MANUAL ON ENERGY CONSERVATION MEASURES IN TEA CLUSTER JORHAT

ENERGY IS LIFE
BEE
CONSERVE IT

Bureau of Energy Efficiency (BEE)

(Ministry of Power, Government of India)

Prepared by :

PCRA

Petroleum Conservation Research Association (PCRA)

(Under ministry of Petroleum and Natural gas)

(Government of India)

ACKNOWLEDGMENT

Indian Tea Industry mainly consists of the units in SME sector and contributes greatly to Indian GDP. The tea sector is very Energy intensive as well, and hence draws focus whenever Energy Efficiency Improvement in Industries is considered. The very basic scale of production of these units makes them prone to inefficiencies in Energy as well as other resource utilization. Improving operating efficiency is going to be the key to survival and this intervention by Bureau of Energy Efficiency (BEE) is a welcome step.

The sincere help and support extended by the various tea associations like ABITA (Assam branch of Indian Tea Association), TAI (Tea Association of India), ATPA(Assam Tea Planters Association), NETA (North east tea Association) etc deserves accolades for facilitating the study. We express our sincere thanks to Shri Abijit Sharma, Secretary ABITA, Shri J Barua, Secretary TAI, Shri D. Bora, Secretary ATPA, Mr. Dipak Kumar Dowerah Secretary NETA and other team members for all the help and support extended during the study. We also put on record the contributions of the TRA (Tea Research Association), Toklai- Jorhat for their valuable suggestions and cooperation, M/s Bonti Consultancy Services, Guwahati for their support in carrying out the study.

PCRA has been supporting units in SME sector continuously and has succeeded in triggering efforts for Energy Conservation in these Industries. However, the Jorhat Tea cluster Job has gravitated the efforts of PCRA more intensely to the cluster. The initiative matches well with our Corporate Mission and provides us opportunity to deliver on the subjects included directly or indirectly in our Corporate Vision as well.

PCRA expresses its sincere thanks to Bureau of Energy Efficiency (BEE) for associating Petroleum Conservation Research Association in its prestigious Pan-India intervention in the SME Clusters aimed at improving performance of these clusters on Energy Consumption through proposed hard interventions.

We thank the following persons from BEE for their valuable support and guidance in the entire process of study and report preparation.

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Shri J. Sood, Energy Economist, BEE

Shri. Pawan Tiwari, Advisor BEE

PCRA would further be working in the cluster for ensuring that the initiatives of BEE does bear fruit and the projects identified in this study actually get implemented. An impact analysis can also be considered at a definite interval to assess how much has been the Energy Saving triggered by this intervention. During onsite study, sufficient awareness about the project was created and the entrepreneurs were motivated to adopt the project.

It is observed that the project would succeed in its aim of improving energy efficiency in the complete cluster and the study as well as the intervention in Jorhat tea cluster would set bench mark for success in the Energy Efficiency in SME sector under cluster model.

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DISCLAIMER

The information given in this manual is based on the data collected form the tea factories that were studied during the project. For preparing the manual every care has been taken to evaluate the data correctly, but the possibility of inadvertent error cannot be ruled out. BEE/ PCRA reserves the right to rectify such errors later on.

Since, the study was carried out at Jorhat Tea Cluster, so the information given in this manual does not necessarily reflect the Indian Tea Industry as whole.

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Executive Summary

Jorhat tea Cluster has very rightly been chosen under BEE SME program as the units here are traditionally very old which have not really progressed in pace with the technological advancements. The Cluster Manual has been prepared to present the overview of the cluster in terms of its features, growth potential, and drivers for growth in past and future prospects. The cluster manual presents an account of present technology and the technological interventions required to improve the Energy Performance of the cluster.

The Cluster Manual also tries to identify the projects required to be undertaken for improving the Energy Intensity of the cluster and analyze them financially so as to trigger adoption in the cluster.

The section on list of energy conservation opportunities and technology gap assessment in its complete perspective has been discussed and a complete techno economics of implementing the proposed technology has also been worked out. Sections also deal in availability of service providers in the cluster and also various barriers to implementation of the projects.

A summary of the techno economics of the proposed technology has been provided in section 5.1.3. The Cluster Manual has been prepared in such a way that it discusses Energy Saving Projects in entirety including cost benefit analysis and it can be adopted readily in any of the units.

Energy conservation opportunities in Jorhat tea cluster:

After conducting detailed audit of the tea estates following saving opportunity were observed for reducing the energy consumption and energy cost to great extent. The table depicting process wise recommendation is appended below:

Table : 1a

Process	Energy saving opportunity	Payback
Withering	Stopping hot air leakage and insulation of hot air ducts.	No cost
	Intermittent withering instead of continuous withering	
	Use of one 70 w MH lamp in trough instead of tube lights.	Low cost
	Blocking Air Leakage in withering troughs	
	Suction of withering fans to be tapered to increase the efficiency of the fan (Fig-2).	Long term
	Use of energy efficient motors for withering	
	Use of energy efficient fan blades (FRP blades)	
	VFD drive for air flow control instead of damper control	
CTC (cutting twisting and curling)	Use of single rotor vane during off peak season	No cost
	Proper sizing of CTC motors (most of the motors were grossly under loaded).	Long term
	Use of synthetic flat belts instead of v-belts.	
Fermentation	Stopping air leakage in case of CFM (Continuous fermentation machine), use of VFD.	Short term
	Regulating the humidifier as per the requirement in floor fermentation.	Low cost
	Use of ball breaker after fermentation to reduce ball formation	

Process	Energy saving opportunity	Payback
Drying (NG fired)	Shaft Mounted ID Fan as opposed to Belt Driven Fan.	Short term
	Monitoring and ensuring bluish flame from the burner.	
	Use of energy efficient burners	Long term
	Use of VFD for hot air ID fan	
	Automatic temperature regulator.	
	Use of heat pump for re-circulation of exhaust hot air for preheating inlet air.	
Drying (coal fired)	Excess air control in coal heaters	Short term
	Monitoring of Drier output moisture content of made tea.	
	Improve heat transfer efficiency by cleaning tubes and ducts.	
	Use of VFD for hot air ID fan	Long term
	Preheating the heater inlet air by flue gas economiser.	
	Use of AFRC (air fuel ratio controller in coal heaters).	
Sorting	Discontinuing with use of incandescent bulbs for heating the rollers of sorting tray.	No cost
	Proper maintenance of fibrous sheet in sorting roller to create static charge for sorting fibre from made tea.	
General recommendation	Proper loading of transformers	No cost
	Monitoring of DG performance	
	Scope for reduction in contract demand	
	Separate servo transformer for lighting	Low cost
	Bio-mass gasification to meet thermal energy requirement	Long Term
	Improvement of power factor by APFC	
	Insttalation of wind-solar hybrid power generation	

1. About BEE SME Program :

Worldwide the Micro, Small and Medium Enterprises (MSMEs) have been accepted as engines of economic growth to promote and accelerate equitable development. The major advantage of this sector is its enormous employment potential at significantly low capital involvement. This can be established from the simple fact that the MSMEs constitute over 90% of total enterprises in most economies and are credited with generating the highest rates of employment growth and also account for a major share of industrial production and exports. In Indian context, MSMEs play a pivotal role in the overall industrial economy. In recent years the sector has consistently registered higher growth rate as compared to the overall industrial sector. With its agility and dynamism, the sector has shown admirable innovativeness and adaptability to survive the recent economic downturn and recession.

As per available statistics (the 4th Census of MSME Sector), this sector employs an estimated 59.7 million persons spread over 26.1 million enterprises. It is estimated that in terms of value, MSMEs have a 40% share in total industrial output at a huge volume of producing over 8,000 value-added products. At the same time, MSMEs contribute nearly 35% share in Direct Export and 45% share in the Overall Export from the country. SMEs exist in almost all-major sectors in the Indian industry such as Food Processing, Agricultural Inputs, Chemicals & Pharmaceuticals, Electrical & Electronics, Medical & Surgical Equipment, Textiles and Garments, Gems and Jewellery, Leather and Leather Goods, Meat Products, Bioengineering, Sports goods, tea, Plastics Products, Computer Software etc.

However, despite the significant contributions made to towards various aspects of the nation's socio-economic scenario, this sector too faces several critical issues that require immediate attention. One such factor that falls in the ambit of this publication is the prevalence of age old technologies across the sectors and inherent inefficiencies associated with resource utilization, including, energy. The National Mission for Enhanced Energy Efficiency in Industry under the National Action Plan for Climate Change (released by Government of India on June 30, 2008) has emphasized the need for improving Energy Efficiency (EE) in the manufacturing sector. A number of sector-specific studies have also unanimously confirmed that energy intensity in the industry can be reduced with the widespread adoption of proven and commercially

available technologies, which will improve EE and produce global benefits from reduced Green House Gasses (GHGs) emissions.

As a result of increasing awareness towards efficient usage of energy and other resources, there has been a visible reduction in energy intensity in comprehensive Indian industrial sector. However, focusing the observation on the MSME sector reveals that the energy intensity per unit of production is much higher than that of the organized large scale sector. Since energy cost is significant contributor to the overall production cost of SMEs due to high and rising energy costs in current scenarios, it is required to increase the Energy Efficiency (EE) levels in order to ensure the sustenance of SMEs. One of the ways to reduce the inefficiencies is by replacing the conventional/old/obsolete technology with feasible and adaptable energy efficient technologies. This would not only contribute towards reduction in production cost, but would also improve the quality and productivity of MSME products. However, while knowing the way out, there are still numerous barriers (as listed below) and market failures that have prevented widespread adoption of new energy efficient technologies.

Key barriers in promotion and adoption of EE technologies in Indian SME sector:

- Lack of awareness and capability on the part of SMEs to take up energy conservation activities
- Lack of scientific approach on monitoring and verification of performance assessment of installed equipments and utilities.
- Non availability of benchmark data for various equipments/process
- Low credibility of the service providers such as equipment suppliers and their technologies
- The SME owners are more concerned on production and quality rather than energy efficiency and conservation
- The key technical personnel employed in the SME units are based on their past experience in similar industries rather than technically qualified personnel and hence, they are not aware of the latest technologies or measures which improve energy efficiency
- Lower priority to invest in improving efficiency than in expansion (this may be due to lack of knowledge on cost benefit)

Majority of SMEs are typically run by entrepreneurs and are leanly staffed with trained technical and managerial persons to deploy and capture energy efficiency practice to reduce manufacturing cost and increase competitive edge. Therefore, it will be useful to build energy efficiency awareness in the SMEs by funding/subsidizing need based studies in large number units in the SMEs and giving energy conservation recommendations including short term energy conservation opportunities, retrofit/replacement options and technology up-gradation opportunities.

In this context, the Bureau of Energy Efficiency (BEE) has laid adequate emphasis on the SME sector as presented in the Working Group on Power for 11th Five-Year Plan (2007-2012)-Sub-Group 5. Consequently, the Bureau has initiated the Energy Efficiency Improvement program in 25 SME clusters in India.

1.1 Program Objectives

The BEE SME Program is aimed to improve Energy Efficiency in SME sector by technological interventions in the various clusters of India. The EE in SMEs is intended to be enhanced by helping these industries in the 25 energy intensive SME clusters of India by:

- Technology interventions
- Sustaining the steps for successful implementation of EE measures and projects in clusters
- Capacity building for improved financial planning for SME entrepreneurs.

The program also aims at creating a platform for :

- Dissemination of the best practices and the best available technologies available in the market for energy efficiency and conservation,
- To create awareness in the clusters, and
- To demonstration the new technology interventions/ projects to stimulate adoption of similar technology/projects in the clusters.

The BEE SME program has been designed in such a way so as to address the specific needs of the industries in the SME sector for EE improvement and to overcome the common barriers in way of implementation of EE technologies in cluster through knowledge sharing, capacity building and development of innovative financing mechanisms. Major activities in the BEE SME program are listed below:

- Energy use and technology studies
- Capacity building of stake holders in cluster for building EE projects
- Implementation of energy efficiency measures
- Facilitation of Innovative financing mechanisms for implementation of energy efficiency projects

The brief objective of each of these activities is presented below:

➲ *Energy use and technology studies*

An in-depth assessment of the various production processes, energy consumption pattern, technology employed and possible energy conservation potential and operational practices in cluster by means of conducting detailed energy audits and technological gap assessment studies in a cluster is presented herewith. The energy audit study includes analysis of the overall energy consumption pattern, study of production process, identification of energy intensive steps/sub-processes and associated technology gap assessment for the individual units. The study also focuses on identifying the Best Operating Practices and the EE measures already implemented in the units.

➲ *Capacity building of stakeholders*

The aim of this activity is capacity building of the enrolled LSPs to equip them with the capability to carry on the implementation of the EE technology projects in cluster on a sustainable basis. The needs of the LSPs will be identified as a preparatory exercise to this activity, as to what they expect from the BEE Program in terms of technical and managerial capacity building.

➲ *Implementation of EE measures*

To implement the EE and technology up-gradation projects in the clusters, technology specific Detailed Project Reports (DPRs) for five different technologies for three scales of operation will be prepared. The DPRs will primarily address the following:

- Comparison of existing technology with feasible and available EE technology
- Energy, economic, environmental & social benefits of proposed technology as compared to conventional technology
- Details of technology and service providers of proposed technology
- Availability of proposed technology in local market
- Action plan for implementation of identified energy conservation measures
- Detailed financial feasibility analysis of proposed technology

➲ *Facilitation of innovative financing mechanisms*

Research and develop innovative and effective financing mechanisms for easy financing of EE measures in the SME units in the cluster. The easy financing involves following three aspects:

- Ease in financing procedure
- Availability of finance on comparatively easy terms and relaxed interest rates
- Compatibility and availing various other Central/ State Governments' incentive schemes like CLCSS, TUFF

1.2 Expected Project outcome

Expected project outcome of BEE SME program in clusters are:

➲ *Energy Use and Technology Analysis*

The outcome of the activity will include identification of the EE measures, potential of renewable energy usage, fuel switching, feasibility analysis of various options, and cost benefit analysis of various energy conservation measures including evaluation of financial returns in form of payback period, IRR and cash flows. The cost liability of each measure, including the capital and operational cost will also be indicated.

The identified EE measures will be categorized as per the following types:

- Simple housekeeping measures/ low cost measures
- Capital-intensive technologies requiring major investment.

The sources of technology for each of the suitable low cost and high cost measures, including international suppliers as well as local service providers (LSPs)/ technology suppliers, in required numbers shall be identified. It is envisaged to create a knowledge bank of detailed company profile and CVs of key personnel of these technology sources. The knowledge bank will also include the capability statements of each of these sources.

The EE measures identified in the energy audit study will be prioritized as per their energy saving potential and financial feasibility. The inventorization survey would establish details like the cluster location, details of units, production capacity, technologies employed, product range, energy conservation potential along with possible identified EE measures and respective technology suppliers.

The specific outcomes of this activity will be as follows:

- Determination of energy usage and energy consumption pattern
- Identification of EE measures for the units in cluster
- Development and preparation of case studies for already implemented EE measures and Best Operating Practices in the units
- Evaluation of technical & financial feasibility of EE measures in terms of payback period, IRR and cash flows.
- Enlisting of Local Service Providers(LSPs) for capacity building & training including creation of knowledge bank of such technology suppliers

- Capacity building modules for LSPs
- Development and preparation of cluster manuals consisting of cluster details and EE measures identified in cluster.

➲ *Implementation of EE measures*

The aim of this activity is development and finalization of bankable DPRs for each of the EE projects, which would presented before the SME units for facilitation of institutional financing for undertaking the EE projects in their respective units.

The activity will ensure that there is close match between the proposed EE projects and the specific expertise of the Local Service Providers (LSPs). These DPRs will be prepared for EE, renewable energy, fuel switching and other possible proposed measures during course of previous activities. Each DPR will include the technology assessment, financial assessment, economic assessment and sustainability assessment of the EE project for which it has been developed. The technology assessment will include the details of the design of equipment/ technology along with the calculation of energy savings. The design details of the technology for EE project will include detailed engineering drawing for the most commonly prevalent operational scale, required civil and structural work, system modification and included instrumentation and various line diagrams. The LSPs will be required to report the progress of the implementation of each such project to BEE PMC. Such implementation activities can be undertaken by the LSPs either solely or as a group of several LSPs.

➲ *Capacity Building of LSP's and Bankers*

The outcome of this activity would be training and capacity building of LSPs so as to equip them with necessary capacity to undertake the implementation of proposed EE projects as per the DPRs. Various training programs, training modules and literature are proposed to be used for the said activity. However, first it is important to ascertain the needs of the LSPs engaged, as in what they expect from the program in terms of technical and managerial capacity building. Another outcome of this activity will be enhanced capacity of banking officers in the lead banks in the cluster for technological and financial

feasibility analysis of EE projects that are proposed by the SME units in the cluster. This activity is intended to help bankers in understanding the importance of financing energy efficiency projects, type and size of projects and ways and means to tap huge potential in this area. Different financing models would be explained through the case studies to expose the bankers on the financial viability of energy efficiency projects and how it would expand their own business in today's competitive environment.

➲ *Concluding workshop*

The outcome of this activity will be the assessment of the impact of the project as well as development of a roadmap for future activities. The workshop will be conducted for the representatives of the local industrial units, industry associations, LSPs and other stakeholders so that the experiences gained during the course of project activities including implementation activities of EE project can be shared. All the stakeholders in the project will share their experience relating to projects undertaken by them as per their respective roles. Effort from industrial units as well as LSPs to quantify energy savings thus achieved would be encouraged. This would lead to development of a roadmap for implementing similar programs in other clusters with greater efficiency and reach.

1.3 Identified clusters under the program & target cluster for implementation

25 most energy intensive MSME clusters across different end use sectors have been identified to implement the BEE SME program for EE improvement. The details of industrial sector and identified cluster are provided in Table 2 below:

Table 1b: *List of clusters identified for BEE SME Program*

S. No.	Cluster Name	Location
1.	Oil Milling	Alwar; Rajasthan
2.	Machine Tools	Bangalore; Karnataka
3.	Ice Making	Bhimavaram; Andhra Pradesh
4.	Brass	Bhubaneswar; Orissa
5.	Sea food processing	Kochi, Kerala
6.	Refractories	East &West Godavari, Andhra Pradesh
7.	Rice Milling	Ganjam, Orissa
8.	Dairy	Gujarat
9.	Galvanizing	Howrah, West Bengal
10.	Brass& Aluminum	Jagadhari, Haryana
11.	Limestone	Jodhpur, Rajasthan
12.	Tea processing	Jorhat, Assam
13.	Foundry	Batala, Jalandhar & Ludhiana, Punjab
14.	Paper	Muzzafarnagar, Uttar Pradesh
15.	Sponge iron	Orissa
16.	Chemicals& Dyes	Vapi, Gujarat
17.	Brick	Varanasi, Uttar Pradesh
18.	Rice Milling	Vellore, Tamil Nadu
19.	Chemical	Ahmedabad, Gujarat
20.	Brass	Jamnagar, Gujarat
21.	Textile	Pali, Rajasthan
22.	Textile	Surat, Gujarat
23.	Tiles	Morbi, Gujarat
24.	Textile	Solapur, Maharashtra
25.	Rice Milling	Warangal, Andhra Pradesh

As a part of BEE SME program, one of cluster identified was the Jorhat, Tea cluster. It was proposed to carry out energy use and technology audit studies in 30 units in the Jorhat, Tea cluster covering all types and sizes of the industries to understand/give valuable insight into the process of developing energy efficiency solutions relevant to the SME industries in the Jorhat, Tea cluster

1.4 Cluster

Jorhat Tea cluster, located in Upper Assam comprises of the Tea Estates located in the erstwhile-undivided Jorhat District of Assam. After the division of the Jorhat District into Jorhat District and Golaghat District, presently the Tea Estates of this cluster is spread over the districts of Jorhat and Golaghat. The type of tea produced in this Tea Cluster is primarily BLACK TEA. The black tea that is being produced in this tea cluster are of CTC (Cut, Tear, and Curl) and Orthodox type.

A glance at the background of the tea gardens in Jorhat Tea Cluster reveals that almost all the tea gardens with in – house factories were established in the pre – independence era and these Tea Estates were managed by either as family business acquired through inheritance or by group companies like Amalgamated Plantations (P) Ltd, Williamson and Magor, etc. In case of the first case the adaptability for new technology is low, whereas in case of Tea estates managed by group companies it is seen that the adaptability for new technology is high as these are managed from outside Assam, mainly from the metros. Also these tea estates have the willingness for technological innovation.

The Bought Leaf Tea factories (BLTF) and the tea gardens without in – house factories were established in the post independence era, mainly after the late '80s. And first generation entrepreneurs mainly start these tea establishments and the adaptability for proven new technology is high but these establishments are not interested to experiment with technological innovation mainly due to financial constraints.

As the BEE SME cluster development program is meant for enhancing the