

# **TERI-SDC Partnership (TSP) Project 2009-11: MSME Component**

## **Report of the External Review**

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## List of Abbreviations

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<b>BASIC countries</b>	<b>Brazil, South Africa, India and China</b>
BDS	Business development services
BEE	Bureau of Energy Efficiency
BMZ	German Federal Ministry for Economic Cooperation and Development
BOP	Best operating practices
CDGI	Centre for Development of Glass Industry
CDM	Clean development mechanism
CI	Corrugated iron
COP	Conference of Parties
CoSMiLE	Competence Network for Small and Micro Learning Enterprises
CO <sub>2</sub>	Carbon dioxide
CPCB	Central Pollution Control Board
CTCN	Climate Technology Centre and Network
DBC	Divided Blast Cupola
DFID	Department for International Development
DPR	Detailed project report
DST	Department of Science & Technology
EE technologies	Energy efficient technologies
EESL	Energy Efficiency Services Limited
FOAB	Foundry Owners Association of Bangladesh
GEF	Global Environment Facility
GHG	Greenhouse gas
GoI	Government of India
IEE	Industrial Energy Efficiency
IFC	International Finance Corporation
IIF	The Institute of Indian Foundrymen
kWh	Kilo watt hour
LCE	Low Carbon Economy
LFA	Logical Framework Analysis
LSP	Local service provider
MoU	Memorandum of Understanding
MSME	Micro, small and medium enterprises
Mtoe	Million tonnes of oil equivalent
NGO	Non-governmental organization
NMEEE	National Mission for Enhanced Energy Efficiency
PAT	Perform, Achieve and Trade
PCRA	Petroleum Conservation Research Association
RDD&D	Research, Development, Demonstration and Deployment
REEEP	Renewable Energy & Energy Efficiency Partnership
RfP	Request for Proposal
SAMEEEKSHA	Small and Medium Enterprises: Energy Efficiency Knowledge Sharing
SBI	State Bank of India
SDC	Swiss Agency for Development and Cooperation
SEDF	South Asia Enterprise Development Facility
SHG	Self help group

SIDBI	Small Industries Development Bank of India (SIDBI)
SME	Small and medium enterprises
SMERA	SME Rating Agency of India Limited
SPRU	Science and Technology Policy Research Unit
TEQUP	Technology & Quality Upgradation Support to MSMEs
TERI	The Energy and Resources Institute
TIC	Technology Innovation Centre
TSP	TERI-SDC Partnership
TT	Technology transfer
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
USEPA	US Environmental Protection Agency
UTs	Union Territories

## Review Abstract

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<b>DONOR</b>	SDC – Swiss Agency for Development and Cooperation
<b>REPORT TITLE</b>	TERI-SDC Partnership Project 2009-11: MSME Component – Report of the External Review
<b>GEOGRAPHIC AREA</b>	India
<b>SECTOR</b>	Industry, multi-sector
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### Subject description

The report is an independent review of the assistance provided by SDC to TERI during the period 2009–2011 for enhancing energy efficiency in selected MSME sectors in India. The objective of the review is to provide a critical external view on how the programme is being implemented, its achievements and scope for improving the project strategy in the future. In terms of the past activities, the review primarily focuses on the work undertaken in the foundry and glass sub-sectors and analyses the results, the effectiveness, efficiency, relevance and sustainability of the programme. The review provides recommendations for strengthening the ongoing activities under the remaining period of the TSP project and also key areas that need to be included in the next phase of the project.

### Evaluation methodology

The review is based on extensive consultations by the three-member review team with a broad range of stakeholders comprising industry associations, MSME entrepreneurs, promoters of demonstration units, the Ministry of MSME, Government of India, Bureau of Energy Efficiency (BEE), Small Industries Development Bank of India (SIDBI), Local Service Providers (LSPs) at cluster level, and NGOs involved in the project. The team also interacted with key persons at TERI and SDC (both in New Delhi and Berne) to understand their perspectives on the projects, the implementation cycle and the challenges navigated. The team perused the ongoing programmes of the Government of India, in particular those of the Ministry of MSME and BEE, to look at synergies and linkages between them and TSP. The team also visited five sites – Howrah, Firozabad, Rajkot, Coimbatore and Ahmedabad – to get a first-hand account of the interventions.

### Major findings and conclusions

The project has been successful in technology demonstration and replications in the MSME clusters where the interventions have been made. It has helped in evolving a model for undertaking such interventions, taking into consideration the barriers that are faced in introducing and promoting new/improved technology in the MSME sector in India. The model includes technology development, capacity building and training, development of LSPs, training of workers on best operating practices and information dissemination. Demonstration of technology has been the key aspect of the success of the project. The major findings and conclusions are:

- Development of local capacities and hand-holding support are vital for technology deployment; LSPs play an important role in making MSMEs understand the economic benefits
- Sustained engagement with MSMEs is necessary for credibility
- Close engagement with partners/stakeholders is necessary for scaling up; promoting enabling policy environment with government stakeholders is needed for mainstreaming the activity

## Recommendations and lessons learnt

The key success factors of the partnership could provide an opportunity to scale up the same at the national level with an appropriate mix of policies, regulations, financing and technical assistance. The TERI-SDC partnership has developed and demonstrated a successful model that incorporates all these aspects and has also benefited similar government programmes. In order to sustain and improve the energy efficiency drive in the MSME sector, it is expedient to continue the TERI-SDC partnership. The model developed by TSP and successfully implemented in the glass and foundry sectors needs to be consolidated by encouraging other units in the two sectors. In addition, TSP should extend this model into other energy intensive MSME sectors in sync with the government initiatives. These sectors could be non-ferrous foundries, metallurgical sectors, ceramics, etc. The following specific aspects are recommended for inclusion in the next phase of the partnership:

- National-level transformation by strategic linkages with national-level initiatives of BEE (SME programme, PAT), Ministry of MSME (TEQUP scheme) and Energy Efficiency Services Limited (EESL)
- Consolidation of key success factors by creating and sustaining a network of LSPs, deepening and broadening engagement (deepening through strategic linkages and broadening by similar efforts in new clusters), and promotion of R&D
- Exploring synergies/participation in the emerging climate change regime through the Climate Technology Centre and Network (CTCN) and by enhancing efforts towards South-South Cooperation in collaboration with national-level organizations in India (BEE, EESL, etc)
- Strengthening stakeholder engagement and enhancement of project management resources to deal with the expanded scope recommended.

The review team recommends continuance of the partnership in the next phase in close coordination with the efforts of the government agencies in order to promote replication in other energy intensive MSME clusters for the economic benefit of entrepreneurs, overall enhancement of energy efficiency and reduction of GHG emissions from the sector.

# TERI-SDC Partnership (TSP) Project 2009-11: MSME Component - Report of the External Review

## 1.0 Introduction

1.1 *Relevance of MSME sector & importance of improving energy efficiency:* The MSME (micro, small and medium enterprises) sector is a major contributor to the Indian economy. It accounts for about 45% of manufacturing output and 40% of exports. As per the Annual Report of the Ministry of MSME, Government of India for the year 2010-11, there are an estimated 28.9 million MSME units that generate and provide employment to 69.5 million persons. The fixed investment in these MSMEs in 2009-10 is Rs. 6938 billion and their output generation is Rs. 9829 billion, which is about 8.72% of India's GDP<sup>1</sup>.

1.2 In accordance with the provision of Micro, Small & Medium Enterprises Development (MSMED) Act, 2006, MSMEs are classified in two Classes:

- a) Manufacturing enterprises: The enterprises engaged in the manufacture or production of goods pertaining to any industry specified in the first schedule to the Industries (Development and Regulation) Act, 1951. The manufacturing enterprises are defined in terms of investment in plant & machinery.
- b) Service enterprises: The enterprises engaged in providing or rendering of services. The service enterprises are defined in terms of investment in equipment.

The limits for investment in plant and machinery/equipment for manufacturing/service enterprises, as notified [vide S.O. 1642\(E\) dtd.29-09-2006](#) are as under:

Manufacturing sector	
Enterprises	Investment in plant & machinery
Micro	Does not exceed two and a half million rupees
Small	More than two and a half million rupees but does not exceed fifty million rupees
Medium	More than fifty million rupees but does not exceed hundred million rupees
Service sector	
Enterprises	Investment in equipment
Micro	Does not exceed one million rupees
Small	More than one million rupees but does not exceed twenty million rupees
Medium	More than twenty million rupees but does not exceed fifty million rupees

1.3 MSMEs have been playing a significant role in meeting national objectives of balanced growth, poverty alleviation and equity promotion and serve as nurseries for corporate enterprises of future. In India, most of the MSME activities are geographically clustered. Within a cluster, there is a great deal of similarity in the level of technology, the operating practices and even the trade practices among the individual units, which means that the potential to develop standard solutions is large. There are many energy intensive sub-sectors operating in the small scale where energy cost accounts for a major share of the operating cost; this means that to remain competitive, it is absolutely essential for enterprises in these sub-sectors to improve their energy performance.

<sup>1</sup> Source: Annual Report of Ministry of MSME for the year 2010-11 available at [http://msme.gov.in/msme\\_ars.htm](http://msme.gov.in/msme_ars.htm)

1.4 In 1991, SDC established a Global Environment Programme to support developing countries in implementing measures aimed at protecting the global environment. In pursuance of this goal, SDC conducted a study of the MSME sector in India to identify areas to introduce technologies that would yield higher energy efficiency and reduce GHG emissions. Subsequently, in 1993 SDC partnered with TERI and other Indian partners to launch an intervention in the MSME sector aimed at finding solutions to the energy and the environmental problems of the small units through technology upgradation and human and institutional development in some of the energy intensive sub-sectors. Three small scale sub-sectors were initially selected – foundry, glass and brick. In each of these sectors, demonstration plants were built to widely disseminate/popularize the technological options at cluster levels. Awareness programmes and the training of the entrepreneurs and operators were carried out simultaneously to familiarize them with the new technologies. Appropriate mechanisms were developed to support the implementation of replicable projects in an effort to try and make this programme sustainable beyond the project intervention. The present three-year TSP project (initiated during the year 2008) is entering an end-of-phase period. An external review of the project was felt important by SDC and TERI for capitalization of project achievements and for consolidation of the activities. This would help in ‘taking stock and learning so as to prepare the basis for a new phase’.

1.5 The MSME sector is often driven by individual creativity and has immense potential for greater innovation, both in terms of products and processes. An inherent strength of the sector is that these enterprises can be set up with very small amounts of investments. As per the Annual report of Ministry of MSME, the sector has the following features:

- (a) A significant proportion of the enterprises are un-registered. Only about 1.6 million units are registered out of the estimated 28.9 million units.
- (b) Of the registered units, their presence is almost equally divided into rural and urban areas (45% and 55% respectively)
- (c) Almost 95% of the registered units belong to the micro category and have very small investments and outputs
- (d) 65% of the registered units are engaged in manufacturing; the remaining are engaged in service and repair/ maintenance
- (e) More than 90% of the units are proprietary concerns
- (f) The labour-to-capital ratio is much higher than in the large industries
- (g) These enterprises are located in clusters all over the country
- (h) Information and data about the enterprise-level energy consumption is sketchy

1.6 *Energy saving potential in MSME sector.* The scope for energy savings in the MSME sector is considerable, as revealed by a recent study commissioned by BEE<sup>2</sup> to assess the

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<sup>2</sup> The Bureau of Energy Efficiency (BEE), set up under the Energy Conservation Act, 2001, is responsible for formulation of strategies and policies that help in reducing the energy intensity of the Indian economy. The major focus of BEE in the industry sector remains large industries that are the major consumers of energy, many of which fall under the category of ‘designated consumers’. However, there are many small scale industries that are also large consumers of energy. To address this important segment, BEE has formulated the “BEE-SME Programme” that aims to accelerate the adoption of energy efficient technologies and practices in a few chosen industry clusters through focussed studies, knowledge sharing, preparation of detailed project reports and facilitating in the process of developing innovative financing mechanisms. TERI has entered into a strategic partnership with the BEE for carrying out some of the activities in the SME sector. Under the partnership, TERI is providing knowledge as well as manpower support to BEE for the development and implementation of their programme amongst SMEs. Under the partnership, a detailed SME programme project is under implementation.

energy saving and conservation potential. There are a large number of other energy intensive clusters in the country where such technology development and dissemination programmes can be facilitated. A comprehensive assessment of energy usage pattern in the MSME sector is a daunting task. A situation analysis of 35 SME clusters in the country was undertaken as part of a larger BEE-SME Programme, in which TERI is providing knowledge and implementation support to BEE. The survey, conducted in 2007 in 35 energy intensive clusters under the Programme, estimated the total energy consumption in these clusters to be around 4.9 million tonnes of oil equivalent (mtoe). Coal/coke/lignite accounted for 86% of total energy usage while the contributions of oil and natural gas, biomass and electricity were 7%, 4% and 3% respectively. The actual biomass usage would be higher as in a few cases (e.g. rice mill clusters, *khandsari* cluster etc.), the biomass which is used as an internal fuel is not accounted for while calculating the total energy consumption. Looking at the pattern of energy usage and the major energy consuming equipment/sections in different industry clusters, the majority of energy use is in thermal form (for instance, in furnaces and boilers). As a result, it is envisaged that major energy saving technologies are likely to involve furnace/boiler re-designing/ refurbishment/ upgradation and corresponding system reconfiguration at the plant level to accommodate these changes. The study and the subsequent energy audits conducted by BEE revealed that energy saving potential of 15-30% exists in these energy intensive MSME clusters.

1.6.1 Recently, TERI conducted an in-house review of a list of 393 manufacturing (industry) clusters in India (a list provided by Foundation for MSME Clusters and being widely used by various agencies dealing with MSMEs), and classified them into 12 product categories based on their energy intensity and probable energy saving potential. The review revealed that there are at least 178 clusters that are energy intensive and may have a high or medium level of energy saving potential. These clusters fall under broad product categories like castings and forging, glass and ceramics, food processing, etc. Significantly, the review revealed that many energy intensive small-scale sectors do not figure among the identified clusters – a typical example being the brick industry.

1.7 As the MSME sector has functioned for five decades within an overly protective economic and industrial framework, a large proportion of Indian MSMEs remain isolated from modern technological developments. They use obsolete, inefficient technologies to utilize commercial energy sources like coal, oil, gas and electricity, leading to wastage of energy as well as release of high volumes of GHGs and particulate emissions that are harmful to health and damage the atmosphere. Many MSME sub-sectors are energy intensive, with fuel costs making up 20%-40% of the total cost of production. While individual MSME units are relatively small in size, their sheer numbers, coupled with the fact that they depend on low energy efficiency technologies, make the MSME sector a sizeable source of carbon emissions. Hence, there is a clear and urgent need for MSMEs to adopt energy efficient (EE) technologies that will help them reduce both fuel consumption and carbon emissions. Interventions by multilaterals and bilateral agencies have supplemented the efforts of the government, particularly in the area of energy efficiency, innovations in technology, information dissemination, outreach, capacity building and training. In order to promote technology upgradation and modernization, the Government of India has been taking several measures aimed at fostering a regime that could remove barriers for accelerated technology upgradation focusing on energy efficiency. Appropriate policy measures, fiscal instruments, and incentives for technology upgradation have been

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put in place. According to the Ministry of MSME, the thrust of the XII Five Year Plan (under formulation for 2012–17) will be on development and promotion of clean technologies and on creation and sustenance of markets for clean EE technologies. Linkages to ongoing global efforts in technology development will also be harnessed. The Plan will also encourage capacity building of stakeholders, entrepreneurs, etc. This is a major positive shift from the XI Five Year Plan of the Government of India, given its focus on market-based deployment of clean technologies. In preparing the XII Five Year Plan, the Ministry of MSME intends to focus on the following:

- (a) Enhanced training and capacity building programme including strengthening of training delivery institutions. Enhancing skills will also encourage faster generation of employment as a result of enhanced capacity for growth.
- (b) Promoting adoption of clean and emerging technologies, not only to reduce the energy intensity (and therefore increase cost competitiveness) but also to upgrade the quality of output.
- (c) Encouraging innovations through the setting up of a large number of business incubators in educational institutions of repute.
- (d) Promoting market-based EE measures which are inclusive.

## 2.0 Strategy and objectives of TERI-SDC Partnership

The TERI-SDC partnership (TSP) in the MSME sector, which started in 1993, has focused on technology development, demonstration and replication of EE technologies. It has targeted three energy intensive MSME sectors, namely, foundry, glass and brick and has developed innovative technologies. In addition to technological development, the partnership has also initiated pilot programmes on social action aimed at addressing the needs of the workers in the three sectors. Starting January 2009, a new 3-year phase was initiated in the TSP project with emphasis on accelerating the adoption of the demonstrated EE technologies by focusing on developing partnerships for technology delivery at cluster level.

2.1 Table 2.1 shows the geographical coverage of the project activities in the present phase.

**Table 2.1:** Geographical coverage of project activities

Sector	Focus clusters/state	
	<i>For technological intervention</i>	<i>For social intervention</i>
Foundry	Rajkot, Ahmedabad, Howrah, Coimbatore	Howrah
Glass	Firozabad	-
Brick	National level	Eastern U.P.

2.2 The project has undertaken a number of initiatives to document and disseminate information through web-sites, newsletters, books and video films. The following are examples:

- (a) Information sharing through websites
  - CoSMiLE website (<http://www.cosmile.org>)
  - SAMEEEKSHA website (<http://www.sameeksha.org>)

(b) Sharing of activities in MSME sector through quarterly newsletters

- CoSMiLE Update
- SAMEEEKSHA



CoSMiLE Newsletter



SAMEEEKSHA Newsletter

(c) Documentation of project efforts in technology development, demonstration and dissemination through publication of books

- Towards cleaner technologies: A process story in the Firozabad glass industry cluster
- Towards cleaner technologies: A process story in small-scale foundries
- Working with brick firemen community



Foundry book



Glass book



Brick book

(d) Video films prepared on project initiatives in foundry, glass and brick sector

- Igniting change: Accelerating collective action for Indian foundry industry
- Changing the convention: Introducing newer concepts in Firozabad glass industry
- Through the smoke screen (Muffle furnaces in Firozabad glass cluster)
- Vertical Shaft Brick Kiln (VSBK) in English and Hindi

2.3 The strategy followed by TSP during the current phase was to develop innovative technology dissemination models for EE technologies, establish strategic linkages, strengthen capacities of stakeholders, pilot social actions and explore South–South cooperation. A detailed account of the strategy is at [Annex-I](#).

2.4 *Pioneering work undertaken on EE technology development among MSMEs.* The TSP project adopted a pioneering approach in its intervention in the small-scale foundry and glass sectors. EE technologies were identified, transferred and adapted to local conditions and requirements under the following approach:

- Conducting energy audits to identify areas in which to improve energy efficiency (needs assessment)
- Identification, design, development and adaptation of EE technological solutions in collaboration with
  - International experts
  - Industry associations
  - Local experts
- Demonstration and fine-tuning of the improved technologies through unit-level demonstration/pilot projects
- Strengthening the knowledge and skills of local entrepreneurs and LSPs, and building their confidence and capabilities in the new/improved EE technologies through ongoing capacity building programmes (thus preparing the ground for dissemination and mainstreaming of the demonstrated technologies)

2.5 *Approach followed and scale-up strategy.* SDC has played a very important role in conceptualizing this project, as also in ensuring guidance without micro managing the day-to-day implementation. This judicious guidance and implementation strategy has ensured that an agency like TERI takes responsibility and builds its capacities to deliver, and has been unique to this project. The other significant aspect of this project is its engagement with ‘difficult’ sectors. MSME units in the foundry and glass sectors are home-grown, and technology adoption from international best practices does not work readily because of the miniaturization that is needed. The technology adaptation needed for the intervention also meant that the chances of failure were high. Despite these challenges, the SDC team decided to go ahead. This approach, more than the success, underlines the true spirit of international development cooperation.

TERI has been a partner of SDC in a range of specific activities carried out in India in locations as diverse as the foundry units in Howrah and glass factories in Firozabad. During the intervention, cleaner technologies were developed with backstopping support from SDC experts. These technologies not only reduced air pollution at local levels, but also brought about substantial improvements in productivity. SDC’s backstopping arrangement in the early stages of the project and its withdrawal after the intervention was successfully institutionalized.

In designing the strategy, SDC and TERI built on the lessons learnt from earlier attempts in such clusters, most notably by SIDBI and SBI. Those interventions did not yield desired results as the handholding and capacity building support, training of intermediaries to

facilitate technology transfer and information dissemination were not undertaken. These measures are vital for successful technology deployment in the MSME sector.

TERI played two important roles during this project:

- As primary recipient of the improved technological know-how, through ongoing capacity building of the TERI team by its overseas partners.
- As facilitator and technology service provider for the development, adaptation, demonstration and promotion of the improved technologies in the concerned MSME sectors, through direct field-level interactions with entrepreneurs, LSPs and other industry stakeholders.

TERI's strategy for intervention in the MSME sector was focused on technology development, dissemination and delivery through (1) strategic partnerships and (2) capacity building and knowledge sharing. The MSME clusters chosen for interventions were:

- Glass - Firozabad
- Foundry - Ahmedabad, Coimbatore, Howrah, Rajkot

The criteria for choosing these clusters were: (1) TERI's past experience in these sectors/clusters, (2) potential for replication, and (3) complementarities with the ongoing initiatives of other agencies/ government departments. For example, in the foundry sector, TERI is working with SIDBI in the Rajkot cluster and PCRA in the Ahmedabad cluster. Both the clusters have good potential for replication of the TERI-designed divided blast cupola (DBC). In the Howrah foundry cluster, the project has a long history of cooperation with cluster level stakeholders, starting with the setting-up of the demonstration DBC unit and subsequent techno-social activities. The glass sector intervention focused on Firozabad glass cluster – the single largest small-scale glass industry cluster in India – wherein the project has achieved significant success in pot furnace replication. The following section summarizes the approach for the foundry and glass sectors.

**2.5.1 Foundry sector.** The DBC technology demonstrated in the foundry sector during the earlier phase of the project was up-scaled through public-private partnerships and adoption



Demo DBC plant at Howrah

of new business models that helped in reducing the energy intensity of the units in this sector. For example, the successful model for DBC technology delivery established at Rajkot foundry cluster in partnership with the industry association was strengthened and applied in Ahmedabad and Coimbatore clusters. In Howrah, the local LSPs who worked with TERI during the DBC demonstration phase have taken forward the dissemination process independently while remaining associated with the project. Local stakeholders such as the cluster level industry associations and/or technical institutions were encouraged to take the lead in promoting the technological innovations in each cluster. The emphasis of the project has been to provide the

necessary technical back-up support for understanding designs of DBC and guidance in installation, commissioning and operation of the technologies for the cluster level institutions. Thus, capacity building and training formed key components of the strategy for scale-up of the EE technology.

**2.5.2 Glass sector.** The energy efficient TERI-designed recuperative pot furnace system demonstrated during the earlier phase of the project was up-scaled by establishing and further strengthening the capacities of LSPs (local consultants, fabricators, masons). This



Recuperative pot furnace system

enabled entrepreneurs to adopt the EE system without having to seek major assistance from agencies outside Firozabad. It is relevant to mention that the glass melting pot furnace (being essentially a masonry structure) requires dismantling and reconstruction at periodic intervals which may extend up to 3 years, depending on the quality of materials used. This applies to the TERI-designed pot furnace as well. Under these circumstances, the sustainable uptake of the TERI-designed pot furnace system depends vitally on the availability, at cluster level, of service providers equipped with the technical capacities needed for

construction/ reconstruction of this EE furnace system. The project strategy, of setting in place and strengthening cluster level expertise on the EE technology, has resulted in the ongoing uptake of the TERI-designed pot furnace system –by units which were already operating these EE systems, as well as by units that had not adopted the TERI-designed system earlier. In addition, the project continued technology development efforts aimed at improving the durability of the pot furnace base and extending pot life.

During the phase, TERI established a strategic partnership with BEE under a project that aims at identifying EE options in two other kinds of furnaces used by glass units in Firozabad:

(a) reheating furnaces, which are ‘ancillary’ furnaces used for glass reheating; and (b) tank furnaces for glass melting. This BEE-supported project synergizes with the experiences and expertise gained by TERI, the linkages established with cluster level stakeholders, and the technological support service established in Firozabad under the TSP project.

The TERI-design recuperative furnace is reportedly 34%–38% more energy efficient than the ‘conventional’ gas-fired pot furnace (which was being used in most pot furnace units by 2001). More than 74 pot furnaces have switched to the TERI design.



Gas-fired muffle furnace

The gas-fired muffle furnace developed by TERI yields, for the same bangle output, an energy saving of 40% over the traditional coal-fired muffle furnace (*pakai bhatti*). However, replication of the gas-fired muffle furnace has been

severely hampered because the *pakai bhatti* units are individually small in size and located in densely populated areas of Firozabad, making it difficult for GAIL India Ltd to supply gas to these units for economic and safety reasons. Hence, almost all the *pakai bhattis* in Firozabad continue to operate on coal.

**2.6 Stakeholders project has worked with.** The project worked with stakeholders at the cluster level as well as policy level. The cluster level stakeholders were essentially those directly connected with implementation of the EE technologies at grassroots level in all the five clusters. They included individual MSME entrepreneurs; factory workers like furnace operators and supervisors; cluster level industry associations; LSPs such as consultants, fabricators, masons, etc.; and technical institutions involved in capacity building and/or technology development efforts. The policy level stakeholders were essentially entities that could facilitate implementation of the EE technologies through the creation and strengthening of an enabling policy environment. Government agencies/ departments having some degree of involvement include BEE, Ministry of MSME, SIDBI, central and state pollution control boards, Petroleum Conservation Research Association (PCRA), GAIL India Ltd, GITCO Ltd, etc. It is worth mentioning that the relationships that this project has spawned are not static. That is to say, because of the capacities that this project has built in an institution like TERI, the relationships will continue to grow. As an example, TERI is now working with SIDBI in two MSME clusters and is also engaged with BEE. Both these interventions would have been difficult had TERI not worked quite as extensively with SDC in various MSME clusters under the TSP project.

### **3.0 Main findings and recommendations regarding impact**

The reviewers interacted with a large number of foundry units which have directly benefited by adoption of the TERI-designed DBC in the four foundry clusters – Howrah, Ahmedabad, Rajkot and Coimbatore. In addition, interactions were held with LSPs involved in local delivery of the technology. Interactions were also held with selected office-bearers of cluster level industry associations. In addition, the review team interacted with Ministry of MSME and BEE. The stakeholder feedback is summarized under the following heads:

- Technology development and innovation
- Replication, up-scaling
- Energy saving
- Capacity building of stakeholders – establishing a delivery system
- Knowledge management - newsletter/website
- Policy linkages (local, state, national, international)
- Global outreach and replication

**3.1 Technology development and innovation.** The approach followed by the TSP project, of technology demonstration, was well received by the stakeholders who felt that this was the right approach to popularize a new technology – small-scale entrepreneurs believe in the dictum ‘seeing is believing’. As a demonstration strategy it is pertinent to note that DBC technology needed to be established afresh when the project moved to a new foundry cluster. This was because the technology needed to be adapted suitably to meet the different conditions and needs of each cluster in terms of size requirement (melting capacity), operating practices (intermittent vs. continuous tapping), type of castings made (pump, auto or textile) and raw material used (high/low-ash coke). Hence, although the project had

demonstrated the DBC technology successfully in Howrah, it needed to improvise and establish the performance gain of the DBC afresh when it moved to Rajkot, Coimbatore and Ahmedabad clusters. After successful demonstration at a cluster, the news of the technology spreads quickly by word of mouth and many people come forward to adopt the technology. Further, the initiative of TERI to provide hand-holding support and training of operators in best operating practices (BOP) through the LSPs has been of immense benefit to the units. Almost all the foundry units and LSPs interviewed rated the technology to be 'excellent'. They acknowledged that the system was scientifically designed, innovative and technologically superior. The entire design being modular, it is easy to maintain. Some of the innovations that were found in foundry clusters are:



Bucket charging system

- Introduction of a mechanical charging system; a new feature introduced by the project, especially in Howrah cluster where manual loading was being practiced. Mechanical charging has not only reduced the drudgery of work but has also reduced the exposure of charging crew to harmful carbon monoxide gas.
- Introduction of mechanical arrangement for separating the cupola shell into smaller-sized segments. This innovation was developed since a large number of foundry units in clusters like Ahmedabad have lower molten metal

requirement and hence use cupolas having smaller internal diameter (15-inch and 18-inch). These cupolas are operated daily for a few hours. The operators used to find it difficult to enter the cupola for maintenance of the refractory lining, as there was little time between melting campaigns to allow the cupolas to cool sufficiently. The foundry owners also faced the problem of reduced cupola life since the repairing of the refractory lining was not being done properly. The introduction of the mechanical splitting arrangement has been a great boon for the cupola operators and foundry owners alike. Being a relatively new innovation, it needs to be propagated widely among foundry units in other clusters.

In the glass sector too, innovations were tried out. The identification of EE technology options for the open pot furnace in Firozabad presented a unique challenge, primarily



Split design 18-inch DBC at Ahmedabad

because a pot furnace is intrinsically inefficient in design. Pot furnaces were being used in countries such as Britain and Germany; but these burned better-quality coal or coke to make very high-value products such as crystal ware, as a result of which the proportion of fuel cost in the product cost (that is, the energy intensity) remained low, making operations profitable. In contrast, the pot furnaces in Firozabad burned medium-grade coal to make relatively

low-value items, and hence the fuel cost made up a substantial portion of the product cost. Following extensive consultations between TERI, its British partners and Sorane SA, a new pot furnace design was evolved through research, development and demonstration in the Firozabad glass cluster: a gas-fired pot furnace with its burner mounted on the crown, and with a recuperator to recover and reuse waste heat from flue gases. The fact that almost all the pot furnace units in Firozabad adopted the *concept* of heat recuperation from the TERI-designed furnace, itself indicates that the entrepreneurs, shedding their traditional reluctance to consider changes in their technology, have become increasingly confident in learning from the improved EE technology and adapting it to suit their individual needs.

These examples emphasize an important point. A long-term commitment and a flexible approach in RDD&D programmes is required by funding agencies; for, change is invariably a slow process at the small-scale industry level. A prime factor that has contributed to the success of the technological innovations under the project is the flexibility and long-term engagement with the project shown by SDC, and the unique partnership arrangement that exists among the project partners at different levels – between funding organization (SDC), implementing agency (TERI), local consultants, international consultants, industry associations at cluster level and grassroots-level agencies. There is a need to develop and replicate similar innovative partnership arrangements on a much larger scale for interventions in the MSME sector.

**3.2 Replication, up-scaling.** Many of the foundry owners interviewed by the project agreed that certain unique designs introduced under the project have been copied by local fabricators and LSPs. Even some of local fabricators interviewed mentioned that they have copied some of the new design features introduced by TERI such as longer air duct, stuffing box, CI insertion pieces etc., if not the entire cupola. One entrepreneur in Howrah, who is also an office-bearer in the foundry association, went as far as to confess that all cupolas operating in the cluster are of TERI design. A good indicator of the perceived benefit of the technology to a foundry already using it is its choice of technology while augmenting production. The DBC technology developed and promoted by the project scored highly on this indicator. Two of the foundry units who were initial adopters of the technology in Rajkot have now replicated the design in the new foundries installed by them later.

The review team's interactions with the stakeholders gave a firsthand account of barriers that the sector faces in embracing new technology. The principle issues in this regard are:

- The new technology had a higher capital cost as compared to the existing ones. Given that many units do not have the capacity to understand the life cycle benefits of the technology and that their financial prowess is limited, the uptake of the new technology is less than what might be expected from its potential benefits.
- The local capacity for and availability of the new technology is limited. This creates an issue about regular maintenance and servicing of the new technology, as against the established system for the existing (conventional) technology.
- Enhancing awareness about the comparative benefits of the new technology could be useful in significantly enhancing its adoption

In both foundry and glass sectors, the project facilitated EE technology development and dissemination by identifying and strengthening the capacities of LSPs (local fabricators, consultants, masons, etc.) to make them capable of delivering the EE technologies as well as providing follow-up technical support services at the cluster level.

In the foundry sector, the project experience during the earlier phase had shown that often, foundry entrepreneurs using conventional cupolas were reluctant to switch over to the new DBC melting technology despite its proven energy savings and attractive payback period, because of the high capital investment required on the new DBC system. Hence, TERI formulated a flexible technological package that provided such entrepreneurs with options to derive moderate increases in energy efficiency at relatively lower costs through:

- (a) 'Retrofitting' their conventional cupola with a new blower and air distribution system, and/or
- (b) Switching from manual charging of the cupola to a bucket charging system.

Such technology delivery models were established for Ahmedabad, Coimbatore, Howrah and Rajkot clusters. Each such model brought together LSPs, consultancy organizations, industry associations and other cluster level entities.

The project activities led to replication of the EE technologies and adoption of best operating practices (BOP) as follows up to December 2010:

- 21 TERI-designed DBCs commissioned in the four foundry clusters during the project term (cumulative replications 89 +).
- 13 TERI-designed recuperative pot furnaces commissioned in Firozabad glass cluster (cumulative replications 74 +).
- Around 300 factory-floor personnel (including furnace operators and supervisors) trained in BOP in foundry sector

In the glass sector, the replication of the main technology, the recuperative pot furnace for glass melting, has been one of the key success factors of the TERI-SDC intervention. More than 74 units have adopted the technology, and all new furnaces are adopting the 'TERI design' as the furnace has come to be known in local parlance. In fact, replication of the TERI furnace seems to be a logical step for most entrepreneurs with whom the team interacted. Hence, the role of a successful replication is absolutely critical, and both Howrah and Firozabad clusters, as also other foundry clusters, symbolize this.

The local technology service providers in Firozabad also played a key role in the replication efforts; they not only supported the replication of the technology once the design had stabilized but also provided the much needed local presence and linkages with the local entrepreneurs.

Fresh from the success at Howrah, TERI negotiated a much higher contribution from the glass unit at Firozabad. TERI found a volunteer who was willing to experiment over several months as the experimentation went through trial and errors. Despite the earlier 'failures' in Firozabad, it is interesting that units were willing to experiment another time and that too with an agency that was seeking investments and did not bring finance as a package. This aspect demonstrates that MSMEs, once convinced, are willing to invest in technology and are also willing to invest time and money to make the project succeed. That said, some areas of India such as Howrah, with its historic industrial base, are perhaps also the most difficult to achieve a breakthrough. Hence, the choice of a cluster for intervention may be of importance in the case of an industry with clusters at many locations.

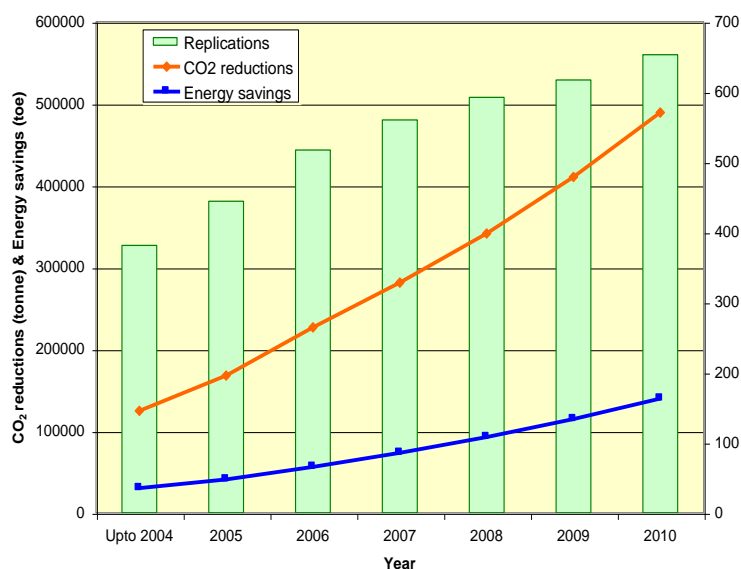
3.3 *Energy saving.* The main benefit of the DBC technology is the lower energy (coke) consumption. The savings in coke is significant and ranged between 15%–30 % for most of the units interviewed. This results in an attractive payback of 1 to 2 years on the investment for a mid-sized foundry unit. Another advantage of the new technology, which was

reiterated by several units, is the increase in metal tapping temperature. A higher metal temperature is needed for foundry units making small castings or castings having thin sections. The DBC design results in a higher melting rate which leads to an overall increase in productivity in the foundry. The technology is also robust in terms of design. The first demonstration cupola which was installed over 12 years ago is still operating well without major maintenance. The units that have adopted the DBC also mentioned that the operation of the cupola has become simpler after adoption of the new design. An advantage of the system is that it is possible for the foundry units to operate using a higher percentage of mild steel and scrap. This leads to additional savings in operating costs. The reviewers found that it is possible to get sufficiently higher melting temperature using high ash coke (nearly 30% ash) with the technology, which is truly remarkable. There are several indirect benefits of the improved melting technology that were reported by the foundry units. A few foundry units confessed that they have benefited by way of an improvement in quality of the castings and reduction in rejections due to the higher and more consistent melting temperature. An entrepreneur in Howrah summed up the intangible benefit of gaining 'peace of mind' after having adopted the technology. Apart from the benefits of coke savings, he now faces few problems with the pollution control authorities.

The cumulative energy savings that have resulted from replication of the EE technologies developed and promoted by the project are as follows (as of December 2010):<sup>3</sup>

- (a) Foundry sector: 27000 toe
- (b) Glass sector: 61000 toe

The energy efficient technologies adopted by different MSME units are yielding significant and consistent energy savings resulting in reduced CO<sub>2</sub> emissions. It was reported by TERI that more than 650 MSME units (including biomass sector) have adopted the EE technologies promoted by the project since its inception in 1993. The estimated cumulative energy savings are about 139,000 toe (tonnes of oil equivalent), corresponding to a cumulative reduction in CO<sub>2</sub> emissions of 487,000 tonnes (see figure below).



<sup>3</sup> Assumptions for estimation of energy savings and CO<sub>2</sub> reduction

- (i) The operating hours and production of the replications units remain same before and after modification
- (ii) The replication units achieve consistent energy savings
- (iii) Average calorific values of fuels (coal, coke and natural gas) have been considered

3.4 *Capacity building of stakeholders – establishing a delivery system.* Under the project, the capacities of stakeholders were enhanced on the efficient use of the clean, EE



LSP training programme

technologies through knowledge sharing initiatives. The primary stakeholders at cluster level were individual MSME entrepreneurs, workers and supervisors, industry associations, technical institutions, fabricators and local consultants. The project helped in developing a few such potential stakeholders as ‘local nodes’ who could assist in accelerating the adoption of the EE technologies both within and beyond the cluster (for instance, Saravana Engineering Work, the LSP in Coimbatore foundry cluster and Mr

Rakshit, the project LSP based in Howrah foundry cluster). The capacities of the cluster level stakeholders were strengthened through training programmes/workshops on BOP – comprising theoretical sessions as well as hands-on sessions in situ – for different levels of factory personnel including entrepreneurs, supervisors and workers. Similar training programmes were organized for LSPs. Exposure visits and inter-cluster exchange visits were also organized for government officials, entrepreneurs and other stakeholders to promote knowledge/information sharing on salient features of EE technologies/ products. Table 3.4 summarizes the capacity building programmes conducted under the project, the different target groups and the outcomes.

**Table 3.4** Capacity building programmes under the project

Target group	Tool/content	Outcomes
Entrepreneurs	One-to-one meetings, cluster level awareness seminars, exposure visits	Accelerated adoption of technologies
Workers and supervisors	Training programmes	Best operating practices on demonstrated technologies
Fabricators, equipment manufacturers and consultants	Training programmes, project-level interactions	Best practices in design, fabrication and commissioning
Government departments/ bilateral & multilateral agencies	Exposure visits	Development of new cluster level programmes

The project also facilitated the formation of informal groups at cluster level which helped promote ‘experience sharing’ on cleaner technological options and operating practices. These informal groups were created at different levels in some of the clusters, e.g. owners, supervisors/ workers, and technology providers.

3.5 *Knowledge management – newsletter/website.* The project shared information related to its activities, experiences and achievements through two media: an ongoing quarterly newsletter titled *CoSMiLE Update* and a website ([www.cosmile.org](http://www.cosmile.org)). The newsletter (currently into its 20<sup>th</sup> issue) and website have helped in spreading awareness on the clean EE technological solutions among the wider community of MSME stakeholders,

both at the national and regional levels. The newsletter is presently mailed to around 400 organizations in both hard copy and soft copy; it is also posted on the website, which in addition hosts a number of freely downloadable project-related documents (process stories, case studies, reports, etc.). SDC-TERI have also joined with BEE and the Ministry of MSME in the formation of a platform for facilitating knowledge sharing among different MSME stakeholders called 'SAMEEEKSHA' (Small and Medium Enterprises: Energy Efficiency Knowledge Sharing). SAMEEEKSHA is an innovative collaborative platform aimed at pooling and synergizing the knowledge and efforts of different organizations and institutions – Indian and international, public and private – that are engaged in facilitating the development of the SME sector through the promotion of EE technologies and practices. The SAMEEEKSHA Secretariat has been established in TERI. The first two issues of the 'SAMEEEKSHA newsletter' have already been brought out, and a dedicated website is in an advanced stage of construction.



4<sup>th</sup> Coordination committee meeting of SAMEEEKSHA

The two initiatives on information dissemination and knowledge management – one a showcase of TERI's own initiatives (CoSMiLE) and the other BEE-led (SAMEEKSHA) – need to complement each other and synergize. In addition, the project has collaborated with IIF in strengthening its website, and has regularly participated in the foundry congresses. These have been important platforms for sharing of information with a wide cross-section of stakeholders, and should be continued.

3.6 ***Pilot social action in foundries.*** The project also undertook social action initiatives through a grass-roots level NGO partner in the foundry sector that have brought small but tangible improvements. Specifically:

- 'Bucket charging system' saves workers from the drudgery of manually lifting heavy loads and also reduces their exposure to high carbon monoxide levels.
- Worker-Owner Platform created opportunities to open dialogue between entrepreneurs and workers on topics such as improvement in workplace environment, health and safety, and training of workers.
- Health cooperative for workers in the Howrah cluster helps in providing primary health care and affordable medicines.

These social initiatives are measures that need to be strengthened as they not only enhance the credibility of the effort but also help improve productivity of the workers.



Worker-Owner Platform, Howrah foundry cluster

3.7 **Rating system for MSMEs.** The project also collaborated with SME Rating Agency of India Limited (SMERA), a joint initiative of SIDBI, Dun & Bradstreet Information Services India Private Limited and several leading public and private sector banks in the country to develop a Green Rating Model for the Indian foundry industry. The initiative seeks to encourage MSMEs to adopt better technologies and processes to prevent environmental damage. The model also takes into account social conditions concerning workplace environment and safety. The project helped SMERA validate the Green Rating Model among foundry units in Rajkot cluster and participated in cluster level awareness meets organized by SMERA. The collaboration with SMERA is useful to enable MSMEs to develop a better understanding of their manufacturing processes and technology and encourage them to adopt cleaner technologies and socially responsible business practices as responsible corporate entities. TERI has now signed an MoU with SMERA to promote the concept on a larger scale.

3.8 **Policy linkages (local, state, national, international).** The successful outcomes of the project progressively helped in establishing TERI's reputation as a capable and reliable technology partner among MSME sector stakeholders – entrepreneurs, associations at cluster and national levels, technical consultancy organizations like GITCO Ltd, fabricators and other LSPs, financial institutions like SIDBI, and government bodies/institutions like CPCB and state pollution control boards, BEE, Ministry of MSME, and PCRA. This in turn led to new partnerships between TERI and other organizations/institutions as indicated below:

- Policy/Advisory
  - TERI provided inputs to Ministry of MSME in the formulation of a number of schemes for improving the competitiveness of the MSME sector through technology upgradation: notably, the Technology & Quality Upgradation Support to MSMEs (TEQUP) scheme.
  - TERI provided inputs in the formulation of the UNIDO-GEF SME Project covering 12 clusters including 3 foundry clusters.
- Replication/Enhanced Outreach
  - TERI is implementing a Business Development Services project in the Chandigarh and Rajkot SME clusters with support from SIDBI under a World Bank-led multi-agency initiative.

- TERI is a knowledge partner with BEE in its SME Programme covering 29 clusters. In this capacity TERI has provided technical and advisory support in programme activities including energy audits and technology gap assessments; preparation of cluster manuals; awareness generation; and preparation of investment-grade detailed project reports (DPRs) for EE technologies.
- Collaborations
  - TERI succeeded in securing support from PCRA for subsidizing the hardware costs of four TERI-designed DBCs in the Ahmedabad foundry cluster. The DBCs were designed specifically to meet the smaller melting requirements characteristic of foundry units in the Ahmedabad cluster.
  - Additional EE initiatives have been undertaken by TERI in the Coimbatore foundry cluster, aimed at information dissemination and strengthening of policy linkages, with support from the Renewable Energy & Energy Efficiency Partnership (REEEP).
- TERI is also implementing the UNDP-GEF project on 'Energy efficiency improvements in brick industry'.

The focus of activities under the project has been at the cluster level. The project has been quite successful in attracting people to various cluster activities, such as the workshops and training programmes it has been conducting regularly. Hence, a key strength of the project has been its cluster level linkages to entrepreneurs, LSPs and industry associations. However, the linkages of the project to government initiatives have been weak, both at the central and state levels. It is possible to address this weakness and build relationships with government schemes in the subsequent phases of the collaboration.

**3.9 Global Outreach and Replication.** The project efforts to promote the DBC in the Indian foundry sector attracted interest from the Foundry Owners Association of Bangladesh (FOAB). At the behest of FOAB and with the support of International Finance



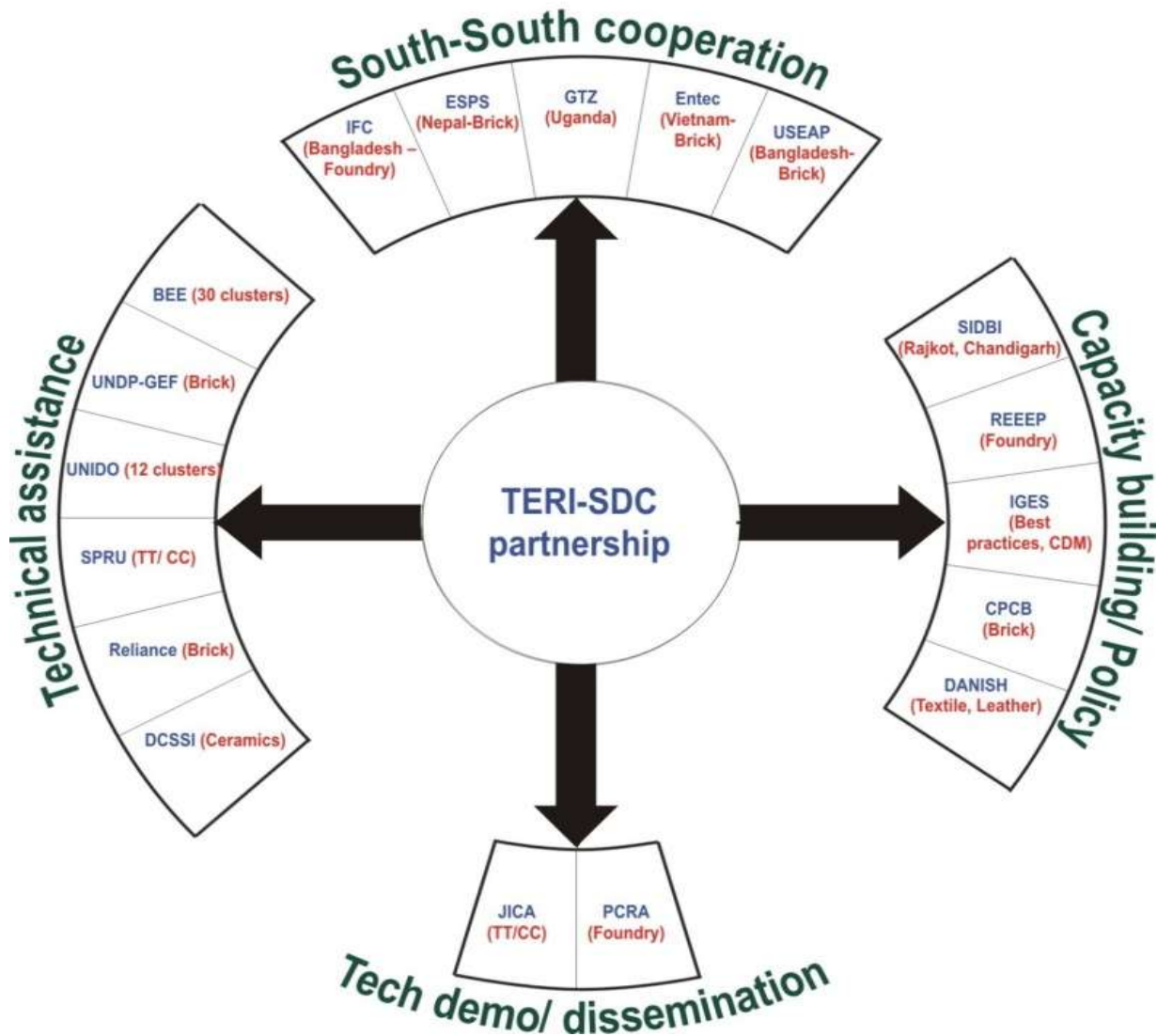
DBC at Bogra, Bangladesh

Corporation's South Asia Enterprise Development facility (SEDF), Dhaka, TERI successfully assisted two small-scale foundry units in the Bogra foundry cluster in Bangladesh in adopting DBCs that were designed to meet the local requirements. Through FOAB, TERI also provided the local furnace operators with training in BOP in foundry operation and maintenance. Some other partnerships that have been influenced by the TSP project are at [Annex-II](#). The figure given below illustrates the different facets and reach of this project.

While the project has led to direct benefits like technology development and energy savings, the benefits go much beyond. The project has upgraded capacities of an institution such as TERI and has established the agency as a significant player in the domain of technology adaptation for energy efficiency. This positioning has brought about linkages with other stakeholders such as SIDBI and BEE

and has enabled replication beyond the sectoral boundaries of the project. The other key benefit of the project is its replication across India's boundaries, demonstrating South-South

cooperation. Multilateral agencies like the World Bank and IFC have played a role in engaging with TERI and in replicating and facilitating technology transfer. Also, some BASIC countries, USEPA, Germany, etc. have found the model interesting and have evinced interest in working with it. TERI's learnings have also been fed into policy at the level of the Government of India, and SDC can take credit for having had a role in influencing and strengthening policy.



#### 4.0 Project management and performance

The implementation of the proposed project in the MSME sector was undertaken by the Industrial Energy Efficiency (IEE) Division, TERI. The Division focuses on development and promotion of technological solutions for efficient utilization of energy in the industrial sector. The Division has about 25 full-time professionals, mostly engineers, located in Delhi and Bangalore. The activities of the Division encompass large industries as well as small and medium enterprises (SMEs). The key activities of the Division are as follows:

- Assist industries in reducing their energy consumption through energy audits at the plant level
- Undertake technology assessment studies with regard to energy and environmental performance for different industrial sectors
- Develop and promote energy efficient and environment friendly technological solutions for SMEs
- Facilitate knowledge sharing and learning among industry stakeholders through workshops, seminars and focused training programmes
- Facilitate development and execution of GEF and CDM projects at different levels for the industry sector
- Undertake corporate GHG accounting and development of GHG emissions calculation tools using internationally accepted guidelines
- Provide inputs on transfer and diffusion of environmentally sound technologies in the context of climate change

The Project Coordinator is the Director, IEE Division. The Project Coordinator is responsible for the overall project management and was the focal point for project monitoring and review process. The team has engaged with stakeholders like industry, entrepreneurs, LSPs, Government agencies, international bodies, associations, NGOs, etc. as detailed in [Annex-III](#).

The SDC-supported project has helped the TERI team to develop a deep understanding on various issues related to the MSME sector. This group within TERI can be considered as one of the most experienced groups in the country – and probably in the developing world – having ‘hands-on’ field level experience of implementing energy conservation projects in the MSME sector in India..

TERI staff have laboured and worked with the staff of international experts, e.g. British Glass in glass sector, to get the project off the ground. Since the technology and scale of the pot furnace in Firozabad is quite unique, the technology intervention has meant an element of trial. While efforts to minimize the trial would have been tried, it remains to be seen whether greater exposure to technology management could reduce such trials in future in terms of depth and extent.

The TERI staff needs some exposure and hand-holding support in managing the financial aspects of projects, especially in a project of this complexity. As an example, the elements of subsidy available to the first adopter of the DBC in Howrah were much higher in percentage and absolute terms than those available to the first adopter of the pot furnace in Firozabad. While cross-cluster parity is not a stated objective, TERI can strengthen its capacities in project costing and collateral support so that some degree of uniformity is ensured. Deviations if any should be part of a stated policy to raise or lower the element of subsidy. Some exposure on financial aspects of project management will be useful to the engineers from TERI.

## 5.0 Way forward for up-scaling

The effort of the partnership has been to design, develop, demonstrate and deploy innovative technologies in the MSME sector. It has also taken measures to build capacity of the LSPs in addition to training of workers, owners and other related stakeholders during

the project. This has led, in some measure, to replication of EE technologies and linkages with other institutions like government and bilateral/ multilateral partners. The efforts now need to be scaled up in the following manner:

## 5.1 Consolidation.

In the two sectors reviewed, it is evident that the technology incubation efforts as well as technology demonstration and deployment have been immensely successful. This has not only helped technical upgradation of the units where this intervention was carried out, but also led to best practices related to the welfare of workers. The need is to deepen the intervention within these sectors, to consolidate as well as expand the coverage of units within them. The steps recommended in this regard are as under:

- (a) Sustained provision of information – this should include best practices documentation and dissemination of successful cases.
- (b) Reaching out to new units through the local associations and LSPs, and providing hand-holding support.
- (c) Engaging with Ministry of MSME and BEE, and providing support to units in these clusters to get financial and technical benefits for EE technologies under their respective schemes.
- (d) Working with the institutional partners, in the government as well as international agencies, to create a system of incentives for adoption of EE technology.
- (e) Enhancing awareness about the benefits of better working conditions (increased adoption by foundry units of the ‘bucket charging system’, split cupolas in Ahmedabad for ease of maintenance, etc.); support to unorganized workers through health insurance and other social security measures.

## 5.2 Expansion /replication

Replication of the model developed is necessary in other sectors. For this, it is suggested that institutional partnerships need to be developed or strengthened to enable mainstreaming of energy efficiency interventions within and across MSME sectors. During the current phase, TERI has partnered with other institutions/organizations in the following programmes in order to upscale EE technologies in the foundry industry:

- *BEE SME programme.* TERI is providing knowledge and human resources support to BEE for the development and implementation of this programme in 35 energy intensive MSME clusters, which include the foundry clusters in Belgaum, Coimbatore, Rajkot, and Ludhiana
- *UNIDO–GEF SME project.* TERI assessed the potential of energy savings in three foundry clusters – Belgaum, Coimbatore, and Indore – to assist in the formulation of this project, which focuses on developing a market environment for EE technology in 12 MSME clusters
- With the support of REEEP, TERI is working in the Coimbatore foundry cluster to create market awareness of and strengthen delivery systems for EE solutions.
- TERI is partnering with SIDBI to implement a DFID/World Bank-aided project to improve the access of SMEs to finance and business development services (BDS) in two SME clusters: Rajkot foundry cluster and Mohali–Panchkula–Chandigarh engineering cluster.

The model developed and deployed successfully by TERI-SDC should be used for creating and sustaining technology incubations, developing them to suit local needs, developing capacities of LSPs, training and capacity building at cluster level. It must also create sustainable value chains for information dissemination to all the relevant stakeholders.

5.2.1 The partnerships that have been forged in this and earlier phases of work under the TSP project can be further strengthened during the next round of intervention. While the approach could broadly remain the same, greater linkages with government agencies will allow replications to happen across others sectors as well. The reviewers understand the inertia that government agencies demonstrate at times, but nevertheless, once this is overcome, significant gains can be achieved in terms of outreach. The government does not lack financial resources, but can benefit greatly from approaches that have worked – and the TSP project can contribute greatly in this direction.

TERI and SDC should go back to the drawing board as far as social interventions are considered. This project was designed as a technology intervention, and the add-on in Howrah in terms of training of workers and devising social security systems appears superficial and does not go well with an otherwise excellent project. So, while worker-level interventions are needed, SDC perhaps cannot address all that ails the SME sector in India. Also, TERI is not the right agency for social interventions, and it is best not to draw TERI into an area where its capacities do not exist.

### 5.3 Technology development

Technology development is the cornerstone of the successes of the partnership, and needs to be continued with. TERI could be the bridge between the specific needs of the MSME and the agencies involved in technology development and incubation. These could be the academic institutions, R&D agencies of government or industry or any other such institution. There have been various international initiatives on needs assessment but few focusing on development of cleaner technologies. In recent years, developing countries have articulated the need for cleaner technological solutions to enable them to move to a low carbon growth path in various international climate change debates. The project objectives are thus in tune with this need expressed by developing countries. The emergence of Climate Technology Centre and Network (CTCN) as a technology mechanism under the ongoing global climate negotiations needs to be carefully examined for synergizing the efforts in this regard. There is a good scope to focus on development of cleaner technologies for many other energy intensive metallurgical sectors where energy is used inefficiently such as non-ferrous metal (aluminium, brass etc.) foundries and the large number of enterprises involved in heat treatment processes.

### 5.4 Engagement with government stakeholders and academic institutions

The phase under review has seen broad collaborations with a diverse set of agencies and government departments. This will be an important aspect while going forward, and has to be followed up as a directed strategy. Government departments such as the Ministry of MSME and agencies such as BEE offer the greatest possible replication potential and opportunity to impact policy level changes. These should be pursued aggressively which will call for concerted efforts. Agencies such as SIDBI and rating agencies such as SMERA should also be engaged as a directed strategy rather than a chance meeting of paths. Outreach to academic institutions has not been established in this phase. It is important that the learnings of the project are in some way taken to the academic world, so that students

graduating and entering the SME sector understand the technological developments. In some sense, the engagement curve with academic institutions may be steeper than with government departments; but the efforts should be made nonetheless.

The project could also explore opportunities of collaboration with Energy Efficiency Services Limited (EESL), the new energy services company promoted by the Government of India with the vision of scaling up implementation of energy efficiency, creating markets for energy efficiency and providing financing support for implementation. The linkages with EESL would be necessary for scaling up, given that the interventions are now in the implementation phase. Close engagement will serve the stated objective of the partnership, of mainstreaming the exercise in the larger policy arena, and thereby ensure its sustainable replication.

## 6.0 Conclusions and key recommendations

### 6.1 Conclusions

The following are the conclusions on the features that were incorporated in the three-year project phase (2009–11) and which have been the critical success factors. Based on the achievements of the current phase, the recommended way forward is to consolidate the key success factors by creating and sustaining a network for LSPs, deepening and broadening engagement (deepening through strategic linkages and broadening by similar efforts in new clusters), and promotion of R&D. The specific conclusions and recommendations are as under:

#### 6.1.1 Development of local capacities and hand-holding support vital for deployment of improved technology

MSMEs were able to acquire the ‘hardware’ (equipment and tools) as well as software (knowledge and skills) components of an EE technology on an ongoing basis. The TERI-SDC partnership enabled them to use the technology optimally. The following were the key aspects of hand-holding support provided to the MSMEs:

- *Training on BOP.* The operators and supervisors in an MSME unit are generally not trained/skilled personnel. It is essential to help them in understanding how the improved technology works, and to provide them with the knowledge and skills needed to operate the various systems efficiently. Hands-on training of operators and supervisors on best operating practices (BOP) hence formed a vital component of technology dissemination.
- *Establishing and strengthening LSPs.* Local service providers (LSPs) were identified at cluster level and their existing technical capabilities strengthened through capacity building programmes to enable them to interpret design drawings, fabricate equipment according to strict quality norms, commission the EE technology, and provide the MSME units with training in BOP as well as technical back-up and trouble-shooting services.

Certification of LSPs can be a way forward for greater replication and creation of a pool of consultants. TERI and SDC can lay down guidelines for certification of consultants. As an example, if the local consultant for the recuperative pot furnace has supported the replication of, say, three furnaces of different types (the number could be more or less), he/she should become a TERI-certified consultant on the pot furnace. This certification should not be restricted to LSPs but should be extended to TERI staff as well. The

certification process should be rigorous and motivational, and ensure a certain minimum quality of the consultant. This will give a fillip to the replication process and enable access for industries to a pool of accredited consultants. A list of such consultants can be maintained on the TERI website.

### 6.1.2 Sustained engagement with MSMEs

Given that the majority of MSME units had very low levels of managerial and technical expertise and that their levels of awareness and information were limited, the TERI-SDC partnership provided them with sustained support to get them to understand the benefits. The credibility of TERI and its partners like Institute of Indian Foundrymen (IIF) went a long way in encouraging the units to take the decision in favour of EE technologies. The non-commercial independent status of TERI also helped it to intervene in the MSME sector. These units are usually wary of opening their doors to outsiders. However, they did not have the same apprehension while working with TERI, probably because they did not feel the threat of company information and data being passed on to their competitors and/or government agencies. The TERI-SDC project, therefore, is a unique model for development and dissemination of EE technologies in the MSME sector through collaborative RDD&D. It could serve as a model for other government/ bilateral/ multilateral initiatives to promote low carbon technologies in the MSME sector. In particular, SDC's principle of long-term engagement allowed the formulation of flexible, participatory schemes and actions under this project that could be undertaken for extended durations. The positive outcomes of this close and continuous engagement with industry stakeholders are evidenced by the increasing uptake of the EE technologies and practices promoted under the project and the tangible benefits they have brought to entrepreneurs and workers as well as to local and global environment.

### 6.1.3 LSPs vital to scale up dissemination of EE technologies

The project experience shows that dissemination of EE technology within an MSME cluster can be supported by establishing capable LSPs. For example, the work undertaken in the Firozabad glass industry cluster as well as in the Howrah foundry cluster was successful primarily on account of the close involvement of the LSPs who were supported under the programme by TERI. In addition, the BEE SME programme includes LSPs as one of the major elements for dissemination and deployment of EE technologies.

### 6.1.4 Close engagement with partners/stakeholders for scaling up

The project has shared its knowledge and experiences in the MSME sector with bilateral/ multilateral organizations, government agencies and other entities involved in promoting energy efficiency in the MSME sector through meetings, seminars, workshops, training programmes, websites, newsletters, etc. This knowledge-sharing approach has helped synergize different initiatives and led to partnerships and launching of new projects in the MSME sector with key organizations like BEE, Ministry of MSME, PCRA and SIDBI, thereby helping in the scale-up of EE technologies. The SAMEEEKSHA initiative that has been recently started with the involvement of Ministry of MSME and BEE is a positive step in coordination at policy and implementation level and needs to be sustained.

### 6.1.5 Enabling policy environment

The project experience has shown that the uptake of EE technology is profoundly impacted by policies related to fuel pricing, supply of electricity/clean fuels, and enforcement of

pollution control norms. It also reveals that there is insufficient awareness at policy and institutional levels on the opportunities and cascading benefits that EE technologies offer – to industry, service providers, markets, banks, and other related sectors. It is therefore essential to generate awareness and provide guidance at policy and decision-making levels on the need to provide the MSME sector with access to clean fuels at affordable prices, and the specific advantages offered by EE technologies. The BEE SME programme, which has TERI as the knowledge partner, has built on the model of this partnership in an effort to undertake energy efficiency interventions in about 35 identified energy intensive clusters. The Ministry of MSME has also recently announced a capital subsidy scheme for encouraging EE technology deployment. This scheme, too, has benefited from the lessons learnt from this partnership.

#### 6.1.6 Economic benefits to entrepreneurs

The direct beneficiaries, the entrepreneurs who run the units with the new EE technologies, have been able to save energy and derive direct economic benefits. This fact was evident from the field visits and interactions with the entrepreneurs. The demand from other entrepreneurs for EE technologies suited to meet their individual requirements was very clearly indicated to TERI. For example, in the case of foundries, the interest was evinced for smaller-size cupolas; in the glass sector it was for pot quality improvement. It was observed that entrepreneurs are reluctant to replace their conventional technologies by new technology, even if there is an attractive return on investment in the new technology. Enterprises usually prefer to make additional investments in new technology either when they are expanding production capacities or need to replace their existing plant.

#### 6.1.7 Limitations of TERI-SDC partnership

While the partnership has been successful in the interventions that it undertook, the following were the limitations that were observed during the review:

- (a) The linkages with national level agencies of the government could have been more pronounced. Apart from TERI's partnership with BEE which started in 2007-08, it has been involved with Ministry of MSME only in a consultative capacity. The engagement with state governments has also been limited.
- (b) While replications did take place and are broadly in line with the LFA indicators, their scale was limited within the foundry clusters in most of the cases. At the same time, the demand-side factors and macro-economic environment played an important role in limiting the uptake of DBCs. On the supply side, considering that the technology delivery models involving new LSPs have been newly developed, it will be some time before the results begin to show. The review team felt that it might be possible to scale up faster if additional resources are allocated, specifically for strengthening the field level project management structure.
- (c) There was limited success in getting financial institutions, in particular SIDBI, involved in the process to enable lending for units. However, the TERI project team informed that as per their project experience, because of the small size of investments involved and poor creditworthiness of SMEs, neither is it attractive for the banks to lend to SMEs nor are the SMEs interested in seeking loans. Most of the entrepreneurs who have replicated the EE pot furnaces and DBCs have used their own resources.

- (d) The dissemination strategy of the partnership has to be a thought-out effort with emphasis on face-to-face interactions. Workshops and seminars have to play a key role in dissemination and may to some degree involve SDC and TERI parading the work that they have done, but will be useful in sending the message to the right places. SDC has always played a quiet, behind-the-scene role in the field of development cooperation; perhaps in the interest of wider dissemination and replication, SDC will consider a more aggressive and in-the-face dissemination strategy. The CoSMiLE website is perceived as a very useful dissemination vehicle in this age of information technology where new-generation MSME entrepreneurs are technology savvy. SDC and TERI can however consider subsuming the CoSMiLE newsletter within SAMEEKSHA, as the outreach of paper-based publications is limited. This move will also enable greater linkages with BEE, and will allow for the success of the programme to ride on a newsletter of the Government of India. The SAMEEKSHA newsletter can continue to provide linkages to the CoSMiLE website.
- (e) Social actions initiated as a pilot in Howrah, though extremely welcome, could not be enlarged due to lack of resources at the command of TERI. Also, SDC will have to think through carefully as to whether it would like to get involved in social initiatives. SDC cannot possibly address all that ails the Indian MSME sector, and in some sense the social sector engagements look like patchwork on an otherwise outstanding technical initiative.
- (f) The project demonstrated a techno-economic model that could be used by SME sectors in several other countries. Though there were some attempts to promote this in Bangladesh, South-South transfer could not take place more extensively.

## 6.2 Key recommendations

The key success factors of the partnership could provide an opportunity to scale up the same at the national level with an appropriate mix of policies, regulations, financing and technical assistance. The TERI-SDC partnership has developed and demonstrated a successful model that incorporates all these aspects and has also benefited similar government programmes. There is need to continue the TERI-SDC partnership to sustain and improve the energy efficiency drive in the MSME sector. The TERI-SDC model developed and successfully implemented in the glass and foundry sectors needs to be consolidated by encouraging other units in the two sectors. In addition, the partnership should extend this model into other energy intensive MSME sectors in sync with the government initiatives. These sectors could be non-ferrous foundries, metallurgical sectors, ceramics, etc. The following specific aspects are recommended for inclusion in the next phase of the partnership. These recommendations have been categorized as follows:

### 6.2.1 Specific measures/ actions to be included to complement efforts at national level

#### 6.2.1.1 Prepare a roadmap for national level transformation

The Government of India is in the process of finalizing the XII Five Year Plan. All the relevant Ministries and agencies like BEE are undertaking the planning process. As mentioned earlier, promotion of clean technologies in the industrial sector is a thrust area of the government. The Ministry of MSME as well as BEE are developing strategies and interventions that will be implemented in the MSME sector during the five-year period

commencing 2012. TERI-SDC must continue to engage with these apex institutions and support the development and implementation of a roadmap for national level transformation. The TERI-SDC partnership could facilitate the planning process of the relevant government agencies by providing technical inputs as well as facilitating stakeholder consultations.

#### ***6.2.1.2 BEE SME Programme***

As mentioned earlier, TERI has been the knowledge partner for the BEE SME programme during the ongoing XI Five Year Plan. It has supported the efforts of BEE to implement energy efficiency initiatives in 35 clusters. Almost 1200 investment-grade DPRs for enhancing energy efficiency will be prepared. During the XII Plan, these DPRs will be implemented with financial support through SIDBI, which has signed an MoU with BEE. In addition, the next Plan period will also see BEE planning the demonstration of some EE technologies as well as increasing the coverage to other energy intensive clusters. It is recommended that TERI must endeavour to continue the partnership with BEE so that it can leverage the experience and expertise it has developed over the long period of engagement with the MSME sector. The BEE programme is now in a take-off stage at the national level. Continuance of the TERI-SDC partnership will help this national transformation, given that the BEE programme benefited from the model developed by the partnership.

#### ***6.2.1.3 Partnership with Ministry of MSME for Technology and Quality Upgradation support to MSMEs (TEQUP)***

The Ministry of MSME has initiated the TEQUP scheme of providing capital subsidy for EE technology upgradation by MSMEs. This is a recent scheme approved by the Government of India. According to the Ministry of MSME, the funding available is likely to be increased in the coming years through the Clean Energy Fund set up by the Government through a levy of cess on coal. TERI-SDC could disseminate information on the scheme and also support eligible units to help access these funds. This would also enable replication of clean technologies in energy intensive MSME clusters. TERI-SDC could enter into a partnership with the Ministry of MSME for this purpose.

#### ***6.2.1.4 Perform, Achieve and Trade (PAT) mechanism***

Under the National Mission for Enhanced Energy Efficiency (NMEEE) being implemented by BEE, a market-based instrument for accelerating energy efficiency in the industrial sector by certification of energy savings is being structured. The Energy Conservation Act, 2001 has been amended to enable the implementation of the scheme. Mandatory energy efficiency targets will be set for large industries covered under the scheme, with an incentive of certification for over-achievement that could be traded for compliance purposes. At present MSMEs are not covered by the regulation under the Act. BEE is likely to widen the coverage of the application of the instrument to sectors not yet covered, and also increase the scope within the sector by lowering the current energy consumption threshold. The TERI-SDC partnership could support BEE in identifying and prioritizing the sectors in terms of techno-economic feasibility of available EE technologies, preparedness of sectors, and other factors that could be mutually decided.

#### ***6.2.1.5 Development and maintenance of national level database***

TERI could, as part of the next phase of this project, endeavour to develop a comprehensive database for addressing the data gaps in the MSME sector in general and for energy use in particular. As a first step, TERI could do a quick scan on the data available and come up with options for expansion of the database into new sectors and/or clusters. This could be

followed up with a more rigorous exercise in the next phase along with concerned agencies of the Government of India and industry associations/ chambers of commerce. This will be a big step in the direction of the overall national goal of transforming the largely unorganized MSME sector into a vibrant and organized sector.

## 6.2.2 Consolidation of Key Success Factors

### 6.2.2.1 *Develop and sustain network of LSPs*

One of the key success factors of the partnership has been the development of LSPs, who have proven technical ability and credibility in the eyes of the units. They are relied on for most technical matters relating to technology decisions, training, and maintenance. The support of LSPs in dissemination of technology has been vital. These LSPs need to be nurtured through an institutional mechanism. It is suggested that a network of LSPs be set up and sustained by capacity building programmes, technical tours and regular meetings. This will not only enable formalization of LSPs in the entire scheme of things, but also promote an institutional mechanism whereby the LSP network will serve as an information clearing house and support dissemination of best practices, visits to demonstration technologies, training and capacity building. The network, once operational, will have linkages with the LSPs being empanelled under the BEE SME programme.

### 6.2.2.2 *Continue engagement with MSMEs*

There is scope to focus on developing the market for the demonstrated EE technologies by targeting units which are expanding or moving to a new location or have furnaces which are reaching the end of their operating life. There is scope for the project to reach out to such units by undertaking awareness campaigns and developing a large number of LSPs at the cluster level. It is pertinent to note that new foundry parks are coming up in Howrah, Ahmedabad, Bangalore and other clusters. The project should have a strategy to engage with these new foundry clusters for faster spread of the demonstrated technologies.

### 6.2.2.3 *Special fund for R&D and technology incubation*

The partnership has highlighted the value of R&D and technology incubation suited to local conditions. It will be desirable if these efforts are continued for different sectors and applications. As stated earlier, the government has set up a Clean Energy Fund by introducing a cess on coal. One of the objectives of the fund is to encourage development of clean technologies by promoting research, development and deployment (RD&D). TERI-SDC could engage with the Ministry of MSME and/or BEE to set up a special fund to promote RD&D in the MSME sector. This fund could promote RD&D of technologies based on a needs assessment of the MSME sector. TERI-SDC could conduct the technology needs assessment for selected MSME sectors.

## 6.2.3 Exploring synergies/ participation in emerging international climate change technology frameworks

### 6.2.3.1 *Synergies with Climate Technology Centres and Network (CTCN)*

The technology mechanism being evolved under the climate change regime, the CTCN, is positioned to provide advice and support related to the identification of technology needs and implementation of environmentally sound technologies, practices and processes. It will help in the following:

- a) Facilitating the provision of information, training and support for programmes to build or strengthen capacity of developing countries to identify technology options, make technology choices and operate, maintain and adapt technology
- b) Facilitating prompt action on the deployment of existing technology in developing countries based on identified needs
- c) Stimulating and encouraging, through collaboration with the private sector, public institutions, academia and research institutions, the development and transfer of existing and emerging environmentally sound technologies, as well as opportunities for North–South, South–South and triangular technology cooperation
- d) Facilitating a network of national, regional, sectoral and international technology centers, networks, organization and initiatives with a view to enhancing cooperation with national, regional and international technology centers and relevant national institutions

India has been at the forefront of the CTCN through the BEE. It would be useful to explore synergies with this effort for faster technology development and deployment. In general, MSMEs themselves lack the capacity to invest in or sustain R&D initiatives. Hence, external support is required to establish and strengthen local-level *technology innovation centres* (TICs) that could evolve, deliver and support innovative cluster-specific technological packages. TICs could be linked to the CTCN through the TERI–SDC partnership to leverage the international effort in development and deployment of frontier technologies. The CTCN, housed under the aegis of UNFCCC, is in the process of preparing RfP for selection of partners at country/regional levels as well as global level. As per the current information, the selection process will be open to agencies other than UN agencies. TERI–SDC must seriously consider participation in the process with a view to accelerate the efforts of technology development.

### **6.2.3.2 *Enhancing South–South transfer***

Enhanced South–South transfer of technical, managerial and implementation expertise gained by the partnership is recommended. TERI–SDC must endeavour to engage with governments of developing countries willing to cooperate in this regard, and enlarge the scope of the activities to other countries with similar issues in the SME sector.

## **6.2.4 Stakeholder engagement and project management**

### **6.2.4.1 *Enhanced linkages with key stakeholders***

It is recommended that the engagement with government agencies is critical. Existing partnerships with BEE and Ministry of MSME need to be strengthened while that with EESL needs to be structured. In addition, TERI–SDC must strengthen linkages with institutions like IIF and synergize the efforts for technology development. For instance, IIF is encouraging foundrymen to go in for ‘duplexing’, even in bigger units, to exploit the high energy efficiency of the cupola in melt down of solid charge and high energy efficiency of the induction furnace in super-heating to higher temperatures.

### **6.2.4.2 *Project management support***

In order that the revised partnership is able to deliver on the recommended line of action, the project management will need to be strengthened. Additional and quality manpower at the disposal of TERI will be necessary to deal with emerging issues like PAT, CTCN, TEQUP as well as handling the additional effort required for sustaining the engagement with government and institutional partners.

## 7.0 Stakeholders consulted

The review team met with a wide spectrum of stakeholders involved in the project during field visits, meetings, etc. These included senior functionaries of BEE, Ministry of MSME, beneficiary units at Howrah, Ahmedabad, Firozabad, Rajkot, industry associations, LSPs, the NGO involved in the project, etc. A list of persons met by the review team is at [Annex-IV](#) and the ToR for the review is at [Annex-V](#).



## Annex-I

### Strategy and objectives of TERI-SDC Partnership

The partnership adopted the following strategy:

- Develop innovative technology dissemination models for EE technologies in selective MSME clusters. The dissemination models in each of the sub-sectors/clusters involved a mix of actors like industry associations, technical consultancy organizations, consultants, other service providers and others involved in the technology supply chain. The lessons derived from the success of replication models established in Rajkot foundry cluster and Ferozabad glass cluster were utilized to evolve similar models in other clusters of interventions.
- Establish strategic partnerships with government organizations and bilateral/multilateral agencies. The project has been successful in developing partnerships with government organizations such as BEE, PCRA and UNDP to support cluster level technology interventions. During this phase, efforts were made to establish/strengthen similar partnerships with other important stakeholders with the objective of capitalizing on existing programmes and leveraging resources.
- Strengthen capacities of direct and indirect stakeholders (enterprises, industry associations, policy makers and academic institutions/NGOs) on EE technologies and climate change instruments. The knowledge base developed under the project on design, implementation and operating practices were shared with the enterprises, industry associations and other local stakeholders through workshops and direct interactions. For the policy makers, field visits were arranged to sites for showcasing the results of the TERI-SDC intervention. This helped in enhancing their awareness on technology demonstration as an effective tool to promote energy efficiency and reducing GHG emissions.
- Facilitate 'co-benefit' activities such as improvement in local environment with GHG reduction. For example, the co-benefits associated with the successful replication of TERI-designed pot furnaces such as improved work environment and reduced CO<sub>2</sub> emissions were showcased to bring about greater awareness on the need for initiating similar interventions.
- Strengthen and enhance social actions in foundry and brick sectors. Efforts have been made to strengthen worker safety measures and make the initiatives more rounded. Thus, concerted and planned efforts have been made to address issues beyond energy.
- Explore opportunities for South-South cooperation and disseminate the technologies developed under the project to Bangladesh foundries.



## Annex-II

### Global outreach and replication

The global outreach and replication of the model of the partnership has had the following influence:

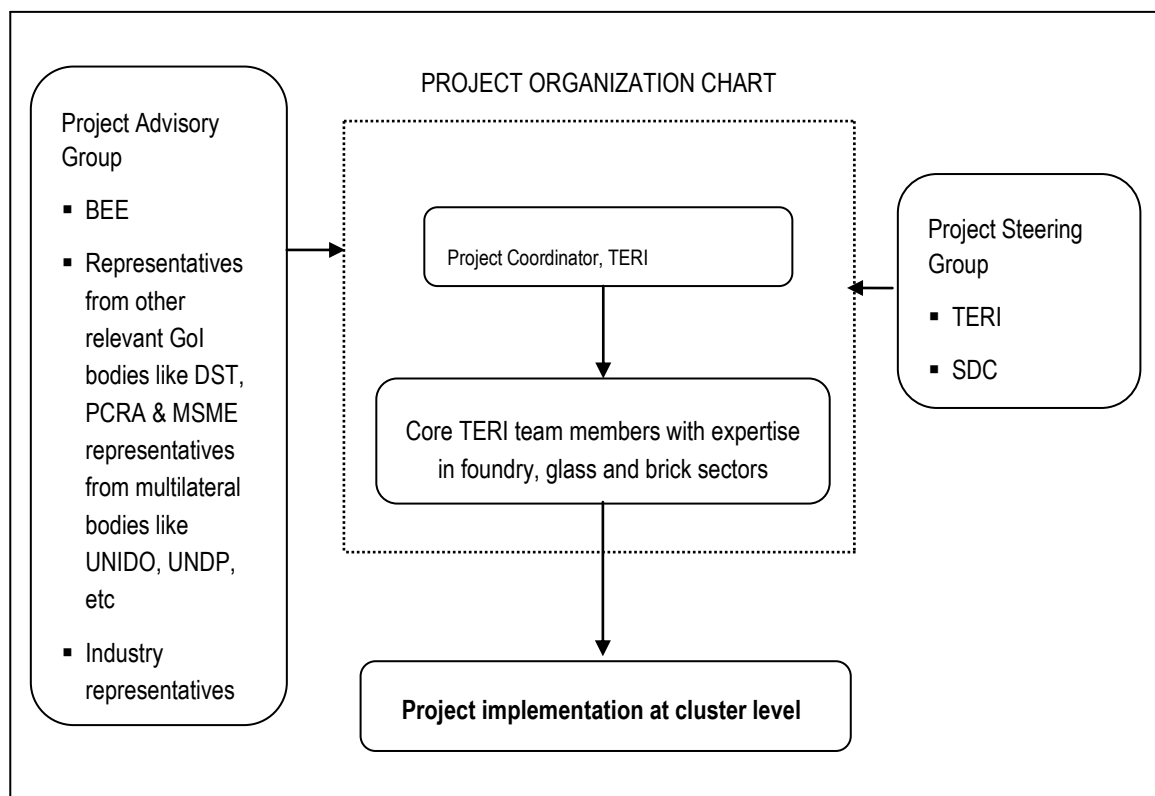
- The growing popularity of the TERI-design DBC among the Indian foundry industry has attracted interest from the foundry industry in Bangladesh, Pakistan, Nepal and other countries in Africa and South America. With the support of International Finance Corporation's South Asia Enterprise Development Facility (SEDF), Dhaka, TERI provided technical assistance to two small-scale foundry units in the Bogra foundry cluster in Bangladesh in adopting DBCs along with BOP. This experience could serve as a model for promoting South-South cooperation in the area of energy efficiency.
- TERI partnered with the Science and Technology Policy Research Unit (SPRU), University of Sussex in a 'UK-India collaborative project to study the barriers to technology transfer (TT) between developed and developing nations'. The project drew on case studies of the successful interventions in the foundry and glass sectors by the TERI-SDC partnership. This suggests that the collaborative RDD&D approach adopted in these sectors could serve as a model for other nations in formulating and implementing TT projects in future.
- The project has also sparked off interest in regional cooperation among BASIC countries (Brazil, South Africa, India and China) in activities to address climate change. For instance, Tsinghua University, China has expressed interest in collaborating with TERI for the development and dissemination of climate-friendly technologies through what it calls 'low carbon technology research centres' (which correspond to the 'climate technology innovation centres' envisaged at COP-16, Cancun).
- The TERI-SDC project has helped in placing the SME sector at the centre of the on-going international dialogue process on the prospects for a Low Carbon Economy (LCE), which was initiated in 2008 by InWent on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), and has participants from seven emerging economies including BASIC countries. In October 2009, TERI and InWent organized an LCE Dialogue Forum on 'Sustainable energies for SMEs' in New Delhi, which drew upon the successful interventions in the foundry and glass sectors to highlight the important role SMEs could play in achieving the goal of LCE. In November 2010, InWent and National Institute of Ecology organized an LCE Dialogue Forum on 'Sustainable Energies for Industries' in Cancun, Mexico. The Cancun Forum focused on identifying policy measures and frameworks appropriate for pushing low carbon technologies in SMEs as well as larger industries. The developing partnership between TERI and Tsinghua University was cited as a concrete example of South-South cooperation in promoting low-carbon technology transfer.

- With the support of the US Environmental Protection Agency (USEPA), TERI is conducting a preliminary study on the black carbon emissions from the brick industry in South-East Asian countries
- TERI is supporting the World Bank–GEF Programme through consultations etc., and the key learnings being shared have been drawn from TERI’s experiences during the course of its engagement with the SDC project.

## Annex-III

### Project management and performance

The organizational structure for the project is shown in the figure below. The project implementation structure, including the constitution of the Advisory Group, was felt to be adequate.



The principal partners' and stakeholders' contributions in the current phase are listed below:

- *MSME entrepreneurs*: Being the primary beneficiaries of the project, the individual entrepreneur contributed the entire financial resources for investing in EE technology. The project provided technical backup support to ensure technology adoption, and trained unit personnel on BOP (either directly or via LSPs and/or NGO partners) in order to ensure optimum and consistent energy savings.
- *Industry associations*. They played a key role in each MSME cluster in the following areas:
  - selecting unit(s) for demonstration of the improved (EE) technology
  - identifying local fabricators/resource persons to play the role of LSPs, whose capacities were then strengthened by the project so as to support the ongoing uptake of the improved technologies

- spreading awareness throughout the industry concerned on the benefits of the improved technology, thereby encouraging its uptake
- *Local service providers (LSPs)*: They play a critical role in ensuring the sustainable replications of the technologies by providing hands-on technical support to MSME units for the adoption of the improved technologies (fabrication of furnaces and other equipment, supply of vital components/systems, training of factory personnel in BOP, etc.). The project itself builds the technical capacities of the LSPs on an ongoing basis in ‘training-of-trainer’ mode.
- *NGOs*: The NGO partners have worked directly with the community of workers and their families to initiate improvements in the quality of their lives through:
  - Building their capacities in social and technical areas (awareness of safety and health issues, training in vocational skills)
  - Facilitating dialogue between workers and owners/entrepreneurs for mutual benefit
  - Generating awareness among the worker community on rights and entitlements
  - Encouraging group initiatives (SHGs) and community action

The current phase has witnessed effective engagement with government organizations, financial institutions like BEE, Ministry of MSME, CPCB, PCRA, SIDBI, etc. They have encouraged replication of the EE technologies through:

- Creating enabling policies and/or schemes for the uptake of the improved technologies
- Providing financial support to TERI for ‘spin-off’ projects to demonstrate and disseminate the EE technologies (developed under the SDC-supported project) in specific clusters/regions
- Enhance the coverage of the model in direct and indirect interventions

TERI also assisted SME Rating Agency of India Ltd (SMERA), an associate organization of SIDBI, in developing a ‘green rating system’ for foundries. The parameters for green rating of a technology cover not only energy and environmental aspects, but also include social dimensions such as working environment and safety. Foundries that obtain the SMERA green rating will find it easier to access bank credit. Thus, the SMERA green rating acts as an incentive for foundry units to adopt measures that will improve working conditions. TERI helped SMERA in road-testing the green rating system in the Rajkot foundry cluster.

A core team of eight TERI professionals from IEE Division spearheaded the implementation of the project. The core teams received support from cluster level LSPs in the project implementation. The expertise available with other Divisions of TERI was utilized appropriately during the implementation of the project: for instance, the TERI Press assisted in preparation of newsletters. For implementation of the social action of the foundry component, a local NGO partner – IMSE in Kolkata – was engaged. The NGO had its own project team to implement the social activities in Howrah cluster. The composition of the

project team was felt to be adequate to execute the planned activities. However, there is scope to strengthen the team of professionals working in the MSME sector within TERI. This is particularly in light of the growing importance of the MSME sector within the Indian economy and the increasing interest being shown by multilateral/bilateral organizations to intervene in the sector.



## Annex-IV

### List of stakeholders

No.	Name	Organization
1.	Dr.Ajay Mathur,	Director General, BEE
2.	Mr.Abhay Bakre	Joint Development Commissioner, MoMSME
3.	Mr Satish Jhunjhunwala	M/s Victoria Iron Works Limited, Howrah
4.	Mr Pradeep Madhogaria	M/s NSI (India) Limited, Howrah
5.	Mr S C Dugar	M/s Bharat Engineering Works, Howrah
6.	Mr Biplab Halim	Institute for Motivating Self Employment, Kolkata
7.	Mr Arun Pal	M/s Bhagyadevi Foundry, Howrah
8.	Mr K Kalimuthu	M/s Amma Alloy (India) P. Ltd, Coimbatore
9.	Mr R Ramar Sr. Executive-Development & QAD	M/s C.R.I. Pumps Private Limited, Coimbatore
10.	Mr R Janakan General Manager-Foundry	M/s C.R.I. Pumps Private Limited, Coimbatore
11.	Mr R Janarthanan Manager-Marketing	M/s C.R.I. Pumps Private Limited, Coimbatore
12.	Mr D Soundararajan Director	M/s Nirmal Pumps (Pvt.) Limited, Coimbatore
13.	Nr Nagendran, Fabricator	M/s Sarvana Engineering Work, Coimbatore
14.	Mr Ketan Kakkar	GITCO Ltd., Ahmedabad
15.	Mr Gaurang Shah, President	Ahmedabad Foundry Cluster
16.	Mr Mittal Patel Managing Director	M/s Dynamic Autolooms India Pvt Ltd, Ahmedabad
17.	Mr Mohanlan Saha	M/s Anish MetaCast Pvt. Ltd. Ahmedabad
18.	Mr Marpat Singh Baput	M/s Anish MetaCast Pvt. Ltd. Ahmedabad
19.	Mr Raj Parekh, Director	M/s Anand Airtech, Ahmedabad
20.	Mr Mahesh Majithia, Quality Control Supervisor	Shining Engineers & Founders, Rajkot
21.	Mr Mahendra Parmar, Fabricator	M/s Ambica Industries, Rajkot
22.	Mr Bharat Parsana Director	Prashant Castech Pvt Ltd, Rajkot
23.	Mr Nitish Patel	M/s Shivanand Casting, Rajkot
24.	Mr Pankaj Patel	M/s Shivanand Casting, Rajkot
25.	Mr Vijay Patel Director	M/s Shining Engineers & Founders Pvt Ltd, Rajkot
26.	Mr Sanjay Soni	M/s Parv Metal Processing Co., Rajkot
27.	Mr S D Jhala	M/s Parv Metal Processing Co., Rajkot
28.	Mr Rohan Kotecha Director	M/s Steelcon Impex Pvt Ltd, Rajkot
29.	Mr. M.I. Khan	MD, Express Glass Works, Firozabad
30.	Mr. B.C. Sharma	LSP, Firozabad
31.	Mr. Piyush Sharma	LSP, Firozabad
32.	Mr. Dinesh Agarwal	S Rajiv Glass Works, Firozabad
33.	Mr. H.P. Garg	President, Glass Industry Syndicate, Firozabad



## Annex-V

### Terms of Reference (ToR)

For external reviewers for the end-of-the-phase review of TERI-SDC Partnership (TSP)  
Project 2009-11: MSME Component

#### 1. Introduction and context

##### *Project background information*

The TERI-SDC partnership in the MSME sector, which started in 1993, has focused on technology development, demonstration and replication of energy efficient technologies in three energy intensive small-scale sectors, viz, foundry, glass and brick. It has also initiated pilots on social action aimed at addressing the needs of the workers in the three sectors. Starting January 2009, a new 3 year phase was initiated in the project. This phase focused on accelerating the adoption of the demonstrated energy efficient technologies by focusing on developing partnerships for technology delivery at cluster level. The approach was especially adopted for the clusters in the foundry sector. The geographical coverage of the project activities in the present phase are shown in table below.

Sector	Focus clusters/state	
	<i>For technological intervention</i>	<i>For social intervention</i>
Foundry	Rajkot, Ahmedabad, Howrah, Coimbatore	Howrah
Glass	Firozabad	-
Brick	National level	Eastern U.P.

In general, the MSME sector has largely remained a neglected and under-served sector from the technology and knowledge support point of view. Some of the major challenges faced by the sector are use of obsolete and resource inefficient technologies, limited access to technology, lack of awareness of best practices, weak support framework and limited knowledge sharing. The project addresses these challenges by focusing on uptake of improved technologies and building capacities of stakeholders. Energy efficient technologies developed by TERI not only offer the MSME entrepreneurs a way to reduce their energy consumption levels and improve their competitiveness but also contribute in reducing the GHG emissions.

The different beneficiaries of the intervention can broadly be divided into two sets namely, (1) Stakeholders directly connected with implementation at field level e.g. MSME units, cluster level industry associations, service providers such as consultants, fabricators etc (2) Indirect stakeholders which facilitate implementation e.g. ministries and organizations at the central/state government levels, financial institutions, and other bilateral/multilateral bodies interested in the sector.

##### *The project*

The origin of the project dates back to 1991, when SDC established a Global Environment Programme to support developing countries in implementing measures aimed at protecting the global environment. In pursuance of this goal, SDC conducted a study of the MSME sector in India to identify areas to introduce technologies that would yield higher energy efficiency and reduce GHG emissions. Four energy intensive areas were selected for intervention – foundries, glass industry, brick kilns and biomass gasifier based thermal applications. The subsequent activities from 1993 focused on action research of cleaner technologies for these sectors, wherein full-scale demonstration plants were set up in the field in close cooperation with various partners. TERI adopted a bottom-up planning approach in all the sectors of intervention and involved the local stakeholders at every stage of decision-making. In all the sectors of intervention, the energy efficient technologies were successfully demonstrated. Subsequently, the project efforts were directed towards increased adoption of the demonstrated technologies.

The goal, outcomes, outputs and activities of the present phase of partnership (2009–11) for the foundry, brick and glass sectors are given in the logical framework analysis (see Annexure 1). The outcomes and impacts of the current phase have flowed directly from the longer engagement with the MSME sector and are summarized below:

- The project helped in improving the energy efficiency of MSMEs in the foundry, glass and brick sectors through a collaborative RDD&D approach involving the pooling of international and Indian competencies.
- The TERI–SDC collaboration is attracting both domestic and international interest as a model to promote energy efficiency and mitigate climate change.
- TERI is poised to play a wider role in regional cooperation to promote low carbon technologies in the MSME sector.
- In association with government bodies (BEE and Ministry of MSME), the project has recently launched a collaborative knowledge sharing platform on energy efficiency called SAMEEEKSHA at the national level.

Specifically, in the *foundry sector*, delivery and support services were strengthened in select clusters for the energy efficient Divided Blast Cupola (DBC) melting technology. In each cluster, the design of the DBC system was adapted and innovated upon to suit local requirements and conditions. Technology packages – comprising detailed system specifications and design drawings – were developed for DBCs of different capacities and sizes. Local fabricators were trained in interpreting the design drawings and in manufacturing cupolas and related equipment according to prescribed system and quality specifications. Also, the capacities of local service providers (LSPs) were enhanced so that they could provide cupola operators with hands-on training in best operating practices (BOP).

In the *Firozabad glass cluster*, the project continued to provide technical backup support through its established LSP, for the construction and re-lining of recuperative pot furnace systems; for training furnace operators and entrepreneurs in their efficient operation, maintenance and troubleshooting; and for capacity building of masons.

In the *brick sector*, the project efforts to increase energy efficiency followed two tracks: (1) capacity building of master firemen and firemen in better kiln operating practices on Bull's Trench Kilns (BTKs) which produce the major share of bricks in India; (2) promoting the Vertical Shaft Brick Kiln (VSBK) as an energy efficient option for small-scale brick production.

The energy efficient technologies adopted by different MSME units are yielding significant and consistent energy savings resulting in reduced CO<sub>2</sub> emissions. More than 650 MSME units (including biomass sector) have adopted the energy efficient technologies promoted by the project since its inception in 1994. The estimated cumulative energy savings are about 139,000 toe (tonnes of oil equivalent) till December 2010, corresponding to a cumulative reduction in CO<sub>2</sub> emissions of 487,000 tonnes.

### *The context of review*

The TERI-SDC partnership is entering an end-of-phase period which requires a review of activities conducted for the purpose of 'taking stock and learning so as to prepare the basis for a new phase'. An external review is also felt important for capitalization of project achievements and for consolidation of the activities. Need for an external review of the project was foreseen by SDC and TERI at the time of formulation of the present three year TSP project (during the year 2008) and accordingly was included in the grant agreement. Although the review will be undertaken for the ongoing three year TSP Project (for the period January 2009 till date) it must be kept in mind that this phase is in fact a continuation of the work undertaken in previous phases and hence it need not be seen in isolation.

## **2. Objectives of the review**

The objective of the review is to provide a critical external view on how the programme is being implemented, its achievements and scope for improving the project strategy in the future. In terms of the past activities, the review will primarily focus on the work undertaken in the foundry and glass sub-sectors. It is expected to provide insights into the results, effectiveness, efficiency, relevance and sustainability of the programme. The outcome of the review will not only be useful for strengthening the ongoing activities under the remaining period of the TSP project but more importantly feed into the design of the next phase of the project.

On the other hand, the review would also be used by TERI internally to strengthen, expand and improve the quality of its services to the MSME sector. The Industrial Energy Efficiency Division (IEED) of TERI focuses on development and promotion of energy efficient solutions for efficient utilization of energy in the industrial sector. The TERI-SDC partnership has greatly strengthened IEED's capabilities to work in the MSME sector. The ever-increasing number of projects being undertaken by the Division is ample proof of the growing emphasis of the sector within TERI's range of activities.

## **3. Expected results**

The review should broadly focus on two aspects (i) review of the broader MSME environment with regard to the need for energy efficiency and (ii) review of the TSP project in general.

The review is expected to answer the following points/questions:

- Relevance of the MSME sector in general and the importance for improving energy efficiency of the sector.
- Was the TERI-SDC partnership programme a pioneer in the field of energy efficiency and environment? Is the programme working with the right stakeholders? Has the programme adapted adequately during this 20 year period as per the changing external environment?
- Has the policy impact of the programme in general been adequate?

- Are the project outcomes and outputs of the 3 year phase in alignment with the originally defined objectives?
- Was the approach and the up-scaling strategy followed by the project adequate?
- Was the cost-benefit ratio of the programme adequate?
- What are the impacts and learning from South-South transfer and is there/ what is the potential for the future?
- Is the choice of focus sectors/clusters suitable? Should the project consolidate its activities in the present sectors/clusters or expand to new sectors/clusters?
- Which are the other sectors/clusters where the project should expand?
- Should the project focus on technology development or on up-scaling?
- How can the project engage more closely with the government organizations?
- What would be the role of other stakeholders like academic/ research institutions that can complement project efforts?
- What was the impact and learning of the knowledge management effort of the programme (and cost-benefit ratio, if possible )?
- Capacity development of TERI and other partners, impact and learnings?

These questions may be seen as only indicative and reviewers are expected to use these to broadly address various aspects with regard to relevance, sustainability, effectiveness, efficiency and impact of the TSP.

The reviewers are expected to prepare three reports: an inception report, a draft report and the final report. The reports are to be written in English. The recipients of the reports would be SDC and TERI. Both SDC and TERI will be free to use or share these reports with other stakeholders as they deem necessary.

#### **4. Methodology and approach**

Background documents need to be studied by the reviewers. The End of Phase Report (EPR) is the first and most important source of background information on which the reviewers can base their observations. Some of the other documents which would be useful for understanding of the overall project are the project's initial logical framework analysis (LFA), the reporting LFA (s), operational reports and outcome monitoring summary. Other publications like newsletters, books, manuals, drawings and reports of the earlier phases can be shared with reviewers as required on need basis. After studying the background documents and interacting with SDC and TERI, it is suggested that the reviewers prepare a brief inception report outlining the work plan for conducting the review (taking into account the available time, resources and availability of data).

Since assessment of beneficiaries is an important component of the review process the reviewers need to travel to a few clusters where the project has worked and interact with project beneficiaries viz. MSME units, service providers and implementing partners. In addition, consultations with some of the key stakeholders at the national level like BEE would be useful. The assessment is to be carried mainly through interaction and observation during the field visit and interviews with individuals. No formal questionnaires are needed because of the diverse nature of stakeholders involved in the project.

The suggested sequence of activities or the approach to be followed is given below:

- Referring to the log frame and end of phase report (EPR), analyse the various outcomes and outputs and identify whether the objectives have been broadly achieved for the interventions in glass and foundry sub-sectors.
- Visit the clusters and interview selected foundry and glass units and LSPs/fabricators to assess the broader impacts of the interventions.
- Interact with the TERI team and other stakeholders, as required, to understand the present external environment of energy efficiency/MSME sector in India. Place the TSP project within this overall framework and provide recommendations on improving synergies with developments in the domestic/international climate policy environment.
- Prepare a brief review report comprising all the findings and recommendations.
- Make recommendations on possible intervention strategies for improving the energy efficiency of the MSME sector as a whole and way forward.
- Any specific recommendation for the new phase planned by TERI and SDC.

#### **5. Expected outcome & deliverables**

Final review report of about 20 pages covering the points listed in previous sections.

#### **6. Timelines (tentative)**

- Initial meeting at SDC on 3 June 2011
- Review work (including field visits) and preparation of the draft review report : 3 – 26 June 2011
- Presentation of the draft review report and review results in Delhi to CCDD (SDC, Delhi) team and TERI – 27 June 2011
- Presentation of the review results at SDC, HO (Berne, Switzerland) in July 2011 (dates to be decided subsequently). The team leader of the evaluation team to present the results.
- Submission of final review report – End July 2011

#### **7. Services to be provided**

TERI will extend logistic support such as travel, hotel bookings etc. during the field visits. Also it would make available documents related to the project to the reviewers. TERI team will accompany the reviewers to the field sites and for various meetings, as necessary.