Preliminary Study Report on East & West Godavari Ceramics & Refractories Industries

From field visit during the period of 11th May to 13th May and with inputs from EESL

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United Nations Industrial Development Organisation

Promoting Market Transformation for Energy Efficiency in MSMEs

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

1. Contents

1 BACKGROUND

The project on Market Transformation of Energy Efficiency in MSMEs focuses on improving energy efficiency in the MSME industrial sector of India via demonstration of promising technology as well as an innovative financial model through continued capacity building, information dissemination, and establishment of standard operating procedures for implementing energy efficiency (EE) investment projects. The major stakeholders in this project are UNIDO, MoMSME, EESL, BEE & SIDBI.

10 MSME clusters are selected for implementing under the project. The 10 clusters are as follows:

SN	Cluster	Location (State)
1.	Textiles	Surat (Gujarat)
2.	Chemical	Ankleshwar (Gujarat)
3.	Tea	Jorhat (Assam)
4	Galvanizing and Wire drawing	Howrah (West Bengal)
5.	Paper	Muzaffarnagar (Uttar Pradesh)
6.	Forging	Batala, Jalandhar and Ludhiana (Punjab)
7.	Textiles	Varanasi (Uttar Pradesh)
8.	Sponge Iron	Sundargarh (Odisha)
9.	Rice	Vellore (Andhra Pradesh)
10.	Ceramic	East and West Godavari (Andhra Pradesh)

Rajahmundry is one of the oldest Industrial clusters and located in state of Andhra Pradesh and manufacturing refractory products and potteries. These industries were in operation since last four to five decades. Earlier, these industries were used to manufacture potteries for domestic market, which are commonly used for storing pickles for longer time. The products called „Jars" are the most commonly used container in Southern India specifically in the state of Andhra Pradesh for storing various food items. During the course of time, the demand for potteries (Jars) was considerably reduced due to change in economy and food habits. These pottery making units were diversified to refractory manufacturing due to demand. Majority of the industries are manufacturing refractory and very few units are potteries. There are about 83 industries in the cluster. These industries have been in operation for the last 20 to 30 years. The main raw materials are clay, refractory grog, other chemicals etc. The major Energy used in refractory cluster is Electricity and Fuels like Coal and Wood. Electricity is used for drive the prime movers of brick making units, grinding machines, mixers etc. Coal and wood are used as fuel in down draft kilns for heat treatment of the bricks. The cost of energy is varies from 30% to 50% of production cost which is depending up on the kilns and capacities. In refractory industries, major cost is contributed by energy cost followed by raw material cost and labor cost.

2 CLUSTER PROFILE:

2.1 East & West Godavari Ceramics & Refractories Industries

Refractory Manufacturing Cluster is spread across in East & West Godavari districts of Andhra Pradesh. The reason behind the spread is availability of raw material i.e. Clay. Majority of industries are located near the city of Rajahmundry, head quarter of East Godavari district. These industries are well connected by road, rail and air. The location of cluster is 150 km from Amaravati, state capital of Andhra Pradesh and 200 km from Vishakhapatnam of Andhra Pradesh. In past i.e. before 2013-14 there are approximately 80 refractory industries with different capacities are installed in east and west Godavari District. However, at present only 15 to 20 units were existing due to various following constraints.

1. Energy Issues
2. Technology Issues
3. Financial Issues
4. Skilled & Unskilled Manpower Issues
5. Service provider Issues
6. End product marketing Issue, etc.

2.2 Kick-off meeting

For briefing about the project to the identified cluster and understanding the present status of the clusters. A joint team of DC MSME office, UNIDO & EESL is visiting all the five newly proposed clusters and E&W Godavari clusters field visit was carried out during the period of 11th to 12th May 2018. A Cluster Level Interaction was done with the Ceramics & Refractories Industries Association Members in East & West Godavari, Andhra Pradesh on 11th May, 2018 at Hotel Riverbay, Rajahmundry with participation from all the main members of east & west Godavari ceramics association followed by industries visits. In this kick-off meeting the main framework of the project was elaborated to the participating members and discussion was held as to what is the present status of energy efficiency and what are the various potential EE technologies that the industries themselves feel that the same would change their bottom line for making them more productive and energy efficient.

3 MANUFACTURING PROCESS AND PRODUCTS

The Refractory Bricks manufacturing process consists of following process involved to complete the one batch production

3.1 Raw Material

The raw material required for the manufacturing Refractory products is mineral based clay. The following types of clay is available in East & West Godavari district, Andhra Pradesh for manufacturing the refractory products.

1. Fire Clay
2. China Clay
3. Vemagiri Clay, etc.

3.2 Fuel Used:

The following energy is used for refractory manufacturing industries in East & West Godavari District of Andhra Pradesh.

3.2.1 Thermal Energy

Thermal energy is required in refractory manufacturing Industries to heating up the refractory material up to 1200C. Fuels used in refractory cluster located in East & West Godavari District are coal & wood.

All the Down draft kilns are required thermal energy for heating the refractory material up to 1100 to 1200 C. The source of thermal energy is from firing the coal and Wood in kiln. None of the Industries are using other forms of energy for heating applications in Kilns. The coal is procured from the Singareni Collieries Company Limited (SCCL).

3.2.2 Electrical Energy

Electrical Energy required in refractory manufacturing industries to operate the motors and prime movers installed. The source of electrical energy is from the Andhra Pradesh Eastern Power Distribution Company Limited (APEPDCL).

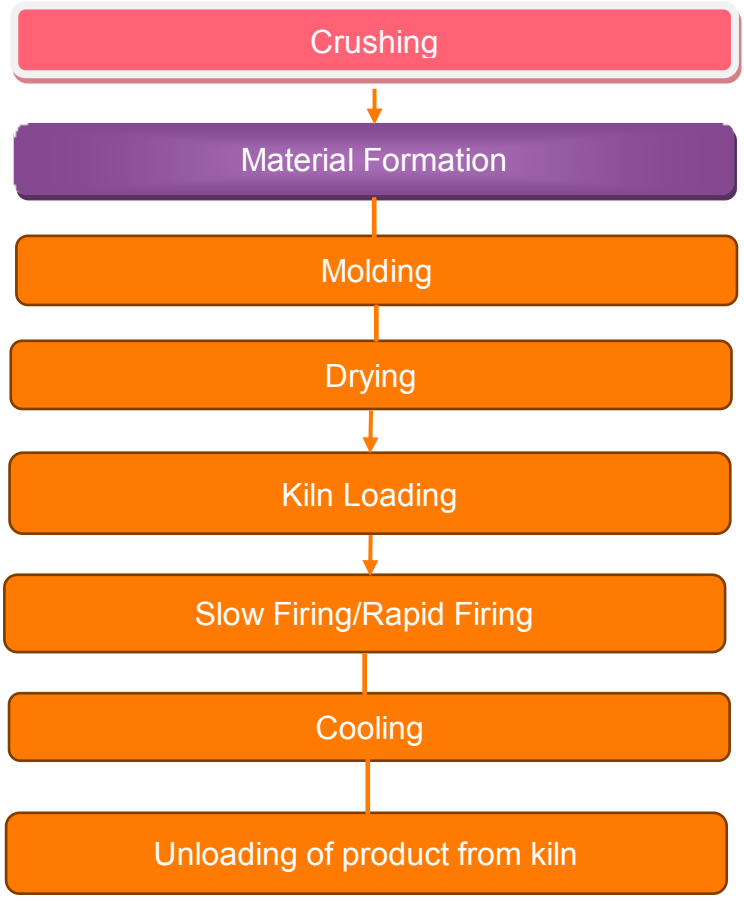
3.2.3 Renewable Energy

The Refractory Manufacturing in East & West Godavari Industries are not utilizing any renewable energy resources except the natural drying process of shaped refractory before kept in kiln.

Based on the findings from the visit of few representative industries and subsequent discussions it is estimated that 1.38 MU of electricity & 180 MKCals of Thermal Energy is used in the existing 20 units.

3.3 Manufacturing Process

The manufacturing process of the Ceramic industries varies depending on the type of products being manufactured by them. The manufacturing process of a typical ceramic manufacturing unit along with the utilities and the energy sources is shown below.



3.3.1 Crushing of Clay/ Grog:

In the crushing process, the procured clay or Grog from the mines/ other sources is crushed in to required sizes by using crushers installed in the plant. This refractory material/ clay is used for preparation of unshaped refractory by using the clay mixer/ball mill. The used refractory material i.e. grog is also used for manufacturing of the refractory material which contains the material properties.

3.32 Unshaped refractory material formation

The crushed raw material i.e. Clay, crushed Grog is mixed with small portion of water in clay mixture/ ball mill for uniform mixture. The raw material is thoroughly mixed in the clay mixture/ ball mill. The product from the clay mixture/ ball mill is called unshaped refractory. This unshaped refractory material is used to prepare product by using molding press/ annual press for required shape

3.3.3 Molding/Pressing

The unshaped refractory material is then used in molding press /press/ manual to form required shape of product. The finished products from molds have moisture content. The shape of products are varies depending up on the requirement of client.

3.3.4 Drying

The shaped refractory contains moisture content. The moisture content in the shaped refractory is removed by natural drying i.e. sun drying or using fan. The drying process will take 2-3 days from the formation of shaped refractory.

3.3.5 Kiln Loading

The dried refractory material is placed into empty kiln by manually through the charging doors provided in kiln in order to heat flames are passing through it. The charging doors are closed after refractory material kept in the kiln by using refractory bricks, clay.

3.3.6 Slow firing /Rapid Firing

In the slow firing process, the heat is passed through the kiln using wood initially from the firing zones located in the kiln. After wood, coal is used for slow firing process to increase the inside temperature of the kiln. During the process the moisture content in the refractory material is removed completely by passing the heat. The slow firing process kept for 2-3 days depending up on moisture content and capacity of the products in refractory material.

After removal of moisture during the slow firing process, rapid firing process starts by supplying more coal to the firing gates in the kiln. During the rapid firing process, the refractory material undergoes physical and chemical changes. The final temperature required during the process is up to 1200 C. During this temperature the refractory material heated up and formed finished product. This process required 48-36 hrs of operation depending upon the quantity of material inside the kiln.

3.3.7 Cooling

In the Cooling process the fired refractory material is kept for cooling to reduce the refractory material temperature from 1100 -1200 C to 50 C. This cooling process is done naturally or by forced air circulation. In the cooling process the cooling of the brick is done by supplying the air either naturally/ forced draft. Due to natural air circulation the cooling process will be more than 2 days depending up on the material inside the kiln and temperature of the material. In all the kilns, the cooling process are done by circulating the air naturally i.e. holes provided in the kiln surface /forced draft air circulation.

3.3.8 Unloading of product from kiln

The cooled refractory product then withdrawn from the kiln by manually and kept for outside. This material then packed and marketed. The finished product is checked manually during the unloading. Any un burn/ cracks material is removed and finished refractory product sent for packing.

4 FIELD STUDY:

Following representative industries Visited were visited in consultation with the local industrial association by the joint team of DI MSME office, EESL and UNIDO during the period of 11/05/2018 to 12/05/2018:

1. Rajendra Clays & Ceramics, Dwaraka Tirumula
2. Sri Satya Sai Ceramics, Dwaraka Thirumala
3. Boppudi Refractories PVT.Ltd., Jaggampeta
4. Tirumalesa Ceramics, Jaggampeta
5. Sri Srinivasa Ceramics, Jaggampeta
6. Padma Ceramics, Tallur.
7. Vearanjaneya Ceramics, Rajahmundry.

5 OBSERVATIONS:

During the visits to above industries, it has been noticed that all the units are using almost identical processes and technologies as given below:

1. Down Draught Kiln: 2 Nos
2. Capacity: Ranging between 100 to 200 Tons/Cycle
3. Average number of Cycles: 3 Cycles for every two months
4. Fuel Used: Coal for firing, Electricity for driving motors and machines.
5. Motors Applications & Range: Jaw Crusher, Disintegrators, Impact Miller, Mixers, Pressing Machines, etc. Ranging between 5 HP to 60 Hp motors.
6. Average selling price: 5000 Rs/Tons of refractories.
7. % of energy cost to Manufacturing cost: 40 to 45% i.e. 2000 to 2200 Rs/Ton of Refractories.

Even if the number of units currently operating is limited in number i.e.15 to 20 Nos, but per unit energy wastage is very high due to usage of inefficient technologies for firing in Kiln, driving of motors etc. During the discussion, it is noticed that all the units are interested to change their inefficient DD KILN with energy efficient KILN especially with Tunnel KILN. The Advantages are:

1. Huge Energy Savings & reduction in energy cost.
2. Reduced Selling Cost
3. Can compete with Global market
4. Reduction of greenhouse gases.

6 PROSPECTIVE TECHNOLOGIES:

6.1 Tunnel KILN technology:

Tunnel Kiln history dates back to 1807 when Hoganas first used this process to produce iron powder of 99.9% purity.

When iron ore is mined or processed (in a crusher), lots of fines are generated. Quantity of fines generation is a function of the quality of ore i.e. whether it is hard or soft. Iron ore fines are usually subject to beneficiation and/or pelletisation thereby converting them back into hard rock-like shapes (pellets) with a proper tumbler index. These pellets are then used for making sponge iron.

Rotary kilns have a drawback upon the size and quality of iron ore that can be used. Initially, when the process was first introduced, the ore with an iron content >/= 65% was preferred and the preferred size of ore was 5-18mm. And coal of minimum "B" grade was required to be used for the solid-state reduction or DRI making process. With the passage in time, quality of both iron ore and coal declined and still DRI was being produced. However, the only solution for iron ore fines was beneficiation, if required, and pelletisation. And coal fines virtually lost their commercial value.

While both of the key materials are available in abundance, one of the best means of utilising them is the Tunnel Kiln. Some of the key attributes of the Tunnel Kiln are…

- Tunnel Kilns can use soft ore
- Tunnel Kilns can comfortably work with Iron Ore fines (</= -5mm)
- Both Haematite & Magnetite can be converted to sponge iron using Tunnel Kilns
- Tunnel Kilns are comfortable with coal fines and mill scale
- Uniform product quality
- Production cost from Tunnel Kilns is lower than that from rotary kilns
- Extremely low on environmental pollution

The Research & Development team of Electrotherm has extensively worked upon this process of Sponge Iron making and we have successfully produced sponge iron from our 25TPD Tunnel Kiln at our steel making complex at Samakhyali, Kutch. A sample of the product from our Tunnel Kiln is shown here…

We had successfully experimented with a variety of raw materials like iron ore fines from Bellary and Barbil (in India), iron ore pellets from Bahrain, domestic and imported varieties of coal, self-developed and imported varieties of saggers etc. and our R&D team has developed a software whereby we can support any combination of raw materials to produce quality sponge iron from a supposedly waste material.

Quality of sponge iron made by the Tunnel Kiln technology is superior as compared to that made from the rotary kilns because, while the input raw material gets just about 24hours for the reaction, the figures almost reverse in case of the Tunnel Kiln. Reaction time of 42 hours in the Tunnel Kiln provides ample opportunity for the raw material to completely react and this results into superior Fe metallic from the end product.

7 CONCLUSION:

From the above it can be noticed that due to various constrains (concerning technology, skilled manpower and easy finance), this cluster is in dire-strait resulting reduction in the number of operating units from 80 to 20 in the last 3 to 4 years. Therefore, since the volume of units is less, even a single pilot project could also help up-scaling of the Tunnel KILN technology with suitable financial mechanism which can subsequently be worked out under GEF-5 program that would lead to the following outcomes.

1. Energy savings potential to the tune of approx. 550 ToE /Industry
2. Approx. 5380 Tons of CO2 emission reduction
3. May provide potential of investment about 25 to 30 Crs. for existing 15 to 20 units

8 Comments:

Even if the number of units currently operating is limited in number i.e.15 to 20 Nos, but per unit energy wastage is very high due to usage of inefficient technologies for firing in Kiln, driving of motors etc.

During the discussion, it is noticed that all the units are interested to change their inefficient DD KILN with energy efficient KILN especially with Tunnel KILN. A simple cost benefit analysis for replacing of DD KILN with Tunnel KILN is estimated as follows as per the discussion with industries.

Rough Estimation for Replacing of DD KILN with Tunnel KILN Based on discussion with Few Ceramics & Refractories Industries in East & Godavari, Andhra Pradesh.			
SN	Parameter	Units	Values
1	No of Kilns per Industry	Nos	2
2	Average capacity of DD KILN	Tons	150
3	Average Cycles produced for every Month	Nos	1.5
4	Total Average Production per Month	Tons	450
5	Average selling Price per Ton	Rs	5000
6	Estimated Average energy consumption cost per Ton of Refractories with existing DD KILN	Rs	2200
7	Estimated Average energy consumption cost per Ton of Refractories with proposed Tunnel KILN	Rs.	1100
8	Difference in Energy Cost per Annum	Rs.	5940000
9	Estimated Investment for 20 TPD Tunnel KILN including Miscellaneous	Rs.	15000000
10	Payback Period	Years.	2.5

Note: This is just an estimation, however a detailed techno-economic feasibility study is to be carried out for getting better clarity, if required.

Advantages:

1. Huge Energy Savings & reduction in energy cost.
2. Reduced Selling Cost
3. Can compete with Global market
4. Reduction of greenhouse gases.

9 Few Barriers for implementation of Tunnel KILN:

The major technical barriers that prevented the implementation of the Tunnel Kiln in the cluster are:

No single unit has installed Tunnel kiln in the cluster units, though some of the unit owners are interested, no demonstration projects or no single unit were implemented Tunnel kiln specially using coal as fuel, this was also one of major reason for not taking up the project in the cluster.

- ✓ Financial Barrier:
  Though, many MSME owners are interested to install Tunnel kilns, due to high initial investment and the MSME owners could not implement in the cluster.

- ✓ Skilled manpower:
  Lack of skilled manpower was also one of the major barriers in the cluster.

- ✓ Marketing:
  Many MSME owners have doubt about the marketing capability to sell as much enhanced production they would make by adopting the tunnel kiln technologies since a Tunnel KILN favours a continuous mode of production Process. Industries apprehension is that to sell out these high quantum of finished product, they are not very sure if the market would respond that positively post conversion to the tunnel kiln technology.

10 ANNEXURE:

Attendance Sheet

Promoting Market Transformation for Energy Efficiency in MSME under GEF-5 Program

Program: Consultation Meeting with East & West Godavari Ceramics & Refractories Industries Association Members

Venue: Arihanth (Conference Hall), Hotel Riverbay, Rajahmundry, Andhra Pradesh

Date: 11/05/2018

SN	Name	Industry Name & Place	Mobile No	E-Mail	Signature
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3	D.V.V. RAMANA Reddy	BOPPUDI REFRACTORIES			
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7	T. VINAYAKA RAO	Sri Lakshmi Ceramic Industry	9848022598	CHE BROWN [illegible]	
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11 PHOTOGRAPHs: