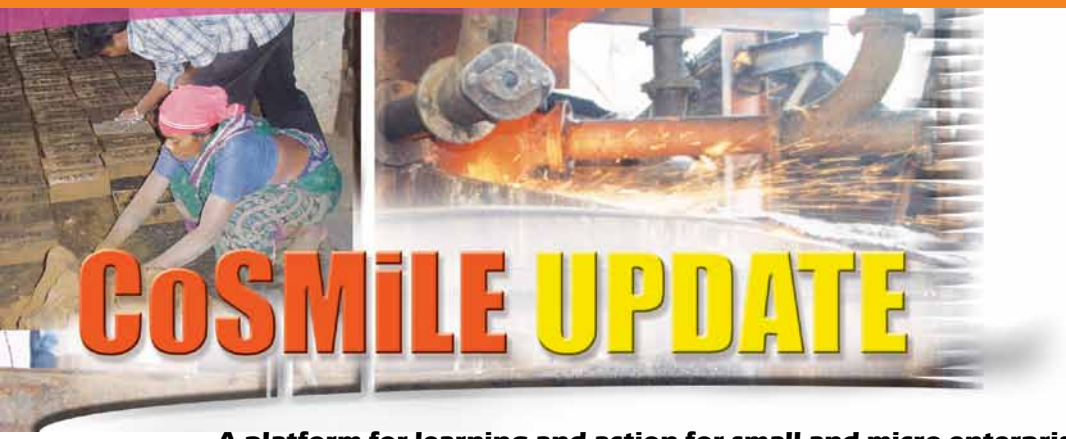

CoSMiLE UPDATE

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A platform for learning and action for small and micro enterprises

Editorial

India annually produces about 600 million tonnes of a variety of biomass resources, which is comparable with coal production in the country. Biomass is primarily used for domestic cooking and for heating applications in the MSME sector. However, unlike coal, the conversion efficiency with biomass is still quite low, at about 10%. The result is a huge wastage of an important natural resource. Also, biomass combustion in traditional devices produces smoke, carbon monoxide, and other health-damaging emissions which create an unhygienic and polluted atmosphere in workplaces.

Gasification technology offers great potential for utilization of available biomass resources more efficiently and in a clean manner. TERI has developed biomass gasifier-based systems for both thermal and power generation applications. Thermal gasifier systems designed and developed by TERI have successfully been adopted by many MSMEs for applications such as silk reeling, textile dyeing, food processing (sweets and namkeen units), non-ferrous melting furnaces, chemical processing, and institutional cooking. TERI has also developed small biomass gasifier-based power systems for rural applications, the aim being to provide access to modern energy sources like electricity by harnessing locally available biomass resources. TERI has commissioned biomass-based rural electrification projects in the states of Orissa, Chhattisgarh, Madhya Pradesh and Rajasthan under the Village Energy Security Program (VESP) as well as in association with NTPC Ltd. The key learning from these experiences is to reduce the system downtime, improve its reliability, ensure sustainable biomass supply, and link electricity use to livelihoods and other development needs of the rural areas.

Under the Rajiv Gandhi Grameen Vidyutikaran Yojana, the Ministry of Power is propagating distributed power generation including that based on other renewable energy sources. Biomass gasifier-based power systems can provide grid-quality power supply on demand in a cost-effective fashion.

Thus, gasification technology has the potential to provide solutions for decentralized energy needs in two main forms: (1) gasifier-based power plants for meeting rural energy, captive and tail end grid applications on a more sustainable basis; and (2) gasifier-based systems for heat applications in MSMEs. The key challenge is to mainstream the technology. In this regard there is a need for further technology development in terms of fuel flexibility (both in type and quality), improving environmental performance in terms of water use and waste disposal, and developing controls and automation. Efforts to address these aspects have already been initiated, and will continue under the new phase of the TERI-SDC partnership. In particular, the focus will be on studying the current biomass resources flow in selected areas, and on putting in place models for dissemination of biomass gasifier-based clean energy solutions among targeted end-users.

Sunil Dhingra
Senior Fellow and Internal Resource Advisor, TERI

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Two-stage gasifier system for power generation

TERI has been working for over two decades in developing and demonstrating biomass-based gasifiers for thermal as well as power applications. Around 30 TERI-designed power gasifiers have been installed within and outside India, adding in all 400 kW_e of power generation. However, the tar content in the gas continues to remain a major challenge related to power gasifier systems. Deposition of tar in the cleaning and cooling system affects the performance of the engine and even increases the downtime of the system. Higher tar contamination of the gas also demands more frequent maintenance of the systems. Hence, conventional gasifier systems have large and elaborate gas cleaning/cooling systems which include coolers, heat exchangers and scrubbers to reduce the tar content in the raw gas to around 350 mg/Nm^3.

TERI has focused its R&D efforts on finding ways to further reduce the tar content and the dust in the gas in power gasifier systems. In technical collaboration with Denmark Technical University (DTU) and Sorane SA, TERI has successfully developed a two-stage gasifier technology that reduces the tar content of the gas to almost negligible levels. The two-stage gasifier technology is based on the concept of thermal cracking of tar during the gasification process itself. Unlike in conventional gasifiers, the reactor is divided into two parts, separating the pyrolysis zone from the oxidation and reduction zones. The high temperature maintained during the process holds the key for reducing the tar content considerably. The reactor concept has been developed by the DTU team, and the cleaning/cooling systems and relevant integration have been developed by TERI team. The system has been validated and run for long-duration tests on a prototype scale of 10 kW_e capacity. The size of wood chips being used in the gasifier system has been optimized for the feeding system. The key features of the two-stage gasifier system include:

- Very low tar content (of the order of 40 mg/Nm^3)
- Low specific fuel consumption
- No waste water generation in cleaning and cooling system
- Higher calorific value of producer gas
- Simplified and compact cleaning and cooling system
- Higher gas yield

Two-stage gasifier system

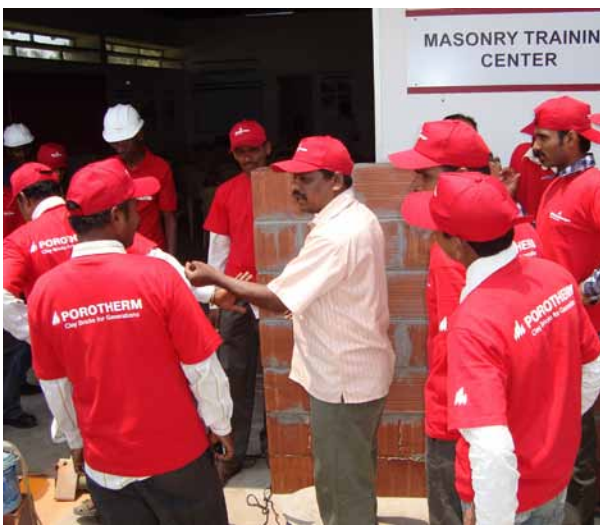
The TERI team gathered considerable hands-on experience while running the system under field conditions for more than 100 hours, with almost 75 hours of stable engine running. The system output ranged between 9–10 kW_e. An up-scaled system of 20 kWe capacity is now under construction; it integrates a waste heat recovery system that will extract heat from hot raw gas and use it to preheat the air entering into the reactor, as well as preheat the pyrolysis zone partially or completely. Heat from the exhaust gas of the engine will also be recovered and used to preheat the pyrolysis zone, and to generate steam at high temperatures. Trial runs will be conducted on this integrated system, and a design package for the system will be handed over to NTPC Ltd, Badarpur. Based on the package, NTPC will build a prototype for validation of the system under different conditions. Finally, the field-tested 20 kW_e system will be replicated in four different locations in India.

Masons trained in using REBs for building construction

In order to promote and support the uptake of energy efficient and environment-friendly construction products like resource

Classroom session

efficient bricks (REBs), efforts to introduce REB technologies among brick making entrepreneurs (on the 'supply' side) must be accompanied by capacity building of masons and other construction workers in the use of REBs (on the 'demand' side). In line with this approach, TERI organized a training programme for 18 masons and building contractors on '*Improved construction practices using clay-fired REBs (perforated bricks)*' on 13 April 2011 in association with leading REB manufacturer, Weinerberger Limited, Bengaluru. The training programme was conducted at the Masonry Training Centre in Wienerberger's plant located in Kunigal, Bengaluru, Karnataka.



Practical session

The first session of the training programme focused on theoretical aspects of building construction using REBs. In the second session, the participants obtained practical experience in using REBs in construction. The programme emphasized important aspects of building construction like proper mortar preparation, use of different tools for masonry work, and optimum use of raw materials. It also covered key areas of proper workmanship such as on-site cutting of blocks, plastering, mortar application, fixing of doors and windows, making allowance for conduits for different services and loads (TV cables, geysers, wall fixtures like mirrors, etc.) and so on. The participants were also briefed on the advantages of using REBs for building construction, including:

- *Savings in mortar*—REBs are of uniform size and shape with levelled surfaces
- *Savings in steel, concrete and labour*—REBs are lightweight compared to cement blocks and therefore have less dead load
- *Reductions in energy costs*—REBs have better thermal insulation properties, and so reduce energy costs for cooling/heating the building

The training sessions were followed by a group discussion in which the participants shared their learning experiences and skills acquired in using REBs. Mr Monnanda Appaiah, Managing Director, Wienerberger

Certificate distribution

India distributed certificates to all the participants.

Training on best operating practices for DBC operators in Coimbatore

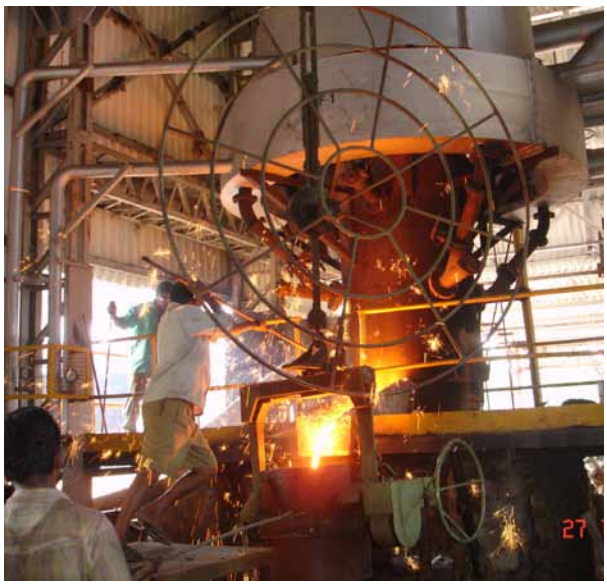
A total of eight energy efficient divided blast cupolas (DBCs) have been installed in foundry units in the Coimbatore and Chennai clusters through local service providers (LSPs) trained by TERI for this purpose. Also, a number of other foundry entrepreneurs have expressed interest in adopting TERI-designed DBCs on completion of their existing cupola campaigns.

In order to extract the maximum benefits from the improved melting technology provided by the DBC, it is necessary for the cupola operators and other factory personnel to be aware of and to deploy best practices in cupola operation, monitoring, maintenance and related areas. TERI therefore arranged an on-site training programme on best operating practices for cupola operators, supervisors and other shop floor personnel directly involved in day-to-day cupola operation among the foundry units that have adopted the DBC.

The training took place during 25–27 April 2011 at the following foundry units in Coimbatore: (1) CRI Pumps (P) Ltd; (2) Veesa Nirmal (a sister concern of Nirmal Pumps (P) Ltd); (3) Amma Alloy India (P) Ltd; (4) Eltex Super Castings Ltd; and (5) Aquasub Engineering. The training sessions were conducted in association with Saravana Engineers, the LSP involved in promoting the TERI-designed DBC among the foundry clusters in southern India. At each site, the training involved demonstration of proper operating practices and hands-on sessions for the factory personnel focusing on the following aspects:

- Moulding and refractory lining
- Best operating practices, safety measures and trouble-shooting
- Melting
- Recording and performance analysis

A total of 41 cupola operators, supervisors and other workers attended the programme.



DBC at Aquasub Engineering

Training programme at Amma Alloys

Interaction with supervisors

In the course of the training sessions, the TERI team observed a number of process areas in which improvements were required in the existing equipment and/or operating methodology, and suggested appropriate solutions to improve process efficiency and increase worker safety.

TERI also visited Blue Mount Castings (P) Ltd, a foundry unit that is presently operating an electrical induction furnace. Its proprietor is keen on adopting the coke-fired TERI-designed DBC, and is awaiting clearance from the Tamil Nadu Pollution Control Board.

Coordination Committee meeting on SAMEEEKSHA

The 4th Coordination Committee Meeting on SAMEEEKSHA, the knowledge-sharing platform for MSME sector stakeholders, was held in TERI on 6 May 2011. The meeting was chaired by Dr Ajay Mathur, Director General, BEE. The other participants included representatives from BEE, SDC, PCRA, SBI, SIDBI, CII, JICA, DFID, GTZ/IGEN, KfW and other specialized agencies. The discussions focused on identifying measures to enhance the effectiveness of SAMEEEKSHA in terms of:

- adding depth and value to the knowledge resources hosted on its website; for instance, by developing and hosting lists of local service providers (LSPs) and vendors in different MSME clusters
- designing the website to make it user-friendly, with easily navigable links to other relevant websites
- Generating wider awareness about SAMEEEKSHA and involving industry stakeholders to a greater degree in its activities

The SAMEEEKSHA website will formally be launched during the MSME summit that is proposed to be held in November 2011 with the support of BEE and Ministry of MSME.

Malur meet: improving the efficiency of brick-making units

On 18 March 2011, TERI's Southern Regional Centre (TERI-SRC) in association with the Indian Ceramic Society, Bengaluru Chapter organized a meet to discuss '*Options on modernization of clay brick/hollow block manufacturing technology*' under the UNDP-supported project for promoting energy efficiency improvements in the Indian brick industry. The event was held at Malur, a leading brick-making cluster in Karnataka (about 40 km from Bengaluru). About 50 progressive brick entrepreneurs from Malur participated in the deliberations.

Brick entrepreneurs at the meeting

The discussions were anchored by SABO SA, a Greek company engaged in the manufacture of machinery and turnkey plants for the brick and tile industry for over two decades. Prior to the meet, the SABO representatives were taken to two brick units—Raghavendra Bricks, Malur (hand-moulded bricks) and Venkateshwara Bricks and Tiles, Hongenahally (wire-cut bricks) — to enable them to assess the potential and identify suitable options for improving the technologies currently used by brick-making units in Malur. Based on observations from their field visits, Mr George Okuras and Mr Haris of SABO S.A elaborated on how the brick-making units of Malur region could be modernized by semi-automatic and automatic processes, using a variety of sophisticated machinery and handling equipment that would enhance productivity and quality as well as reduce manpower.

Mr Haris explaining a point on drying of bricks

A lively debate took place among the participants, following which SABO suggested that as a first step towards improving efficiency, the following changes could be adopted by the local brick entrepreneurs.

- Replace the present extruder by a heavy duty one to reduce the moisture level of the extruded bricks from 23% to 18%. This would greatly assist in handling and drying of green bricks as well as improve the quality of fired bricks.
- Use a forklift truck to transfer the green bricks to the drying shed and arrange them on racks (instead of transporting them by hand-cart and arranging them manually on the floor as presently practised). This measure would reduce: (i) drying cycle time; (ii) handling losses; (iii) manpower requirements for these tasks; (d) space in the drying shed.
- Provide a conveyor belt for transferring the dried bricks from the drying shed to the kiln (instead of manually transferring the bricks using hand-carts).

The SABO representatives will provide detailed estimates on the different kinds of equipment required to suit the needs of brick units in the Malur region.

Biomass-based power gasifier for agro enterprises

The Central Institute of Agricultural Engineering (CIAE), Bhopal is engaged in a project titled '*Value chain on biomass based decentralized power generation for agro enterprises*' in India. The objectives of this project are:

- Standardization of technology package for collection, densification, transportation and storage of agro residues at utilization centre
- Standardization of technology package for feedstock preparation for biomass gasification
- Development and adoption of efficient biomass gasification system for power generation
- Integration of biomass-based power generation system with agro enterprises

Under the project, CIAE is providing support to TERI for the establishment of two 50 kW_e biomass gasifier-based power generation systems at Maana village, about 50 kilometers from Bhopal. The systems will be tested for their performance using the loose agro residues converted into briquettes along with woody biomass available locally. The briquettes will be used in different ratios with woody biomass to optimize the system design, and to arrive at a specific briquette–woody biomass combination which yields optimal system performance and allows trouble-free operation.

View of gas dehumidification unit

Panoramic view of gasifier system

The power generated will be utilized to run a water pumping station that is situated next to the power plant. The surplus power generated will be used to run the briquetting plant, making it self-sustainable. Once the gasifier system is optimized and trial runs successfully conducted, it will be replicated under actual field conditions in a number of rural locations across India. The aim is to establish a proven model that addresses the needs of the entire value chain related to biomass-based power generation for various applications in rural areas across the country: namely, collection of biomass; processing/briquetting of biomass; and stand-alone gasifier-based power generation.

Corrigendum

In Volume **6** (1) March 2011 in paragraph 1 on page 3, the text reading "energy savings of around 140,000 mtoe" should be read as "energy savings of around 140,000 toe".
The error is regretted.

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