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Editorial

Ready for saturation — EE measures in small industries

During my 20 years at SDC, promoting EE measures in energy intensive small industries has been a stable long-term programme. ‘Ring the Changes’ is the story of transformation in the glass melting units in Firozabad (the story can be viewed at https://www.youtube.com/watch?v=oUgG0L5fUSU). The lessons are clear— transformation is a long term multi-step process. It needs robust solutions and local skill building. The entrepreneurs in Firozabad cluster have internalized ‘heat recovery’ as a part of their operational culture. That is a big step.

Today the canvas of interventions is large and varied. The programmes of MoMSME, BEE, JICA, AfD, EU, and GEF through WB and UNIDO have added new dimensions to the interventions and also covered more sectors and clusters. Last year, MoMSME initiated the compilation of a matrix of clusters reflecting the efforts made by various bilateral and multilateral projects in one place. BEE has recognized the need to increase the focus on technology development or customization to suit the requirements of the cluster level actors. Accordingly, during the 12th Plan, BEE proposes to showcase 10 EE technologies through demonstrations in five energy intensive SME sectors.

During the last three years, various projects have focused on developing a saturation approach whereby specific clusters are targeted to cover a large number of units for small and big measures that would reduce energy consumption. We could also refer to these select clusters as designated clusters and monitor them closely for results and further programme design insights.

The need of the day seems to be to put in place systems to collect and establish robust baselines for energy consumption. This would allow us to link financial incentives with possible savings that can be realized. This would also encourage entrepreneurs to monitor the energy consumption in a systematic manner.

As SAMEEEKSHA consolidates further as a knowledge exchange platform, the key to developing transformational pathways seems to be to develop partnerships with sectoral institutions to set a stage for new solutions and lateral learning.

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Embassy of Switzerland in India
Background

One of the largest and fastest growing MSME clusters in India is located in Faridabad, Haryana. Faridabad is located just 25 km away from Delhi, and is well connected to the rest of the country by rail and road. The development of the Faridabad industrial cluster began in the 1950s, when a number of large-scale industries were established in the town to manufacture tractors, auto parts, shoes, etc. Many MSMEs were set up to cater to the needs of these large-scale plants for products and processes like castings, auto components, electroplating, heat treatment, etc. Since then, many more large-scale industries have come up in Faridabad/Delhi–NCR, accompanied by a corresponding increase in the number of MSMEs. The development of the Faridabad industrial estate has been catalyzed by Haryana Government bodies such as Haryana State Industrial Development Corporation (HSIDC), Haryana Urban Development Authority (HUDA), and the Directorate of Industries and Commerce. Also, a number of private developers like DLF have developed industrial plots with suitable infrastructural facilities in the Faridabad area. The number of MSMEs in the cluster registered a sharp increase from 2006–07 onwards, following the signing of an MOU between the Japanese and Indian Governments that year for the Delhi–Mumbai Industrial Corridor (DMIC) Project which passes through Faridabad. Today, Faridabad is one of the leading light engineering industrial clusters in India. There are an estimated 12,015 MSME units in the cluster, of which 38% are micro units, 59% small scale, and 3% medium scale units.

<table>
<thead>
<tr>
<th>Size-wise distribution of MSMEs in Faridabad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro</td>
</tr>
<tr>
<td>Small</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>4,612</td>
</tr>
<tr>
<td>7,039</td>
</tr>
<tr>
<td>364</td>
</tr>
<tr>
<td>12,015</td>
</tr>
<tr>
<td>38%</td>
</tr>
<tr>
<td>59%</td>
</tr>
<tr>
<td>3%</td>
</tr>
<tr>
<td>100%</td>
</tr>
</tbody>
</table>

About 60% of all the MSMEs in the Faridabad fall under three broad industry segments—automobile parts (35%), sheet metal components (14%) and fabrication (11%). The other major industry segments include castings, chemicals & paints, electroplating, forging, heat treatment, industrial fasteners, plastic products, railway equipment, rubber products, and textiles. A large number of the MSMEs function as vendors to Original Equipment Manufacturers (OEMs) in the automobile sector such as Escorts, Mahindra, Eicher, Yamaha, Maruti, Honda Siel Cars, New Holland, etc. The Faridabad cluster has an estimated annual turnover of over one trillion rupees (Rs 106,668 crores), and provides employment to over 0.8 million people.

There are over 10 industry associations in Faridabad, comprising a mix of location and industry specific segments. Some of the major associations are: Faridabad Small Industries Association; Faridabad Chamber of Commerce and Industry; DLF Industrial Association; Faridabad Foundry Association; Faridabad Industries Association; and Faridabad Plastics Association. Other major cluster-level stakeholders and their primary roles are listed below:

- Dakshin Haryana Bijli Vitran Nigam (DHBVN)—local power utility
- Adani Gas Ltd (AGL)—piped natural gas supply utility
- HUDA and HSIDC—development of industrial estates, approvals for plot usages, financial services, etc.
- Academic and R&D institutions—IIF, Faridabad chapter; Manav Rachna International University (MRIU), Central Mechanical Engineering Research Institute (CMERI); and Regional Labour Institute (RLI)
- Technology providers, local consultants and fabricators who manufacture and install different kinds of equipment.
- Financial institutions—around 25 banks, including...
SIDBI, operating in the cluster with a total of over 70 branches.

**Technology status and energy use**

The MSMEs in Faridabad use a wide range of raw materials, equipment, machinery, and processes, depending on the different industry segments to which they belong. The erratic power supply from DBHVN poses a major challenge to the MSMEs in Faridabad. In order to ensure electricity supply during the frequent and lengthy power outages, almost all the MSMEs have installed DG sets. Besides electricity, the main energy sources are diesel, furnace oil, LPG, pet coke, wood, and gas. The total energy consumption in the Faridabad cluster is estimated at about 426,167 (data for 5,347 units) tonnes of oil equivalent (toe) as shown in the figure.

**Options for energy saving**

Energy costs account for a significant portion of manufacturing costs, varying from just over 2% in fabrication units to over 44% in foundry units. While a number of units have taken measures to upgrade their technologies—often through their own innovations—there exists potential to improve the energy efficiency of the existing systems and processes as summarized below.

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**Key energy conservation options in Faridabad cluster**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Option</th>
<th>Energy Saving Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thermal/Utility Side</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Refurbishment/repair of insulation/refractory for furnaces &amp; boilers etc.</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Installation of VFD in the re-circulating water pumps</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Air pre-heater for normalizing/hardening furnace</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Waste Heat recovery in furnaces by using recuperator</td>
<td>Medium</td>
</tr>
<tr>
<td>5</td>
<td>Condensate recovery in boilers</td>
<td>Medium</td>
</tr>
<tr>
<td>6</td>
<td>Excess air control in the furnace &amp; boiler</td>
<td>High</td>
</tr>
<tr>
<td>7</td>
<td>Fuel switch from FO to PNG/Electricity</td>
<td>High</td>
</tr>
<tr>
<td>8</td>
<td>Furnace temperature based control system</td>
<td>High</td>
</tr>
<tr>
<td><strong>Electrical system and utility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Optimising pressure setting of air compressor</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Replacement of inefficient air compressor with energy efficient compressor</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Application of VFD on compressors</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Arresting air leakage in the compressed air network</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Process level interventions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Vertical Torque Drive (VTD) for different machines</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Installation of automatic band saw cutting machine</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Reduction in container metal (design modification to reduce the weight)</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Replacement of arc welding machines with inverter based welding machine</td>
<td>High</td>
</tr>
</tbody>
</table>

Forging Unit In Pune Adopts ECMs
A CASE STUDY FROM PUNE, MAHARASHTRA

Partners : World Bank-GEF, SIDBI, BEE, AIFI, SB Engineers, TERI
Duration : November 2013 to present

About the cluster
The Pune forging cluster accounts for about 20–25% of the total national production of forged components. The annual energy consumption of the MSMEs in the cluster exceeds 24,000 tonnes of oil equivalent (toe). About 80%–90% of the energy is used for heating. As reported earlier, TERI studied the energy profile of the Pune forging cluster under the GEF-World Bank project titled ‘Financing energy efficiency at MSMEs’ being co-implemented by SIDBI and BEE. TERI also conducted detailed energy audits on a number of units, and identified specific Energy Conservation Measures (ECMs) that could be adopted by units in the cluster [see Sameeksha Newsletter 4(4), December 2013]. This case study summarizes how an MSME unit in the Pune forging cluster has benefitted by implementing some of the ECMs recommended by TERI.

About the intervention in the unit
S B Engineers is a forging unit established in 1993. It is engaged in the production of shafts, crankshafts, gears, and flanges, and has an installed annual production capacity of 3,600 tonnes. Steel bars constitute the main raw material. The steel bars are subjected to quality checks, and cut into billets of required lengths using bandsaw and shearing machines. The billets are heated up to about 1200 °C, and then hammered into the desired shapes using drop hammers. The products are trimmed and coined to remove excess material, and then hardened and tempered in heat treatment furnaces to yield the finished products. Furnaces fired by Natural Gas (NG) are used for forging and heat treatment; the unit also has an electrical induction furnace for billet heating. Electricity is used to drive pumps and motors, and for lighting.

In July 2012, TERI conducted a walk-through audit on the unit during which data was collected on the different process equipment and utilities used by the unit, along with details on the consumption of different energy forms and production data. At the unit’s request, TERI conducted a detailed energy audit in the unit in November 2013 to identify process areas with high energy consumption and also to identify options for energy saving. Based on its study, TERI prepared an Investment-Grade Detailed Project Report (IGDPR) covering a number of ECMs that could be adopted by the unit. The unit has since implemented a number of these ECMs. TERI helped in identifying technology providers/vendors for the ECMs; facilitated interactions between the unit and technology providers; finalized the specifications for the identified ECMs; and provided technical support to the unit during commissioning of the new/improved systems. The implemented ECMs and their benefits are summarized in the next section.

Investments, energy savings, and other benefits
Ceramic fibre insulation to reduce heat loss in forging furnace
The unit uses a NG fired forging furnace of capacity 200 kg per hour, associated with a 300-tonne press. The refractory lining of this furnace was found to be damaged. As a result, the surface of the furnace reached temperatures as high as 150–180 °C, resulting in heat losses estimated at over 24,000 kCal per hour. To cut down on surface heat losses, the furnace was re-lined with ceramic fibre at a cost of 1.85 lakh rupees. This measure has brought about an estimated annual energy saving of 11,633 SCM of NG, equivalent to an annual monetary saving of 4.88 lakh rupees. The simple payback period on this ECM is less than three months. Another benefit is that the reduced surface temperature makes it more comfortable to work near the furnace.

Veneering technology to reduce NG consumption in heat treatment furnace
The unit has three NG-fired heat treatment furnaces. As reported earlier [see Sameeksha Newsletter 4(2), March 2013], veneering technology was implemented in one of the furnaces (700 kg/hour capacity) to demonstrate
it as an economically attractive ECM. The unit has now implemented veneering technology in a second heat treatment furnace (300 kg/hour capacity). Veneering modules were applied to the existing refractory lining on the inside hot face of the furnace. The veneer reduces the levels of heat storage by the refractory, and thereby decreases heat losses during furnace operation. Conversely, the veneer enables the refractory bricks to retain heat during furnace shutdown, thereby reducing the heat and time required for the next start.

Earlier, the cold start-up time for the furnace after the weekly off was nearly two hours. With the application of veneering modules, the cold start-up time has been reduced by nearly 50 minutes. The annual energy saving is 12,581 SCM of NG, equivalent to a monetary saving of Rs 5.30 lakh against the cost of veneering at Rs 1.03 lakh. Besides the reduction in specific energy consumption (NG consumed per tonne of product), electricity too is being saved due to the reduction in operating hours of the furnace, and consequently, the electric motor used in the furnace blower. The simple payback period on this ECM is less than 3 months.

**Installation of appropriate capacitor banks in APFC panel to improve power factor**

The TERI study found that the average Power Factor (PF) of the unit was less than unity (0.97) in the previous year, indicating sub-optimal use of power being drawn from Maharashtra State Electricity Distribution Company Limited (MSEDCL). In order to improve the PF to unity, the unit installed additional capacitors of appropriate rating in the existing Automatic Power Factor Control (APFC) panel, at a cost of 32,000 rupees. This ECM has enabled the unit to avail the PF incentive of about 7% on energy charges provided by MSEDCL. With a monetary saving of Rs 4.95 lakh per year, the simple payback period is less than a month.

**Other ECMs in progress**

The unit is in the process of implementing a number of other ECMs recommended by TERI. These include

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**Benefits of ECMs**

<table>
<thead>
<tr>
<th>S. No</th>
<th>ECM</th>
<th>Annual Energy Savings (kWh)</th>
<th>Investment (Rs lakh)</th>
<th>Annual monetary savings (Rs lakh)</th>
<th>Simple payback (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ceramic fibre insulation to reduce heat loss in forging furnace-2 (200 kg/hr capacity)</td>
<td>0</td>
<td>11,633</td>
<td>1.85</td>
<td>4.88</td>
</tr>
<tr>
<td>2</td>
<td>Veneering technology to reduce NG consumption in heat treatment furnace-1 (300 kg/hr capacity)</td>
<td>194</td>
<td>12,581</td>
<td>1.03</td>
<td>5.30</td>
</tr>
<tr>
<td>3</td>
<td>Improvement of power factor to unity by installation of appropriate capacitor banks in the existing APFC panel</td>
<td>0</td>
<td>0</td>
<td>0.32</td>
<td>4.95</td>
</tr>
<tr>
<td>4</td>
<td>Replacement of existing old air compressors 2, 3 and 4 with single new energy efficient screw air compressor*</td>
<td>27,236</td>
<td>0</td>
<td>11.47</td>
<td>2.09</td>
</tr>
<tr>
<td>5</td>
<td>Replacement of existing lighting scheme with energy efficient lighting scheme*</td>
<td>7,217</td>
<td>0</td>
<td>1.66</td>
<td>0.55</td>
</tr>
</tbody>
</table>

*in progress
(1) replacement of three old air compressors by a single new energy efficient screw air compressor; and
(2) replacing the existing lighting system by an energy efficient lighting system. The table (Benefits of ECMs) summarizes the benefits that are being/will be derived from the implemented ECMs in terms of energy and monetary savings, and reduced CO₂ emissions.

**Key lessons**

The experience of the TERI team while working with S B Engineers—during the detailed energy audit as well as during implementation of the ECMs—clearly underlines the lesson that the key to successful implementation of an ECM lies in creating and strengthening understanding of how and why the ECM will bring benefits—not only at the level of the entrepreneur and/or top management, but also at the level of the operators and other factory floor personnel. Only through this understanding is the entrepreneur/management convinced to adopt the ECM and sustain it in the long term. Equally important, it is only through this understanding that operators and other factory floor personnel adopt proper operating practices so that the ECM yields the maximum benefits.

For instance, during the energy audit, the TERI team conducted a thermography profile of the heat treatment furnace-1 which revealed the high levels of heat loss from the surface, evidenced by spots at temperatures as high as 100–120 °C. The results were shared with the entrepreneur while explaining the proposed ECM (veneering technology), and helped him take a swift decision to adopt the ECM. Indeed, so impressed was the entrepreneur that, after the veneer modules were applied, he insisted on another thermography profile being conducted on the furnace. This was duly done—revealing, to the entrepreneur’s satisfaction, that the earlier ‘hot spots’ on the surface’ had now dropped to 70–80 °C!

At the factory floor level, the TERI team made the plant staff aware of how they could achieve considerable fuel savings just by improving their operating practices—for instance, by maintaining the proper air–fuel NG ratio at the furnace burners. Earlier, the operators would increase the gas flow without adjusting airflow, and often increased flame length for faster heating. Now, they have learned how to optimize the air–fuel mixture (and thereby save NG) through observation of the flame colour and flame length.

**Contact details for further information**

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Compiled by TERI based upon the ongoing activities being undertaken by TERI under the WB-GEF-SIDBI project ‘Financing Energy Efficiency at MSMEs’
The 8th Coordination Committee Meeting of SAMEEEKSHA was held at TERI, New Delhi on May 23, 2014. The meeting was chaired by Dr Ajay Mathur, Director General, BEE and attended by SAMEEEKSHA members. The discussions focused on three key areas: (1) the need for members to share case studies and standardizing the existing templates; (2) the findings of an SDC-sponsored study by E&Y on upscaling energy efficiency in the MSME sector; and (3) GIZ’ work related to financing of energy efficiency in MSMEs. The important points that emerged from the presentations and discussions are summarized below.

- Members’ websites should provide links to the SAMEEEKSHA website.
- A section to describe the challenges/barriers faced by the unit(s) in adopting energy efficiency has been added to the existing case study templates which would interest MSME entrepreneur.
- Data on the following initiatives will be provided by the concerned members to the SAMEEEKSHA secretariat for hosting on the website:
  - FMC—energy data collected on six foundry clusters under an EU project.
  - FICCI/SIDBI—market demand for EETs in five energy-intensive MSME clusters, from SIDBI-World Bank–GEF project.
  - YES Bank—various financial products and services for MSMEs.
  - UNIDO—(i) energy data collected from the 12 clusters covered under the UNIDO–GEF SME Project; (ii) new GEF-funded project being administered with co-financing from Ministry of MSME, titled ‘India Cleantech Program’; (iii) details on some of the programs from the third phase of the Automotive Industry Cluster Development Program.
  - NPC—(i) project to improve energy efficiency in six steel re-rolling clusters; (ii) compilation of case studies on lean manufacturing initiatives undertaken in 100 SME clusters.
  - SBI—a new term loan product for EE projects.
  - DC-MSME—unit-level energy data gathered in the Chennai engineering cluster.

- E&Y identified the following major barriers to upscaling of EETs in MSMEs, categorizing them at four broad levels:
  - **Policy and regulatory**: Lack of holistic EE policy for SMEs; information gap on energy consumption; lack of innovative policies and information systems; overlap of government programs; lack of strong industry associations.
  - **Technology**: Lack of innovation; ignoring of new upcoming clusters; and low replication rates of successful technologies.
  - **Finance**: Inherent perception towards the sector; lack of more innovative financing schemes.
  - **Capacity building**: Training programs are often generic, lacking in quality, with content that is outdated and not related to ground realities; under-utilization of academic institutions and MSME tool rooms.

- Under GIZ’ MSME Umbrella Programme, the following initiatives have been undertaken:
  - Bankers’ training programs for over 2000 bankers, conducted by D&B in 50 selected MSME clusters in partnership with SBI and SIDBI (the summary report is available on the SAMEEEKSHA website).
  - Study of international best practices by Frankfurt School of Finance.
  - Identifying and selecting 50 SMEs for bank finance in the pilot regions (Mandi Gobindgarh and Ludhiana) after conducting energy audits in these units.

- Under GIZ’ ‘Responsible Enterprise Finance’ program in three pilot clusters (Bhubaneswar, Ludhiana, and Agra); ‘matchmaking’ events were conducted to enable interactions for mutual benefit among key stakeholders.
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.

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.

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.

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