SAMEEEKSHA

SMALL AND MEDIUM ENTERPRISES: ENERGY EFFICIENCY KNOWLEDGE SHARING

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NEWSLETTER

Promoting Energy Efficiency in SMEs

SAMEEEKSHA

A PLATFORM FOR PROMOTING ENERGY EFFICIENCY IN SMEs

In this issue...

Editorial

This year the IEE division of TERI completes 20 years of its intervention for promoting clean, energy efficient technologies (EETs) in the MSME sector, with the support of SDC/Embassy of Switzerland. This is an appropriate time for us to take stock of what has been achieved—from the early years, when we were engaged hands-on in developing and demonstrating EETs in energy intensive MSME clusters, to the past few years when we have been actively involved in establishing and strengthening collaborative platforms like SAMEEEKSHA to consolidate and spread the knowledge and experiences of TERI as well as other agencies involved in the MSME sector.

TERI followed the approach known as RDD&D (research, development, demonstration and dissemination) to promote EETs in four MSME sub-sectors—brick, foundry, glass, and biomass (through thermal gasifiers). Over the years, it was realized that for the sustainable uptake of EETs, it was necessary to address the technological, capacity and financial needs of the MSME sector simultaneously. For this, the various agencies working in the MSME sector would have to pool their knowledge and expertise and coordinate their activities in these different focus areas. It was against this backdrop that the SAMEEEKSHA knowledge sharing platform was set up jointly by BEE, Ministry of MSME, Embassy of Switzerland and TERI.

SAMEEEKSHA has now been functioning for over three years, and has added over 35 members from all categories such as bilateral/multilateral agencies, government departments, leading SME industry associations, energy consulting and implementing agencies. Besides publishing this quarterly newsletter, SAMEEEKSHA has developed its website with useful information on diverse aspects of energy efficiency—from energy-related data on over 45 MSME clusters and cluster profiles, to DPRs for EETs and success stories on implementation of EETs. SAMEEEKSHA also successfully organized a first-of-its kind 'National Summit on energy efficiency in MSMEs', which saw the active participation of over 70 cluster level industry associations.

SAMEEEKSHA is thus a small but very significant step forward in spreading energy efficiency in India's MSME sector. Today, SAMEEEKSHA touches over 2000 MSME stakeholders including about 100 industry associations. We are confident that with the increasing participation of more stakeholders, SAMEEEKSHA will continue to support the all-round development of the MSME sector.

Girish Sethi
Director, TERI

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CLUSTER PROFILE

PUNE FORGING CLUSTER

Background

The forging industry is one of the important contributors to the Indian economy, with a turnover of around Rs 15,000 crores (USD 3 billion) in 2007–08. Large, medium and small-scale forging units process a range of metals to manufacture forged components that are used in many industrial sectors, in particular, the automotive industry. A large portion of the forged products are exported to the US, Europe and China. In 2010–11, the Indian forging industry manufactured around 2.3 million tonnes of products for domestic and overseas markets.

What is forging?

Forging is one of the oldest known metal-working processes. In simplest terms, it is the process by which metal is shaped using localized compressive forces. Traditionally, forging was performed by a blacksmith in a workshop called 'smithy' or 'forge'. The metal part to be shaped is placed on an anvil and hammered into the desired shape. This manual method is practiced even today. However, industrial forging is done either with presses or with hammers powered by hydraulics, compressed air, electricity, or steam. Forging is often classified according to the temperature at which it is performed: thus, forging can be 'cold', 'warm', or hot'. Forged parts can range in weight from less than a kilogram to over 500 tonnes. The forging process produces a metal part that is stronger than an equivalent cast or machined part.

One of India's largest forging industry clusters is located in Pune, Maharashtra. All sectors of the automotive industry are represented in Pune: two-wheelers, auto rickshaws, cars, tractors, tempos, excavators and trucks. Among the large automotive companies located in and around Pune are Fiat, Force Motors (Firodia Group), General Motors, Kinetic Motors, Mahindra & Mahindra, Mercedes Benz, Tata Motors, and Volkswagen. Several automotive component manufacturers are located in the Pune area, including Continental Corporation, Friedrichshafen AG, Robert Bosch GmbH, Saint-Gobain Sekurit, Tata Autocomp Systems Limited, and Visteon. These automotive industries require forged products like axles, cams, connecting rods, crown wheels, gears, shafts, wheel hubs and so on, which are manufactured by the forging units in the cluster. Forged components are also manufactured for a range of other industries in and around Pune, from engineering firms and chemical manufacturers to sugar industries, ordinance factories and food processing plants.

The Pune forging cluster accounts for about 20–25% of the total national production of forged components. Large-scale forging units account for about 65–70% of the total forging production in the cluster, while MSMEs account for the remaining 30–35%. There are around 50 forging MSMEs located in Pune. In addition, there are around 20 heat treatment MSMEs that function as vendors to these forging units. These MSMEs provide direct and indirect employment to around 20,000 people, and are located in industrial estates developed by the Maharashtra Industrial Development Corporation (MIDC) in Pimpri–Chinchwad, Chakan, and Bhosari, as well as in other areas like Kharadi, Alandi, Haveli, Shikrapur and Sanaswadi.

The gross annual turnover of the forging MSMEs in Pune is estimated at Rs 500–600 crores (about USD 300 million), while that of the heat treatment MSMEs is Rs 80–100 crores (about USD 60 million). The production levels of the units range between 500–3500 tonnes per annum (tpa). The production levels have shown a downward trend in recent times, due to the slowdown

Closed-die forged components

Profile of forging and heat treatment MSMEs in Pune									
Category	*No. of units*	*Size of units*			*Production level of units (tpa)*			*Total annual production (t)*	
		Micro	*Small*	*Medium*	*500–1000*	*1000–2000*	*2000–3500*	*2010–11*	*2011–12*
Forging	50	5	35	10	10	25	15	120,000	80,000
Heat treatment	20	–	13	7	5	15	–	40,000	28,000
Total	70	5	48	17	15	40	15	160,000	108,000

in the Indian automobile market as well as the slump in exports resulting from the downturn in the US and European economies.

The Association of Indian Forging Industry (AIFI) is the main industry association representing small-scale and large forging units in Pune, with about 150 members. AIFI plays an active role in promoting the forging industry, and pursues issues such as budget and export–import policies with the Government of India (GOI). AIFI also has strong linkages with its counterpart forging associations in the US, European countries, Japan and China. These linkages facilitate new business opportunities for member-units. With support from GOI, AIFI has established an R&D Centre at Chakan, which offers product testing and validation facilities for the forging industry in Pune. Other industry associations connected to the Pune forging cluster include Pimpri-Chinchwad Chamber of Industries, Commerce, Services and Agriculture; Maharashtra Chamber of Commerce, Industries and Agriculture; Chakan Industries Association; Pimpri-Chinchwad Small Industries Association; and Deccan Chamber of Commerce, Industries and Agriculture. Other important cluster-level stakeholders include:

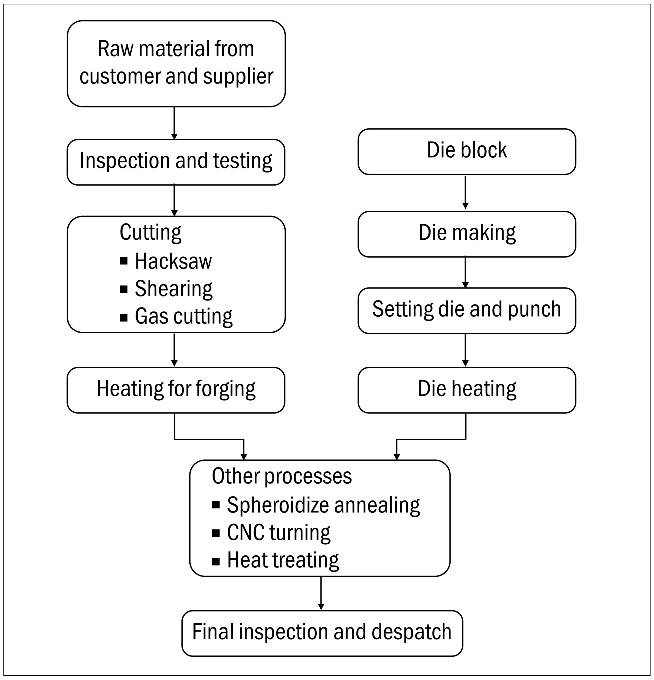
- The Automotive Research Association of India (ARAI)—it has a forging division which organizes training and undertakes R&D projects. ARAI has a testing and validation facility.
- MIDC
- District Industries Centre (DIC), Pune.
- Financial institutions—there are about 20 banks operating in the cluster. They provide the units with financial assistance for expansion and upgrade of infrastructure. SIDBI is the leading financial institution in the cluster, with several branches in Pune city and MIDC areas.

Technology status and energy use

In general, the forging process involves the following broad steps: (1) cutting and heating of billets; (2) forming operations; and (3) final treatments, such as flash removal, punching and cooling. Different kinds of forging processes are used by the units in Pune, such as closed or impression die forging; cold forging; open die forging; and seamless rolled ring forging. The major raw materials include mild steel, carbon steel, alloy steel, stainless steel, super alloy, non-ferrous metals, etc. Most of these raw materials are available locally or sourced from other domestic markets. The main equipment/systems used by the forging and heat treatment units include the following:

- *Oil and gas-fired furnaces*. Forging and heat treatment furnaces commonly use furnace oil (FO), light diesel oil (LDO) and LPG as fuel. The forging furnaces are used to heat the raw material (usually, billets of various grades of steel) to about 1200° C. The production capacities of the furnaces range from 50 kg/hour to 400 kg/hour. The furnaces have different designs like box, 'L' and pusher types. The heat treatment furnaces are used for normalizing, annealing, hardening, tempering and carburizing of forged and machined components according to job specifications. The oil consumption ranges between 100–200 litres/tonne in the forging furnaces, and 60–80 litres/tonne in the heat treatment furnaces. The gas consumption ranges between 100–150 standard cubic metre (scm)/tonne in the forging furnaces, and 50–80 scm/tonne in the heat treatment furnaces.
- *Electric furnaces*. Electrical energy is also used for heating billets for forging, and for heat treatment. The

Furnace oil fired forging furnace



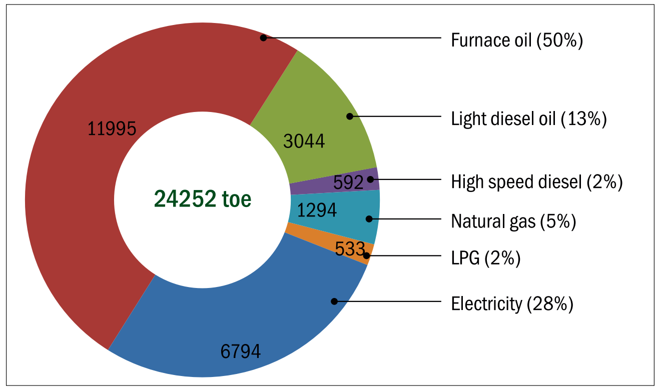
Process flowchart

production capacities of the electrical billet heating furnaces range from 45 kg/hour to 500 kg/hour, with connected loads ranging between 50 kW and 450 kW. The specific electricity consumption for the billet heating furnaces varies between 400–450 kWh/tonne. The electrical resistive heating furnaces used for heat treatment are either batch (pit) type or continuous (pusher) type, and have capacities ranging from 200 kg to 600 kg. The rating of the heat treatment furnaces varies from 45 kW to 120 kW.

- *Close die hammers of belt drop type*. These hammers are used to forge hot billets into various shapes for shafts, flanges, rollers, hubs and so on. The hammers have capacities between 0.5–3 tonnes. Electric motors of 30 hp to 100 hp are used to drive the hammers.
- *Pneumatic screw presses*. Screw presses with capacities ranging from 100 tonnes to 1500 tonnes are driven by electric motors of 30 hp to 150 hp. Screw presses with electric motors of 5 hp to 30 hp are used for trimming and coining operations.
- *Open die hammers*. These hammers, with capacities of 0.5 tonnes to 5 tonnes, are mainly used to forge certain kinds of shafts and flats.

Energy use

Electricity and other fuels are used by the forging furnaces as well as for heat treatment processes like hardening, tempering and stress relieving. Some of the forging and heat treatment units have both oil-fired furnaces and electrical furnaces for heating. The total annual energy consumption of the Pune forging and heat treatment units is estimated at 24,252 tonnes of oil equivalent (toe) in 2011–12.



Annual energy consumption

Options for energy saving

Around 80–90% of the energy consumed by the Pune forging cluster is used for heating. The balance energy is used by other equipment like hammers, presses, pumps, air compressors and so on. A large number of the forging and heat treatment units use inefficient systems that offer significant potential for energy saving. The options available for improving energy efficiency are summarized below.

Key energy saving options in Pune forging cluster

Energy saving option	*Energy saving potential*
Efficient induction furnace to replace old oil-fired forging furnace	30–70%
Efficient gas-fired furnace to replace old oil-fired heat treatment furnace	10–20%
Control systems for oil/gas-fired furnaces (burners, blowers, temperature controllers) for forging and heat treatment units	Up to 5–10%
Controls and best operating practices in compressed air systems for forging and heat treatment units	Up to 5–15%
Use of energy efficient motors and pumps	Up to 5–15%
Use of energy efficient lighting (like CFL, LED, T5 etc.)	Up to 5–10%

Compiled by TERI from 'Cluster Profile Report: Pune Forging Cluster', prepared by TERI in 2012 under the World Bank–GEF–SIDBI project titled 'Financing Energy Efficiency at MSMEs'

Implementing Low Carbon Technologies: Electric Heat Pump Technology For Improving Energy Efficiency of Dairy Units

A CASE STUDY FROM PUNJAB DAIRY CLUSTER

Backdrop

The dairy industry is of crucial importance to the Indian economy. India is the largest producer of milk in the world (about 128 million tonnes annually) and also the world's largest producer of dairy products by volume. The Indian dairy industry boasts of an annual growth rate of 7%, and exports of dairy products have been growing consistently at about 25% annually. The dairy industry plays a key role in providing employment and income generating opportunities for millions of rural families, particularly for marginal farmers and women. Cooperatives account for about 60% of the installed milk processing capacity. At the village level, cooperative societies of milk producers undertake the collection, chilling and transportation of milk to the processing plants. The milk is processed and marketed by 170 milk producers' cooperative unions at the district level, which federate into 15 State Cooperative Milk Marketing Federations at the state level. The National Dairy Development Board (NDDB) is the apex institution responsible for the development of the dairy sector.

Despite its impressive and growing production levels, the Indian dairy industry is finding it hard to meet the escalating demands for milk and dairy products arising from changing consumption habits and rapid urbanization. Most of the small and medium-sized (SME) dairy units use conventional-design steam generators (boilers) and refrigeration plants that are low in energy efficiency, and typically account for more than 75% of the total energy costs. Hence, the dairy industry is looking for modern, energy efficient technologies that would help units improve their productivity and profitability by reducing energy costs.

EHP Unit

Dairy technology

The basic manufacturing process in dairy units requires both chilling and heating applications. At the village-level collection centres, the milk is chilled to 4° C or below to ensure that it remains fresh during transport to the processing plants. Here, the milk is pasteurized by heating it very rapidly to a high temperature for a precise duration of time, and then quickly cooling it to 4° C or below. This destroys the bacteria naturally present in the raw milk, and helps preserve the milk for a longer period. The pasteurized milk is then packaged for distribution to consumers.

Intervention

In this backdrop, TERI in partnership with Institute for Global Environmental Strategies (IGES), Japan undertook a project to identify, demonstrate and promote the application of an energy efficient, low carbon technology (LCT) in the Indian dairy industry. The project is part of a larger research collaboration titled 'Research Partnership for Application of Low Carbon Technology for Sustainable Development' (ALCTS), funded by Japan Science and Technology Agency (JST) and Japan International Cooperation Agency (JICA), which aims to promote Japanese LCTs in energy-intensive MSME sectors in India.

The project conducted feasibility studies on a range of LCT options available with Japanese manufacturers, and finally selected the electric heat pump (EHP) technology for demonstration in the Indian dairy industry. In parallel, the project conducted a number of surveys and site visits to different dairy clusters/units in India,based on which the project selected two dairy units for demonstration of EHP technology: one each in the states of Punjab and Gujarat. These states are among the leading producers of milk and dairy products in India (Punjab produces 9.5 million tonnes of milk annually, while Gujarat produces 9.8 million tonnes/year). They host a large number of dairy-based SMEs, and hence offer enormous potential for energy savings and reduction of carbon emissions through the adoption of LCTs by dairy units. This case study focuses on demonstration of EHP technology in the dairy unit of the Punjab State Cooperative Milk Producers' Federation Limited (MILKFED) in Verka, Chandigarh.

Energy and emissions profile of Punjab dairy cluster	
Total energy consumption	4.7 PJ
Specific energy consumption (average)	0.51 GJ/tonne
Total CO_2 generation	0.54 million tonnes
Emission intensity	0.06 t CO_2/ t product

EHP technology

An EHP system works on the principle of the 'heat pump'. This is the cyclic process in which heat is taken up from an area of cold temperature and discarded into an area of high temperature. A heat pump cannot operate by itself; it requires an external energy source. In an electric heat pump (EHP) system, electrical energy is used to drive the heat pump.

In simple terms, an EHP system utilizes the heat emitted by a refrigeration process to heat water. Thus, EHP technology provides heating as well as cooling output simultaneously. EHP systems are very suitable for the dairy industry, as they can be used to meet the process cooling and heating requirements of a dairy unit, while reducing the load on its existing boiler and chilling plant.

The project conducted detailed studies at the Verka dairy plant to gather baseline performance data and identify possible energy saving options. The existing equipment in the Verka plant included a chilling facility, two boilers operating on furnace oil (of 4 tonnes and 3 tonnes capacity), and production equipment such as pasteurizer, milk separator, dryer, butter churner, etc.

Based on its analyses, the project recommended the installation of an EHP system which would simultaneously provide pre-heated supply water to the boiler facility and pre-cooled return chilled water for the chiller facility. The EHP system was designed and customized by the Japanese firm Mayekawa. The EHP system uses CO_2 as a refrigerant, and is designed to preheat boiler feed water to around 80° C, and cool the return water for the chiller by about 4° C.

The EHP system was installed, integrated with the existing systems at the Verka plant, and successfully commissioned in June 2013, under the guidance and supervision of the project team from India and Japan.

Results

The project has been monitoring the performance of the EHP system following its commissioning. The results so far indicate that with a potential annual operating time of 3672 hours per year (i.e.12 hours daily for 51 weeks of the year), the EHP system is achieving an annual primary energy saving of about 35%, or 19 tonnes of oil equivalent (toe). In terms of curtailing greenhouse gas emissions, the EHP system is achieving an annual reduction in CO_2 emissions of 62.6 tonnes (about 38%). The Verka plant personnel have been trained in the operation and maintenance of the EHP system. Under the ongoing project, performance monitoring of the EHP system will continue till the end of March 2014.

About 50 other dairy units in Punjab and Gujarat could potentially adopt the EHP system similar to the demonstration plant. These replications would result in a saving in equivalent primary energy of 952 toe/year, and a reduction in CO_2 emissions of 3128 tonnes/year. The project is undertaking a dissemination workshop in January 2014 to generate wider awareness and motivate other dairy units to adopt the energy efficient EHP technology.

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Compiled by TERI based upon the ongoing activities being undertaken by TERI, IGES under the JICA-JST project

7th COORDINATION COMMITTEE MEETING OF SAMEEEKSHA

The 7th Coordination Committee Meeting of SAMEEEKSHA was held at TERI, New Delhi on 23rd October 2013. The meeting was chaired by Dr. Ajay Mathur, DG, BEE. The other participants included representatives from AfD, BEE, SDC/Embassy of Switzerland, GIZ, JICA, KFW, PCRA, SIDBI, UNIDO, industry associations, and technical consultancy organizations. The salient points and recommendations that emerged from the discussions are as follows:

SAMEEEKSHA platform

- All the DPRs prepared under the BEE-SME program have been uploaded on the SAMEEEKSHA website for access by all stakeholders. Also, a few case studies related to the TERI-SDC program have been developed and uploaded.
- An interactive map featuring cluster-specific information could be developed and hosted on the SAMEEEKSHA website. GIZ has shown interest in pursuing this initiative.
- Websites of other members and key organizations should be cross-linked with the SAMEEEKSHA website. TERI will initiate action in this regard.
- Representatives of DST (Department of Science and Technology) should be invited to future SAMEEEKSHA meetings.

Consolidation of information on EE initiatives

- DC-MSME has started collating energy-related data from various clusters through its network of MSME Development Institutes (MSME-DIs).
- DC-MSME has also initiated an exercise to collect information on EE initiatives by various agencies in the form of a 'matrix'. The filled-up matrices are being consolidated. So far, the exercise gives the overall impression that many agencies are focusing more on awareness generation/capacity building, rather than actual implementation assistance at unit/cluster levels.
- The data collected through matrices on various EE projects should be categorized into themes, based on the kind of interventions. Three broad themes could be (1) awareness & capacity building; (2) interventions in clusters; and (3) business models and approaches. As different agencies have followed different implementation approaches in the past, such categorization would help to draw valuable lessons from the various kinds of interventions. Analyses of the matrix data could also provide the bases for a discussion paper.

Activities of BEE under 12th Five Year Plan

- The BEE-SME Program will continue during the 12th Plan (2012–2017). Its focus will be on implementation of DPRs already prepared under the Program. A sector-specific approach would be followed for implementation. The Program has a budget of 40 crore rupees, and will result in an estimated energy savings of 99,000 toe.
- An energy-intensive cluster-based approach should be adopted for formulation and implementation of supportive policies. The concept of 'designated consumer' as defined under the PAT scheme may be extended to MSMEs as 'designated clusters' for higher impact.
- The capacities of LSPs should be enhanced to ensure that replications of EETs yield energy savings similar to those of demonstration units.

Brick sector: Challenges and opportunities

- Factsheets on different brick technologies will be prepared with the support of SDC as a part of the Climate and Clean Air Coalition (CCAC) program to reduce short-lived climate pollutants. This information will also be uploaded on the SAMEEEKSHA website.

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.

ABOUT TERI

A dynamic and flexible not-for-profit organization with a global vision and a local focus, TERI is deeply committed to every aspect of sustainable development. From providing environment friendly solutions to rural energy problems to tackling issues of global climate change across many continents and advancing solutions to growing urban transport and air pollution problems, TERI's activities range from formulating local and national level strategies to suggesting global solutions to critical energy and environmental issues.

With staff of over 900 employees drawn from diverse disciplines, the institute's work is supported by ministries and departments of the government, various bilateral and multilateral organizations, and corporations of repute.

VISION OF SAMEEEKSHA

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.

FOR MORE DETAILS, PLEASE CONTACT

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