FOUNDATION FOR MSME CLUSTERS (FMC)

Energy Issues in Indian Clusters :

A Background Note on Energy related interventions in Indian Clusters

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Section 1: Indian MSME Clusters and its energy issues – An Introduction

MSMEs (previously called Small Scale Industries) also popularly known as SSIs plays a huge role in global as well as Indian economy by generating large scale employment, contributing towards rise in incomes & returns and promoting regional development. In India, MSMEs has a share of 40% in the industrial production and 45% of the total manufactured exports of the country. In terms of employment generated, this sector is next only to agriculture employing approximately 41 million people. This sector has grown rapidly over the years wherein the number of small-scale units has increased from an estimated 0.87 million units in the year 1980-81 to over 13 million (as per the latest data).

MSMEs producing a range of similar or same products are found to co-exist in typical geographical locations for decades and even for centuries and are referred to as Clustering of MSMEs. Some of the prominent examples in India include Chennai for Leather products, Ludhiana for bicycles and bicycle components, Tirupur for cotton knitwear and Surat for cut diamonds. There is no data available which can directly establish the percentage of clustered MSMEs amongst the 3 million (as of 2000) MSMEs. However, few studies suggest that a significant percentage of MSMEs are found in Clusters. For example, Panipat produces 75% of the total blankets produced in the country; Tirupur, a small township in the Coimbatore district of Tamilnadu contributes 80% of the country's cotton hosiery exports. Similarly Ludhiana in Punjab produces 95% of the country's woollen knitwear, 85% of the country's sewing machines and 60% of the nation's bicycle and bicycle parts.

Clusters are growing continuously throughout the world because there are lots of benefits associated with them on active economies of scale, such as improvement in product quality, access to larger markets etc. Also they acquire many advantages similar to that of a large size individual industry. Broadly a cluster of enterprises may be defined as a typical geographical concentration of micro, small, medium and large firms producing same or a similar range of products (goods or services). Units in a cluster face same or similar set of threats (e.g. product obsolescence, lack of markets, etc.) and opportunities (e.g. increasing turnover through quality up gradation or introduction of new products or markets, etc.) **(MSME: 2006)**. The firms producing 'the product' by which a cluster is known are called principal firms or principal stakeholders of the cluster.

Clusters in India can be broadly divided into three categories as given below:

Table 1: Typology of Cluster: Significance to the National Economy

Parameters	Micro enterprise Clusters	Traditional Manufacturing Clusters	High Tech Clusters
Typology of Products (Few Products)	Handloom, Handicraft, Coir, village Industries	Leather & Leather products, automotive components, ceramics etc	Information Technology, Pharmaceuticals, Bio-technology,

			computers, tourism, education etc
Number of Clusters	6000(93.6%)	388(6.1%)	20 approx. (0.3%)

Source: Annual Report of various Ministries, Government of India and UNIDO-CDP cluster database & estimates

Awareness about cluster started to increase in late 80's and in India SBI's Uptech scheme was one of the first programmes targeted around select firms in clusters. The holistic Cluster Development Program acquired some momentum in late 2002-03. So far 24 schemes have been put in place to support cluster development initiatives in country. The organizations which are engaged in these activities include Ministries of Central Government (Textiles, MSME), Some State Governments (Kerala, Orissa, Gujarat, MP, and Rajasthan), Financial & Technical institutions (SIDBI, SBI), international agencies (Such as UNIDO, ILO) and Techno Commercials Institutions (Such as TERI, CII & RUDA). Around 1358 Clusters have been supported (Operational or completed) so far, of which 278 are traditional manufacturing and 1080 are micro enterprise clusters. Total assistance is estimated at Rs 700 crore till 2006-2007, of which 91.4% has been contributed by the Central Government.

Interface with Energy

There is interaction among energy, environment and sustainable development in an economy. As most of the environmental problems are associated with energy use and economic development without energy use is difficult, there is an "energy trilemma" involving energy consumption, economic development and environmental impact ***(Khan, 1992)***. It is very difficult to come out of this vicious circle especially for developing countries with their expanding economic activities causing amplified energy consumption. Demand for energy in a growing economy stems from diverse sectors such as agriculture, industry, commerce, transport, and residential. Of these major sectors, the industrial sector is the largest energy consumer in most developing countries ***(Ross, 1997)***. At the global level, the industrial sector is the largest energy-consumer accounting for about 32% of total energy use ***(IEA, 2004)***.

Industry has emerged as the major energy-consuming sector in India as well, with a share of about 42% of the total energy consumption ***(Reddy and Balachandra, 2003)***. Even though India's industrial sector comprises both small and large-scale enterprises, the former accounts for a lion's share of total number industrial units.

From the clusters' perspective the maximum energy intensive industries are the part of traditional manufacturing clusters and some of the prominent energy intensive clusters include Foundry, Glass and ceramics, Electroplating, Rubber and Plastic, etc. The detail list of the 388 clusters categorised as per the products is attached as Annexure 1.

As there is no macro level information available to map the energy utilisation of MSME Clusters, analysis for the entire MSME sector is being presented to understand the scenario. The data also suggests that energy source in the MSMEs is dictated by availability, price, reliability and convenience of use and not much on environmental considerations.

The distribution of main sources of power in MSMEs is shown below:

Table 2: MSMEs: Main Power Sources

Characteristics	Registered MSME Sector	Unregd. MSME Sector	Total MSME Sector
No power needed	3,60,611(26.23 %)	38,55,035 (42.15%)	42,15,646 (40 %)
Coal	28,841 (2.10 %)	2,95,165 (3.23 %)	3,24,006 (3.1 %)
Oil	40,401 (2.94 %)	5,55,416 (6.07 %)	5,95,817 (5.66%)
LPG	7,222 (0.53 %)	55,237 (0.60 %)	62,459 (0.59 %)
Electricity	8,99,657 (65.43 %)	40,25,262 (44.01%)	49,24,919 (46.8%)
Non-conventional energy	7,142 (0.52 %)	60,539 (0.66 %)	67,681 (0.64 %)
Traditional energy/ Firewood	31,100 (2.26 %)	2,99,562 (3.28 %)	3,30,662 (3.14 %)

Source: Third All India Census of SSI, Ministry of MSME (reference period 2001-2002)

The above table clearly indicates that:

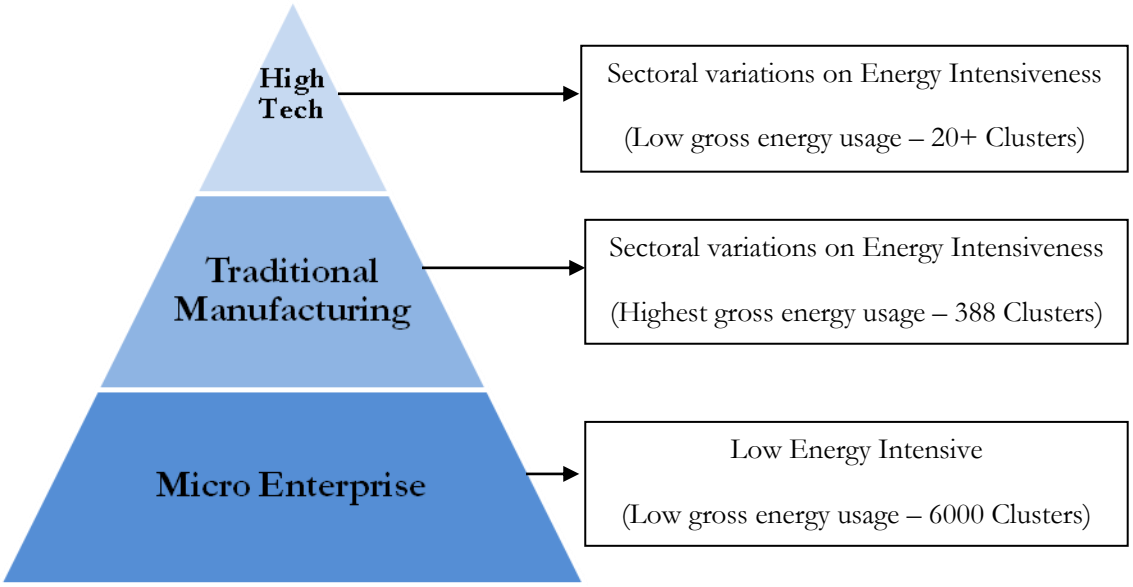
- A large percentage of MSMEs (40%) do not require any power and these are mainly micro enterprise based rural clusters as most of their operations are manual. Very little energy is utilised for lighting or heating purposes.
- Among the registered MSMEs, majority of them utilise electricity as their main power source and this category the traditional manufacturing industries including the service industries are the major consumers.
- It may be noted here that non-conventional energy sources are highly under utilised where only 0.64% of the MSMEs are using this form of energy.

As already mentioned, no exercise has been carried out so far to clearly map the energy intensiveness in the clusters. However, as per the broad groups (as mentioned above) of the Indian clusters, some characteristics w.r.t energy utilisation and energy intensiveness can be put forth. As depicted in Fig 1,

- The artisanal and rural enterprise clusters either consume very little energy or do not consume at all. Hence, the energy intensiveness is low in these clusters.
- The traditional manufacturing clusters consume relative more amount of energy as processes involved in these kinds of firms require energy. One can derive from Table 1 that most of units in the traditional manufacturing clusters either consume electricity, coal, oil or firewood or all of them. In most of the clusters the technologies used are likely to be outdated and accordingly energy efficiency may be low. There are sectoral variations on energy usage and an attempt has been made to categorise clusters on the energy intensiveness at Annex 1.

- The hi-tech clusters can be broadly categorised into two kinds, the first wherein energy is used in their main line of function whereas the second wherein energy is required only for support functions. However, considering the fact that there are only few high tech clusters, the gross energy usage is quite small.

Figure 1: Energy Intensiveness in Indian Clusters



The above mentioned facts clearly highlight the need to focus upon 388 Traditional Manufacturing Clusters (comprised of SMEs) from the energy perspective. The huge numbers have the immense potential to make large scale impact at the national level. There are some sectoral variations in this category, however, there are large numbers of clusters who are highly energy intensive and have the potential to move towards energy efficiency (refer Annex 1). Some of the prominent sectors in this category which are energy intensive are: Foundry, Glass, Tiles and Sanitary ware, Electroplating, Building materials, Plastic, Mini – steel rolling mills, Handtools, Sponge iron and forging, Confectionary and Food processing.

Some of the common methods in which the energy efficiency in the traditional manufacturing clusters can be obtained is as below:

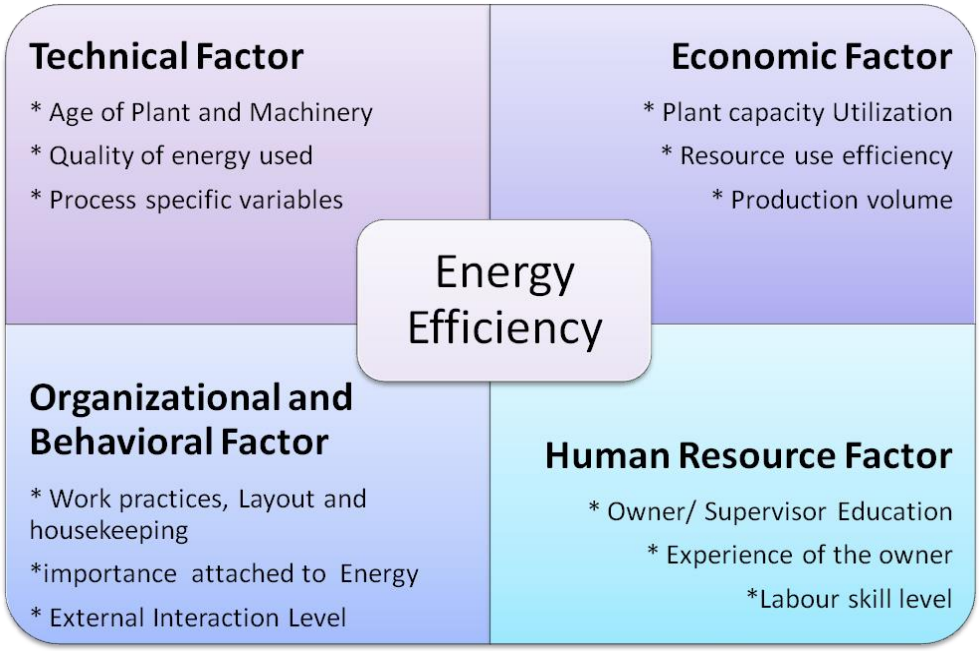
1. **Processes involving Electrical energy**: Here there should be appropriate balance between capacitator load and inductor load. Generally, adding capacitator increases the efficiency. Commonly, there is mismatch between the requirement and power of the motor installed. Putting the appropriate motor size is also one of quick ways to reduce energy consumption. The efficiency can also be obtained on lighting load and by line balancing

2. **Furnace related mainly using oil, coal or biomass**: Changing the line of furnace, using better quality of bricks and giving training to workers are some of the ways in

which energy efficiency can be obtained in the industries where furnaces are installed. Also, usage of better technology can have significant impact on energy consumption.

A study of environmental pollution by SSI clusters in Karnataka has identified labour skill levels, owner qualifications, and technology levels as important factors in explaining the energy consumption and environmental impact of SSIs (Subrahmanya and Balachandra, 2002). The figure 2 below outlines the multiple factors that affect energy usage and its efficiency in SMEs.

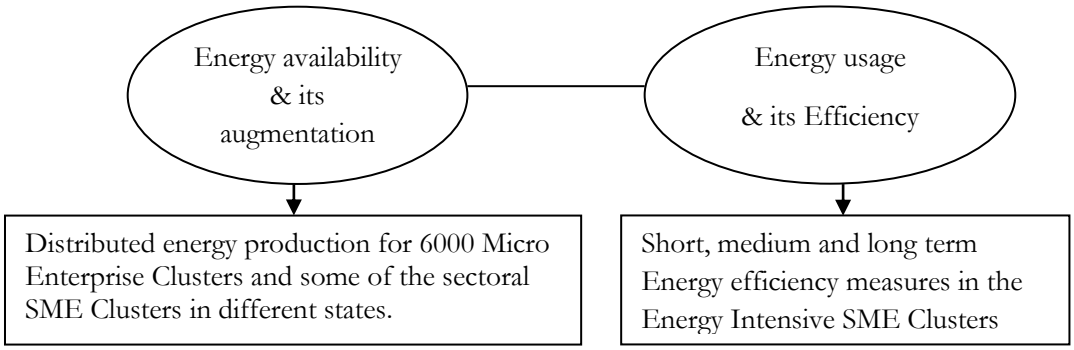
Figure 2: Factors Influencing Energy Efficiency in the SSI Clusters



Thus, it is implied that while the need for technology up gradation to enhance Energy Efficiency and hence sustainability of MSMEs clusters is undisputable, this alone cannot succeed in meeting the goal either. But, human resource, economic, organizational and behaviour issues of SSIs also need to be properly addressed for fruitful results.

The key issues at the cluster level from the energy perspective can be briefed as in following fig 3.

Fig 3: Key Energy Issues in India Clusters



Section 2: Major energy related Initiatives in Indian clusters

Studies carried out by researchers of various institutes around the world suggests that in the fast growing industrialised nations, policies are required to be framed with proper attention towards energy issues. It is also stated that there is a positive relation between energy intensity and value of output but a negative relation between energy intensity and factor productivities and therefore it is required to have a 'energy efficiency improvement' focus for enhancing SSI competitiveness.

The ongoing and completed interventions on Indian clusters can be categorised into two broad categories from the energy related interventions perspective:

1. Classical Cluster Development Approach: The classical cluster development approach focussed on holistic development of the clusters as such lot of effort was on joint action around various themes. Accordingly, the focus was not on energy intensive clusters. In the energy intensive clusters, the energy related interventions were largely short term in nature (pressure points) emerged as during diagnostic studies. The prominent programmes in this category are UNIDO's Cluster Development Programme and MSE CDP of DC MSME.
2. Focus on technology upgradation and energy efficiency: Some of the cluster development programmes e.g. SBI Uptech focussed on technology upgradation and energy efficiency in the clusters, however remained limited to about 15 out of total 25 clusters. The clusters selected for intervention were highly energy intensive, e.g. Foundry, and Handtools. In these programmes the classical cluster development approach was not adopted wherein CDAs were not deployed and each agency adopted its own programme management structure. Three programmes that attached greater significance to energy are SBI UPTECH, SDC – TERI and UNIDO Handtool

The details of these programmes from energy related intervention perspective is being presented below:

Programme 1	**SBI UPTECH** (Year 1988 onwards)	
Programme Objective	Technology upgradation, a national priority, is needed for : • planned growth of Indian Industry • preventing obsolescence • enhancing global competitiveness and exports • energy conservation	
Partner Organisations	SITARC (Small Industries' Testing & Research Centre, Coimbatore), IDBI(Funding agency); CSIR and others	
Concerned Sectors and Clusters (For energy related interventions)	Foundry	Belgaum, Agra
	Auto Components	Jamshedpur, Coimbatore, Pune
	Pump Set	Coimbatore
	Auto Engine	Kolhapur, Pune, Bangalore
	Rice Milling	Palakkad, Gondia and Rudrapur
	Glass	Firozabad
	Machining Fabrication	Bhopal
	Hosiery	Ludhiana

Main Intervention Features	• Energy audits in 20 clusters • Demonstration of Energy efficiency approaches • Financing for technology upgradation which directly/indirectly let to energy efficiency • Exposure visits of the principal stakeholders • Techno managerial studies on energy conservation in Ludhiana • Introduction of an improved technology in cupola melting (Divided Blast) in Coimbatore
Outcome	• Designed and developed three energy and cost effective Pumpsets in the 3 and 5 H.P. category at Coimbatore and launched for commercial exploitation by the industry. • Trained workers at Coimbatore • Rs. 120 Lacs saving in coke alone in Pumpsets, Coimbatore (30% fuel saving) • Shift from winches to soft-flow dyeing machines to save water and energy in Ludhiana

Programme 2		**TERI-SDC** (Year 1995 onwards)	
Programme Objective		Technology development, dissemination and capacity building for the energy intensive industries in small and medium sector	
Intervening & Partner Organizations		TERI (The Energy and Resources Institute) and SDC (Swiss Agency for Development and Cooperation)	
Sectors	**Clusters**	**Main Interventions Features**	**Outcome**
Brick Kilns	Demonstration units setup in: 1. Datia 2. Kankia 3. Palakkad 4. Pune	• Vertical shaft brick kiln (VSBK) • Best Operating Practices (BOP) in Bull's trench kilns (BTKs)	• Energy saving of 20 – 40% through VSBK • Energy saving of 10 – 15% through BOP in BTKs • Suspended particulate matter emissions measured in VSBKs ranged between 100-250 mg/Nm3.
Foundry	1. Howrah 2. Nagpur 3. Kolkata 4. Rajkot 5. Coimbatore 6. Vijayawada 7. Bhavanagar 8. Alwar 9. Hyderabad	• Divided blast cupola (DBC) • Venturi scrubber system	• Coke savings of 25%–65% • Suspended particulate matter emissions brought below 70 mg/Nm3

	10. Bangalore 11. Ahmedabad 12. Mangalore		
Glass	Firozabad	• Natural gas fired pot furnace with recuperator • Natural gas fired muffle furnace	• Energy savings of 25%–50% • Significant pollution reduction
Puffed rice	1. Davangere 2. Hubli-Dharwad cluster in Karnataka	• Improved oven with heat recovery unit and dust arrestor	• Energy savings of 15%–45% • significant pollution reduction
Thermal Gasifier Applications	Many locations in different states.	• Gasifier based furnaces for various end-use applications	• Energy savings of 35%–60%

Programme 3	**UNIDO CDP** (Year 1992 onwards)		
Intervening Organization	UNIDO (United Nation Industrial Development Organization)		
Objective of the Programme	**Holistic Cluster Development**		
Concerned Sector and clusters (Energy related interventions)	**Sectors**	**Clusters**	**Specific Interventions**
	Cotton Hosiery	Tirupur	Energy audit, Rainwater Harvesting, Installation of Windmill (after the project period)
	Pharma	Ahmedabad	Energy audit
	Leather	Ambur	Energy audit; 22 tanneries implemented energy conservation measures. They made estimated annual savings of Rs 2.5 millions (USD 54,000).
	Machine Tools	Bangalore	Energy Audits
	Knitwear	Ludhiana	Energy audit, Proper Energy Usage with the usage of bamboo

			boilers, Trainings conducted
	Foundry	Hyderabad	Energy audit, Workshops on energy efficient cupolas
	Food Processing	Pune	Demonstration of energy efficiency techniques
	Jeans	Ballary	Energy audits of washing and dyeing units, Demonstration of energy conservation measures
	Engineering	Rourkela	Setting up of Captive power plants to minimize energy cost, Consultant Hired and Seminars organized on Energy Conservation
	Food Processing	Vijaywada (Krishna District)	SHGs were trained in use of solar driers by SEED- Society for Energy and Environment.
	Rubber	Kottayam, Kerela	Energy audit, Technology upgradation (5-8% savings and labour and energy)
Outcome	• 22 Tanneries implemented energy conservation measures and saved Rs. 2.5 millions in Ambur • Potential source of Energy wastage and prevention is known for Ambur • 2 Firms benefited from energy audits in Bangalore through immediate 0.2 million of savings and Joint action developed for Foundries and Heat Treaters • Processing quality improved at Ballary • 65 Firms benefited from Cupolas at Hyderabad • 3 firms saved about 1 lakh Rs. Per year on account of energy audits at Hyderabad • 4 firms saved same amount as above by walk through audits on energy usage at Hyderabad • Savings up to 15% in Energy bills is expected at Rourkela		

Programme 4	**UNIDO Energy** (2003 – 2006)	
Objective	To Promote Energy Efficiency in Hand Tool SSI Sector in India (demonstration)	
Intervening Organization	UNIDO	
Concerned Clusters and Sectors	Hand Tools	Jalandhar, Naguar
Main Interventions	• Energy Audits • Technology Up gradation (subsidy grant upto 25%) • Strategies for Energy Saving and raw materials through demonstration	
Outcome	• 25% Energy saving in selected units	

Programme 5	**Ceramic Cluster Development Programme: CGCRI**		
Objective	Technology upgradation of the ceramic firms		
Intervening and Partner Organization	CGCRI(Central Glass & Ceramic Research Institute) Government of Gujarat		
Concerned Clusters and Sectors	**Sectors**	**Clusters**	**Specific Interventions**
	Ceramics	Morbi-Wankaner Thangadh	• Workshop on Energy conservation in Ceramic Industry, jointly with CGCRI and GEDA • 60 participants attended the program
	Tiles and Sanitary Wares	Himmatnagar	• Training program on "Energy Conservation and Energy Audits" with PCRA/NPC/GEDA etc

Programme 6	**MSE Cluster Development Programme**
Objective	Holistic Cluster Development
Intervening Organization	DC, MSME
Concerned Clusters and Sectors	• Total intervention in 84 clusters wherein energy audits conducted in almost 20 clusters • No information available on output/impact.

Few Cases

Case 1	**Technology development in Foundry clusters of Howrah**
Objective	Technology upgradation to improve energy efficiency
Intervening Organizations	TERI – SDC - SIDBI
Main intervention features	• Level 1 to level 2 through Divided Blast Cuplos (DBC) with SIDBI's support • Level 2 to level 3 due to Judicial Pressure • Level 3 to 4 (SDC's Complete funding through TERI's technical assistance) • TERI brought in international consultants *Note: Level 1 is the lowest and level 4 is the highest*
Outcome	• 13 firms out of a cluster adopted the Level 4 technology. • Energy savings up to 11.5% of Energy bills

Case 2	TREC-STEP (2002 – 2005)	
Intervening and Partner Organization	Trichy Regional Engineering College – Science & Technology Entrepreneurs Park (TREC-STEP) – [Implementing Agency] National Science and Technology Entrepreneurship Development Board(NSTEDB) of DST – [Funding Agency] BHEL(Bharat Heavy Electricals Limited)	
Concerned Cluster and Sector	**Sector**	**Cluster**
	Heavy Engineering Fabrication	Trichy
Main interventions	• Since 2002 • Power Consumption Study and energy audits with PCRA • Energy Survey • 1 day energy awareness seminar focusing on energy saving strategies with PCRA • Optimum Transportation Matrix developed	
Outcomes	The turnover has doubled over the intervention period	

Section 3: Some of the New/Upcoming Initiatives

After going through above facts and figures it is clear that in coming future Energy issues are going to be crucial for Cluster Development and vice versa. Sensing this many organisations are showing interest in this field. Some of the initiatives planned by them are given below:

BEE (Bureau of Energy Efficiency)

Project Activities

The main Energy related project activities are:

1. Energy Use and Technology Analysis
2. Implementation of EE measures, and
3. Facilitation of Innovative Financing Mechanisms

These are described in detail below.

1. Energy Use and Technology Analysis

Objective

The objective of the activity is to develop better information base on status of SMEs in the 25 chosen clusters, possibilities for undertaking EE measures, potential of impact, status technology and energy use and identification of possible EE measures that could be undertaken by the SMEs.

This activity will be carried out in two phases:

(A) **Situation Analysis in 35 SME clusters:** The outcome of the activity will be a assessment of total energy usage, preparedness of the cluster to undertake further action and a list of units where further action is recommended along with filled in data collection formats.

(B) **Energy Use and Technology Audit:** The output of this activity will be cluster manual for each of the 25 SME clusters which will give an overview of the cluster in terms of name and numbers of units, contact details, production capacity, technologies in use, products manufactures, potential for energy savings, EE measures applicable, sources of technology/expertise and case studies on Best Practices / Technological Innovations in the cluster.

2. Implementation of EE Measures

Objective

The objective of this activity is to facilitate implementation of EE measures in the 25 identified clusters through development of DPRs.

This activity will be carried out in two phases:

(A) Preparation of DPRs: The output of this activity is a bank of 15 DPRs for all the 25 clusters and a match for experts and projects in all the 25 clusters. Thus the total number of DPRs will be 375.

(B) Capacity Building of LSPs: The LSPs will be equipped with the necessary capacity to undertake the implementation of the EE projects measures in the identified clusters.

3. Facilitation of Innovative Financing Mechanism

Objective

The objective of this activity is to encourage uptake of EE measures through facilitation of innovative financing mechanisms without creating market distortion.
This activity will have following three elements.

(A) Facilitation of Financing EE: The output of this activity will be an arrangement between the World Bank and with SIDBI/lead banks which will fund collaterals for EE measures.

(B) Capacity Building of banks to evaluate EE projects: The outcome of the activity will be enhanced capacities in the lead banks in the 25 clusters where the project is working. The training programme will also come up with a training manual.

(C) Concluding LSPs Workshop: This activity will result in an assessment of the impact of the project and a roadmap for future action.

DIPP (Department of Industrial Policy and Promotion)

DIPP requested UNIDO to help them in Energy Mapping across various sectors in India. This is likely to be 2 – 5 year effort since reliable secondary information is not available around clusters.

MSE-CDP

It is an open ended scheme wherein the clusters can take up energy efficiency wherein Common Facility Cnetres (CFCs) can be set up where the total project cost can go upto Rs. 10 crore.

(Source: http://pib.nic.in/release/release.asp?relid=34166)

CoSMiLe by TERI

CoSMiLe is the ongoing initiative by TERI supported by SDC India. The goal of CoSMiLe is to improve the economic, environmental, and social conditions of entrepreneurs and workers of small and micro enterprises. CoSMiLe will focus on increased adoption of resource-efficient technologies and knowledge-sharing to enhance competitiveness of the targeted small and micro enterprises.

The above interventions can also be classified as per the nature of the energy focused activities in the following manner:

1. **Short term**: Energy audits and subsequent immediate measures or 'low hanging fruits'. These interventions normally maintain the status quo in terms of energy source, technology being used and also benefit the firms immediately. Once can easily make out that the UNIDO and MSE CDP fall into this category.

2. **Medium term**: These mostly comprise of low – end technological solutions with not very heavy investments. UNIDO's handtool programme and SBI's Uptech can be put in this category.

3. **Long term**: These interventions require technology development or adoption which may require change in processes and also heavy investment. Firms in India are generally not willing to undertake these changes. TERI – SDC's effort can be put in this category.

Most of the interventions till date have mostly looked at the processes within the firm with few exceptions where the firms in the clusters have come together to augment the energy supply. E.g. Tirupur Exporters Association (TEA) located in Tirupur Export Knitwear Industrial complex (TEKIC) came together to set up Wind Energy Generators (WEGs) and benefitted by about a 75% reduction in cost of power. The Ministry of textiles supported the project by way of part grant-in-aid assistance on capital expenditure of upto Rs 12 crore. It is reported that the WEGs have not been installed so far. TEA has also launched an energy cell for CDM facilitation. Few other initiatives which may be mentioned here include efforts of spinning units in Solapur and Punjab to set up biomass/bio gas based projects.

The energy related interventions in clusters in few cases have matured enough to demonstrate the learning and challenges; however, most of them are in nascent stage. A more concerted and systematic effort is required to comprehensively deal with the energy issue in clusters.

Section 4: Lessons and Challenges

Economizing the consumption of energy inputs has lot of scope as it leads to profitability enhancement in MSME clusters. A reduction in the consumption of energy inputs and therefore, a reduction in cost of production as well as pollution can be achieved through not only technology shifts but more importantly an improvement in the quality of human resources comprising labour skills and entrepreneurial qualifications.

MSME Clusters can give special impetus to the energy efficiency initiatives as clustering bundles up the requirements where the needs and demands could be aggregated. Some of the energy efficiency measures are capital intensive wherein the stakeholders can exercise joint action for procurement. Improved Business Development Providers (BDS) services can lead to passive cooperation wherein all the cluster members can be accessed.

Some Lessons and Challenges which one would learn from interventions and outcomes are:

- Most of the energy related initiatives in clusters have been short term with a few initiatives being medium term. In order to convert entire cluster into an energy efficient one, the duration of cluster development programme needs an increase (May be from current 3 years to 5 years). Also this could be possible in clusters where the technologies have been developed and the major intervention would be to disseminate the technologies. The clusters which require technology development would certainly require much longer duration as evident from the SDC – TERI initiative.

- Energy mapping in all the clusters is required to identify the energy intensive and inefficient clusters in order to strategise the energy related interventions in clusters. DIPP has shown interest to undertake this activity with UNIDO's assistance and BEE has already launched a small initiative; however, given the number of clusters in India, this effort would require multiple agencies to undertake this activity.

- Energy related intervention in clusters would require collaboration of the firms, major technological shifts, development of BDS alongwith cost effective choices for the firms. Overall, energy efficiency should make business sense to the MSME firms. Classical CDP methodology with few modifications can undertake these objectives as it has been developed after lot of exercises on the field. Few of the previous initiatives (focused on energy efficiency) did not succeed as much as some of the social and economic aspects of the clusters were not fully integrated. It is also very important to understand the Cluster Development Agent's role in this context. Pure technology upgradation programmes in clusters which do not directly relate to their needs normally are not received very well in the clusters.

- Availability of energy to the MSME clusters is also an area of concern which requires urgent attention. It is important for the country to produce and supply cost effective energy to MSMEs to ensure sustainable economic development. There are a number of artisanal and micro enterprise clusters and SME Clusters who are underachievers wherein one of the major factors is the irregular and inadequate supply of energy. Decentralised production of energy from variety of sources is required.

- Use of Alternative and Renewable source of Energy has good potential for application in clusters. Specific programmes can be designed as per the needs and energy intervention areas of the clusters.

Annex 1: List of Clusters around products and their Energy Intensiveness

S. No	Products	No. of Clusters	Energy Intensive Status (High/Medium/Low)
1	Agricultural Implements & Machinery	10	High
2	Aluminium, Ball/Metal Utensils	11	High
3	Auto Components	12	High
4	Bicycle Parts	1	High
5	Brassware	4	High
6	Building materials & Hardware	13	High
7	Castings, Forging and Fabrication	12	High
8	Ceramics and Sanitaryware	5	High
9	Cutting Tools	1	High
10	Diesel Engines	4	High
11	Electroplating, Engineering & Fabrication	21	High
12	Forging	1	High
13	Glass Products	1	High
14	Handtools	6	High
15	Nuts/ Bolts	1	High
16	Paper Products	2	High
17	Powerloom	39	High
18	Printing (Including textile)	2	High
19	Sewing M/C & Components	1	High
20	Stone Crushing, slate	5	High
21	Chemicals & Pharmaceuticals	21	Medium
22	Coir & Coir Products	4	Medium
23	Electric Goods and Equipment	20	Medium
24	Engineering Equipment	6	Medium
25	Fishing Hooks(Information awaited)	1	Medium
26	Foods and Food Processing	28	Medium
27	Leather Products & Tanning	15	Medium
28	Locks	2	Medium
29	Machine Tools	9	Medium
30	Mixies & Grinders	1	Medium
31	Oil Mills	6	Medium

32	Packaging Material	5	Medium
33	Plastic & Fibre Glass Products	7	Medium
34	Power Driven Pumps	1	Medium
35	Rice Mills	27	Medium
36	Rubber Products	4	Medium
37	Ship Breaking	1	Medium
38	Textile Machinery	2	Medium
39	Weights & Measures	1	Medium
40	Wet Grinding Machines	1	Medium
41	Cloth Weaving, weaving, hosiery , spinning	28	Low - Medium
42	Furniture	16	Low - Medium
43	Sports Goods	3	Low - Medium
44	Soap & Powder	2	Low
45	Artificial & Real Jewellery, Diamonds	9	Low
46	Dyes & Intermediates	2	Low
47	Perfumery & Essential Oils	1	Low
48	Plywood/Board/Blackboard	1	Low
49	Safety Matches & Fire works	2	Low
50	Scientific Instruments	5	Low
51	Silk	1	Low
52	Toys	2	Low
53	Wall Clocks	1	Low
54	Rigs	1	NA
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References

1. Dasgupta, N. (1999). Energy e$ciency and environmental improvements in small-scaleindustries: present initiatives in India are not working. *Energy Policy* , 789-800.

2. IEA (International Energy Agency). (2004). Key World Energy Statistics. Energy Statistics Division of IEA, Paris.

3. Khan, A.M. (1992). Energy Systems: End Uses. Proceedings of Workshop and Conference on Global Change and Environmental Considerations for Energy System Development. Asian Institute of Technology, Bangkok, Thailand.

4. MSME Clusters, F. f. (2007). *Policy and Status Paper on Cluster Development in India.* New Delhi.

5. M. Thiruchelvam, S. K. (2003). Policy options to promote energy efficient and environmentally sound technologies in small- and medium-scale industries. *Energy Policy* , 977-987.

6. Nagesha, N., & Subrahmanya, M. H. (2006). Energye efficiency for sustainable development of small industry clusters: what factors influence it! *The International Journal of Economic Policy Studies* , .

7. Padmanand & Jadeja, (2007). Strengthening Industry Value Chains. Mumbai

8. Padmanad & Gulati (2006). Interventionary instruments for Cluster Development: A Handbook. Hyderabad

9. Reddy, B.S. and P. Balachandra. (2003). Integrated Energy Environment Policy Analysis - A Case Study of India. Utilities Policy 11(2):59-73.

10. Ross, M. (1997). Energy Efficiency (in: Bisio, A. and S. Boots – ed., Encyclopaedia of Energy and Environment, Vol. I), John Wiley and Sons, New York, pp. 530 -567.

11. Subharmanya, M. B. (2006). Energy intensity and economic performance in small scale bricks and foundry clusters in India: does energy intensity matter? *Energy Policy* , 489-497.

12. World Development Report (Special Issue). 1999. Industrial Clusters in Developing Countries. Vol 27. No.9. Pergemon N.W.

13. Micro, Small and Medium Enterprises in India: An Overview. 2007. Ministry of MSME, Govt. of India

Websites

1. www.msme.gov.in/

2. www.pib.nic.in/release/release.asp?relid=34166

3. www.cosmile.org/

4. www.laghu-udyog.com/schemes/scuptech.html

5. www.unido.org/file-storage/download/?file_id=46496

6. www.nmcc-vikas.gov.in/IndianClusterProjects/Pages/SBI.aspx

7. http://www.ifmr.ac.in/sefc/UNIDO%20Review.pdf