participants used a differences approach relating weather normalized consumption data at the facility level from the electricity billing system
M&E period:	September 1996 up to December 1998

Program Results	
# of participants by year:	The program covered 14,945,000 households and sold CFLs: 200,000 (1996); 657,000 (1997); and 844,915 (1998) About a large number of small and medium sized businesses, and non-residential Green Program participants also participated
Savings per year:	Demand savings 2 MW Energy Savings27,000 MWh
Cumulative savings (kW, kWh):	11.6 MkW 71,400 MWh
Program Costs:	US$2.03 million

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's cost of electricity Provided low cost CFLs to customers Peak load reduced, fostered customer relations Contributed environmental benefit to society Residential – 2.08 baht/kWh Non-residential – 2.00 baht/kWh Utility – 0.898 baht/kWh; 6,999 baht/kW



SOUTHERN CALIFORNIA EDISON (SCE) – LOW INCOME RELAMPING PROGRAM – UNITED STATES

Program Summary	
Program overview:	Introduction of Compact Fluorescent Lamps (CFLs) to low income customers
Program objectives / goals:	To promote efficiency in the utilization of electric energy to be able to meet the desired system load shape To meet Public Utility Commission mandated assistance obligation to low income customers To stimulate awareness of energy conservation To encourage better bill paying behavior
Program design and implementation strategy:	Utility driven program Partnership between utility and community organizations CFLs were distributed at no cost to low-income, mostly recent immigrant customers The utility provided the conceptual design, technical and administrative requirements of the project
Program results: (1985 to 1991)	Energy Savings – 418,500 MWh Demand Savings – 13.85 MW
Key lessons learned:	Benefits from data processing system for customer service and follow up Effective role of community-based organizations (CBOs) in identification of eligible consumers

Utility Characteristics	
Utility Name:	Southern California Edison (SCE)
Utility characteristic:	Private-owned utility Service areas covers the central and southern California Approximately 4 million residential customers registered in 1991
Phase in restructuring:	Private-owned
DSM initiatives: (1993)	DSM was an important part of SCE operation Total budget spent between 1973 and 1991 on residential, commercial and industrial DSM initiatives was US$800 million

Program Design	
Program Description:	SCE provided up to five CFLs free of charge to low income customers deemed eligible by community-based organizations The program was a collaborative effort undertaking between SCE and CBO with the latter for service rendered was compensated for the marketing and assistance provided to the entire process of recruitment and evaluation of customers' eligibility and installation of CFLs

Program Goals:	Targeted the lighting end use, which is a significant contributor to the SCE peak demand To reduce the system peak during the evening	
Customer / market characteristics:	Low income residential lighting	
DSM measures (technology / management):	Replace Incandescent lamps with energy-efficient Compact Fluorescent Lamps (CFLs)	
Types of incentives:	Free of charge CFLs based on eligibility	
DSM marketing strategy:	CBO marketed program leveraging their regular interaction with customers SCE distributed program literatures	
Implementing organization:	SCE Numerous CBOs	
Projected Savings:	Program Period 1991: Program launched in 1985 and was terminated in 1991	
	Energy Savings:	1,100,000 MWh (Lifecycle)
	Demand Savings:	3.0 MW

Program Implementation	
Program delivery:	SCE and CBO were both responsible for all delivery from marketing, recruitment, evaluation of eligibility, conduct of simple energy audit, CFLs installation, and carry out energy-efficiency education session
Staffing:	SCE assigned 3 staff on a part-time basis CBO employed most personnel needed for marketing and implementation Data processing services were outsourced
Customer participation:	At the end of 1991, about 48% of 750,000 eligible customers had participated in the re-lamping program (36000)

Program Monitoring and Evaluation	
M&V objectives:	Standard program management To evaluate utility benefits To evaluate customers' benefits
M&V types:	Contractor Summary Report to track CBO activity including CFL inventory Customer satisfaction survey
Organization:	External Consultant subcontracted
Data collection:	Energy savings values are obtained from engineering estimate Progress report were output of the external data processing service Customer benefits were obtained from survey
M&E period:	1985 to 1991

Program Results

# of participants by year:	51,647 participants
Savings per year:	17,400 MWh
Cumulative savings (kW, kWh):	121,833 MWh 13.85 MW
Program Costs:	US$23.55 million

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's cost of electricity Provided no cost CFLs to customers Peak load reduced, fostered customer relations Contributed environmental benefit to society Cents/kWh at 9% real discount rate: 3.77 (1989); 3.03 (1990); 2.59 (1991)

CAGAYAN ELECTRIC POWER AND LIGHT COMPANY (CEPALCO) – COMPACT FLUORESCENT LAMP (CFL) PROGRAM – PHILIPPINES

Program Summary	
Program overview:	Introduction of Compact Fluorescent Lamps (CFLs) to residents of pilot area Financing scheme for CFLs procurement by residential customers
Program objectives / goals:	To promote efficiency in the utilization of electric energy to be able to meet the desired system load shape To be able to implement sets of pilot programs to show the potential of DSM as an energy resource To develop the organizational capability of CEPALCO to deliver large scale DSM programs
Program design and implementation strategy:	Utility driven program Private sector participation – trade allies (lighting vendors / suppliers) A grant amounting to PhP300,000 was drawn on to finance the procurement of CFLs to be used in the project CEPALCO provided the conceptual design, technical and administrative requirements of the project
Program results: (2001 to 2002)	Energy Savings of 51 kWh per 50w Incandescent lamp replaced by a 15w Compact Fluorescent lamp Demand Savings – reduction of 1.2%
Key lessons learned:	The low uptake rate during the initial launch could have been avoided with the use of full-time personnel for the program Word-of-mouth marketing was found more effective in CFL promotion Provision of discounts by manufacturers enhanced the profitability of the program on a gross margin basis Creative and efficient billing for payments is necessary for a successful program Benefits from computerization of tracking system for customers Savings are not detectable through billing analysis; instead savings are easy to demonstrate with engineering techniques using good data on lamp usage collected through survey Determining the number of lamps in service actually providing kW and kWh savings in service ,is difficult The success of the program was further enhanced after the relaxation of the no-arrears criteria in the selection process which dissuaded and/or disqualified a lot of potential participants

Utility Characteristics	
Utility Name:	Cagayan Electric Power and Light Company, Inc. (CEPALCO)
Utility characteristic:	Private-owned utility Service areas include a city, 3 municipalities, and industrial estate Total substation capacity of the electric utility is 75 MVA Maintains and operates a total of 38 km of 69 kV transmission line Total peak load of 91 MW

Phase in restructuring:	Private-owned
DSM initiatives: (since1996)	Compact Fluorescent Lighting Program High Efficiency Fluorescent Lighting Program Commercial and Industrial Energy Audit Program Industrial Demonstration Program Spin-off of one of CEPALCO's services departments into an Energy Service Company (ESCO)

Program Design		
Program Description:	Pilot scale program designed to test viability of a distribution scheme that can overcome barriers to lighting retrofits Features were adopted from the CFL leasing programs in other developed countries Distributed 1000 pieces 15w CFL of various brands intended for a one-time replacement of 50w incandescent lamp Prices of CFLs distributed to residential customers were subsidized Customers bought CFLs with no down payment, 18-month warranty period, and payable in cash or installment over 12, 24 and 36 months	
Program Goals:	Targeted the lighting end use, which is a significant contributor to the CEPALCO peak demand To reduce the system peak during the evening To demonstrate that CFLs are able to provide the same light output as an incandescent lamp with considerably less energy input To evaluate the practicability of a scaled-up CFL program that will succeed the pilot program	
Customer / market characteristics:	The Residential sector accounted for 81% of CEPALCO' s customers and consumed about 24% of electric utility's total electricity consumption Lighting accounted for 11 ~ 12% of the electricity used in a typical residential customer Efficiency improvement in lighting will have a considerable impact in Residential Sector's energy consumption	
DSM measures (technology / management):	Replace Incandescent lamps with energy-efficient Compact Fluorescent Lamps (CFLs)	
Types of incentives:	Discounted lamp price (33% discount to market price, in uniform price of PhP260)	
DSM marketing strategy:	House-to-house promotion Personalized recruitment of program participants Bought airtime in radio programs to educate and create awareness amongst customers as well as entice them to join the CFL program	
Implementing organization:	CEPALCO's Technical Services Division ELI Working Group of Iberpacific / Soluziona	
Projected Savings:	Program Period: 2001 - 2002	
	Energy Savings:	51 kWh per 50W incandescent lamp replaced
	Demand Savings:	1.2% reduction in CEPALCO's system demand

Program Implementation	
Program delivery:	"Paylight" program launched in October 2001 and was terminated in September 2002 Scaled-up program's timing of implementation was set to depend on the approval by Energy Regulation Commission of the "Megalight" program Participating lighting vendors supplied the CFLs Distribution of lamps was carried out with the program staff visiting residential houses within an identified

	housing subdivision to promote and sell the CFLs Participants were selected from the list of customers with no delinquent accounts with CEPALCO Documentation of the transaction was through a two-page "Sale by Installment Agreement" which also provided a scheme for the integration of the amortization in the regular utility bill
Staffing:	Task Force composed of CEPALCO technical personnel
Customer participation:	Residents from the pilot area started to purchase CFLs on their own, through word of mouth having learned about the benefits

Program Monitoring and Evaluation	
M&V objectives:	Evaluation of utility benefits Evaluation of customers' benefits Evaluation of financing and repayment scheme
M&V types:	Billing analysis for determining system benefits and customers' acceptance of the program Survey for estimating lamp usage
Organization:	CEPALCO Task force and ELI working group
Data collection:	Energy savings values obtained from engineering estimate Daily lamp use obtained from survey of participants
M&E period:	October 2001 up to last quarter of 2002

Program Results	
# of participants by year:	386 participants as of August, 2002
Savings per year:	51 kWh/yr per 50W incandescent lamp replaced
Cumulative savings (kW, kWh):	41,500 kWh 35 kW
Program Costs:	PhP 300,000 (for CFLs only)

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's cost of electricity Availability low cost CFLs to customers Peak load reduced, fostered customer relations Contributed environmental benefit to society PhP210 per CFL per year

ILLUMEX – PROMOTING USE OF COMPACT FLUORESCENT LAMP (CFL) – MEXICO

Program Summary	
Program overview:	Promoting the use of CFLs to save electricity in residential sector
Program objectives / goals:	To promote the concept of electricity energy efficiency among consumers and importers/suppliers To induce customer adoption of CFL technologies in the residential sector and existing commercial buildings
Program design and implementation strategy:	Utility driven program Private sector participation – trade allies (lighting vendors and retailers) National electric utility CFE purchased the CFLs in bulk under competitive procurement from manufacturers, receiving a significant discount over retail market price
Program results:	Energy Savings – 169,000 MWh/year Demand Savings – 1000 MW
Key **lessons learned:**	The utility distribution mechanism tends to have dampening effect on market development at the retail level It appeared that wealthy consumers are leaders in technology adoption, due to ability to pay, knowledge, and/or higher electricity rates Poor power-quality was a factor in higher failure rates and in level of consumer acceptance of the new technology Cost-effectiveness and economic benefits appeared to be lower than originally forecasted because the fuel mix for electricity generation had changed, and because average lamp usage per day is less than originally estimated. Also, a large share of the consumers who purchased CFLs through the project had relatively high monthly electricity consumption Consumers with high monthly consumption pay electricity rates higher than the utility's narginal generation costs, thus lowering the economic benefits to the utility due to lost profits from these consumers

Utility Characteristics	
Utility Name:	The Comisión Federal de Electricidad (CFE)
Utility characteristic:	State-owned utility Mandated to implement DSM programs in the electric power sector
Phase in restructuring:	N/A
DSM initiatives:	CFL Subsidy Program

Program Design	
Program Description:	Designed to reduce the first-cost of CFLs by passing along discounts through bulk purchase from participant manufacturers

	Focus mainly on CFLs for residential use	
Program Goals:	To accelerate the adoption of CFL technologies by the residential customers To reduce electricity consumption and demand of low-income residential customers	
Customer / market characteristics:	The project took place in two states: Nuevo Leon and Jalisco which are the largest customer serve by the national electric utility Low-income consumers were particularly targeted by the program	
DSM measures (technology / management):	Energy-efficient CFLs	
Types of incentives:	CFLs sold at subsidized price were approximately 60% cheaper than the regular market price	
DSM marketing strategy:	Utility DSM program with extensive consumer marketing and outreach activity	
Implementing organization:	The national electric utility purchased CFLs and sold them directly to consumers through its offices	
Projected Savings:	Program period: 1994 - 1997	
	Energy savings:	135,000 MWh/year
	Demand savings:	78 MW

Program Implementation	
Program delivery:	The significant retail price reduction was attributed to the subsidy provided by the national electric utility and discount price given by manufacturer from bulk purchases
Staffing:	Representatives from distribution utilities , consultants, Research Institutes, and lighting equipment suppliers
Customer participation:	The utility sold about 1.7 million CFLs with no difficulty due to residential customers positive response to the promotional program

Program Monitoring and Evaluation	
M&V objectives:	To assess the extent to which the program was achieving the targeted benefit and reductions in greenhouse gas emissions
M&V types:	Billing analysis Survey
Organization:	Data not available
Data collection:	Energy savings values are obtained from engineering estimate Program parameters gathered from survey
M&E period:	Data not available

Program Results	
# of participants by year:	Data not available
Savings per year:	169,000 MWh/year
Cumulative savings (kW, kWh):	1000 MW
Program Costs:	Total program budget of US$ 23 million (funding from the Global Environment Facility (US$ 10 million

	grant), the Norwegian government (US$ 3 million grant) and the CFC (US$ 10 million)

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's cost of electricity Provided low cost CFLs to customers Peak load reduced, fostered customer relations Contributed environmental benefit to society Lower utility rates Clean air; reducing CO2 emissions by 27,500 tonnes/ year, SO2 emissions by 1,500 tonnes/year and NOx emissions by 175 tonnes/year Energy savings

Ceylon Electricity Board (CEB) – Compact Fluorescent Lamp (CFL) Loan Program – Sri Lanka

Program Summary	
Program overview:	Introduction of Compact Fluorescent Lamps (CFLs) Technology Financing mechanism for CFLs procurement by residential customers
Program objectives / goals:	To promote efficiency in the utilization of electric energy to meet the desired system load shape To be able to implement sets of pilot programs to demonstrate the potential of DSM as an energy resource Reduce the environmental costs and risk in energy production
Program design and implementation strategy:	Utility driven program Private sector participation – trade allies (lighting vendors / suppliers) CEB fund was drawn on to finance the subsidy for CFL procurement assist the residential customers and by participating lamp providers for import taxes and other duties In the scaled-up program, Energy Conservation Fund (ECF) joined in the implementation of the loan scheme by offering financing in the public sector utilizing its own funds
Program results: (1995 to 1999)	Energy Savings – 64,100 MWh per year Demand Savings – 46.7 MW
Key lessons learned:	

Utility Characteristics	
Utility Name:	Ceylon Electricity Board (CEB)
Utility characteristic:	State-owned utility Service areas include 12 provinces in Sri Lanka Installed capacity of 1699 GWh, 91% is self generated and the balance produced by private sector and hired power producers Transmission and distribution of power are shared by CEB with Lanka Electricity Company (LECO)
Phase in restructuring:	Restructuring framework on the separation of generation, transmission, and distribution functions of CEB was put in place in mid 2000 Generation function to be split into IPP, Thermal and Hydro. The Hydro generation function and Transmission will remain within the government, but the distribution companies will be private entities A Regulatory Commission will be setup with 6 members appointed by the Executive Department

Utility Characteristics	
DSM initiatives:	CEB has been undertaking DSM initiative since 1995. Some of the initiatives undertaken are: Compact Fluorescent Lighting Program Energy Audit Program Power Factor Correction Program Customer Awareness and Education Program

Program Design		
Program Description:	Subsidy provided by the CEB to include import taxes and other duties Program advertisement through brochures, seminars and electronic media 2 year manufacturers warranty on the lamps Customers were required to sign an agreement with the CEB to pay for the lamps (limit of 4 lamps per customer) in twelve monthly installments through their electricity bills The customers collect the lamps from participating dealer network that would be reimbursed by the CEB for the full cost of the lamps Customers have the option to buy the lamps upfront The ECF program involves a service charge of 7% and cost recovery through participant's salary	
Program Goals:	To give opportunity to residential, religious and public sector customers to purchase CFLs Reduce the system peak during the evening CFLs are able to provide the same light output as an incandescent lamp with considerably less energy input Improvement of system load factor Improvement of power quality Improvement of customer relations	
Customer / market characteristics:	The Residential and Religious sector accounts for 88% of CEB's customers and consumes about 40% of electricity consumption Residential lighting causes the system peak demand Efficiency improvement on lighting will have a considerable impact in Residential Sector's energy consumption	
DSM measures (technology / management):	Lighting retrofit Incandescent Lamps with Compact Fluorescent Lamps (CFLs)	
Types of incentives:	The lamps offered to customers at a subsidized price	
DSM marketing strategy:	Mailed program information, brochures of participating suppliers and application form Newspaper advertisements outlining the key benefits and program participation details Suppliers' marketing strategy including billboards and newspaper advertising and TV commercials	
Implementing organization:	CEB' s DSM Branch provided overall administration and management, and Regional Offices implemented the program LECO was responsible for the customers in franchise area and received funding from CEB for the loan scheme ECF of Ministry of Irrigation and Power was responsible for program implementation in the public sector utilizing its own funds Five participating vendors provided CFLs for the program	
Projected Savings:	Program Period: 1995 - 1999	
	Energy Savings:	64,100 MWh per year
	Demand Savings:	46.7 MW

Program Implementation

Program delivery:	Pilot program was launched in 1995 and terminated in 1996 Scaled-up program was implemented during the period 1997-1999 with the inclusion of public sector employees and use of the Energy Conservation Funds (ECF) CEB's DSM Branch approved list of participating CFL suppliers / vendors for the program Total investment cost for the Program amounted to 250,000 Rs (Srilanka) and which produced sales of 262,410 Rs (Srilanka) for direct sales A total of 171,617 CFLs were utilized by the Program
Staffing:	CEB's DSM branch and regional office staff managed and implemented program. Adequate and relevant support provided by other agencies
Customer participation:	Data not available

Program Monitoring and Evaluation	
M&V objectives:	Evaluation of Utility benefits Evaluation of Customers' benefits Evaluation of Financing and Repayment Scheme
M&V types:	Billing analysis - to evaluate system benefits, customers' acceptance of the program, and CEB's procedures and systems effectiveness Survey – to estimate lamp performance and participation statistics
Organization:	SRC International (SRCI)
Data collection:	Energy savings values were obtained from engineering estimate Daily lamp use was obtained from the survey of participants Other implementation aspects were evaluated through interviews and impact assessment
M&E period:	October 2001 up to last quarter of 2002

Program Results	
# of participants by year:	55,000 villages
Savings per year:	64,100 MWh per year
Cumulative savings (kW, kWh):	256,400 MWh 46.7 MW
Program Costs:	2.96 million Rs (Srilanka)

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced cost of electricity Availability of low cost CFLs to customers Peak load reduction, fostered customer relations Environmental benefit to society 3.06 Rs (Srilanka) per kWh 1200 Rs (Srilanka) per kW per year

GRID CORPORATION (GRIDCO) – PARADIP PORT TRUST COOKING FUEL SUBSTITUTION PROGRAM – INDIA

Program Summary	
Program overview:	Introduction of LPG as a domestic cooking heating medium to replace electric stoves used by Paradip Port Trust employees for household cooking
Program objectives / goals:	To reduce system peak demand
Program design and implementation strategy:	Utility driven program Private sector participation – utility customer Initiated and funded by Paradip Port Trust which is a bulk customer of GRIDCO
Program results:	Energy Savings – LPG fuel replaced electricity, which was used in electric stoves Demand Savings – 2.3 MW morning peak load and 3.2 MW evening demand
Key lessons learned:	The most important attribute of this case study is the nature of the customer. Paradip port trust is a single bulk customer, supplying electricity to its employees with greater control on the supply conditions. This kind of DSM activity is suitable for public-sector, private-sector and other organizations providing residential facilities to its employees in a single large complex

Utility Characteristics	
Utility Name:	GRIDCO, the electricity supply company of Orissa
Utility characteristic:	GRIDCO is involved with the transmission and bulk distribution of electricity in Orissa
Phase in restructuring:	The electricity company in Orissa was unbundled & trifurcated in the 1990's, GRIDCO is now a semi-private agency
DSM initiatives: (since 1996)	GRIDCO is not known to have DSM programs

Program Design	
Program Description:	The program involves replacement of all the electric stoves with LPG cooking stoves Almost 90% of the 3592 households in the residential facility used electric stoves for cooking, adding approximately 3.23 MW to the electricity demand for household use
Program Goals:	Reduction of electricity demand, by almost 7,076 MWh per annum by replacing 2155 electric stoves with LPG stoves

Customer / market characteristics:	The project was planned for the household cooking activity in the residential sector as this activity contributed to approximately 60% of the electrical usage in each household. As electricity is supplied to the employees at a subsidized average flat rate of Rs.132 per month, the Port trust has to bear an annual loss of around Rs.31 million. The maximum contract demand of Paradip port was 7.5 MVA. The peak demand often reached 9 to 10 MVA, resulting in levy of penalty charges. The industrial load does not exceed 4 MVA at any point in time but the domestic use exceeds the contract quantity by 2 to 3 MVA during peaks. As electric stoves are the largest contributors to the peak demand, replacing these with LPG cooking stoves would result in considerable energy and cost savings	
DSM measures (technology / management):	The electric stoves were replaced with LPG cooking stoves. The package includes, cooking stoves and LPG cylinders. As the flat rate for electricity supply was reduced and slabs were fixed for charging flat rate or GRIDCO rate, individual meters were installed for monitoring the electricity consumption by individual households. A LPG cylinder bottling plant, with assured gas supplies from the port was planned in the area to ensure adequate supply of LPG cylinders	
Types of incentives:	The Port trust offered the customers the following incentives to move from electric stoves to LPG stoves: 100% subsidy on purchase of LPG connection and gas stove 100% reimbursement of cost of the LPG cylinder, upon showing the proof of purchase Flat rate electricity tariff reduced from Rs.132 to Rs.80 Limit of electricity consumption for flat tariff fixed at 108 units a month. Any consumption above this, to be charged at the full purchase price of Rs.3.37 per unit	
DSM marketing strategy:	The end-user in this project is an employee of the Port and is thus directly connected to the promoter of the scheme. The area being a finite, controlled geographical area, it is easier for the Port to create awareness, market and control the program	
Implementing organization:	The Port was the implementing agency, directly replacing the electric cookers with LPG cooking systems. As the port was in economically sound condition, they could self-finance and manage this project	
Projected Savings:	Program Period: Data not available	
	Energy Savings:	A 60% uptake of the LPG replacement scheme is assumed for calculation of the projected savings. The annual projected savings, of Rs.15 million, after deducting the direct costs, of Rs.19 million, gives a simple payback period of 1.3 years. This is assumed at an Internal Rate of Return (IRR) of 88%
	Demand Savings:	Data not available

Program Implementation	
Program delivery:	The Port trust is the main stakeholder responsible for the financing, procurement, and implementation and monitoring of the project. The major investment in this project is the procurement and installation of the LPG cook-stoves and electric meters in individual households in the residential facility, was as follows Gas stoves for 2874 houses @ Rs.1200 Rs.34,48,800 Enrolment fees for 2874 houses@ Rs.1000 Rs.28,74,000 Fire resistant panel in huts @ 1000 Rs.12,62,000 Security cages, pipes for cylinders@ 800 Rs.10,09,600 Fire extinguishers for huts -200 @ 5000 Rs.10,00,000 Electricity meters for all houses @ 2500 Rs.89,80,000 Publicity & Safety trainings - 2874 @ 400 Rs.11,49,600 Total Initial Costs Rs.1,97,24,000 This entire cost was to be borne by the Port trust and recovered through electricity and cost savings
Staffing:	The Housing department of the Port trust was responsible for this entire program. The additional cost of running the program was identified as Rs.200,000 per year
Customer participation:	The bulk customer, namely the Port trust, is the sponsor and implementation agency for the program. The port trust is responsible for involving the end-user in the conversion program through various awareness and publicity programs

Program Monitoring and Evaluation	
M&V objectives:	Data not available
M&V types:	Data not available
Organization:	Data not available

Data collection:	Data not available
M&E period:	Data not available

Program Results	
# of participants by year:	
Savings per year:	Demand savings 2.3 MW & 3.2 MW in morning and evening peak load respectively
Cumulative savings (kW, kWh):	Data not available
Program Costs:	Data not available

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Data not available

AHMEDABAD ELECTRIC COMPANY (AEC) – HIGH-RISE BUILDINGS WATER PUMP PROGRAM – INDIA

Program Summary	
Program overview:	Promoting energy efficient water pumping systems in residential complexes
Program objectives / goals:	To promote efficiency in the utilization of electric energy to be able to meet the desired system load shape To retrofit drive of the pumping system of 4000 private housing complexes in Ahmedabad with energy efficient electric motor
Program design and implementation strategy:	Utility driven program Demonstration project on high-efficiency motor application in water pumping systems Showcasing of actual energy savings achieved with the implementation of energy efficient motors retrofit in the water pump-sets of four housing complexes in Ahmedabad city
Program results: (2001 to 2002)	Energy Savings – 1000 MWh at full implementation of program Demand Savings – 2 MW
Key lessons learned:	Hands-on demonstration by AEC in the pilot project Considerable energy efficiency potential in the water pumping operation which can reduce electricity bills of consumer and lower system peak demand of the electric utility Water pumping hours, pumping systems and pumping time coincidence with the peak load on electric utilities are factors common across the country Program is replicable across India in various municipalities and any initiative by the electric utility will be effective

Utility Characteristics	
Utility Name:	Ahmedabad Electricity Company (AEC)
Utility characteristic:	Private-owned utility Service area is the Ahmedabad region in Gujarat with a total customer base of 1,112,000 including industrial, commercial, residential and a small number of agricultural users Generated about 3,169 MUs and purchased 10% of power requirement from Gujarat electricity Board (GEB) The system demand ranged from 300 – 575 MW with load factor of 70%, which peak recorded in 2002-2003 was 693.5 MW
Phase in restructuring:	Private-owned utility

Utility Characteristics	
DSM initiatives: (since 1996)	Piloted programs under the 1994 USAID funded Energy Management Consultation and Training (EMCAT) project include: High rise building water pump program Time-of-use meters program Motor program High-tension industrial energy audits Energy conservation at AMC DSM budget (1995-1997): Rs. 5.2 – 11.0 million DSM cell (1995-1997): 1 to 9

Program Design		
Program Description:	Pilot scale program designed to demonstrate the energy savings achieved from replacing existing motor drive with high efficiency motor on water pumping system in high-rise buildings	
Program Goals:	To increase system efficiency of the pump-sets To improve unit power factor to attain energy savings and lower peak loads for the electric utility	
Customer / market characteristics:	High-rise buildings are a very important component of the residential electricity demand in any urban sector. As the municipal water supply and water pumping to over-head tanks coincides with the system peaks, curtailing this demand would reduce the peak load on AEC	
DSM measures (technology / management):	High efficiency motors Power factor capacitors Optimization of pump performance for energy efficiency	
Types of incentives:	Implementation was a demonstration project supported with a grant	
DSM marketing strategy:	Demonstration project focused on single host consumer The need for a marketing campaign, media or outreach planning was not considered	
Implementing organization:	AEC	
Projected Savings:	Program Period: 1996 – 1997	
	Energy Savings:	Data not available
	Demand Savings:	Data not available

Program Implementation	
Program delivery:	AEC entirely managed the demonstration project and provided the conceptual design, technical and administrative requirements of the project The utility intervention to improve the pumping efficiency of four housing complexes was initiated with AEC conducting the energy audit to look at the existing pumping system for energy conservation opportunities EMCAT Project provided the funding assistance necessary for the implementation of the energy efficiency measures identified during the project development phase of the program Installation of project managed by AEC staff
Staffing:	AEC staff was responsible for designing the demonstration program and interacting with the consumers DSM cell at AEC grew from one officer in 1994 to a core group of four officers and three staff members managed by two senior executives in 1996-97
Customer participation:	Consumer perspective has been considerably change and an increasing interest in energy conservation initiatives has emerged

Program Monitoring and Evaluation

M&V objectives:	To monitor project status To report impact of the program
M&V types:	Billing analysis Energy audit of substation
Organization:	AEC
Data collection:	Energy savings values are obtained from engineering estimate Hourly performance measurements as recorded on pump station logbook
M&E period:	1994 to 1995

Program Results	
# of participants by year:	Data not available
Savings per year:	Data not available
Cumulative savings (kW, kWh):	Data not available
Program Costs:	Data not available

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's cost of electricity Avoid load-shedding measures Peak load reduced, fostered customer relations

BESCOM EFFICIENT LIGHTING PROGRAM (BELP) – INDIA

Program Summary	
Program overview:	Pilot program to promote efficient lighting among residential sector in India First-of-its kind efficient lighting in India
Program objectives / goals:	To promote efficient lighting among Indian domestic consumers by facilitating removal of price and quality barriers Demonstration of the first utility-driven efficient product branding and promotion in India
Program design and implementation strategy:	Utility driven program adhering to the transparent procurement procedures in one of the un-bundled distribution utility in India BESCOM short-listed suppliers on the basis of pricing, number of years in business in India, ability to honor 12-month warranty to its consumers and willingness to participate in the joint marketing campaign Program targeted design of utility-driven CFL branding exercise in India with potential replication in
Program results: (2005)	Energy Savings – 24.3 Million Units Demand Savings – 13.5 MW
Key lessons learned:	Utility branding helped remove the price barrier for promoting CFLs Utility-sponsored warranty helped influencing the trust in technology

Utility Characteristics	
Utility Name:	Bangalore Electricity Supply Company (BESCOM)
Utility characteristic:	Distribution utility under the state government Service area includes 4 districts and 1.3 Million customers; pilot program (BELP) was designed only for the urban sector Installed capacity of close to 3000 MW
Phase in restructuring:	Un-bundling process for the power sector complete; Karnataka state has 4 DISCOMS; BESCOM being the largest among all Annual tariff-setting process involves BESCOM making proposals to Karnataka Electricity Regulatory Commission (KERC)
DSM initiatives:	BESCOM has been undertaking several DSM initiatives such as rural load management system, TOD, TOU tariff and in is the process of evolving agricultural DSM program.

Program Design

Program Design		
Program Description:	BESCOM went through the following steps before the launch of the program: • Short-listing of suppliers based on competitive tendering process • Design of joint marketing campaign and training of BESCOM officials on program implementation • Design of tamper-proof hologram to be used on CFLs After the program launch BESCOM completed the following: • Focused marketing campaign in specific geographical areas within BESCOM urban territory • Sensitization workshops for Residents' Welfare Association • Training of BESCOM consumer center staff on issuance of vouchers and tracking program success	
Program Goals:	To remove barriers for CFL uptake such as high price and treat from cheap imported CFLs. Utility backed-up warranty for free replacement of CFLs was also one of the important program features. Creation of a business model for utility driven DSM programs in India	
Customer / market characteristics:	Most of the domestic sector customers under the BESCOM territory are subsidized. This program allowed 1.3 Million domestic sector customers to avail of low price and 12 month warranty backing, also allowing them repay in 9 monthly installments BELP also raised awareness about 36W fluorescent tube-light to be used in domestic sector replacing 40W conventional fluorescent tube-light	
DSM measures (technology / management):	Lighting retrofit – Replacing Incandescent Lamps with Compact Fluorescent Lamps (CFLs)	
Types of incentives:	BESCOM moderated 12 month warranty to its consumers also bringing down prevailing market rates by almost 20%	
DSM marketing strategy:	Use of marketing materials such as posters, leaflets, car stickers and moving advertising boards (during launch) Mailed program information, brochures of participating suppliers Newspaper advertisements outlining the key benefits and program participation details Suppliers' marketing strategy including billboards, newspaper advertising and TV and radio commercials (electronic media)	
Implementing organization:	BESCOM partnered with International Institute for Energy Conservation supporting the Bureau of Energy Efficiency under a bilateral funding from USAID. Three participating vendors provided CFLs for the program using their distributors and retailers during the road-shows and generic implementation	
Projected Savings:	Program Period: December 2004 to June 2005 (extended up to end of September 2005)	
	Energy Savings:	BELP was a pilot program with no specific savings target
	Demand Savings:	BELP was a pilot program with no specific savings target

Program Implementation	
Program delivery:	Pilot program was launched in December 2004, which was supposed end to in June 2005. BESCOM however, extended the program through September 2005 In addition to program for consumers, BESCOM also initiated a program targeted to its employees. A specific design of the program to support use of CFLs for connection was evolved too. Participating suppliers reported an increase in sales by over 100%, resulting in added sales of 300,000 CFLs
Staffing:	BESCOM appointed three dedicated staff to oversee the program in addition to the top management review periodically. Staffing under the USAID technical assistance through IIEC also helped BESCOM to keep the program under regular review.
Customer participation:	BESCOM was able to ensure participation of some of the Residents' Welfare Associations in promoting this initiative to wider base of consumers

Program Monitoring and Evaluation	
M&V objectives:	Evaluation of Utility benefits Evaluation of Customers' benefits Evaluation of Financing and Repayment Scheme
M&V types:	Billing analysis - to evaluate system benefits, customers' acceptance of the program, and BESCOM's procedures and systems effectiveness Survey – to estimate lamp performance and participation statistics
Organization:	IIEC
Data collection:	Energy savings values were obtained from engineering estimate Daily lamp use was obtained from the survey of participants Other implementation aspects were evaluated through interviews and impact assessment
M&E period:	August to September 2005

Program Results	
# of participants by year:	More than 50,000 individual consumers
Savings per year:	24.3 Million units (estimated)
Cumulative savings (kW, kWh):	– Million units 13.4 MW
Program Costs:	Program design ensured cost neutrality for BESCOM. In this market-driven approach, participating suppliers contributed Rs. 15,00,000.

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced cost of supply of electricity Availability of low cost, high quality CFLs to customers under utility branding and warranty moderation Peak load reduction, fostered customer relations Environmental benefit to society

A-2: Municipal Sector

SEATTLE CITY LIGHT (SCL) – COMPREHENSIVE MUNICIPAL DSM – UNITED STATES

Program Summary	
Program overview:	Comprehensive municipal energy efficiency program Scope covered industrial, commercial and residential customers
Program objectives / goals:	To promote energy efficiency under an evolving deregulated power industry and competitive business environment To implement programs designed to meet city-wide policy orders and annual energy savings goals of 6 MW of load reduction
Program design and implementation strategy:	Utility driven program Program provided rebates, loans, and grants for energy-efficient measures, design assistance and energy audits to all sectors Technology covered weatherization, lighting, appliances, energy-efficient water heaters, water efficiency measures, and efficiency improvements in motors and HVAC
Program results: (2001 to 2002)	Energy Savings – 8,072,400 MWh (Cumulative Savings) Demand Savings – 102 MW (2002) Customer Savings – US$310 million (nominal) Program Cost – US$422.9 million
Key lessons learned:	Not investing in nuclear power helped propel SCL into conservation DSM staff experience and dedication Support from local government and voter opinion have been important in shaping SCL policies Pragmatism at SCL with regard to DSM The catalyzing role of the BPA which provided financial support by reimbursing costs incurred by SCL programs Dependence on BPA as a major source of funds is problematic Building relationships with interest groups and citizen committees helped marketing. Trade partners are major marketers of programs Effective collaboration with other City departments and utilities, affording means of cost effectively serving communities Community and long-term approach was a key to program success.

Utility Characteristics	
Utility Name:	Seattle City Light (SCL)

Utility characteristic:	Vertically integrated utility Service area covered about 360,632 customers with total electric revenues of US$562.2 million from an energy sales of 8,923,000 MWh
Phase in restructuring:	Municipal power company
DSM initiatives:	DSM is a major component of SCL operations Annual budget was equivalent to 4.3% of gross revenues for the Energy Management Services Division

Program Design	
Program Description:	Residential Programs Built Smart & Long-Term Super Good Cents Program Energy Efficient Water Heater Rebate Program Low-Income Electric Program Multi Family Conservation Program Neighborhood Power Program:lighting, weatherization, warm home Retail-Wise Lighting & Appliance Programs Commercial & Industrial Programs Energy Savings Plan Program Energy Smart Design Program Energy Smart Services Program Lighting Design Lab Program Smart Business Program Sustainable Design & Energy Code Programs
Program Goals:	To offer comprehensive energy management services To support neighborhood-wide integrated resource conservation To offer industrial DSM pollution control service To take lead in the Municipal Resource Conservation Program Deliver services in collaboration with other City Departments
Customer / market characteristics:	Customers residing in single family homes, multiplexes, mobile homes, condominiums, and multifamily apartment buildings within the Seattle City Light service area Low-income customers residing in electrically-heated homes Owners of apartment buildings with electric space heat Landlords of rented housing as well as owner-occupied homes Existing and new industrial and commercial projects Business facilities where there is manufacturing activity
DSM measures (technology / management):	More efficient construction practices on building shell (insulation), efficient thermostats, efficient ventilation fan systems, lighting measures, and efficient appliances Energy efficient appliances and lighting retrofits and energy conservation improvements in manufacturing industries Construction projects that incorporate more sustainable, “green” materials and methods
Types of incentives:	Payments for energy efficiency compliance with per-square-foot incentive structure Efficient water heater rebates Lighting incentives calculated on per-fixture Weatherization grants provided for mandatory insulation repair Full-cost grant to owner who agree not to raise rents due to conservation measures for a period of five years A 10-year, zero-interest loan, with five year deferred payment and a 50% discount for first-year payoff Special utility tax “windfall” to installing energy efficient devices Utility grant of $3 per square foot on insulated windows

Program Design	
DSM marketing strategy:	Bonneville Power Administration Seattle City Light
Implementing organization:	PEA EGAT DSM Office
Projected Savings:	Program Period: 1997 to 2002 Energy Savings: 480,000 MWh Demand Savings: 12 MW

Program Implementation	
Program delivery:	The programs were implemented by the utility in association with various vendors, builders and contractors/installers The utility worked with interested customers in monitoring energy consumption and load management. Detailed audits of commercial and industrial customers focused on the key end users Customer is encouraged to implement the measures using own fund or full/partial loan, and incentives offered to pay back portion of the investment based on the savings
Staffing:	Employed 69 full-time equivalent staff Organized functional teams within sector-based groups Some programs implemented by City Light divisions and by other departments (construction, land use, housing and human services)
Customer participation:	Participation levels started slowly in 1977 and peaked in 1982 with the installation of over 107,000 free water-heater wraps in 1981-83 Participation peaked more in 1992 with the installation of efficient-flow showerheads in 92,000 households in 81,000 buildings SCL' s DSM programs reached more participants when residential customers installed CFLs as part of the Conservation Kit Program

Program Monitoring and Evaluation	
M&V objectives:	To track program impacts and suggest program enhancements To ensure that programmatic savings are accurately measured
M&V types:	Billing analysis Survey and interviews
Organization:	Technical staff of SCL
Data collection:	Evaluation based on customer energy data & surveys using analytical techniques to isolate program performance and impact
M&E period:	Annually Energy conservation accomplishments published every year

Program Results	
# of participants by year:	Residential Program – 603,967 Commercial/Industrial Program – 17,103
Savings per year:	323,000 MWh
Cumulative savings (kW, kWh):	8,072,400 MWh 32.7 MW (Residential); 64.4 MW (Commercial/Industrial)

Program Costs:	US $371,221,779

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's cost of electricity Incentives to offset up-front cost Load reduced, fostered customer relations, mainstreaming energy efficiency Contributed environmental benefit to society

PROVINCIAL ELECTRICITY AUTHORITY (PEA) – STREET LIGHTING PROGRAM – THAILAND

Program Summary	
Program overview:	Introduction of High-Pressure Sodium Lamp (HPS) Technology Socio-economic service to rural village life
Program objectives / goals:	To promote efficiency in the utilization of electric energy to be able to meet the desired system load shape To develop the organizational capability of PEA and EGAT to deliver large scale DSM programs To increase the security of rural village life
Program design and implementation strategy:	Utility driven program Private sector participation – lighting manufacturers A GEF grant (55 million baht) managed by EGAT is drawn on to finance the procurement and installation of street lighting project Collaboration between PEA and Electricity Generating Authority of Thailand (EGAT) wherein the former provided the administrative requirements of the project and the latter acted as adviser and funder
Program results: (1997 to 1998)	Energy Savings – 79,883 MWh Demand Savings – 3,300 kW and US$969.70 avoided cost per kW
Key lessons learned:	The program has no impact on peak demand as peak hours (1400-1700 on weekdays) are outside the hours of street lighting operation HPS introduced by the program is positioned as premium products with relatively higher mark-up than the standard product The project's viability drops significantly when the expected replacement costs of HPS is included, and to be cost-effective lamp price would have to drop by half or lamps that generate higher savings would have to be used Program's cost-effectiveness is only valid for first time installation with a subsidy The methodology for the analysis of the program impact, which is survey questionnaires did not achieve the objectives due to the absence of metering and billing data indicating the consumption for street lighting First cost for the lighting gears is zero as service is free-of-charge and the electric poles already existed to carry power lines.

Utility Characteristics	
Utility Name:	Provincial Electric Authority (PEA)
Utility characteristic:	State-owned electric distribution utility Distribution systems and retail service areas cover Nonthaburi and Samut Prakarn provinces and all areas of country except Bangkok Operates the distribution (wire) business of 22kV and below Power produced by EGAT is supplied to PEA via the high-voltage transmission lines.

Phase in restructuring:	PEA was set for restructuring in 2000-2002 with its current function organized into 4 network business units and 12 regulated delivery companies, while non-core businesses retained by PEA
DSM initiatives:	The distribution utility does not have the mandate to implement DSM, but collaborates with EGAT (generating entity) which has a full-time DSM Office

Program Design		
Program Description:	The program was a collaborative initiative between PEA and EGAT with financial assistance from the GEF Fund Relighting installation project replacing existing street lighting system constructed of two-36W Fluorescent tubes with 70W high-pressure sodium lamps Procurement of lamps through purchase agreements with Thai manufacturers No advertising and/or promotion made in order to disseminate information about the program implementation A subsidy of 200 Baht per unit is provided to offset the incremental procurement cost of 275,000 lamps at 383.2 million baht total cost Street lighting fixtures were installed by PEA free-of-charge and that there are no charges for the street lighting service Street lights of 5 fixtures per village are installed along secondary rural roads that connect villages to the main access road About 55,000 villages which spread across PEA territory benefited in the program	
Program Goals:	Targets the street lighting end use, which is a significant contributor to the PEA peak demand To reduce the system peak during the evening To show that HPS lamps are able to provide higher light output as a Fluorescent tube with considerably less energy input To stimulate local manufacturers and importers to produce and import energy-saving and efficient lighting system	
Customer / market characteristics:	Participating villages spread across PEA territory Streetlights are installed on secondary rural roads to illuminate villages situated along the main access road The villages have no financial resources to pay for luminaries	
DSM measures (technology / management):	Replace street lighting fixture of Fluorescent tubes with High-pressure Sodium Lamps (HPS)	
Types of incentives:	Street lighting service is free of charge	
DSM marketing strategy:	Tie-up with Thai lighting manufacturer No advertising and / or promotions	
Implementing organization:	PEA EGAT DSM Office	
Projected Savings:	Program Period: 1997	
	Energy Savings:	1.107 baht per kWh
	Demand Savings:	6,324 baht per kW per year

Program Implementation	
Program delivery:	Pilot program launched in March 1997 and was terminated in August 1997 HPS and lighting gears supplied by Thai manufacturers The lighting fixtures installed on existing power line poles and on secondary rural roads that connect villages to the main access road Villages were not charge for street lighting service, but the free service was limited to 5 fixtures per village. If any village wished to have more than 5 fixtures they had to pay for the extra unit

	Total procurement cost for the 275,000 HPS fixtures was 383.2 million Baht
Staffing:	Consultants were dispatched during the 2 missions intended for the program design and the impact assessment
Customer participation:	Participants from the pilot villages provided information in survey questionnaires distributed early in the study

Program Monitoring and Evaluation	
M&V objectives:	Evaluation of utility benefits Evaluation of customers' benefits
M&V types:	Engineering algorithm: to estimate cumulative energy savings for the life expectancy of HPS lamps compared to Fluorescent tubes Survey: to define the total amount of light from the lamp per unit of power used
Organization:	Third party paid by PEA for consulting services
Data collection:	Technical and cost specifications of lamps and utility system parameters collected from the EGAT System Planning Department and the DSM Office
M&E period:	March 1997 to December 1998

Program Results	
# of participants by year:	55,000 villages
Savings per year:	79,883 MWh
Cumulative savings	17,215 MWh 4.3 MW
Program Costs:	US$2.2 million

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Energy saving 17,215 MWh per year Increased security of rural village life Improved load factor, fostered customer relations CO_2 emissions reduced by 11,135 tonnes 143.5 million baht

TUKUMS MUNICIPAL COUNCIL (TMC) – STREET LIGHTING PROGRAM – LATVIA

Program Summary	
Program overview:	Introduction of energy efficient lighting technology (High-Pressure Sodium bulb) in municipal streetlighting system Improvement of aesthetic and social value of Latvian municipalities
Program objectives / goals:	To promote efficiency in municipalities through efficient lighting To improve the streetlighting system in Tukums municipality by reducing energy consumption and physical degradation of the street lights and replacing old luminaires and bulbs with efficient lighting technology and correct lighting design
Program design and implementation strategy:	Municipality (Tukums Council) driven program Private sector participation – ESCO, IFC/GEF Efficient Lighting Initiative The program focussed on the renovation of streetlighting system using efficient lighting technology The energy efficiency project was implemented through third party financing provided by Nordic Investment Fund (NIB) and Latvian Environmental Investment Fund (LEIF)
Program results:	Energy Savings - 630 MWh per year CO2 emission reduction - 365 tonnes per year Safety and health of inhabitants by providing efficient and well-designed streetlighting system Reduction of night crimes and transgression Increasing night activities in Tukums municipality
Key lessons learned:	Success of the project was attributed to the good cooperation between project partners, Tukums Council, involved experts and financial institutions Successful creation of an ESCO system in Latvia and promotion of energy efficiency measures between the Latvian Municipalities The important role of information dissemination and training courses in changing the attitude of municipalities and private companies towards such program, and increasing awareness of hidden saving behind energy efficiency projects and more third party financing The project has very high replicability in all small and middle size municipalities of Latvia, the Baltic states and other post socialism countries

Utility Characteristics	
Utility Name:	Local electric utility was not involved in the program
Utility characteristic:	Not applicable
Phase in restructuring:	Not applicable
DSM initiatives:	Not applicable

Program Design		
Program Description:	The improvement of street lighting system in Tukums municipality employed the concept of third party financing that is typically offered by ESCO Renovation of the existing old street lights included installation of 70-100W high-pressure sodium fixtures and improving the lighting systems: a) change of luminaires in 21 km of main streets; b) change of luminaires in all inner and small streets; c) new street lighting system in 2.7 km of main streets; and d) change of distribution panels A 10-year agreement between ESCO and the Tukums Council provided for the lighting project implementation and the subsequent O&M service contract awarded to partner ESCO Total project cost: 395 kEuro (Tukums); 127 kEuro loan ; 268 (ESCO) from LEIF and Hipotek bank	
Program Goals:	Targets the street lighting end use, which is a significant contributor to the utility peak demand during evenings To show that HPS lamps are able to provide higher light output than a mercury vapor and incandescent lamp	
Customer / market characteristics:	Tukums is a city in Kurzeme region about 65 km from Riga Latvia with a population of 19,000 Latvia is characterized by cold, long and dark winters so that a good and warm streetlighting is a necessity Existing streetlighting system is about 25-40 years old and generally the technology used was mercury vapor and incandescent bulb lamps The lighting system had approximately 1000 light points illuminating main streets, inner streets and squares for a total length of around 90 km Total electric power consumption of streetlighting was around 896 MWh per year representing energy costs of 53,200 Euro per year Total demand of the system was 320 kW	
DSM measures (technology / management):	Energy-efficient lighting system Energy Service Companies (ESCO)	
Types of incentives:	None	
DSM marketing strategy:	Dissemination of information on energy efficiency projects through seminars and training courses for municipalities Training of companies on third-party financing were employed to show benefits of the project	
Implementing organization:	Ekodoma Engineering Consulting Company – ESCO Danish Power Consultant – ELI program leader Hansen&Henneberg – Consultant Tukums Council	
Projected Savings:	Program Period: 2001 to 2012	
	Energy Savings:	630 MWh per year
	Demand Savings:	225 kW

Program Implementation	
Program delivery:	Ecodoma conducted energy audit in 2001 of the existing streetlighting and used the results during the feasibility study for selecting the right alternative and preparing the business plan for Tukums Council Ekodoma also carried out marketing investigation and a series of training courses for potential energy service companies and for Latvian municipalities The Council selected an ESCO and signed an agreement with them for a project duration of 10 years for the implementation and O&M ESCO executed the project providing third party financing for upgrading 845 lights for a total of 77.3 km of streets and for constructing new streetlighting system for a total length of 2.7 km

Staffing:	Data not available
Customer participation:	Improved acceptance by Latvian municipalities of energy efficiency projects and a positive response to third party financing method of project undertaking

Program Monitoring and Evaluation	
M&V objectives:	Evaluation of project benefits
M&V types:	Engineering algorithm Energy audit
Organization:	Ecodoma Engineering Consulting Company
Data collection:	Billing analysis Measurement of streetlighting performance
M&E period:	Data not available

Program Results	
# of participants by year:	Data not available
Savings per year:	630MWh
Cumulative savings (kW, kWh):	37,000 Euro per year 225 kW
Program Costs:	Distribution of total project cost: 395 kEuro (Tukums) 127 kEuro (Tukums Council) loan from NIB; 268 kEuro (ESCO) , of which 136 kEuro loan from LEIF and 132 kEuro loan from Hipotek bank

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Increased security of rural village life Reduction of peak demand Development of ESCO industry

AHMEDABAD ELECTRIC COMPANY (AEC) – MUNICIPAL WATER PUMPING SYSTEM EFFICIENCY IMPROVEMENT PROGRAM – INDIA

Program Summary	
Program overview:	Improving energy efficiency of water pumping system in a municipal water supply company
Program objectives / goals:	To promote efficiency in the utilization of electric energy to be able to meet the desired system load shape To improve the pumping system efficiency in order to reduce the peak demand and save energy for the electricity and water utility
Program design and implementation strategy:	Utility driven program Pilot-scale project on promoting energy efficient pumping system Demonstration of actual energy savings achieved with the implementation of a renovation of pump assembly and installation of capacitors on the 85 HP pump-set at Ahmedabad Municipal Company (AMC) pumping station
Program results: (1997 to 1998)	Energy Savings – Data not available Demand Savings – Data not available
Key lessons learned:	Hands-on demonstration by AEC in the pilot project Considerable energy efficiency potential in the water pumping operation which can reduce electricity bills of consumer and lower system peak demand of the electric utility Water pumping hours, pumping systems and pumping time coincidence with the peak load on electric utilities are factors common across the country Program is replicable across India in various municipalities and any initiative by the electric utility will be effective

Utility Characteristics	
Utility Name:	Ahmedabad Electricity Company (AEC)
Utility characteristic:	Private-owned utility Service area is the Ahmedabad region in Gujarat with a total customer base of 1,112,000 including industrial, commercial, residential and a small number of agricultural users Generated about 3,169 MUs and purchased 10% of power requirement from Gujarat electricity Board (GEB) The system demand ranged from 300 – 575 MW with load factor of 70%, which peak recorded in 2002-2003 was 693.5 MW
Phase in restructuring:	Private-owned utility

Utility Characteristics	
DSM initiatives:	Piloted programs under the 1994 USAID funded Energy Management Consultation and Training (EMCAT) project include: DSM cell (1995-1997): 1 to 9 High rise building water pump program Flour mill program Time-of-use meters program Motor program High-tension industrial energy audits Energy conservation at AMC DSM budget (1995-1997): Rs. 5.2 – 11.0 million

Program Design		
Program Description:	Pilot scale program designed to demonstrate the energy savings achieved from improving the energy efficiency of the 85 HP equivalent capacity of AMC's water pumping system	
Program Goals:	To increase system efficiency of the 200 units 85 HP pump-sets by as much as 15% To improve unit power factor to attain energy savings and lower peak loads for the electric utility	
Customer / market characteristics:	AMC is the largest bulk customer of AEC, contributing almost 8% of the system peak Daily total demand varied between 15 MW and 30 MW over 24 hours with maximum peak demand for only 3 hours per day Out of this total demand of AMC, water supply system consumption contributed about 79%	
DSM measures (technology / management):	High efficiency motors Power factor capacitors Optimization of pump performance for energy efficiency	
Types of incentives:	Implementation was a demonstration supported with grant	
DSM marketing strategy:	Demonstration project focused on single host consumer The need for a marketing campaign, media or outreach planning was not considered	
Implementing organization:	AEC AMC	
Projected Savings:	Program Period: 1994 to 1995	
	Energy Savings:	Data not available
	Demand Savings:	Data not available

Program Implementation	
Program delivery:	The utility intervention to improve the pumping efficiency of AMC was initiated with AEC conducting the energy audit to look at the existing pumping system for energy conservation opportunities AEC entirely managed the demonstration project and provided the conceptual design, technical and administrative requirements of the project AMC hosted the project and provided access to facilities data, personnel and equipment EMCAT Project provided the funding assistance necessary for the implementation of the energy efficiency measures identified during the project development phase of the program Installation of project managed by AEC staff and carried out in-house by AMC personnel Due to the very good results seen in the demonstration project, AMC decided to replicate the measures in the remaining pump-sets
Staffing:	AEC staff was responsible for designing the demonstration program and interacting with the designated AMC personnel

Customer participation:	Consumer perspective has been considerably change and an increasing interest in energy conservation initiatives has emerged

Program Monitoring and Evaluation	
M&V objectives:	To monitor project status To report impact of the program
M&V types:	Billing analysis Energy audit of substation
Organization:	AEC AMC
Data collection:	Energy savings values are obtained from engineering estimate Hourly performance measurements as recorded on pump station logbook
M&E period:	1994 to 1995

Program Results	
# of participants by year:	Data not available
Savings per year:	Data not available
Cumulative savings (kW, kWh):	Data not available
Program Costs:	Data not available

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's cost of electricity Avoid load-shedding measures Peak load reduced, fostered customer relations

A-3: Commercial Sector

NEW YORK POWER AUTHORITY (NYPA) – HIGH EFFICIENCY LIGHTING PROGRAM – UNITED STATES

Program Summary	
Program overview:	Introduction of energy efficient lighting and other devices to public sector and institutional customers
Program objectives / goals:	To promote DSM as the least cost and most beneficial way of providing reliable electricity under its mandate
Program design and implementation strategy:	Utility driven program Guaranteed 3-year cost recovery of up-front costs Customers were given option of borrowing full up-front cost through the utility's Conservation Loan lending facility
Program results: (1992)	Energy Savings: 1,700,000 MWh at various stages of development Lifecycle Savings: 1.39 million MWh with additional 15.9 MW savings in development Demand Savings: 14.2 MW per year
Key lessons learned:	It is possible for a utility to very quickly "ramp" up an aggressive DSM program (allocated 50% of 5-year budget and realized 50% of estimated 5-year energy savings in less that 3 years) Without guarantee, actual payback estimated to stretch up to 4-6 years Higher than expected, installed cost of capacity saved (US$2,000 per kW versus US$1,500 per kW) Actual customer savings (25% to 35%) were significantly lower than initial utility's proclamation (50% to 75%) Avoid shortage of key lighting equipment and components (e.g., ballast) Incentive compensation based on milestone and benchmark for implementation contractors instead of hourly wages

Utility Characteristics	
Utility Name:	New York Power Authority (NYPA)
Utility characteristic:	State-owned utility Mandated by the state to supply New York State with lower-cost electricity Customers includes designated companies and state government facilities and the investor-owned utilities which resale power without profit to their customers Owns generation and certain transmission assets Number of customers – 166 Energy Sales – 36.200 million MWh Energy Sales Revenue – US$872 million Net rated output – 6,875 MW

Utility Characteristics	
Phase in restructuring:	State-owned utility
DSM initiatives:	DSM initiatives are a central part of the utility's strategic plan Budget for energy efficiency programs in 2003 is about US$100 million annually

Program Design		
Program Description:	Cash incentives / options program offered to customers interested in implementing energy efficient lighting and other devices in public sector and institutions Eligibility of customers for cash incentives is establish by a facility review or an energy audit conducted at the site for the purpose of identifying energy saving package which would become the basis for an action plan	
Program Goals:	To promote DSM as the least cost and most beneficial way of providing reliable electricity under its mandate	
Customer / market characteristics:	Primarily targeted lighting in government (state) and other public/semi-public institutional customers in southeastern New York Scope expanded to include HVAC and drive power technologies Opened out to participants from public school sector in Long Island	
DSM measures (technology / management):	Fluorescent lamps Electronic ballasts Specular reflectors CFLs High efficiency discharge lamps (HIDs) Photocells Occupancy sensors Converted exit sign lighting from incandescent to CFL HVAC upgrade measures were made available in March 1992	
Types of incentives:	Guaranteed cost recovery Concessionary financing Full service implementation	
DSM marketing strategy:	"Glossy, powerful brochure" Multimedia (diskette, video, etc) Personal communication at high level (NYPA Chairman visits large customers)	
Implementing organization:	NYPA with oversight over private Implementation Contractors that bid for contracts to perform audit, design and oversee retrofits Subcontractors that perform the installations NYPA handled certain smaller projects internally	
Projected Savings:	Program Period 1990 to 1992: Implemented over a period of three years when it was launched in 1990 and terminated in 1992	
	Energy Savings:	151,647 MWh
	Demand Savings:	30.9 MW

Program Implementation	
Program delivery:	Program marketed using varied strategy to targeted sectors and institutions Enticed customers submitted expression of interest and assented to all conditions stipulated by signing a cost sharing agreement with the program

	NYPA performed a facility review and/or an energy audit performance subcontracted to external consulting firm An action plan with recommended saving package presented to the customer Cash incentives/options available to customer estimated and a Customer Implementation Contract signed by both NYPA and the participant Retrofits are installed Consultants are hired for the program evaluation
Staffing:	100 NYPA personnel (Energy Conservation, System Planning, etc) were assigned to the program working on part-time basis including 20 full-time equivalent staff
Customer participation:	At the end of 1991, 48% of 750,000 eligible customers had participated in the relamping program

Program Monitoring and Evaluation	
M&V objectives:	To monitor project status To report impact of the program
M&V types:	Bill impact analysis Monthly progress reports – "Trustee" Reports on overall DSM prepared for NYPA senior management
Organization:	NYPA System Planning Division – assigned to monitor of each Implementation Contractor Contracted external consultant – performed program evaluation
Data collection:	Energy savings values are obtained from engineering estimate Daily lamp use is obtained from survey of participants
M&E period:	Implementation period

Program Results	
# of participants by year:	Data not available
Savings per year:	50,549 MWh
Cumulative savings	151,647 MWh 30.9 MW
Program Costs:	US$55,342

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's cost of electricity Provided no cost CFLs to customers Peak load reduced, fostered customer relations Contributed environmental benefit to society 4.26 Cents/kWh at 9% real discount rate

A-4: Agricultural Sector

BONNEVILLE POWER ADMINISTRATION (BPA) - WATERWISE PROGRAM - UNITED STATES

Program Summary	
Program overview:	Introduction of water-saving, energy-efficient irrigation systems and system management to northwestern United States
Program objectives / goals:	To reduce BPA electrical load through reduction in load for water irrigation system
Program design and implementation strategy:	Utility driven program Diverse sectors participation – public utilities, consultants and irrigators Funds allocated for irrigation system evaluation and design work for new and expanding systems; and financial incentives for electrical efficiency improvements to upgrade existing irrigation systems Consultants were used by public utilities to provide technical assistance to irrigators on system testing and design work, hardware retrofits, and irrigation management techniques an as-needed basis
Program results: (1983 to 1993)	Energy Savings – 506,300 MWh Lifecycle Energy Saving – 1,419,000 MWh Demand Savings – 11.0 MW Cost (to BPA) – US$24.5 million
Key lessons learned:	A program involving a number of diverse players can be successful Working with the agricultural community takes patience when trying to market new technologies Farmers need to see demonstrated benefits Farmers tend to trust each other so word-of-mouth marketing is important Monetary incentives such as rebates are important, but structuring of incentives need to be fine tuned to elicit greater participation The need to target large irrigators and to expand measures that qualify for support under the program Improving irrigation system efficiency does not always yield water or energy savings (e.g., in cases of under-watering) Complex irrigation systems can require professional consultant services (auditing and scheduling) and analytical software Large potential for irrigation scheduling

Utility Characteristics	
Utility Name:	Bonneville Power Administration (BPA)

Utility characteristic:	Government entity that sells wholesale power from 30 federal dams and 1 non-federal nuclear plant to large customers Clients include private utilities and large industrial facilities in Washington, Oregon, Idaho, and Montana, plus parts of California, Nevada, Utah, and Wyoming Owns large transmission assets in the Pacific Northwest
Phase in restructuring:	Customer utilities were both public and private
DSM initiatives: (1982 to 1993)	**<u>Residential</u>** Residential Weatherization (Weatherwise) Manufactured Housing Acquisition (MAP) Appliance Efficiency Oregon & Washington State Energy Codes SGC Manufactured Homes Consumer Rebate Long-term Super Good Cents Super Good Cents **<u>Commercial</u>** Energy Smart Design Energy Edge Project Lighting Design Lab Commercial Retrofit & End-Use Study (CREUS) **<u>Industrial</u>** Sponsor Designed Plan Aluminum Smelter Conservation/Modernization Energy Savings Plan Agricultural Irrigated Agriculture (WaterWise) Expenditure – US$1.343 billion

Program Design	
Program Description:	The initiative was made a part of BPA's Conservation and Renewable Discount Program in December 2003 A regional pump testing and system evaluation program was operated by participating utilities, but financed by BPA The program provided incentives and rebates for encouraging irrigators to adopt cost-effective energy conservation measures Program also offered contracts with certified analyst to test and evaluate irrigation system
Program Goals:	To reduce BPA electric load through water and energy savings in irrigation systems
Customer / market characteristics:	Irrigation systems under the 39 participating retail utilities with combined consumption equivalent to 15% of total load of all irrigation systems in the Northwest region Direct market covers farm lands that require extensive amounts of irrigation and pumping due to lower natural precipitation and availability of water for crops Large irrigators and the irrigation districts that use extensive pumping and distribution systems pump directly from the Snake and Columbia Rivers Smaller irrigators sourced water from on-site groundwater wells
DSM measures (technology / management):	Good pumping system maintenance and operating practices Improved irrigation system design and management techniques
Types of incentives:	Administrative reimbursements for utilities One-time incentive payments provided to eligible participating irrigators

Program Design		
DSM marketing strategy:	Customer bill inserts, basic promotional materials Awareness campaign at local fairs and utility organized meetings Information sharing with engineers and other professionals Third-party word-of-mouth	
Implementing organization:	Participating utilities	
Projected Savings:	Program Period: 1983 – 1993	
	Energy Savings:	Data not available
	Demand Savings:	Data not available

Program Implementation	
Program delivery:	Energy audit conducted by local utility and/or Consultant to determine eligibility of farmer applicant Energy saving measures implemented, and monitoring and verification of results carried out to determine incentive payment
Staffing:	3 full-time equivalent BPA staff during 1990-93
Customer participation:	From the 2,575 irrigation system that applied for the program, 75% of them were evaluated for eligibility requirement and only 40% of these eligible systems carried on to receive incentives (1983-93)

Program Monitoring and Evaluation	
M&V objectives:	Evaluation of utility benefits Evaluation of customers' benefits Evaluation of incentives payment
M&V types:	Billing analysis -- system benefits Survey – factors influencing irrigation system electricity use
Organization:	Pacific Northwest Laboratory
Data collection:	Energy savings values were obtained from use of engineering algorithm Incentives payments were determined through survey of system
M&E period:	1986 up to 1990

Program Results	
# of participants by year:	421 participants (1983-93)
Savings per year:	14,892 MWh (1993) 1.6 MW (1993)
Cumulative savings (kW, kWh):	94,608 MWh (1983-93) 11 MW (1983-93)
Program Costs:	BPA costs: US$24.5 million (1983-93); US$7.41 million (1991-93)

Program Benefits

Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's energy and water costs Increased crop yields based on irrigation management techniques Peak load reduced, fostered customer relations Contributed environmental benefit to society Levelized cost of saved energy (cents/kWh, 9% real discount rate): 3.68 (1991); 3.79 (1992); 1.64 (1993)

NOIDA POWER COMPANY LTD. (NPCL) – AGRICULTURAL PUMP-SET EFFICIENCY IMPROVEMENT PROGRAM – INDIA

Program Summary	
Program overview:	Promotion of energy efficient agricultural pump-sets
Program objectives / goals:	To reduce energy consumption and losses in the electrical distribution system by improving the energy efficiency of agricultural pump-sets
Program design and implementation strategy:	Utility driven program Private sector participation – trade allies (pump suppliers) and financial institutions Pilot-scale program
Program results: (2001 to 2002)	Energy and demand savings – induced by pump power input rating reduction and power factor improvement
Key lessons learned:	Demonstration of considerable energy savings from converting existing distribution line to high voltage system in rural areas which was incidental to retrofitting agricultural pump-set with high efficiency unit of appropriate motor rating Significant benefits in terms of cost savings and equipment performance can be achieved by installing capacitors on pumps.

Utility Characteristics	
Utility Name:	Noida Power Company Ltd (NPCL)
Utility characteristic:	Private-owned utility Services the Greater Noida region of Uttar Pradesh Provides transmission and distribution services to about 335 sq. km of Greater Noida city and 118 neighboring villages covering around 23,000 customers Total supply was distributed as follow: 19% for agricultural pump-sets; 64% for large industry; and 17% for urban, institutional and small industry consumers
Phase in restructuring:	Private-owned by RPG Group since 1993
DSM initiatives: (since 1996)	Agricultural Water Pumping System Improvement Program

Program Design

Program Design	
Program Description:	Pilot scale program designed to showcase the benefits from improving agricultural pumping system performance through retrofit with efficient design and optimum motor size matched to average load of pump-set Funding mechanism offered to agricultural customers provides free of charge pump-sets and a scheme of 70% debt and 30% equity in purchase and installation of capacitors and metering device Reduction of system losses in power supply line for an agricultural pump-set through extension of high voltage distribution system to pump site
Program Goals:	To achieve energy savings by as much as 51% from improving electrical performance of motor through high efficiency and unit power factor To reduce line loss by increasing the HT:LT ratio
Customer / market characteristics:	The agricultural sector consumed about 19% of the total electricity demand from NPCL Distribution system servicing the sector is characterized by high T&D loss, low revenue generation and high cases of theft and pilferage
DSM measures (technology / management):	Energy efficient pumping system Power factor correction capacitor Metering system High voltage distribution system
Types of incentives:	Replacing pump-sets is free of charge
DSM marketing strategy:	Outreach activity undertaken by involving local community institutions
Implementing organization:	NPCL provided the conceptual design, technical and administrative requirements of the project
Projected Savings:	Program Period: 2003-04 Energy savings: Data not available Demand savings: Data not available

Program Implementation	
Program delivery:	Outreach undertaken jointly by NPCL and local community institutions in the area to promote and entice agricultural customers to participate in the program NPCL used its staff engineers to conduct the survey to look at the existing pumping system for opportunities to improve efficiency particularly in unit power factor and motor appropriate sizing New pump-sets with a lower capacity at 3 HP replaced the existing 5 HP drive and capacitors required to improve its power factor to 0.8 were installed together with the metering system for the pump station HT mains on the power distribution system in the area extended while insulated LT lines installed on the power service entrance of the pumping system
Staffing:	NPCL staff were directly involved in evaluating the potential for high voltage distribution system Pump-set suppliers were involved with verifying efficiency levels of pumping system
Customer participation:	Customer gave access to pump-sets and provided some information on usage and system parameters for evaluation

Program Monitoring and Evaluation	
M&V objectives:	To monitor project status To report impact of the program
M&V types:	Energy audit
Organization:	NPCL used in-house technical personnel to analyze operations reports from the field and relied on local

	community organizations for assistance and guidance
Data collection:	Data output from metering of substation Hourly performance measurements as recorded on pump station logbook
M&E period:	Data not available

Program Results	
# of participants by year:	Data not available
Savings per year:	Data not available
Cumulative savings (kW, kWh):	Data not available
Program Costs:	Data not available

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Improved water discharge (from 17 to 21 liters/sec) Cheaper cost of electricity due to reduced demand and metering Reduced peak load and energy demand, fostered customers relations Contributed environmental benefit to society

A-5: Industrial Sector

MINISTRY OF ELECTRIC POWER – BEIJING INDUSTRIAL DSM PROGRAM – CHINA

Program Summary	
Program overview:	Introduction of DSM practices in Beijing industrial sector
Program objectives / goals:	To promote efficiency in the utilization of electric energy to be able to meet the desired system load shape
Program design and implementation strategy:	Government agency driven program The Ministry of Electric Power funded the program with 17.72 million RMB particularly intended for peak load shifting initiatives by the industrial customers Demonstration project
Program results:	The key results were, reduction in peak demand of about 50 MW and improvement in the load factor due to the 150,000 MWh increased in consumption during the valley load period
Key lessons learned:	The project was successful primarily because it focused on peak load management which is easier to implement than other DSM programs Gained experience from the success of the load management project proved useful for the development of programs that result in long-term reductions in demand through efficient end use technologies

Utility Characteristics	
Utility Name:	China State Power Corporation (CSPC)
Utility characteristic:	State-owned utility Utility functions are generation, transmission, and distribution Service area is the entire Beijing city
Phase in restructuring:	In 2002, the China State Council decided to restructure the electric utility sector by proposing the creation of five generation companies, two grid companies and a regulatory commission which sets pricing mechanism to regulate them The new State Electricity Regulatory Commission (SERC) initiated the reforms such as development of regional power grids in the northeast and eastern parts of the country in 2003, and the launching of competitive bidding for about 20% of the power in East China in 2004
DSM initiatives:	Utility has designed numerous DSM programs which have not been put into implementation because of structural, regulatory and financial impediments in carrying out these initiatives

Program Design	
Program Description:	The program was designed to meet demand management objective with load shifting strategy employed to reduce peak load during peak hours while building load in the off-peak time is allowed
Program Goals:	To reduce the peak demand and improve the system load factor through load management program which

	encourages industrial customers to shift discretionary and large load to off-peak from peak hours To promote the load factor increase through opening up the power market in off-peak hours
Customer / market characteristics:	Industrial sector accounted for over 55% of the typical winter daily electricity consumption, thus, considered as the primary baseload in Beijing's power network About 51% of the system's morning peak and 50% of the evening peak were attributed to the demand of the industrial sector
DSM measures (technology / management):	System load management Time-of-use rate structured from the price differential between the peak and valley hours tariffs
Types of incentives:	The investment to produce the peak load shift of 50 MW was 12.05 million RMB in 1997 and 5.67 million RMB in 1998
DSM marketing strategy:	Involvement of government agencies, medium and large power consumers, research institutes, universities and other organizations in promoting the use of DSM in China Stakeholders gained experiences from international exchange and cooperation, training courses, pilot studies, demonstration projects and educational activities
Implementing organization:	State Development and Reform Commission (SDRC) State Grid Company
Projected Savings:	Program Period: 1997 - 1998
	Energy Savings: Data not available
	Demand Savings: 50 MW

Program Implementation	
Program delivery:	Beijing Power carried out power market survey to determine the condition of customer's electric equipment and consumption patterns prior to developing effective measures for peak load management Marketing of the program initiated with large industrial customers and was focused on convincing customers to employ load management through the rational arrangement of discretionary load Signed interruptible load agreements with large customers, first on a pilot basis, then on a more widespread basis Provided financial assistance based on actual upgrading and retrofitting needs
Staffing:	Utility personnel
Customer participation:	Rearranged production schedules so that scheduled maintenance can take place during peak hours Upgraded and retrofitted high loss electrical equipment, installed reactive power compensators for high and low voltage equipment, and arranged equipment to operate at peak hours or off-peak hours depending on their diversity factors

Program Monitoring and Evaluation	
M&V objectives:	To assess the actual impact of load shifting on the energy use and demand for the equipment and plant systems
M&V types:	Energy audit
Organization:	CSPC
Data collection:	Energy and demand savings values are obtained from engineering estimate Equipment and plant performance parameters were gathered in the energy audit
M&E period:	1997 to 1998

Program Results	
# of participants by year:	Data not available
Savings per year:	50 MW (Demand savings)
Cumulative savings (kW, kWh):	Avoided cost of new generation capacity at 24.8 million RMB
Program Costs:	12.05 million RMB (1997) 5.67 million RMB (1998)

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's cost of electricity System load reduced, fostered customer relations

CAGAYAN ELECTRIC POWER AND LIGHT COMPANY (CEPALCO) – INDUSTRIAL DEMONSTRATION PROGRAM – PHILIPPINES

Program Summary	
Program overview:	Introduction of DSM technologies and practices in industrial sector
Program objectives / goals:	To promote efficiency in the utilization of electric energy to meet the desired system load shape To induce customers to adopt energy-efficient technologies and production processes in the industrial sector that can reduce system demand
Program design and implementation strategy:	Utility driven program CEPALCO provided 75% of the funding for the cost of equipment while customer shouldered the installation cost Utility provided the conceptual design, technical and administrative requirements of the project A grant from the USAID funded Philippine DSM Project was extended to CEPALCO for the equipment procurement for the demonstration project
Program results:	Energy savings and demand reduction. Energy savings 1245 MWh
Key lessons learned:	Project completion encountered delays because of technical difficulties in the process of finalizing the agreement between the utility and customers due to the complexity of the negotiation process held with respective recipients of the program The demonstration projects were assisted by USAID Consultants in various stages of baseline measurements, engineering design and commodity procurement as some technologies and/or their application in these projects have not been applied before in the Philippines Most of the project met the expected average pay-back period at 3 years and below

Utility Characteristics	
Utility Name:	Cagayan Electric Power and Light Company, Inc (CEPALCO)
Utility characteristic:	Private-owned utility Power distribution company with generation capacity Service area include a prime city, three municipalities and industrial estate Total substation capacity is 75 MVA distributed among the Company's four power substations that are strategically located in the franchise area Maintains and operates a total of 38 kilometers of 69 kV transmission line, and has a total peak load of 91 MW
Phase in restructuring:	Private-owned

Utility Characteristics	
DSM initiatives:	Compact fluorescent Lamp (CFL) Program High Efficiency Fluorescent Lighting Program Commercial and Industrial Energy Audit Industrial Demonstration Program Energy Service Company

Program Design		
Program Description:	The demonstration program showcased cost-effective application of energy efficient equipment and plant practices for improving energy use in industry in a utility-led undertaking which provided customers the assistance needed in financing, engineering, procurement, installation and performance monitoring of the project Committed industrial companies hosted demonstrations involving production process changes and energy-efficient technologies including: lighting, motors, and adjustable speed drives External assistance given to utility in various stages of baseline measurements, engineering design and commodity procurement The retrofit consisted of application of high efficiency motors, variable speed drives, energy-efficient lighting and process optimization	
Program Goals:	To accelerate the adoption of energy efficient equipment and process optimization strategy by the industry To reduce electricity consumption and demand of industrial customers of CEPALCO	
Customer / market characteristics:	CEPALCO' s industrial sector accounts for 0.41 % of its customers and which consumes about 30.7 % of total electricity supplied Electric motor accounts for 90 % of the electricity used in a typical industrial customer, while about 10% for lighting and other means of electric heating, thus any improvement in efficiency will have a considerable impact on industrial energy consumption	
DSM measures (technology / management):	High efficiency motor (HEM) retrofit and optimum unit size matching the average load of equipment Energy efficient lighting (32w fluorescent fixtures, HPS) Process optimization	
Types of incentives:	The projects were provided funding of 75% of total cost of installed equipment and customers had the option to pay the 25% of the remaining project cost in full or apply for a 1-, 2- or 3-year installment plan, included in the monthly service fees or service connection fees (for new customers)	
DSM marketing strategy:	Increased consumer awareness of the DSM technologies' benefits was realized through technical seminars and technology presentation during site visits of the plants	
Implementing organization:	CEPALCO Technical Services Division	
Projected Savings:	Program Period: 1996	
	Energy Savings:	668 MWh
	Demand Savings:	Data not available

Program Implementation	
Program delivery:	Project was a collaborative undertaking between CEPALCO and the customers, and procurement of equipment done under a competitive bidding process participated by local vendors The engineering aspects of the project execution were provided by CEPALCO, while the required scope of installation was subcontracted to customer's accredited contractor External technical assistance to these demonstration projects was provided at various stages of baseline measurements, engineering design and commodity procurement

Staffing:	CEPALCO technical services staff USAID consultants
Customer participation:	Involvement of customer's personnel was mainly in coordinating the installation work to arrange the schedule of facilities shutdown to facilitate installation of the units and that the utilization of plant manpower did not create any distractions to their usual work Provided unimpeded access to the equipment site in carrying out of the monitoring activity

Program Monitoring and Evaluation	
M&V objectives:	To assess the actual reduction in energy use and demand for the equipment and plant systems
M&V types:	Energy audit that include systematic series of checks and measurements on the project
Organization:	CEPALCO
Data collection:	Energy savings values obtained from engineering estimate Equipment and plant performance parameters gathered in the energy audit
M&E period:	1997 to 1998

Program Results	
# of participants by year:	3 industrial facilities
Savings per year:	Industrial lighting : 411 MWh Process improvement : 694 MWh High efficiency motor : 140 MWh
Cumulative savings (kW, kWh):	1245 MWh
Program Costs:	Industrial lighting – US$127,000 Process improvement – US$123,000 High efficiency motor – US$11,000

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Reduced customer's cost of electricity Lighting levels at workstations improved, minimized motor burnouts System load reduced, fostered customer relations

GRID CORPORATION (GRIDCO) – ORISSA INDUSTRIAL DSM – INDIA

Program Summary	
Program overview:	Establishment of a waste heat recovery Captive power plant to reduce dependence on utility power
Program objectives / goals:	To generate power by recovery of the waste heat generated from the operational kilns to produce electricity
Program design and implementation strategy:	Consumer driven program Minimal involvement of the electric utility The private sector company financed the investment and completely managed the implementation of the cogeneration plant
Program results: (2001 to 2002)	Capacity addition from the captive plant – 8-10 MW Utility load demand was reduced and GRIDCO will be able to use this demand elsewhere
Key lessons learned:	The private company identified the opportunity to recover waste heat to generate electricity at 8-10 MW which is enough for the operation of both OSIL and the Orissa Steel Works (OSW) Type of project is replicable in all industries with similar process and energy requirements

Utility Characteristics	
Utility Name:	Grid Corporation (GRIDCO)
Utility characteristic:	Private-owned utility responsible for electricity transmission throughout the state of Orissa
Phase in restructuring:	The electricity company in Orissa was unbundled and trifurcated in the 1990s, GRIDCO is now a semi-private agency
DSM initiatives: (since 1996)	DSM is not a main-stream operation in the utility

Program Design	
Program Description:	The demand management program involved the establishment of a captive power plant to produce 8-10 MW electricity from the waste heat generated by the Direct Reduction Plant (DRI) kilns The program would free-up GRIDCO capacity and offset capacity addition by at least 8 MW
Program Goals:	To generate power through waste heat recovery and free up about 8 MW capacity from GRIDCO for supply to other customers
Customer / market characteristics:	The private company spent approximately Rs.43 million in electricity bills per year OSI and OSW would be utilizing the electricity generated from the captive power plant and any reduction in this out-flow will assist in strengthening the company's profit margin

Program Design		
DSM measures (technology / management):	Waste heat recovery Captive power plant (CPP)	
Types of incentives:	There was no utility incentives involved in the project, however, under tax laws, a CPP is offered tax holiday for 5 years with Rs. 0.24 per kWh generation tax from 6th year onwards	
DSM marketing strategy:	The project was promoted, implemented and managed by the OSIL itself and there was no requirement for any marketing campaigns and so on	
Implementing organization:	OSIL was the implementing agency and involvement of GRIDCO was limited to a negotiated stand-by charge OSIL approached banks and other financing agencies for partial assistance for establishing the captive power plant	
Projected Savings:	Program Period: 1997 – 1999	
	Energy Savings:	Cost savings in terms of electricity charges up to Rs.43 million based on annual rate of interest on borrowing at 19%
	Demand Savings:	Data not available

Program Implementation	
Program delivery:	OSIL was responsible for operation and maintenance of the power plant The site work and the commissioning of plant began in 1997 and was completed 1999
Staffing:	Estimated man-power as labour and supervision for the CPP is 29 All personnel provided by OSIL
Customer participation:	OSIL implemented the project

Program Monitoring and Evaluation	
M&V objectives:	To monitor project status To report impact of the project
M&V types:	Hourly metering on plant data loggers and instruments
Organization:	OSIL and third party contractors
Data collection:	Measurement of CPP performance parameters on hourly, daily, monthly and yearly basis
M&E period:	

Program Results	
# of participants by year:	One (OSIL)
Savings per year:	Data not available
Cumulative savings (kW, kWh):	Data not available

Program Costs:	Data not available

Program Benefits	
Benefit to the Customers, Benefit to the utility, Other benefits, Cost of energy saved:	Savings in electricity charges Offset capacity addition of 8-10 MW Offset of coal-based generation addition requirement

Appendix B: Currency Exchange Rates - Current

In the Guide book, monetary figures are given in different currencies. Current currency exchange rates (August-2005), are given in the following table for reference.

Foreign Currency	Equivalent Value I Indian Currency
1 US Dollar	45 INR
1 Euro	55 INR
1 Yuan (RMB)	5.56 INR
1 Baht (Thailand)	1.09 INR
1 Ph Peso (Phillipines)	0.8 INR
1 Rupee (Srilanka)	0.45 INR