SAMEEEKSHA

SMALL AND MEDIUM ENTERPRISES: ENERGY EFFICIENCY KNOWLEDGE SHARING

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NEWSLETTER

A PLATFORM FOR PROMOTING ENERGY EFFICIENCY IN SMEs

In this issue...

Editorial

The MSME sector plays an important role in the Indian economy with a contribution of eight percent to the country's GDP, 45 percent to the manufacturing output and 40 percent to the exports. It also provides the largest share of employment after agriculture. In recent times, however, a decline has been observed in the contribution of the MSME sector. While various efforts are being taken by the government to improve its profitability and share, one of the ways MSMEs can help themselves is by improving energy efficiency and adopting renewable energy solutions that replace costly and polluting fuels like fuel oil, coal or diesel. Renewable energy technologies are increasingly playing an important role in meeting the growing energy demand of the MSME sector. Solar and biomass energy technologies are spearheading this revolution. Solar thermal technologies for drying and water heating, concentrated solar thermal technologies for medium temperature steam generation, and solar air heating systems are some of the commercially viable applications, particularly in the food processing industry.

Biomass gasifier based thermal heating systems, that can save conventional biomass used in micro and small units for making food products like namkeen, sweets and puffed rice, have become popular in recent times. Other prominent examples are the use of solar concentrating dish technologies in dairy and milk processing, and solar drying of food products. Biomethanation technologies, that can use waste from food processing industries for biogas production, are also suitable for food processing industries. Field studies under the recent ComSolar study carried out by GIZ indicate that in the food processing industry alone, the potential for replacing existing steam generation systems with solar thermal systems is 7-9%. Cost benefit analysis shows that installation of solar water heating systems for the preheating of boiler feed/ makeup water can give IRRs ranging from 39% to 51% with capital subsidy and 27% to 34% without capital subsidy. (http://www.comsolar.in/images/PDF/Food%20Processing.pdf). However, lack of awareness, lack of appetite for capital investment in new technologies, and resistance to adopt new technologies are some of the major barriers to the large scale use of renewable energy technologies in the food processing sector. This issue of the newsletter highlights a key segment of the food processing industry and also presents a case study on renewable energy application in this industry.

The MSME sector needs capacity building and awareness creation, supported by adaptation of renewable energy technologies to suit the process requirements. The Ministry of New and Renewable Energy (MNRE), Government of India and GEF–UNDP are implementing a subsidy cum support program on Industrial applications of Concentrated Solar Heat (CSH). The program provides technical and financial assistance to implement CST in industrial sector (http://www.cshindia.in/).

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MSME

CLUSTER PROFILE

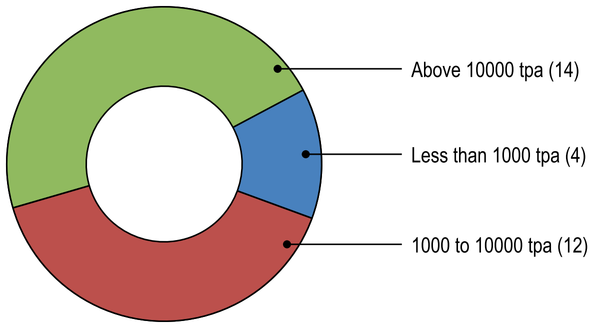
KOCHI SEAFOOD PROCESSING CLUSTER

Background

The seafood processing industry is a substantial contributor to India's exports earnings. According to the Marine Products Export Development Authority (MPEDA), a statutory body under the Ministry of Commerce and Industry, in the financial year 2013–14 India exported 0.98 million tonnes of marine products (primarily, seafood) valued at USD 5007 million (Rs 30213 crores). The principal markets for these products, in terms of USD values realized, were: South East Asia (26.38%); USA (25.68%); EU (20.24%); Japan (8.21%); China (5.85%) and the Middle East (5.45%). MPEDA envisages an exports target of USD 6 billion in 2014–15 for marine products

The state of Kerala has the largest number of seafood processing units in the country (about 80). An important cluster of seafood processing units is located around the port city of Kochi. The units are spread along the National Highway between Thoppumpady in Ernakulam District and Aroor in Alappuzha District. Kochi pioneered seafood exports from India in 1953, taking advantage of good catch throughout the year, availability of skilled labour, and access to Kochi port. Initially, units in the Kochi cluster focused on exporting canned shrimp. While shrimp continues to be the major product, accounting for about 45% of total earnings, the Kochi units have since diversified into processing other kinds of fish and cephalopods like squid, cuttlefish, octopus, crab, clams, mussels, etc.

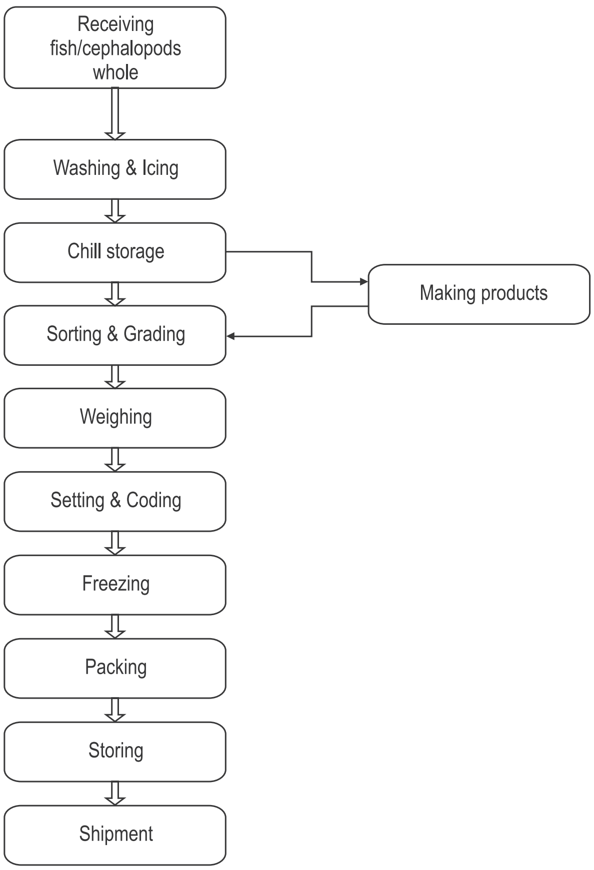
There are around 35 seafood processing units in the Kochi cluster, of which 30 units were selected for study under the BEE SME Program. All 30 units are registered as small-scale industries with the Government of Kerala, and are members of the Seafood Exporters Association of India (SEAI). Many of the units also have entrepreneurship memorandum numbers issued by the Department of MSME. The production capacities of the units range from 456 tonnes per annum (tpa) to 46500 tpa. Their daily operating capacities vary depending on the season and the nature and availability of fish being processed.



Categorization of Kochi seafood processing units by production capacity

Technology status and energy use

Seafood products are highly perishable. Hence, proper handling and preservation techniques are needed to ensure that the products have a long shelf life and retain the desired quality and nutritional value. The chart shows the process typically followed in a seafood processing unit. In all the 30 units surveyed, the pre-processing and



Process flow chart

Table 1. Types of freezers used by seafood processing units

No.	*Type of freezer*	*Main features*
1	Individual quick freezer	▪ Each product individually frozen in the chamber ▪ Reduced cycle time compared to conventional freezers ▪ Air temperature around −40° C ▪ High air speed over the product to enhance heat transfer
2	Blast freezer	▪ Blower forces chilled air over products for rapid cooling ▪ Movable trays for positioning products; assortment of freezing compartments ▪ Air temperature around −40° C ▪ High air speed over the product to enhance heat transfer
3	Plate freezer	▪ Stack of horizontal metal plates placed inside adjustable steel frame; the plates are cooled to sub-freezing temperatures by internally circulating refrigerants ▪ Packaged products are firmly pressed between the plates ▪ High rates of heat transfer obtained between product and plates ▪ Plate freezers are used to freeze flat products and brick-shaped packages..

cleaning of the feedstock is carried out outside the units and the operations within the unit start with the freezing of the pre-processed/cleaned feedstock.

Freezing is a key element of seafood processing, as low temperatures kill or slow down the growth of pathogens that would otherwise spoil the seafood. The freezer extracts heat from the seafood product, thereby lowering its temperature and converting its free moisture into ice. The freezing process has to be carried out sufficiently fast so that the degradation of the product is minimized; the rate of freezing keeps pace with the production schedule; and upon exit from the freezer, the average product temperature roughly matches the subsequent storage temperature. Seafood products may be preserved for several months by freezing. Table 1 summarizes the three main kinds of freezers used by the units. Other equipment used by the units include different kinds of compressors, condensers, cooling towers, ice making units, and the motors connected to these various systems.

Energy consumption pattern

Electricity is the primary source of energy for all the Kochi seafood processing units. The freezing process accounts for nearly 75% of the total electricity consumption in the cluster. The freezers used by the units are typically built on-site by local fabricators. They are generally operated without any automation or feedback control, which reduces energy efficiency. Because of the fear of rejection of products that do not meet core temperature specifications, most units deliberately over-freeze their products; this again translates to excessive energy consumption.

Seafood processing unit

Refrigeration system

The total annual electricity consumption in the cluster is about 30000 MWh, or 2574 tonnes of oil equivalent (toe). The specific energy consumption ranges from 0.032 toe/t to 0.072 toe/t.

Options for energy saving

Table 2 summarizes a number of energy conservation measures (ECMs) that could be adopted by the units in the Kochi cluster. As most of the units follow similar processes, there is good scope for replication of these ECMs if they are initially taken up in one or two units.

Table 2. Key energy conservation options in Kochi seafood processing cluster

No.	*Existing process/ technology*	*ECM*	*Energy saving potential*
1	Ice making process	Install thermal storage system for ice making process	High
2	Compressor	Replace reciprocating compressor with screw compressor	High
3	Centrifugal pumps	Use of VFD for centrifugal pumps	Medium
4	Condenser/ heat exchanger	Replace shell & tube condensers/ plate heat exchangers and cooling towers with evaporative condensers	Medium
5	Refrigeration system	Replace vapour compression refrigeration with vapour absorption machine (VAM) operated with LNG or biomass fuels	High
6	Compressor motor	Replacement of V-belt drive with flat belts	Low
7	Insulation	Maintenance and replacement of damaged insulation	Medium
8	Thermocol insulated door	Replace with PUF insulation	Low
9	Lighting feeder	Install servo stabilizer	Low
10	Under- loaded motors	Install automatic star delta star starter	Low

Compiled by TERI from (i) 'Manual on energy conservation opportunities in seafood processing industries, Kochi' under the BEE-SME Programme, 2010; (ii) 'Benchmarking and mapping Indian MSMEs energy consumption': a BEE–AfD–TERI study, 2012

AWARENESS WORKSHOP ON JAPANESE EE TECHNOLOGIES AND BEST PRACTICES

TERI and Institute for Global Environmental Strategies (IGES), Japan are collaborating to enhance the awareness of Indian stakeholders on Japanese low carbon technologies (LCTs); Joint Crediting Mechanism (JCM) scheme; and Measurement, Reporting and Verification (MRV) methodologies. An awareness workshop on 'Energy Efficient Japanese Technologies and Best Practices' was organized in Bangalore on 25th September 2014. The event was attended by about 50 participants comprising technical experts from Japan, metal casting entrepreneurs, and representatives of industry associations and government agencies. Information was shared with the participants on Japanese LCTs related to the metal casting sector. Representatives of a new foundry park coming up in Hospet, near Bangalore, evinced interest in adopting these technologies. An overview of the Shimoga foundry cluster, which has 45 foundries and produces about 65000 tonnes of castings annually, was provided by representatives from the cluster.

Experts from IGES highlighted the following:

- 'Achievements of the JICA–JST ALCT project', presented by Dr Rabhi Abdessalem.
- 'Energy saving measures in castings', presented by Mr Junichi Takeuchi. He emphasized the importance of Kaizen activities in saving substantial amounts of energy as well as reducing rejections and improving yield in Japanese foundry units. The need was perceived to collect reliable energy consumption data at the unit and cluster levels.

- 'Energy saving operation in foundry', presented by Mr Kenji Shiotani. A case study was shown of a Japanese foundry unit, highlighting various energy efficient best practices such as differential metal tapping, better matching of melting with moulding operation, marking of the grade on the runners and risers, full power operation, and so on.

The details of the event including the presentations are available in the 'Events' section of the SAMEEEKSHA website.

Energy Conservation through Solar Tunnel Drying System for large-scale drying of agro-products

Location: Udaipur and Pali Districts, Rajasthan

Partners: PCRA; College of Dairy and Food Science Technology, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan

Duration: 12 months

Backdrop

Open sun drying has traditionally been practised across the country for drying agricultural produce such as food grains, fruits, vegetables, spices etc. Open sun drying of materials is also practised by agro industries like rice mills, pulse mills and small flour mills, and by cottage industries engaged in making potato/banana chips, papad, grinding spices, etc. Although there are no energy costs for open sun drying, it has a number of disadvantages. Open sun drying is highly labor intensive, time consuming and requires a large area. Materials may spoil because of exposure to wind, moisture, and dust; materials are also at risk to foraging birds and animals, insect infestations and fungus growth. A few agro industries, particularly those dealing in food products, have adopted mechanized drying systems that substantially reduce the drying time and retain product quality and purity. However, in such cases the investments on the drying equipment, and hence the costs of drying, are very high. In general, the cost of drying using commercial sources of energy is twice to four times that of open sun drying.

An improved method of sun drying is the solar tunnel dryer (STD). It offers the virtually nil-energy-cost advantages of open sun drying, and at the same time protects the materials being dried from the effects of exposure to adverse weather conditions and attacks by microbes, insects and animals.

Intervention

In 2008-09, Petroleum Conservation Research Association (PCRA), in association with College of Dairy and Food Science Technology, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, implemented a project titled 'Energy Conservation through Solar Tunnel Drying System for Large-Scale Drying', aimed at promoting the adoption of STDs by farms and other agro-based enterprises in Rajasthan. The project focused on identifying organized farms and agro industries that were willing to installed STDs on cost-sharing basis for large-scale drying of their products; for, this would reduce the burden of capital cost of the STD system on each user and encourage its adoption. The project provided all the required technical specifications free of cost.

Technology

The STD system operates on the principle of the solar green house, popularly called poly house. The STD consists of a hemi-cylindrical metallic frame structure covered with UV-stabilized semi-transparent polythene sheet of 200 micron thickness. The floor of the tunnel, as well as the trays that hold the agricultural produce to be dried, are normally painted black to absorb the sunlight entering into the tunnel. The floor and materials inside the tunnel dryer absorb the incident solar energy and emit long wave thermal radiation, which is reflected by the polythene sheet cover and hence retained inside the tunnel. The trapped thermal energy raises the temperature of the air inside the tunnel and accelerates evaporation of moisture from the materials placed in the trays within. The moist air is removed through natural convection current. The micro-climate inside the tunnel may be controlled by using exhaust fan(s) to regulate the air flow rate through the dryer.

Investments, savings and other benefits

Till now, a total of 10 natural convection STD systems of different sizes have been installed and commissioned by agro-based enterprises in Rajasthan (table 1). These systems are being used for the bulk drying of fruits, vegetables, spices, surgical cotton, rose petals and other agro-industrial products. The batch size varies from a few hundred kilograms to over a tonne.

The investment per unit mass of dried product for the 'walk-in' type of STD is far lower than that for commercially available forced flow type solar dryers. Typically, the construction cost of an STD of floor dimensions 18 m × 3.75 m, capable of drying one tonne of agriculture produce, is about Rs 225,000. The STD system greatly reduces the cost of drying (in some cases, by more than 50%) when compared to drying methods

Table 1. Location of STD systems installed under the project		
S. No	*Installed at*	*Drying applications*
1	Aaditya Agro Biotech, Nimaj, Pali District, Rajasthan	*Churan*, spices and medicinal plants
2	Balsahyogni Santhan, Village Baghpura , Block Jhadole, Udaipur	Forest products at village level; adopted through self help group (SHG)
3	Sunrise Agro Industries, A-112 , Road No. 1, I.P.I.A., Kota	Garlic flakes, *Aonla* powder and tomato powder
4	Nakoda Farm, Gudli, Udaipur	*Aonla* and other agriculture products
5	Cellulose Waste Recycling Education Project, Ramgiri, Udaipur	Handmade papers
6	SHG constituted through Forest Department, Udaipur, at village Gayaripatha , Jhadole Block	Local forest produce
7	Janouthan Samiti, village Baghpura , Jhadole, Udaipur	*Aonla* and other fruits
8	Chaudhary Biotech, Kothputli, Jaipur	*Aonla* and other vegetables
9	M/s Shri Amar Singh and Sons, Agricultural & Horticulture Farm, Rajgarh, Kota District	Agricultural products
10	Sun Foods, Aravali Dairy Farm, RIICO, Gudli, Udaipur	Vegetables and other agricultural products

based on electricity or fossil fuels. Thus, adoption of the STD systems has also helped prevent the emission of greenhouse gases.

The project tested the performance of an STD system installed at Shri Amar Singh and Sons, Agricultural & Horticulture Farm. This system has been installed for drying 500 kg agriculture and horticulture products in a batch. Data was gathered for both no load and full load during winter and summer seasons. The average temperature inside the tunnel was found to be 18–20°C higher than the ambient temperature. In a single solar day, the moisture content of the produce (*aonla*) was reduced from 80% to around 9%. Figures 1 and 2 depict the STD system's performance.

STD system

Inside the tunnel - STD system at Chaudhary Biotech, Kothputli, Jaipur

Contributed by PCRA

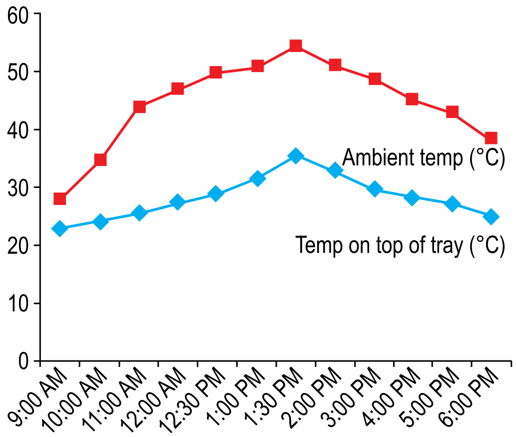


Figure 1. Temperature variation inside STD system under no load testing on a summer day

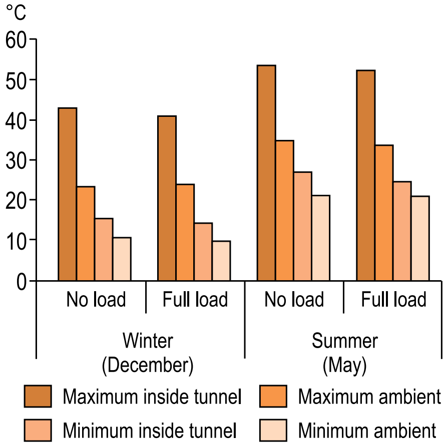


Figure 2. Average seasonal temperatures inside STD system

TRAINING PROGRAMS ON ENERGY EFFICIENCY IMPROVEMENTS IN FOUNDRIES

India is the second largest producer of metal castings in the world, with over 5,000 foundries producing nine million tonnes of castings annually. The foundry industry is one of the most energy intensive MSME sub-sectors in India. There are about 20 prominent foundry clusters that offer considerable potential for energy savings and CO_2 reductions through the adoption of relatively simple and low-cost energy efficiency measures.

In this context, TERI with support from BEE organized four training programs on 'Energy efficiency improvements in foundries' during June–August 2014 in four major foundry clusters— Coimbatore (Tamil Nadu), Belgaum (Karnataka), Indore (Madhya Pradesh) and Kolhapur (Maharashtra). The training programs were organized under the ongoing World Bank–GEF project titled 'Financing Energy Efficiency at MSMEs', and received an overwhelming response, particularly from the local foundry units in each cluster. In all, about 170 participants from foundry units (including 120 energy professionals), along with representatives from MoMSME, BEE, UNIDO, and cluster level industry associations, attended the training programs.

The training programs focused on capacity building of foundry sector energy professionals on key technical aspects such as energy auditing methodology; performance evaluation of major energy consuming areas in a foundry industry—namely, the electrical and thermal systems, and the melting furnaces; and technology options including better operating practices for energy conservation in metal casting units. The melting furnace sessions covered both electrical induction furnaces and cupola furnaces. Actual case-studies were presented on each of these focus areas to

provide the participants with in-depth knowledge. In each program, the extensive classroom sessions were followed by a half-day visit to a leading metal casting unit in the cluster.

Recognizing the importance of strengthening the ability of MSMEs to access finance for adopting energy efficient technologies (EETs), the training programs also focused on building the capacities of energy professionals on important financial aspects such as developing a good bankable DPR, and providing information on various financial incentives and subsidies offered by MoMSME and banks to adopt EETs. A generic template for developing investment grade DPR (IGDPR) was provided to the participants. Additionally, the necessary monitoring and verification (M&V) protocols for EET projects were also highlighted.

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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