SMALL AND MEDIUM ENTERPRISES: ENERGY EFFICIENCY KNOWLEDGE SHARING

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Inside...

Promoting Energy Efficiency in SMEs

SAMEEEKSHA

VISION

SAMEEEKSHA envisages a robust and competitive SME sector built on strong foundations of knowledge and capabilities in the development, application, and promotion of energy-efficient and environment-friendly technologies.

Bureau of Energy Efficiency | SHAKTI SUSTAINABLE ENERGY FOUNDATION | The Energy and Resources Institute | MSME

A PLATFORM FOR PROMOTING ENERGY EFFICIENCY IN SMEs

IN THIS ISSUE...

The theme of this issue is Demand Side Management (DSM), a strategy that is being explored by a growing number of electricity distribution companies (DISCOMs) across India with the aim of reducing the energy demand and energy bills of consumers on the one hand, while simultaneously improving the operational efficiency and profitability of the DISCOMs themselves on the other. As the theme article elaborates, DSM provides significant opportunity for DISCOMs to promote energy efficiency on a large scale among their MSME customers, through initiatives along two broad parallel tracks: (a) reducing the overall electricity demand from MSMEs by encouraging them to adopt energy efficient technologies such as LEDs for lighting, high efficiency IE3 motors, etc.; and (b) reducing the electricity demand during peak hours of the day by encouraging MSME consumers to shift or redistribute their loads to non-peak hours through incentives such as lower tariffs for electricity.

The theme article presents the highlights of the DSM studies undertaken by TERI in 11 DISCOMs over the past few years, with specific focus on the energy saving opportunities identified for MSME consumers. Many of these DSM studies indicate that significant energy saving potential (5–8%) exists among the MSME consumers, and can be realized through focused DSM initiatives undertaken by the concerned DISCOMs in collaboration with industry associations, ESCOs and other cluster-level stakeholders. The article also summarizes the DSM Action Plan prepared by TERI for JUSCO S-K, a distribution utility in the state of Jharkhand that services a large industrial estate having over 800 MSME units. A separate article provides details on the DSM study undertaken by TERI in MESCOM, an important distribution utility in Karnataka, with support from MacArthur Foundation. This article outlines the energy saving measures identified for MSMEs in four different sub-sectors, and an Action Plan for MESCOM to implement these measures through focused initiatives incorporating elements of technical and financial assistance, awareness generation and capacity building, and ESCO-managed demand aggregation for energy efficient equipment/ technologies.

SAMEEEKSHA Secretariat

ROLE OF MSMES IN PROMOTING DEMAND SIDE MANAGEMENT

Context

Everyone likes a cut in their energy bill. Indeed, the most attractive aspect of an energy efficient technology (EET) is that it reduces the energy bill; and the less it costs to implement the EET, the more readily it is adopted by the consumers. These aspects of energy efficiency have been well established by the various initiatives undertaken to introduce EETs in the MSME sector, where energy cost makes up the major portion of product cost in many cases and any reduction in the energy bill translates directly to increased profits.

Electricity is used as an energy source by virtually all MSME units in every industrial sub-sector, for lighting and to operate different kinds of electrical equipment/machinery such as air compressors, motors, pumps, fans, boilers, cooling towers, dryers, freezers, furnaces, grinders, hammers, and so on. In sub-sectors such as light engineering, foundry, forging, etc., electricity may account for almost the entire unit-level energy consumption. However, many MSMEs continue to face challenges in accessing affordable and reliable (uninterrupted, steady voltage) power supply from the grid—especially during peak hours. Low power quality disrupts production processes in various ways and directly impacts profits. On the other hand, the electricity distribution utilities ('DISCOMs') are grappling with the challenge of catering to the growing demands for power from different sectors of the economy while ensuring profitability of their own operations. In many cases, especially during peak hours, the DISCOMs have to resort to purchasing power at very high costs from the power markets. The challenge is all the more formidable, given the fact that the financial health of many DISCOMs is extremely poor—primarily because the pricing of power is far below the average cost of supply (CoS), particularly for the agricultural consumers.[1]

In recent years, some of the DISCOMs have started undertaking various initiatives under a strategy known as Demand Side Management (DSM), which focuses on better management of power demands from consumers, while simultaneously improving the operational efficiency and profitability of the DISCOMs themselves. DSM can be considered as a win-win option for all stakeholders, be it the utility, consumers or even manufacturers. By bringing about reduction of power demand during peak hours, the DISCOM avoids the financial losses associated with buying power at high costs; the consumers reduce their electricity bills by re-adjusting the timing of their electricity use (from peak to off-peak hours) and also by adopting EETs that reduce their overall power consumption; and the electricity system as a whole benefits through more reliable and continuous power supply.

Also, DSM helps in balancing electricity supply with demand, and thereby improves the efficiency with which electricity is utilized. As most of the electricity generated in India comes from thermal power plants, DSM in effect helps in avoiding additional GHG emissions from the power sector[2].

Very few DSM interventions have been undertaken so far in different sectors of the Indian economy, such as:

- Agriculture sector—promotion of EE pump sets and solar-based pump sets
- Domestic and commercial sectors—large-scale dissemination of EE appliances such as lights, ceiling fans and air-conditioners
- Industry sector—providing tariff-based incentives for shifting or curtailing loads at peak hours through Time of Day (ToD) tariff mechanism.

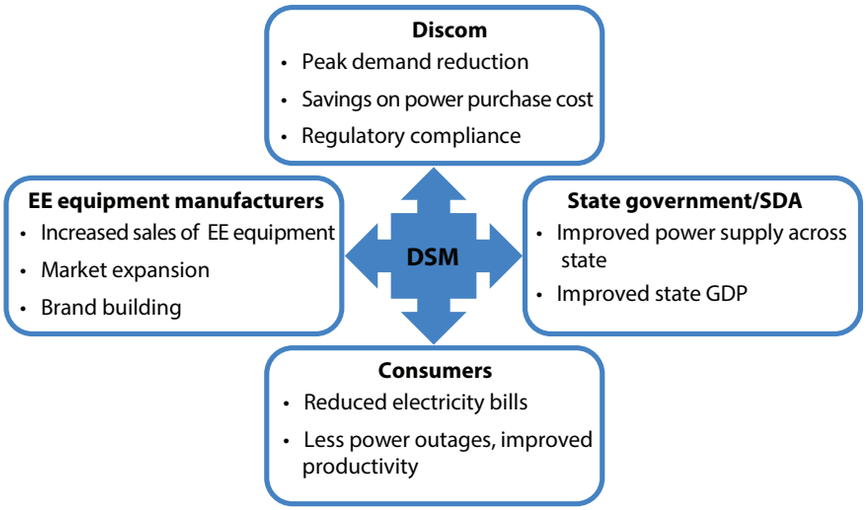
However, as this article outlines, DSM also can offer great potential to manage demand among MSMEs, which typically draw low tension (LT) power of 230–400 V.

DSM works along two tracks: (1) Energy Efficiency, and (2) Demand Response (also known as Dynamic Load Management).

- Energy Efficiency: It reduces the overall electricity demand from consumers, by encouraging them to adopt EETs (e.g. LEDs for lighting, EE motors).
- Demand Response (DR): It reduces electricity demand during grid stress, by encouraging

[1] 'Lack of affordable & quality Power is shackling India's Growth Story; a FICCI Report'. Energetica India, July/August 2013.

[2] Coal-based power plants account for over 59% of total installed capacity in India (192.2 GW out of 326.6 GW as of March 2017). The power sector was responsible for 888.3 million tonnes of CO_2 emissions in 2016–17. [Source: CEA; 'CO_2 Baseline Database for the Indian Power Sector—User Guide, Version 13.0, June 2018'. Available at http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf]



consumers to shift or redistribute their loads to non-peak hours in response to control or pricing signals from the DISCOMs such as 'time of day' (ToD) tariff for electricity.

Some typical DSM actions for the industrial sector include:

- curtailing or shifting of non-critical loads to non-peak periods through ToD or Demand Response (DR) programs
- increasing the use of EE devices/equipment (EETs)
- increasing the use of RE-based devices
- power factor (PF) correction, to increase the efficiency of power use at the consumers' end

Implementing DSM

In order to design and develop a practical DSM program for implementation by a DISCOM, it is necessary to conduct a comprehensive study—called 'load research'— of the daily and seasonal variations of electricity demands from the DISCOM (known as 'load curve'), as well as of the characteristics of the different consumer categories and their electricity usage patterns. Load research helps to identify which consumer loads contribute to the peak demand and to what extent; and the scope for curtailing these loads—in the short term, through Demand Response measures that help shift loads temporarily (to off-peak hours), and/or in the long term, through energy efficiency measures that bring a permanent reduction in electricity consumption across the load curve. Based on the load research, a practicable DISCOM-driven DSM program can be drawn up for implementation, with the identification and involvement of public and private stakeholders drawn from various fields.

Time of Day (ToD) tariff

DISCOMs provide electricity at different rates to their consumers according to their category: industrial (manufacturing units), domestic (residential), commercial (shops and offices) and agricultural. Within each category there are separate rates for LT (230–400 V) and HT (11 kV and above) consumers. Electricity rates are typically highest for industrial consumers and lowest for agricultural consumers.

During peak hours, when the demand for electricity is at its highest, DISCOMs often have to purchase power at very high cost—much higher than the price paid by consumers—to meet the peak demand. In order to reduce the peak demand, many DISCOMs in India are implementing a tariff mechanism initiative known as 'Time of Day' (ToD) for industrial consumers. In simple terms, ToD is a tariff structure which sets different prices for electricity depending on the time of day. Thus, ToD makes electricity expensive during peak hours so that consumers use less of it; while it reduces the electricity price during off-peak hours, as an incentive for consumers to reschedule their loads from peak to off-peak hours.

Opportunity for MSMEs

With its two-pronged approach of promoting EETs and offering cheaper power during off-peak hours through Demand Response initiatives, DSM provides MSME consumers with an exciting, hitherto largely-unexplored avenue through which they can improve their energy efficiency and reduce their energy bills. Although the electricity consumption by an individual MSME with LT connection may be very low compared with a large-scale HT consumer, the large number of MSME units in a typical MSME cluster may collectively consume a significant amount of electricity—enough to make it worthwhile for the local DISCOM to consider a DSM initiative in the cluster. This presents an opportunity for DISCOMs to promote EETs on a large scale among MSMEs through DSM initiatives based on demand aggregation – an approach that can be demonstrated in some clusters. Demand Response initiatives such as ToD, too, may be practicable for DISCOMs to implement in energy intensive MSME clusters, if the load research indicates such potential.

Industry associations will play a critical role in the formulation and implementation of such DSM initiatives: through facilitating the cluster-level surveys, studies and awareness generation initiatives during load research; enabling demand aggregation through active engagement with their member-MSMEs; and supporting the necessary training and capacity building initiatives on DSM and energy efficiency during implementation. The industry associations can also work with ESCOs that are capable of implementing the DSM programs and supporting and sustaining the energy efficiency measures in the long term. The ESCO can also typically be a cluster-level business entity having good rapport and strong linkages with the local MSMEs, and the business acumen and financial wherewithal to provide the MSMEs with turnkey services for replacing their existing low-efficiency technologies with EETs on a large scale.

TERI has undertaken DSM studies in more than 11 DISCOMs over the past few years, and many of these studies have shown that there is significant potential to introduce DSM programs focused on MSME consumers. Table 1 provides a list of such DISCOMs in which TERI has undertaken DSM studies, along with proposed interventions in the selected MSME clusters. Energy saving potential in the range of 5–8% exists in many of these applications. A separate article in this issue provides more details on the DSM study undertaken by TERI in MESCOM (Karnataka).

DSM Action Plan approved for JUSCO S-K, Jharkhand

Jharkhand State Electricity Regulatory Commission (JSERC) notified DSM regulations in 2010 with the overall objective of power shortage mitigation, seasonal peak reduction, cost effective energy savings, lowering the cost of electricity, and reduction in emissions of GHGs. Based on the guidelines set by JSERC, TERI conducted a DSM study and prepared a DSM Action Plan for JUSCO S-K, an industry-dominant DISCOM serving consumers in the Saraikela-Kharsawan district of Jharkhand which includes the Adityapur Industrial Area, home to over 800 MSME units. During the study, TERI conducted detailed system-level and demand side load research to identify DSM interventions among various consumer categories. The key DSM interventions identified in the industry category are:*

- ***Implementation of focused energy efficiency program:*** *To promote energy auditing among selected industrial clusters through a list of empaneled energy auditors; enhance their energy efficiency levels by identifying energy conservation measures (ECM); support them in technology selection; and facilitate the implementation of ECMs. The key sub-sectors identified for implementation are plastics, engineering & fabrication, steel-sheet making & rolling, and forging.*
- ***EE lighting program:*** *To promote EE lighting systems in industrial premises through ESCO mode.*
- ***Employee awareness program:*** *To create awareness among the operators and supervisors about new/EE technologies and best operating practices (BOPs).*

JSERC has approved the proposed DSM action plan in 2019, and has advised JUSCO S-K to initiate implementation of the identified interventions among its key consumers, i.e., in the industry category. The success of these initiatives will draw the attention of different stakeholders, including other distribution companies in Jharkhand, to the importance of DSM and its potential among industrial consumers.

[*Ninety per cent of the total power sales of this utility is consumed by industrial sector]

Table 1. DSM studies undertaken by TERI in DISCOMs with focus on MSME clusters

Particulars	DISCOMs					
	MESCOM (Karnataka)	JUSCO S-K (Jharkhand)	UHBVNL (Haryana)	PSPCL (Punjab)	DGVCL, MGVCL, UGVCL, PGVCL, TPL-A, TPL-S (Gujarat)	ED-Goa (Goa)
Key MSME clusters studied	Foundry Plastic Cashew nut Ice making	Engineering & fabrication Forging Steel sheet-making & rolling Plastic	Textile (dyeing house) Brass & utensils Rice mills Cold storage	Textile (dyeing house) Foundry Engineering & machine tools Steel melting & rerolling Oil mills	Power looms Textile (dyeing house) Foundry Engineering & fabrication Chemical & pharmaceutical Diamond cutting & polishing Ice making	Pharmaceutical Foundry
DSM potential (% saving)	4–6%	6–8 %	5–7 %	6–8 %	7–9 %	3–5 %
DSM interventions identified						
Focused energy efficiency programs to promote cluster-based energy audits	✓	✓	✓	✓	✓	
Energy efficient lighting program	✓	✓	✓	✓	✓	✓
Awareness program for operators and supervisors	✓	✓	✓	✓	✓	✓
Adoption of premium efficiency class (IE3) motors	✓	✓	✓	✓	✓	✓
Installation of VFD enabled screw air compressors	✓	✓		✓	✓	✓
Explore scope for demand response (DR) in industries			✓	✓	✓	✓
Installing FRP blades in cooling towers		✓		✓	✓	
Replacing slip ring motor by squirrel cage motor with VFD		✓		✓		
Harnessing renewable energy through solar water heaters/rooftop systems		✓	✓	✓	✓	
Installation of IGBT type induction furnace	✓	✓		✓	✓	✓

DSM ACTION PLAN FOR MESCOM, KARNATAKA IDENTIFIES ENERGY SAVING MEASURES FOR MSMEs

TERI, with funding support from the MacArthur Foundation, conducted a load research study and developed a comprehensive DSM action plan for Mangalore Electricity Supply Company (MESCOM), an electricity distribution company serving consumers in the state of Karnataka. MESCOM is vested with the responsibility of power distribution in four districts (circles) of Karnataka: Chikmagalur, Dakshina Kannada, Shimoga and Udupi. The majority of its consumers (74%) fall under the domestic category, followed by agricultural consumers (13%). The poor financial health of MESCOM is due, in large measure, to the provision of subsidized power to agricultural consumers and low-income consumers in domestic category. Industrial consumers make up only 2% of all consumers, but account for 15% of the total electricity consumption, underlining the need to explore electricity saving through DSM measures in this category (figure 1).

The TERI study involved detailed analyses of the utility's profile, key operational parameters, system-level load behaviour, and category-wise load profiles of consumers. The load research was supported through in-depth consumer surveys (based on a sampling technique) and interactions with the stakeholders. The study revealed that the industrial consumers under MESCOM consumed a total of 703 million units (MU) of electricity in year 2016–17 of which 140 MU was consumed by MSMEs in four key industrial sub-sectors—foundry, plastic, ice-making, and cashew nut processing (table 1).

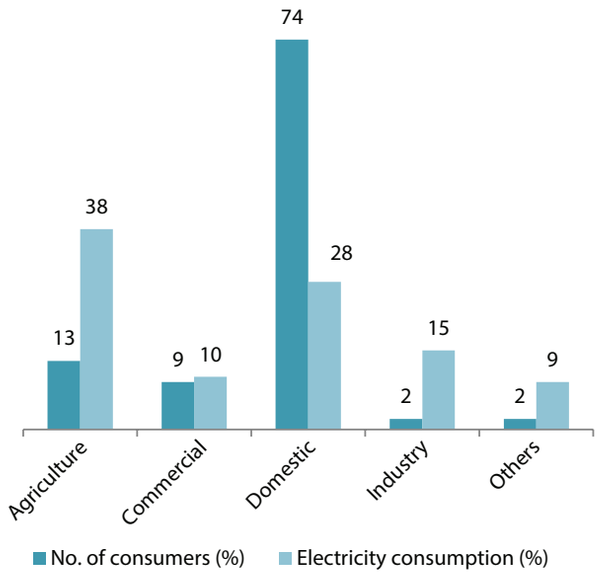


Figure 1. Category-wise profile of consumers served by MESCOM

DSM Action Plan

TERI conducted walk-through energy audits (EAs) among selected MSME units in these four sub-sectors in order to understand the technologies, processes and operating practices in use, and to identify possible measures for energy saving and demand reduction. Some of these energy saving measures are applicable in all the four sub-sectors studied, while a few are specific to the foundry sub-sector, as summarized in table 2.

Implementation of the proposed energy saving measures will save an estimated 14.5 MU in the four MSME sub-sectors studied (figure 2).

Based on its study, TERI has prepared a DSM Action Plan for MESCOM with suggestions and guidelines for its implementation, as summarized below.

Table 1. Key MSME sub-sectors/clusters under MESCOM

Sub-sector	Cluster locations	No. of units	Type	Electricity consumption (MU/ year)
Foundry	Shimoga	45	HT	58.0
Plastic	Baikampady; Surathkal	95	HT & LT	32.0
Ice making	Mangalore City; Baikampadi; Malape	57	HT & LT	26.5
Cashew nut processing	Bairampalli; Hebri; Kundapur; Karkala; Udupi	200	LT	23.3
Total				139.8

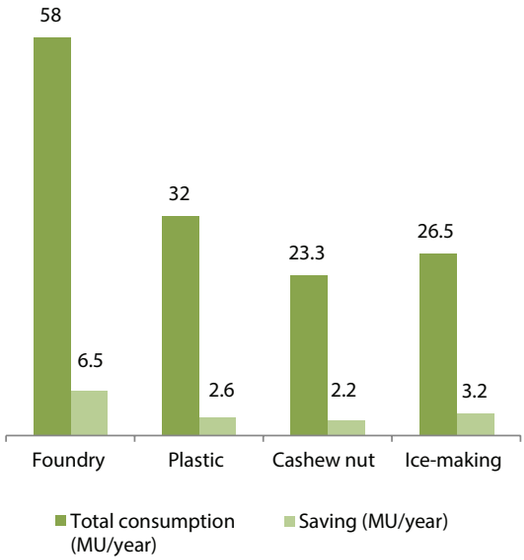


Figure 2. Potential electricity savings from implementation of DSM measures

Implementation of focused energy efficiency program in energy-intensive clusters

The DSM cell of MESCOM may offer to develop cluster-based energy efficiency programs in four identified clusters/ sub-sectors in association with the State Designated Agency (SDA), Ministry of MSME, Government of India, and other development agencies to offer a wide spectrum of technical assistance, financial incentives and guidance to encourage energy efficiency among its industrial consumers. The program could include the following key elements:

- MESCOM may empanel/register energy audit agencies that provide services to industrial consumers for technology selection and implementation support. To help industrial units meet the cost of the energy audits, funds may be provided under various schemes promoted by BEE through SDA and Ministry of MSME.
- The technical support to the industries will also focus on creating awareness about new and energy saving techniques/technologies, and on the ongoing government schemes for technology up-gradation and energy efficiency applicable to the identified industry sub-sectors.
- Industrial Incentive Program—MESCOM may consider providing incentives to the industrial units that implement measures which meet the minimum energy saving potential (as specified

Table 2. Energy saving measures identified for MSMEs in the four sub-sectors studied

Process area	Proposed energy saving measure	Energy saving potential (%)	Simple payback period
All four sub-sectors			
Compressed air systems	Optimizing air generation pressure settings to meet process requirements	6–17%	Immediate
	Ensuring intake air temperature is close to ambient temperature	1.5–2%	Up to 3 months
	Installing VFD on existing screw air compressor/Installing new VFD-enabled air compressor	10–25%	Up to 12 months
Various motor-driven systems and applications	Replacing under-loaded and/or multiple rewound motors with energy efficient IE3 motors of optimum capacity	3–7%	18–24 months
Lighting	Replacing low efficiency lamps with energy efficient lamps like LEDs and induction lamps	3–12%	6–24 months
Foundry			
Melting	Replacing existing (old) induction furnace having high SPC* of 695–750 kWh/t molten metal, with IGBT induction furnace having SPC 550–575 kWh/t molten metal	12–15%	Up to 24 months
	Installing lid mechanism for induction furnace to minimize heat losses through convection and radiation	3–6%	Up to 9 months
Auxiliaries	Replacing existing low efficiency pumps with energy efficient pumps	10–12%	6–9 months

*SPC—specific power consumption

in the relevant unit-specific EA report), with the energy savings duly verified and certified by an energy auditor. The incentive could take the form of rebate in the electricity charges for a justified period (such as the payback period of the concerned energy efficiency project).

- The DSM cell of MESCOM and associated energy audit agency may also help MSME units in their documentation and applications for the subsidy/ incentives offered by various government agencies, such as 'Credit Linked Capital Subsidy Scheme for Technology Up-gradation' of Ministry of MSME, 'Technology Up-gradation Fund Scheme' of Ministry of Textiles, etc.

Employee awareness program

MESCOM along with the SDA, MSME Development Institute (MSME-DI) and energy consultants may prepare an 'employee awareness toolkit' which will help MSMEs to develop Employee Awareness Programs within their units. The posters, fact sheets, stickers, slide presentations, and other materials in the toolkit will explain how everyday actions can significantly reduce energy waste, decrease operating costs and increase competitiveness. The implementation strategy could include the following key elements:

- Hiring of suitable agency to conduct a capacity building needs assessment study for the MSME cluster/sub-sector, and for preparation of materials for capacity building and outreach.
- Organizing training workshops, with maximum participation of the entrepreneurs and local industrial associations.
- Conducting energy assessments for units that participate in the training workshops.

Promotion of EE appliances/ equipment

Electric motors and lighting account for a significant portion of energy demand in the selected MSME clusters/sub-sectors, particularly at times of peak demand. Hence, the aim is to accelerate installation of premium efficiency class motors and EE lighting systems among the MSMEs. Measures to save electricity in electric motors and lighting normally require some capital investment; but the amounts are not excessive, and typically allow payback within 12–18 months.

- Under the UJALA scheme of Energy Efficiency Services Ltd (EESL), MSMEs can acquire EE lighting systems such as LED tube lights and LED bulbs at competitive prices—for retrofitting and/ or for new installations.
- Also, under its National Motor Replacement Program, EESL offers replacement of inefficient motors in industrial units by premium efficiency class (IE3) motors, through an innovative financing model.

Cashew nut unit in MESCOM area

ABOUT SAMEEEKSHA

SAMEEEKSHA is a collaborative platform aimed at pooling the knowledge and synergizing the efforts of various organizations and institutions—Indian and international, public and private—that are working towards the common goal of facilitating the development of the Small and Medium Enterprise (SME) sector in India, through the promotion and adoption of clean, energy-efficient technologies and practices.

SAMEEEKSHA provides a unique forum where industry may interface with funding agencies, research and development (R&D) institutions, technology development specialists, government bodies, training institutes, and academia to facilitate this process.

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