



VOLUME 2
ISSUE 3
September 2007

A platform for learning and action for small and micro enterprises

Editorial

Availability of reliable and quality electricity is one of the major challenges in furthering the growth and development of India. The Integrated Energy Policy of the Planning Commission envisions energy security for the country and its citizens by stating that energy services should be safe, reliable, techno-economically viable, and sustainable considering different forms and fuels of energy, conventional as well as new and alternative sources. This is a Herculean task, considering the challenges that the electricity sector faces in the form of current and planned generation capacities on one hand and high T&D (transmission and distribution) losses on the other. Distributed generation, defined as small modular power generating technologies that can be combined with energy management and storage systems and used to improve the operations of the electricity delivery systems at or near the end user, may perhaps provide the answer to this challenge. A distributed generation system can employ a range of technological options from renewable to non-renewable, and can operate either in the grid connected or off-grid mode. The size of a distributed generation system typically ranges from less than a kilowatt to a few megawatts.

The Working Group on Power for the Eleventh Five-year Plan has estimated a potential of 10 000 to 15 000 MW (megawatt) capacity additions through the distributed generation mode in the Eleventh and Twelfth Five-year Plans. Distributed generation would be relevant for India to cover 100% village and household electrification, to meet peak load shortages, and to supply quality power at economical rate to the 'last mile' consumer. Distributed generation based on renewable energy resources could also be a GHG (greenhouse gas) mitigation option, while simultaneously facilitating socio-economic well-being, and local and regional environmental sustainability.

Through the efforts of MNRE (Ministry of New and Renewable Energy), renewable energy technologies are widely demonstrated in a variety of applications. However, distributed generation is yet to be tried on a large scale in India. There are many challenges and barriers that need to be addressed in order to promote this concept. Some of these are – grid connectivity and interfacing; reliability of operation and field performance; funding and financing mechanism including institutional arrangements for built, own, operate; capacity building; and regulatory requirements, quality and safety mechanisms.

The establishment of the Centre for Distributed Generation as a part of Energy-Environment Technology Division in TERI is a timely initiative in view of the opportunities that this sector offers for innovations in research and implementation. Our immediate focus is to develop and standardize technology packages for a variety of applications, innovate and institutionalize sustainable implementation models, and enhance capacities at all levels.

Akanksha Chaurey

Associate Director, Centre for Distributed Generation, TERI

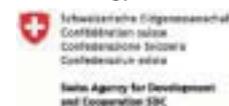
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The Energy and Resources Institute



Biomass gasifier stove for cleaner cooking

At present, millions of traditional stoves are being used in the country. These stoves are characterized by very low thermal efficiencies and exhibit high pollution levels (smoke and other toxic emissions), mainly due to incomplete combustion of the biomass fuel. To address this issue, TERI considered developing a biomass gasifier stove under the CoSMiLE project for providing a user-friendly system having higher efficiency.

The biomass stove uses the concept of gasification. This concept is generally used for large-scale applications such as industrial-process heating and power generation because a gasifier system is complex when compared to the simple clay-made chula (stove). However, TERI has now developed a simple, inverted downdraft version of a gasifier-based stove integrated with a burner. The stove is expected to cater to the needs of domestic cooking, as well as to find use in applications such as community cooking (for example, in preparing mid-day meals for schools). TERI is making efforts to establish and promote active public-private partnership to facilitate wide-scale adoption of the biomass-gasifier stove.

Features of the TERI-designed biomass gasifier stove

The biomass gasifier stove has been designed with various user-friendly operational features. This has been achieved through constant interaction with the end-users to obtain their feedback and incorporate their suggestions into the stove design. The water-boiling test on the stove showed an efficiency of 44%; in comparison, traditional stoves have an efficiency of 10%–15%. The special features of the TERI-designed stove include the following.

- Easy start-up
- Complete combustion, leading to near-smokeless burning and comfortable working conditions
- Flame regulator, to vary the input power as per requirement



Biomass gasifier stove

- Uninterrupted operation, through the provision of a low-wattage fan along with power backup
- Faster cooking, comparable with LPG (liquefied petroleum gas) stoves
- Ability to operate with a variety of fuels such as wood chips, nut shells, briquettes, and pellets
- Stainless steel body to ensure long life.

To add to these positive features of the stove, TERI is presently working on improvement of the flame regulator for 'smooth control' of the fan. TERI is also working on optimization of material specifications and sizing, and of stove design parameters, to reduce the overall cost of the stove and thereby encourage its adoption on a large scale.

District-level award for SHG — owned VSBK—Thogur project

The VSBK (vertical shaft brick kiln)—Thogur commissioned with support from TERI under the CoSMiLE project has bagged the Manimekalai Award, given by the Tamil Nadu government to the best performing SHGs (self-help groups) and the PLFs (Panchayat-level federations) for SHGs. A cash award of 50 000 rupees was given by the Minister for Local Administration, Mr M K Stalin to the 11 women SHGs who have set up the VSBK-Thogur, at a function organized at Thanjavur on 27 September 2007.

These SHGs, comprising of 200 women members, was formed and motivated by Thanjai Janaseva Bhawan, an NGO (non-governmental organization) working for the empowerment of women. TERI provided the technical assistance in VSBK construction and extended support for the operation of the kiln. The DRDA (District Rural Development Agency), Thanjavur provided grants and SBI (State Bank of India), Thanjavur extended a loan to the SHGs for the project. STED (Science Technology Entrepreneurship Development), Thanjavur was entrusted with the task of coordinating the work of different agencies during project implementation. The salient features of VSBK-Thogur include semi-mechanization – a soft mud-moulding machine for green brick moulding, and the use of an electricity-operated winch for lifting dry bricks to the loading platform.

Visit to Bogra foundry cluster, Bangladesh

In 2006, Bangladesh foundry association contacted TERI for providing assistance in disseminating the energy-efficient DBC (divided blast cupola) among foundry units in Bangladesh. At their request, a TERI professional visited Bangladesh between 10–12 June 2007 to assess the status of the Bangladesh foundry sector and the potential for DBC adoption.

The majority of the foundry units in Bangladesh are located in and around Bogra, an industrial town, about 100 km north of Dhaka. A meeting with



Field visit to a Bogra foundry

foundry owners was organized at Bogra on 11 June 2007. Bogra has about 30 small-scale foundry units and the FOAB (Foundry Owners Association of Bangladesh) is also based there. During the interactive session, TERI provided inputs on the benefits of the DBC and best operating practices related to improvement of cupola efficiency. TERI also undertook a field visit to representative Bogra foundry units and observed similarities in cupola design and moulding practices compared with foundry units in Howrah. Most of the Bogra foundries use relatively large cupolas (internal diameter of 30 inches or more). The metallic charge usually consists entirely of scrap metal and foundry returns; pig iron is rarely used. Pollution control does not seem to be an important issue. Most of the foundries produce small-sized castings used in machine tools, agricultural implements, and automobiles.

Deliberations with the entrepreneurs and the field visit indicated significant energy saving potential by upgrading of conventional cupolas in Bogra to DBCs. Besides, the comparatively higher cost of energy (coke) in Bangladesh offers an attractive payback on investment. (The cost of coke per tonne in Bangladesh is Taka 45 000, equivalent to Rs 28 000, compared to Rs 18 000 in India.)

TERI's visit elicited a quick response. Two units have already shown keen interest in adopting the DBC. It was also decided that a delegation from Bangladesh comprising 8–10 foundry owners would visit Indian foundry units to gain a better understanding of technological and other issues through interactions with entrepreneurs and other stakeholders. This visit took place in July 2007.

300 kW_e, 100% biomass-based gasifier system installed in Sri Lanka

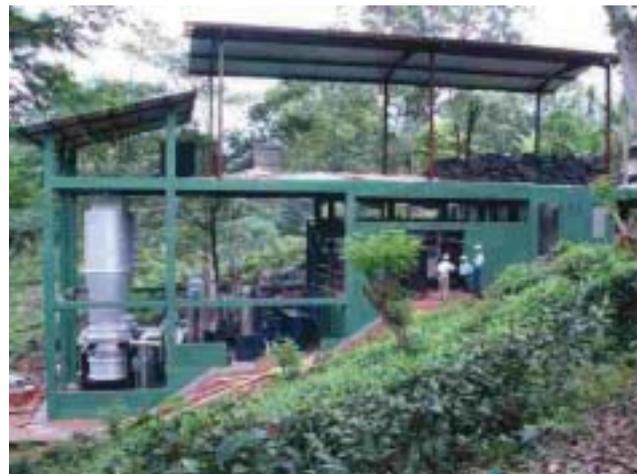
Recently, TERI installed a biomass-based power generation system of 300-kW_e (kilowatt electricity) capacity in southern Sri Lanka. This is the largest 100% biomass-based system designed and installed by TERI. It consists of two units, each of 150-kW_e capacity. A stand-by generator has been provided to take care of the power supply during shutdown. The system is designed to provide power to the Talwakkelle tea estate. Biomass generated in the tea estate is used in the gasifier, thus ensuring sustainability of biomass supply to the unit. About 500 kg per hour of biomass is required to run the gasifier at full load capacity. The tea estate has two processing units, each requiring about 150 kW_e of power. The excess power available from the estate will be sold to the grid. The project cost is being borne by the tea estate itself. A significant feature of this gasifier system is that being based entirely on biomass for its operation, it saves an equivalent amount of fossil fuels that would have otherwise been consumed in generating power from conventional power plants.

Based on the expertise required in diverse fields, a number of partners have been involved in this project. Puritas, a Sri Lanka-based company, undertook the task of overall project coordination, and also took care of various local activities such as site preparation, civil works, and installation and commissioning of the system. TERI's main role involved developing and finalizing the design of the gasifier and associated systems, fabrication and sourcing of various system components related to the gasifiers, and supervision and capacity building during the process of installation, fine-tuning, and commissioning.

The biomass gasifier has a downdraft throatless design, and is provided with air nozzles located at two tiers. This arrangement ensures improved gas quality. TERI sourced engines of required specifications from

Amrfeo, a Kolkata-based company. Amrfeo also supplied the water cooler and control panels, and provided necessary assistance in installation, commissioning, and synchronization of the engine at the site. Puritas took care of arrangements related to grid connection.

The gasifier has been provided with a continuous ash-removal system, having a rotating-grate arrangement. The system



Power gasifier at Sri Lanka

is designed to reduce impurities in the gas. The entire gasifier system is located in a natural slope arrangement that helps in easy fuel feeding. A major challenge faced during the project related to the quality of biomass. The biomass available in the tea estate has high volatile content and low bulk density. Due to high humidity levels and frequent rains, it is hard to provide fuel with less than 10% moisture. The wet fuel adds to the difficulty of purifying the gas. TERI has addressed this problem by developing an additional mist-separator and a condensator for removal of moisture and impurities.

Commissioning and fine-tuning of the system is under way, and is expected to be completed in October 2007. A successful commissioning of the system is expected to throw open the market for a large number of similar systems in Sri Lanka.

Exposure visit for the workers and owners of puffed rice units

TERI organized a one-day exposure visit for the workers and owners from six puffed rice clusters in Karnataka (Ranebennur, Guttal, Bankapur, Haveri, Hubli, and Dharwad) at BVBCET (BVB College of Engineering and Technology), Hubli on 6 July 2007. About 35 people, comprising of 6 workers and 29 owners, participated in the programme. Exposure and hands-on-training were provided to all participants on various biomass technologies. These included downdraft gasifier oven, updraft gasifier oven, turbo-stove, wood-based improved oven, loose biomass-based improved oven, low-cost stepped-grate oven, and low-cost rice dryer. Data and information was shared with the participants related to working principles, advantages, and cost-benefit analyses of different technology options. The programme helped in creating significant interest among the participants in specific technologies.

The puffed rice units from Ranebennur cluster showed keen interest in the low-cost stepped-grate ovens, rice dryer, and gasifier-based oven. TERI has already installed a rice dryer and a stepped-grate oven in one of the puffed rice units in the cluster during July 2007. The entrepreneur met 75% of the hardware costs,



Participants observing biomass devices

while the balance 25% was provided under the CoSMiLE project and by BVBCET. These systems were commissioned on 24 July 2007.

The puffed rice units from Dharwad and Hubli clusters have shown interest in the wood-based improved oven and loose biomass-based improved oven. These units will choose their technologies based on capacity requirement, fuel type, existing practices, ownership, and other criteria.

The exposure visit facilitated hands-on-training for the workers in puffed rice making using new technologies. It thereby provided the workers with the opportunity to work with a variety of fuels and feeding practices, and to ascertain their comfort levels in operation of the systems. The initiative is expected to help the workers in making informed choices.

Glass artisans in cooperation

As part of its intervention in the Firozabad glass cluster, TERI has undertaken pilot social-action initiatives in partnership with an NGO (non-governmental organization), named 'Vikas Sansthan', to attempt to bring about improvement in the socio-economic conditions of workers in the household-level units that process bangles and glass- decorative items. One such initiative has been taken in Daukeli, a village near Firozabad known for making exquisite glass toys. The project team interacted extensively with the glass artisans, and motivated them to set up an artisans' cooperative—the 'Daukeli Toy Workers' Suvidha Sahakari Samiti Ltd'. With support from the project, the cooperative was registered with the local administration; a step that has helped it acquire some visibility and credence in the market. The cooperative has enabled the artisans to set up a raw-materials bank, and provide them with a platform to discuss and take collective decisions related to products, markets, improving their skill-sets, and so on. Its membership has increased from 12 to 50, and in 2006, it succeeded in registering a small surplus.

With the Daukeli initiative showing small but visible signs of success, the project has undertaken a similar initiative in Kushwanagar—a Firozabad locality where artisans specialize in making decorative items out of 'borosil'. Here, too, an artisans' cooperative has been formed and registered; at present, it has 32 members. The Kushwanagar cooperative proposes to set up a bank of gas cylinders (oxygen, and possibly also LPG), which the artisans use in their work.

The initiatives at Daukeli and Kushwanagar have brought some financial benefits to artisans, and helped in making them aware of the benefits of cooperative ventures. However, Vikas Sansthan observes that it is a constant challenge to sustain their enthusiasm, and to find regular buyers for their products beyond the existing local markets.

Bangladesh delegation visits Indian foundries

TERI followed up its visit to the Bogra foundry cluster (Bangladesh) in June 2007, by facilitating a visit to India by a delegation about 10 foundry entrepreneurs from Bangladesh during 15–23 July 2007. The team also included members of the FOAB (Foundry Owners Association of Bangladesh) and other foundrymen. The delegation visited the foundry clusters of Howrah in West Bengal, Rajkot and Ahmedabad in Gujarat, and Agra in Uttar Pradesh. The objective of the visit was to identify low-cost, energy-efficient foundry technologies suitable for Bangladesh and to help the delegates to build their capacities. The team visited foundry units that use the TERI-designed DBC (divided blast cupola) in Howrah and Rajkot. These field visits by the Bangladeshi team, and their interactions with foundry owners, indicated that there is significant scope to save energy by upgrading the conventional cupolas being operated by foundry units in Bangladesh to DBCs. The FOAB has already formulated a programme to take this process forward.

Exposure meet on biomass gasifier technology for power generation

TERI was associated in an event organized by the MSRIT (M S Ramaiah Institute of Technology) on 'Renewable energy for electrical power generation and thermal applications'. About 40 persons participated in the event, which took place in Bangalore on 31 August and 1 September 2007. It comprised of senior lecturers, assistant professors, and students from different engineering colleges. TERI shared the case studies of successful interventions made with biomass technologies under the CoSMiLE project with the participants. The group exchanged views on the role of engineering colleges in technology



Bangladesh delegates during field visit to an Indian foundry

innovation, developing technology packages, market research, and support required by service providers. The group also deliberated on the following issues.

- Assessing the potential for biomass systems for enterprises in Karnataka, using 'Karnataka at a glance 2004/05' as information base
- Assessing the electrical load in MSRIT itself, and exploring the potential to meet its load using biomass gasifiers
- Examining the capacities of engineering institutions to take up renewable energy research and promotion, by means of SWOT (strengths, weaknesses, opportunities, and threats) analysis
- Identifying potential projects for students.

World Bank project on 'Biomass for sustainable development': TERI as national consultant and regional consultant

The MNRE (The Ministry of New and Renewable Energy) has identified TERI as the national consultant and one of the regional consultants to assist in implementation of the pilot phase of the VESP (Village Energy Security Programme) projects in India under the World Bank supported project entitled 'Biomass for sustainable development'. The VESP is a community-based initiative that aims at providing energy security in remote villages/hamlets through locally available renewable energy sources (preferably biomass) and locally available technologies/systems. The focus of the World Bank project is to develop business models for small-scale biomass-based renewable applications that can meet energy needs related to productive uses, lighting, and cooking, and thereby bring about sustainable rural development and reduce greenhouse gas emissions. The total duration of the project is 18 months.

As a national consultant, TERI will assist MNRE in the national assignment entitled 'National Contract for Economic & Financing, Monitoring & Evaluation Frameworks and Policy & Institutional Issues'.

TERI's role includes

- developing an economic and financial viability framework for different end-use applications;
- developing a reporting and monitoring framework, including consideration of CDM (Clean Development Mechanism) proposals; and
- reviewing performance, impacts, and lessons of the test-phase to draw up institutional and design recommendations for a larger programme.

As a regional consultant, TERI will assist various implementing agencies in Assam and West Bengal under the regional assignment entitled 'Regional Contract for Project Design and Development and Capacity Building and Outreach'. TERI's role includes

- extensive capacity building and technical assistance to various stakeholders (communities, local NGOs [non-governmental organizations],

state and district implementing agencies, etc.) to facilitate the implementation of 21 VESP sub-projects; and

- technical support for identification, preparation, and assistance with the implementation of 9 new VESP sub-projects including participatory village energy plans, financial models, and M&E (monitoring and evaluation) frameworks.

Training programmes conducted for brick firemen community

Sensitization meet for firemen sangathan

Lokmitra, an NGO (non-governmental organization) partner under the CoSMiLE project, organized a sensitization meet between 20-21 August 2007 at Harchandpur (Rai Barelli) in association with the CBWE (Central Board for Workers Education), Ministry of Labour, Lucknow. Forty men and women belonging to the firemen *sangathan* (federation) participated in this programme, and discussed various issues related to the firemen community. The Divisional Vice president, Bhartiya Kissan Union spoke on the benefits brought about by the *sangathan*. Details regarding RTI (Right to Information) Act were provided to the participants to make them aware of their entitlements under various government schemes. The participants also discussed various features of the NREG (National Rural Employment Guarantee) programme.

A member of the *sangathan* highlighted the importance of having an *iqarnama* (agreement) with the brick kiln owners, and the necessity for firemen to possess individual passbooks and identity cards when they leave their villages for work. An official from the CBWE stressed the importance of basic education for firemen, considering it as vital to make them aware of their rights. He also urged them to ensure education for their children.

Technological training programme

Two technological training programmes were conducted for the firemen community during September 2007. The first programme was organized at Lalgopalganj (Allahabad) between 5-6 September 2007 along with PEPUS (Paryavaran Evam Pradhyogiki Utthan Samiti), one of the NGO partners in the CoSMiLE project. The second programme was organized at Suchi (Rai Barelli) between 7-8 September 2007 along with Lokmitra, another NGO partner in the brick-sector intervention. A total of 90 firemen participated in these training programmes.

The programmes focused on improved brick-firing options and best operating practices that would help in fuel saving and environmental improvement in BTKs (bull's trench kilns) where the firemen usually



Training programme for brick firemen community

work. A Hindi video film on BTKs entitled '*Int bhatte mein behtar karyavidhi-bachat ki or*' (better operating practices in brick kilns—for increased savings) was also shown to the participants. The film highlighted various energy-saving options related to fuel feeding, firing, and operating practices. The film triggered a brainstorming session among the participants.

Five groups were formed among the participants, and specific problems were assigned to them related to BTK operation. The groups had intensive interactions to reason out the causes of the problems, and to identify various options/solutions to overcome them.

The groups also shared their experiences in the kiln sites. The session helped in exposing the traditional knowledge possessed by the firemen. Participants were also given ideas about new technologies and products to increase their understanding about future trends in the brick industry. Photographs were used as aids to explain the concept and features of the tunnel kiln, and to describe new products such as extruded bricks, tiles, and other decorative items that can be produced in the kiln.

At the end of the session, a manual on better feeding, firing, and operating practices for BTKs was distributed among the participants free of cost. This manual was sponsored by the PSCST (Punjab State Council for Science and Technology). The participants were also given individual certificates of participation in the programme, issued by the CoSMiLE project.

Social training programme

Under the CoSMiLE project, TERI and Lokmitra organized a training programme for the firemen community between 24-25 August 2007 at Ghuisarnath (Pratapgarh, Uttar Pradesh). Forty-five men and women members of the firemen *sangathan* from Sangipur, Lalganj, and Sandwa-Chandrika blocks participated in this programme. The participants were enlightened on issues such as the importance of the *sangathan*, gender aspects, the role of the panchayat, identity cards, *iqarnama*, the significance of the RTI Act, NREG programme, and so on. A representative from the NGO 'Udhamita Vikas Sansthan' informed the participants

about the policies and initiatives of Khadi Gramodyog Board and District Industries Centre.

Discussion on knowledge aspects

Encouraged by the technical training programme conducted by TERI and Lokmitra between 7–8 September 2007 at Suchi, the firemen themselves organized a one-day discussion on technological aspects at Suchi on 15 September 2007. The focus of the programme was to find ways to enable the firemen community to earn a respectable place in society by increasing their knowledge and by producing better quality bricks. In this programme, the more experienced firemen/master firemen responded to the queries raised by young firemen on different technological issues—for instance, the reasons why white-coloured fired bricks were formed, the causes for slow movement of fire, better fuels for brick-making, and so on. This programme is indeed noteworthy for the fact that it was initiated and organized by the firemen themselves.

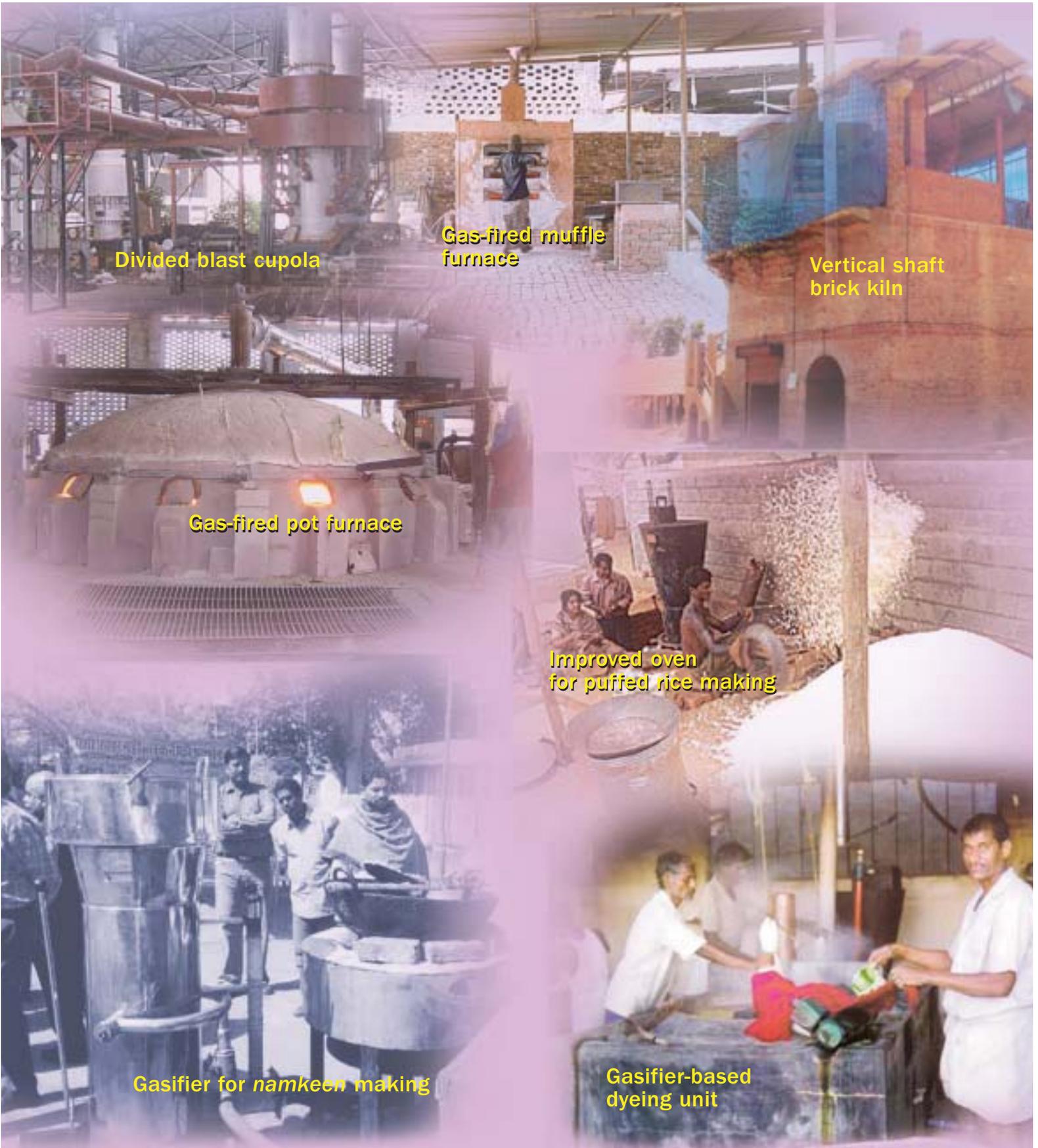
Construction begins on a new VSBK in Tamil Nadu

The successful operation of a VSBK (vertical shaft brick kiln) at Punal Vaasal (Thanjavur district, Tamil Nadu) by a private entrepreneur has kindled interest in this technology. Another private entrepreneur in Kadalur (Tamil Nadu) has now decided to set up a VSBK. Construction of the new kiln has already begun and TERI is providing technical-backup support to the entrepreneur.

The VSBK will have two shafts with a production capacity of about 8000 bricks per day. Each shaft will have a nominal size of 1 metre × 2 metres. Other salient features of the kiln include a soft mud-moulding machine for green brick moulding, an electric-winch system for lifting green bricks to the loading platform, and the use of sheds to store bricks. The total project cost is about 3.3 million rupees, for which the entrepreneur has availed a loan from the SBI (State Bank of India).

Events calendar

- 1 Awareness programme for self-help groups of puffed rice workers and owners on financial support from the banks for technology adoption and alternative skill development; 5 October 2007, Gollara Oni, Dharwad, Karnataka.
- 2 Social-training programme for brick industry firemen, and master firemen; 5–6 October 2007, Lalgopalganj
- 3 Presentation on Energy conservation and carbon credits. National seminar on energy savings, cost, quality, and eco-friendliness. Organized by IIF (Institute of Indian Foundrymen); Pune Chapter, Pune, 13–14 October 2007.
- 4 Social training programme for brick industry firemen and master firemen; 23–24 October 2007, Dalmau, Rae Bareilly.
- 5 Awareness programme to promote modern biomass technologies; jointly organized by CART (Centre for Appropriate Rural Technologies) and TERI; 31 October 2007, NIE (National Institute of Engineering), Mysore.
- 6 Central Worker-Owner Convention; Annual event of the Worker-Owner Forum formed at Howrah; November 2007, Kolkata.
The event will focus on sensitizing stakeholders, in particular government agencies, on various issues related to foundry sector.
- 7 Workshop on 'Dissemination of learning of CoSMILE'; jointly organized by the Department of Commerce and Industry and TERI for implementing officers of the Government of Karnataka (Department of Industries and Commerce, Karnataka Council for Technological Upgradation, and so on); November 2007, Bangalore.
- 8 Sensitization programme for puffed rice makers of southern India; 30 November 2007, Ranebennur (Karnataka).
- 9 Meeting with financial institutions to promote modern biomass technologies; December 2007, Bangalore.
- 10 Meeting on biomass gasifier stove; December 2007, New Delhi.
The meeting will sensitize various end-users on adoption of the improved gasifier stove. It will also demonstrate the technology with actual cooking during the meeting, and would obtain feedback from users that will help in improving the existing design.



Divided blast cupola

Gas-fired muffle furnace

Vertical shaft brick kiln

Gas-fired pot furnace

Improved oven for puffed rice making

Gasifier for namkeen making

Gasifier-based dyeing unit

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