



# PROMOTING AN ENERGY-EFFICIENT PUBLIC SECTOR: CASE STUDIES

## Energy Conservation Initiative at the Maharashtra State Electricity Board (Prakashgadh Building) , Mumbai, India

### CASE STUDY INDEX Background and Motivation

#### Country

- China
- India
- Mexico
- South Africa

#### Building Type

- Hospital
- Office
- Public Building
- School

#### Intervention

- Awareness Creation
- O&M
- Building Retrofits
- Other

#### Energy Savings

- Less than 10%
- 10 - 20%
- 20 - 30%
- More than 30%

#### About PEPS Case Studies:

The primary purpose of the case studies is to recognize exemplary efforts by public sector organizations to promote energy conservation/efficiency and encourage their replication at other organizations through information sharing. This case study was prepared by Lawrence Berkeley National Laboratory with support from Environmental Protection Agency and USAID. For more information, please contact Satish Kumar (SKumar@lbl.gov).

### Background and Motivation

This case study documents the planning, implementation, and the results of the energy conservation initiative implemented by Maharashtra State Electricity Board (MSEB) at the Prakashgadh building in Mumbai.

Under the direction of its Chairman, MSEB decided to undertake a low-cost approach to achieve energy savings in summer 2003. In addition, this initiative to conserve energy was meant to alleviate the acute power shortage that has been plaguing Maharashtra for the last few years.

### Building and System Information



- ◆ Built up area: 200,000 sq. ft.
- ◆ Number of people in the building: 1,500
- ◆ Cooling Capacity: 600 tons of cooling capacity provided by three chillers with an initial rated capacity of 200 tons each
- ◆ Current chiller uses R11 refrigerant and either needs to be upgraded/replaced with a system that uses non-CFC refrigerant to comply with the Montreal protocol
- ◆ High Pressure Mercury Vapor lamps are used for outdoor lighting and 40 watts and 20 watts fluorescent luminaries are used for both closed and open office areas. CFLs are installed in circulation areas (elevator lobbies, corridors, etc.) where there is little access to daylight.

- ♦ Wall mounted, ceiling, and pedestal fans are installed to augment circulation of air inside occupied spaces.

## Design and Implementation

The energy conservation initiative at Prakashgadh building, through several rounds of discussions and brainstorming sessions, identified the following three strategies to achieve energy savings:

### Changes in operation schedule

Since energy savings was not meant to be achieved through infrastructure improvement, optimizing the operation of HVAC, lighting, and elevators was a key component of the energy saving strategy. This was accomplished after analyzing the existing operation schedule of the main building systems and then optimizing the operation of these systems based on their requirements.

The operating hours of the air conditioning plant were reduced by 25% without compromising thermal comfort for occupants of the Prakashgadh building. In addition, the operating schedules for the three elevators were altered based on the analysis of elevator loading during peak and off-peak hours. All the elevators were operated during peak hours but the operation of the elevators during off-peak hours were optimized based on the reduced load requirements. By adopting these simple measures, it was possible to minimize energy consumption caused by the unnecessary and unwarranted operation of building systems.

### Lighting retrofit

Majority of the energy savings can be achieved through the elimination of unwanted or excessive lighting fixtures or by the substitution of electric lighting by natural daylight. In addition, a large portion of the energy savings can be obtained by inducing a sense of responsibility into the users who then make sure to turn off lights when it is not needed. The following steps were taken to reduce electricity consumption by the building lighting systems:

- ♦ The schedule of exterior lighting such as flood lights and building illumination lights was optimized to conserve electricity;
- ♦ Delamping of lighting fixtures was performed in areas where illuminance level for office work met local standards after the delamping of fixtures.;
- ♦ The lighting fixtures located in the common areas such as corridors, toilets, elevator lobbies, staircases, waiting lounges were replaced with CFL lamps.

### Leadership and education

Leadership displayed by the MSEB management, played

a vital role in enhancing the energy conservation efforts. Since most of the savings can be achieved through simple measures adopted at the user level, getting support of the management in educating the user group on the simple methods of energy saving and the resulting positive impact were very important. Apart from the energy savings achieved, educating the users also brought about awareness and a sense of responsibility which contributed to the cost-effective approach to achieve energy and cost savings.

To further promote energy conservation, leadership and education was also seen as an important element for the success of the project. Being an esteemed organization in the power sector, the energy conservation initiative was propagated at all levels of the organization. Aligned with the motto "Electricity saved means Electricity generated", education of every employee of the organization and awareness about the project was a major component of the energy conservation drive. As a result, the motto for the project resulted in a more responsible attitude on the part of the employees towards electricity savings. This type of behaviour would help reduce the acute power shortage that was prevalent in the State of Maharashtra. Other means of spreading knowledge included distributing pamphlets and circulars to the head of all the different departments who were coordinating the conservation activity as well as to the intermediate and junior staff to educate and encourage their participation in the project.

A significant portion of this effort of initiating and developing the project was achieved through the leadership role taken up by the various groups in the organization. Besides the constant and complete support from the top management team, the maintenance staff of the departments of Estate Management, Construction and Maintenance took upon the lead role and worked extensively towards achieving the goal. Also, the awareness and the knowledge transfer regarding the importance of energy conservation was spread through all the levels of management.

## Performance Evaluation and Results

### Energy Savings

In view of the acute power shortage in the state and based on the instructions of Maharashtra Energy Regulatory Commission, the project was initiated with the goal of reducing power consumption by 20% during the months of May and June 2005. Thus the strategies and techniques described earlier were carefully applied and performance was monitored. As a result, the energy consumption was measured to be reduced by 28% and 22%

during the months of May and June 2005 respectively.

Annual Energy and Cost Savings from the Project		
Fiscal Year (April to March)	Energy Savings [kWh (%)]	Cost Savings [million Rs. (%)]
FY2003	318,320 (13.3%)	1.97 (12.5%)
FY2004	326,160 (13.65%)	3.18 (19.8%)
FY2005 (first five months)	295,183 (29.6%)	1.77 (27%)
<b>Total Savings</b>	<b>939,663</b>	<b>6.92 (Approx. \$150,000)</b>

Also, with the installation of Automatic Power Factor correction panel on the lighting circuit, the power factor was raised from 92% to 98%, reducing the maximum demand. In addition, behavioral changes in the user group (e.g. switching off lights when not needed) have resulted in about 10% energy savings.

### Lessons Learned

As evident from the case study, the project has been successful in achieving the goal of energy conservation through simple strategies by involving everyone within the organization. Among the various energy saving measures, the few valuable and important lessons learned that can be outlined are:

- Getting the support of top management within the organization is crucial to ensuring the success of the project.
- While considering delamping of lighting fixtures, it is very important to ensure that the illuminance levels are maintained as per national/international lighting standards so that measures don't result in negative productivity impacts.
- While quantifying energy savings from the

measures is important, documenting the experience of workers in the building through well-designed questionnaires and surveys and taking steps to address reasonable grievances can be very helpful in maintaining the morale of employees and making them feel part of the ongoing initiative. If building occupants express dissatisfaction with the prevailing indoor environmental conditions that is a result of the energy conservation initiative, their concerns should be addressed in a proper manner.

- Energy savings should be calculated by creating a proper baseline that not only takes into account the energy consumption but also the indoor environmental conditions (e.g. set point temperature, ventilation rate, illuminance level, etc.) prevailing in the building before and after the implementation of energy conservation measures.
- It is important to identify one person or a group (Energy Champion) and give them responsibility so that he/she can play a leadership role in planning and implementing the project in an effective fashion.
- Deferred maintenance can prove very costly to an organization and MSEB has learned it the hard way in case of chillers. It is very important for organizations to develop an operation and maintenance schedule and allocate budget for repair and replacement of expensive building systems.

### Acknowledgement

The PEPS-India team acknowledges the contributions of Mr. B. R. Marathe and Mr. V. S. Kambli of MSEB for sharing the information about the energy conservation initiative with us and for their tremendous support that made the compilation of this case study possible.