

Capacity Building workshop

# Energy conservation in Khurja pottery industries

8<sup>th</sup> March 2018 at Khurja

Under the project  
Capacity Building of Local Service Providers (LSPs)

Supported by  
GEF-UNIDO-BEE Project  
Promoting Energy Efficiency and Renewable Energy in selected  
MSME clusters in India





# Table of contents

---

<b>WORKSHOP SUMMARY.....</b>	<b>1</b>
Overview of workshop .....	1
Summary of points discussed in the meeting.....	1
Feedback forms .....	2
Suggestions by participants .....	3
Learnings by participants .....	3
<b>ANNEXURE 1: AGENDA OF THE PROGRAM.....</b>	<b>7</b>
<b>ANNEXURE 2: LIST OF PARTICIPANTS .....</b>	<b>9</b>
<b>ANNEXURE 3: SELECTED PHOTOGRAPHS OF THE EVENT .....</b>	<b>17</b>
<b>ANNEXURE 4: SAMPLE FEEDBACK FORMS .....</b>	<b>19</b>
<b>ANNEXURE 5: COPY OF PRESENTATIONS .....</b>	<b>24</b>





# Workshop summary

---

## Overview of workshop

Capacity Building workshop of Local Service Providers (LSPs) on energy conservation in Khurja pottery industries was organized by TERI on 8<sup>th</sup> March 2018, Thursday in association with Central Glass and Ceramic Research Institute (CGCRI) under GEF-UNIDO project. Total 45 participants were present during the workshop and for the institute/training centre visit, which was organized after the workshop. Agenda of the workshop and list of participants are attached in the annexure 1 and annexure 2 respectively.

## Summary of points discussed in the meeting

Dr C S Prasad, CGCRI welcomed the participants and thanked TERI and UNIDO for arranging the capacity building workshop. He reminded the participants about CGCRI's involvement in promoting energy efficiency among pottery industries in Khurja and stressed the need for adopting potential energy conservation measures, which will not only reduce the production cost but same time also improves competitiveness of the unit for better sustainability. He explained the importance of the training programme on the emerging issue for the Khurja pottery cluster and need for capacity building programme that focuses on energy efficiency of gas based tunnel kiln being adopted by the local pottery industries. He encouraged all participants to actively take part in the programme and take full advantage of the knowledge sharing programme.

Mr Ajeet Singh, UNIDO representative for Khurja pottery cluster provided a brief background of the GEF-UNIDO-BEE project activities in Khurja pottery cluster and also explained the objective of the workshop. He stressed that awareness on best operating practices is equally importance similar to adoption of advance technology to improve overall energy efficiency in any manufacturing process. Therefore, it is essential to upgrade the skill of the service providers on the emerging technology for the cluster. He informed about the current available equipment at energy cell and how industries can benefit by availing energy audit services at low costs.

Dr. C S Prasad, CGCRI, Khurja discussed the issues of dead weight in kiln furniture which was even more than 3:1 (dead mass to product mass) in earlier days but now a days it has been reduced to 1:1 using various options of low thermal car. He highlighted the issues of product profile to be kept in mind while selecting low thermal mass kiln car configuration, which could have facilities to vary the height between two rows to accommodate different product height, i.e. provision for fixing height as need while loading green products on the car. He showed photo views of different options in this regard.

Mr. A M Ghosh, TERI gave descriptive presentation on best operating practices and fault diagnosis for gas based kiln in Khurja cluster, issues related to system design and specification of equipment to be considered for air and gas train including and piping for their integration. He explained the primary reasons which may affect the operational efficiency of the firing kiln and how to improve using good practices, which eventually results in significant amount of energy savings. He also shared various operational parameters to optimise the performance of existing gas fired tunnel kiln system. He explained about the energy efficient machines though required high capital cost can result in

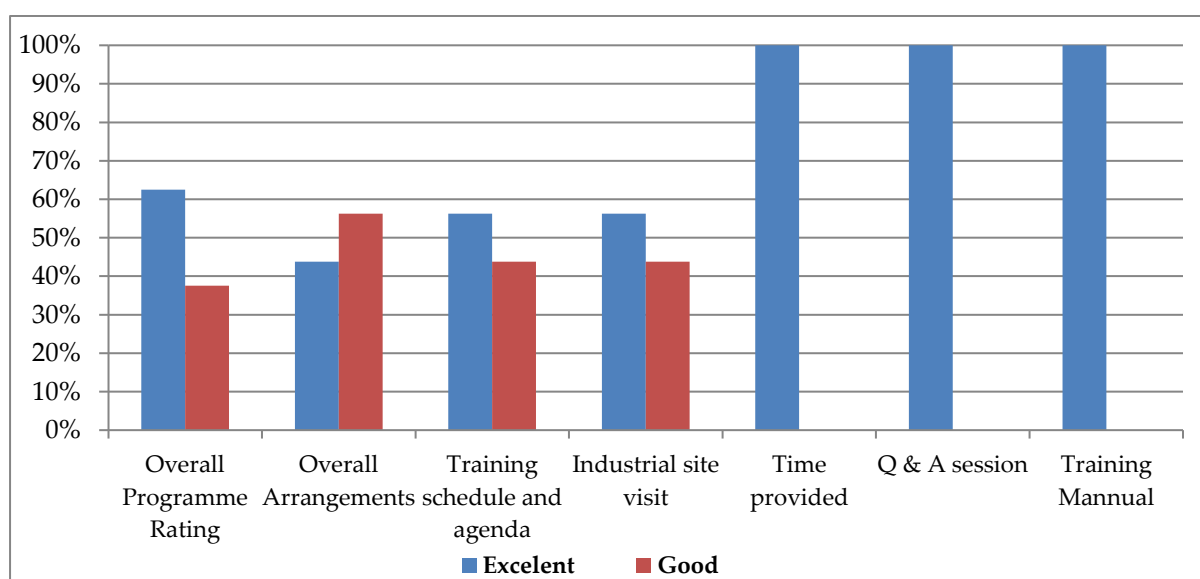
lower running cost over a lifetime due to its efficient operation. It was also mentioned that some instruments are essential to be available in place for online monitoring of process parameters, which will help in smooth operation of kiln as well as routine maintenance of the kiln system. He also reminded the participants about the frequently observed operational faults and the ways to undertake corrective maintenance.

Mr. Ashish Sakhare, TERI presented various potential options to reduce electrical energy consumption in pottery industries. He took a case study on ball mill, which has generally highest capacity connected motor load. Presented case study on adoption of energy efficient motor (IE 3) to replace existing motor in ball mil system showed that the first cost can be recovered within one year period. Financial analysis indicates that IE3 motor adoption is not only feasible but has very attractive monetary benefits. Regarding energy efficient lighting, both indoor and industrial shop floors were discussed with potential option to reduce light load in a given factory.

After the class room session, the participants were taken to a local pottery industry to show them a running unit with gas based tunnel kiln. Participants were told the data monitoring gap due to lack of instrument in place. Participants were shown the process steps and briefed about potential changes can be introduce to reduce energy cost in the process. Selected photos of the workshop are provided with the annexure 3.

## Feedback forms

Based on the analysis of the feedback forms received from the participants, it was observed that workshop was well received by the participants and 100% participants were satisfied with ceramic visit, Q&A session and training module provided to them. About 63% participants have rated overall program as “Excellent” while rest of them have rated it as “Good”. More than 50% of participants were satisfied with arrangements made, training schedule and agenda of the program. Few sample feedback forms are attached in the annexure 4.



Analysis of feedback forms

## **Suggestions by participants**

Some participants have made suggestions as follows:

- 1) Demonstration on high alumina ball mill
- 2) Energy efficient lighting and fans

## **Learnings by participants**

Some of the topics learned by the participants and mentioned by them are listed below;

- 1) Use of low thermal mass cars
- 2) Fault diagnosis in kiln operation



# Annexures



# Annexure 1: Agenda of the program



Capacity building workshop

## Energy conservation in Khurja pottery industries

Thursday, 8<sup>th</sup> March 2018

Conference Hall, CGCRI, Khurja ceramic Cluster

Under the project:

**Capacity Building of Local Service Providers (LSPs)**

Supported by:

**GEF-UNIDO-BEE Project**

**Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India**

### Agenda

13:00 – 13:30	<b>Registration</b>
13:30 – 13:35	<b>Welcome Address</b> Dr C S Prasad, Central Glass and Ceramic Research Institute
13:35 – 13:40	<b>Opening Remarks</b> Mr Ajeet Singh, UNIDO, Khurja
13:40 – 14:00	<b>Energy efficient kiln furniture for pottery industries</b> Dr C S Prasad, Central Glass and Ceramic Research Institute
14:00 – 15:00	<b>Best operating practices and fault diagnosis for gas based kiln in Khurja cluster</b> Mr Ananda Mohan Ghosh, TERI
15:00 – 16:00	<b>Energy efficient electrical utilities for Khurja pottery industries</b> Mr Ashish Sakhare, TERI
16:00 – 16:30	<b>Q&amp;A</b>
16:30 – 18:00	<b>Site Visit / On-site training</b> Visit to a pottery unit, Khurja
18:00 – 18:20	<b>Feedback from participants</b>
18:20 – 18:30	<b>Vote of thanks</b> Dr C S Prasad, Central Glass and Ceramic Research Institute
18:30 – 19:00	<b>Hi-Tea</b>

Organized by







## Annexure 2: List of participants

S. No	Name	Organization	Mobile No	Email ID
1.	Faruk	K L Ceramics	9758183886	
2.	Ajay	K L Ceramics	9695086196	
3.	Manoj Kumar	Ramanuj Parshi	8865920461	
4.	Vinesh Chandra	Technical Consultant	9639010425	
5.	A M Ghosh	TERI	9811836693	amghosh@teri.res.in
6.	Ajeet Singh	UNIDO	8980371090	cl.khurjacluster@gmail.com
7.	Ashish Sakhare	TERI	8587923342	ashish.sakhare@teri.res.in
8.	Ram Balak Yadav	Furnace Operator	9219296673	
9.	Munna Lal	Fabricator	8171099974	
10.	Rajdeep Singh	Fabricator	7917733904	
11.	Sonu	Furnace Operator	9837141617	
12.	Harishankar		9045401448	
13.	Ravi S	Supervisor	8218886883	
14.	Umesh Kumar	Fireman	7830537155	
15.	Akhilesh Kumar	Electrician	8755118416	
16.	Nennu Kumar	R K Pottery	9037045476	
17.	K M Divya	Vineet Decoration	9758431692	
18.	Kamal Singh	Brite Industries	7310716143	
19.	Sham Singh	Rajeev Pottery	9927064215	
20.	Jeevanth Yadav	Rajeev Pottery	9720177162	
21.	Bhikari Chand	Dada Ceramics	7897129630	
22.	Rishipad	Fireman	9759952546	
23.	Amarjeet	Furnace Operator	7917833593	
24.	Amar Nath Verma	J K Engg. Works	9058608591	
25.	Anurag Singh	Raj Engg. Works	9897373223	
26.	Ravi Shankar	Anas Engg. Works	9045373759	
27.	Rajesh Singh	Furnace Operator	8859253323	
28.	Harkesh	-	7290945842	
29.	Dharmendra Singh	-	9045927626	
30.	Rajeev Kalra	Kalra Care Products	9837093975	kalracare@yahoo.com
31.	Yogehora Yadav	Oriental Collection	9839757582	orICollection@gmail.com
32.	Mukul Saxena	CGCRI, Khurja	9536105448	Mukulsaxena72@gmail.com
33.	Arpita Goswami	CGCRI, Khurja	9897294928	Arpita.goswami20@gmail.com
34.	Ashok Kumar Yadav	Anuj Industries	9759277118	
35.	Liteshwar Sharma	Bihar Ceramics	9897545702	litesharma@gmail.com
36.	Shakeel Ahmed	Geo Industries	9837094402	geoindustries@gmail.com
37.	Sanjeev Bathla	Viswanath Ceramics	9837066242	viswantceramics@gmail.com
38.	Ravinder Kumar	Rahul Ceramics	9897162915	
39.	Umar Sagar	Roshni Ceramics	9152179637	
40.	Radheshyam Yadav	Jai Jagdish Ind	7500561723	
41.	Parag N	Minhas Pottery	8273237095	
42.	Rajesh Tomar	SICICO & CHEMICO	9837093500	
43.	C S Prasad	CGCRI	9412227617	
44.	Jai Prakash	Bihar Industries	8937005101	
45.	Riya Sat	Hitech Engg. Works		



Capacity building workshop  
**Energy conservation in Khurja pottery industries**  
8<sup>th</sup> March 2018, Conference Hall, CGCRI, Khurja ceramic cluster

S. No	Name	Organization	Mobile No	Email ID	Signature
1.	कृतिवर्मा	K.L Ceramics	975 81 83886		कृतिवर्मा
2.	अजय	KL Ceramics	6395086196		Ajay
3.	मनीष गुप्ता	मनीष गुप्ता	886592046		मनीष गुप्ता
4.	Viresh Chandra.	Technical Consultant	9639010625		Viresh
5.	AM Ghosh	TERI	9811836693	amghosh@teri.res.in	AM Ghosh
6.	Ajeet Singh	UNIDO	8980371090	CL-Khurja cluster@gmail.com	Ajeet
7.	Ashish Sakhare	TERI	8587923342	ashish.sakhare@teri.res.in	Ashish

S. No	Name	Organization	Mobile No	Email ID	Signature
8.	राम कानक भादुर	परनेश ओपरेटर	9219296673		रामकानकभादुर
9.	सुब्बा लाल	जेब्री केयर	8171099974		सुब्बा लाल
10	राजेश कुमार	जेब्री केयर	7417733904		राजेश कुमार
11	SONU	परनेश ओपरेटर	9837141617		Bunar
12	हरि शर्मा	जीजी इंड	9045401448		
13.	Ravi Saini	Supervisor	8218866883		Ravi Saini
14	Umaesh Kumar	Firman	7830537155		Umaesh Kumar
15	Akhilesh Kumar	Electrician	8755118416		Akhilesh
16	Mannan	R. K. Pottery.	9837045478		Mannan
17	Km - Divya	Vineet Decorator	9758431692		Km - Divya

S. No	Name	Organization	Mobile No	Email ID	Signature
18	Komal Singh	Brite Ind.	7310716143		Komal Singh
19	शिवकुमार सिंह	राजीव जोड़ी	9927064215		शिवकुमार सिंह
20	जीवानन्त यादव	राजीव जोड़ी	9720177162		जीवानन्त यादव
21	त्रिवेदी चन्द	Dada Ceramics	9897129630		Trivedi Chand
22	रिषीपाल	पाथरमैन	9755952546		Rishi Pal
23	Amarjeet	furnace operator	7417833573		Amarjeet
24	Anar Nath Verma	JK Engg. Works	9058608541		Anar Nath Verma
25	Anurag Singh	Rite Engg. Works	9897373223		Anurag Singh
26	Ravi Shankar Singh	Anas Engg. Works	9045313457		Ravi Singh
27	Rajesh Singh	परनेश ओरेर	8859253727		Rajesh Singh



S. No	Name	Organization	Mobile No	Email ID	Signature
28	ERAJET		7290945842		ERAJET
29	Shamimudra Singh		9049927626		Shamimudra Singh
30	RAJEEV KALRA	Kalra Cere Products	9837093975	Kalracere@yahoo.com	Rajeev Kalra
31	Yogendra Yadav	Oriental Collection	9839757582	oricallection@gmail.com	Yogendra Yadav
32	MUKUL SAXENA	CGCRI, Khurja	9536105448	mukulSaxena72@gmail.com	Mukul Saxena
33	Arpita Goswami	CGCRI, Khurja	9897299928	arpita.goswami.20@gmail.com	Arpita Goswami
34	Ashok kr. Yadav	Anuj Industries	9759277118		Ashok kr. Yadav
35	LITESHWAR SHARMA	BITHA CERAMICS	9897545702	litesharma@gmail.com	Liteshwar Sharma
36	Shakeel Ahmad	Geo Industries	9837094402	geoindustries@gmail.com	Shakeel Ahmad
37	VISWANATH CERAMICS	SANJEEV. BATHUR	9837066242	VISWANATHCERAMICS@gmail.com	Sanjeev Bathur

S. No	Name	Organization	Mobile No	Email ID	Signature
38	राहुल कुमार	Rahul Ceramics	9897162915		राहुल कुमार
39	Umar Sagar	Roshni Ceramics	9152179637		Umar Sagar
40	Radheshyam Yadav	Jai Jagdish Ind.	7500561723		Radheshyam Yadav
41	PARAS NARAYAN	MINHAS POTTERY	8273237095		Paras Narayan
42	Rajesh Tomar	SILICO CERAMICS	9837093500		Rajesh Tomar
43	Dr. C.S. Prasad	C.G.C.R.I	9412227617		Dr. C.S. Prasad
44	Jai Prakash	Bihar Industries	8837005101		Jai Prakash
45	Riyasat	Hiteesh Envy. Works.			Riyasat





## Annexure 3: Selected photographs of the event

---





## Annexure 4: Sample feedback forms



Capacity building workshop

### Energy conservation in Khurja pottery industries

Thursday, 8<sup>th</sup> March 2018

Conference Hall, CGCRI, Khurja ceramic Cluster

Supported by:

**GEF-UNIDO-BEE Project**

**Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India**

#### Evaluation Sheet for Participants

Feedback Form for Participants			
Parameter	Feedback		
	Excellent	Good	Average
How would you rate the overall programme?		<input checked="" type="checkbox"/>	
How would you rate overall arrangements?		<input checked="" type="checkbox"/>	
How was the training schedule and agenda?		<input checked="" type="checkbox"/>	
How was the industrial site visit?		<input checked="" type="checkbox"/>	
Do you think that adequate time was provided for each topic?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Do you think that satisfactory answers were given to your questions during the training programme?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Do you think that the background training manual is informative and useful enough?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Do you think that the discussion on EE/RE will help you in your work?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Suggestions & Recommendations for Improvement:			
Name two learning, which from this programme you will be able to implement in your plant?			
Signature: <u>Amar Nath Verma</u>			
Name of participant:			
Organization:			
Mobile No: <u>9050608541</u>			
Email ID: <u>amarpatel299jgr@gmail.com</u>			

Organized by



The Energy and Resources Institute





Capacity building workshop  
Energy conservation in Khurja pottery industries

Thursday, 8<sup>th</sup> March 2018

Conference Hall, CGCRI, Khurja ceramic Cluster

Supported by:

GEF-UNIDO-BEE Project

Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India

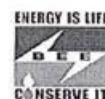
Evaluation Sheet for Participants

Feedback Form for Participants			
Parameter	Feedback		
	Excellent	Good	Average
How would you rate the overall programme?	✓		
How would you rate overall arrangements?	✓		
How was the training schedule and agenda?	✓		
How was the industrial site visit?	✓		
Do you think that adequate time was provided for each topic?	Yes [ ✓ ]	No [ ]	
Do you think that satisfactory answers were given to your questions during the training programme?	Yes [ ✓ ]	No [ ]	
Do you think that the background training manual is informative and useful enough?	Yes [ ✓ ]	No [ ]	
Do you think that the discussion on EE/RE will help you in your work?	Yes [ ✓ ]	No [ ]	
Suggestions & Recommendations for improvement:			
Name two learning, which from this programme you will be able to implement in your plant?			
Signature: <i>Anurag Singh</i>			
Name of participant: <i>Anurag Singh</i>			
Organization: <i>CGCRI</i>			
Mobile No: <i>9897373223</i>			
Email ID:			

Organized by







Capacity building workshop

Energy conservation in Khurja pottery industries

Thursday, 8<sup>th</sup> March 2018

Conference Hall, CGCRI, Khurja ceramic Cluster

Supported by:

GEF-UNIDO-BEE Project

Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India

Evaluation Sheet for Participants

Feedback Form for Participants			
Parameter	Feedback		
	Excellent	Good	Average
How would you rate the overall programme?	✓		
How would you rate overall arrangements?	✓		
How was the training schedule and agenda?	✓		
How was the industrial site visit?	✓		
Do you think that adequate time was provided for each topic?	Yes [ ✓ ]	No [ ]	
Do you think that satisfactory answers were given to your questions during the training programme?	Yes [ ✓ ]	No [ ]	
Do you think that the background training manual is informative and useful enough?	Yes [ ✓ ]	No [ ]	
Do you think that the discussion on EE/RE will help you in your work?	Yes [ ]	No [ ]	
Suggestions & Recommendations for improvement:			
Name two learning, which from this programme you will be able to implement in your plant?			
Signature: 21/03/2018 राधेश्याम यादव			
Name of participant: Radhe Shyam Yadav			
Organization: Jagdish Pottery			
Mobile No: 7500561723			
Email ID:			

Organized by





Capacity building workshop

## Energy conservation in Khurja pottery industries

Thursday, 8<sup>th</sup> March 2018

Conference Hall, CGCRI, Khurja ceramic Cluster

Supported by:

GEF-UNIDO-BEE Project

Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India

### Evaluation Sheet for Participants

Feedback Form for Participants			
Parameter	Feedback		
	Excellent	Good	Average
How would you rate the overall programme?	<input checked="" type="checkbox"/>		
How would you rate overall arrangements?		<input checked="" type="checkbox"/>	
How was the training schedule and agenda?	<input checked="" type="checkbox"/>		
How was the industrial site visit?	<input checked="" type="checkbox"/>		
Do you think that adequate time was provided for each topic?	Yes [ <input type="checkbox"/> ]	No [ <input type="checkbox"/> ]	
Do you think that satisfactory answers were given to your questions during the training programme?	Yes [ <input checked="" type="checkbox"/> ]	No [ <input type="checkbox"/> ]	
Do you think that the background training manual is informative and useful enough?	Yes [ <input checked="" type="checkbox"/> ]	No [ <input type="checkbox"/> ]	
Do you think that the discussion on EE/RE will help you in your work?	Yes [ <input checked="" type="checkbox"/> ]	No [ <input type="checkbox"/> ]	
Suggestions & Recommendations for improvement:			
Name two learning, which from this programme you will be able to implement in your plant?			
Signature:			
Name of participant: SANJEEV BATHLA			
Organization: VISWANATH CERAMICS			
Mobile No: 98370 66242			
Email ID: VISWANATHCERAMIS@gmail.com			

Organized by



The Energy and Resources Institute





## Annexure 5: Copy of presentations



### **Capacity Building of Local Service Providers (LSPs) Energy conservation**

**Mr. Ananda Mohan Ghosh, TERI**

**Mr. N Vasudevan, TERI**

*Supported by:*

**GEF-UNIDO-BEE Project  
Promoting Energy Efficiency and Renewable Energy in selected MSME  
clusters in India**



### **About TERI**

- ☐ Not-for-profit, independent, research institute, established in 1974
- ☐ Head office in New Delhi. Regional offices: Bangalore, Mumbai, Guwahati, Mukteshwar and Goa
- ☐ Staff strength of over 1,000
- ☐ Industrial Energy Efficiency Division of TERI focuses on energy efficiency in industry sector including MSMEs



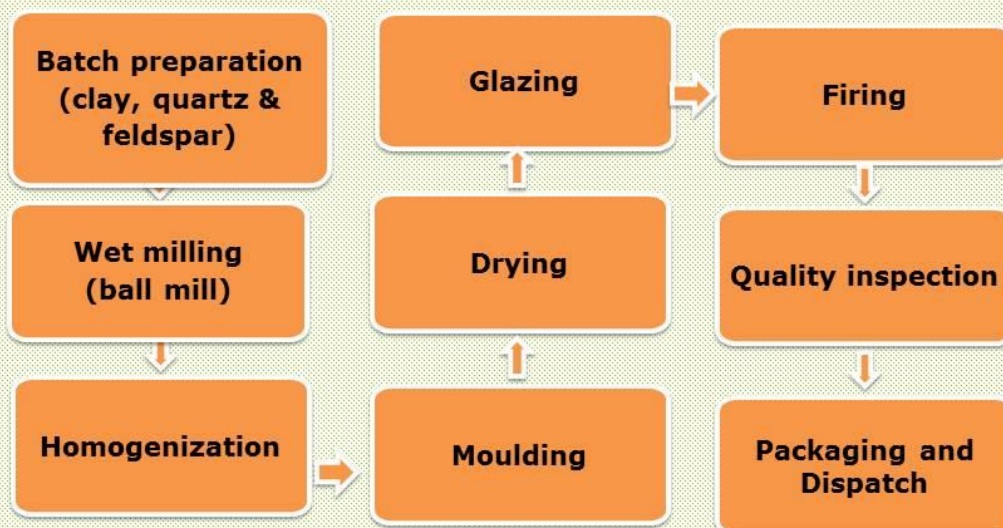


## Energy audits - TERI's experience

- ❑ Pioneered energy audits in India
- ❑ Highly experienced multi disciplinary team of about 30 engineers at Delhi & Bangalore
- ❑ 2000+ assignments on detailed energy audits completed
- ❑ Bank of latest portable instruments/software
- ❑ Temperature pressure, flow, electricity, water analysis, illumination, gas analysis and softwares (simulation, efficiency calculation)
- ❑ Good networking with major equipment suppliers
- ❑ Feedback system/post energy audit assignments



## Production process in a ceramic unit



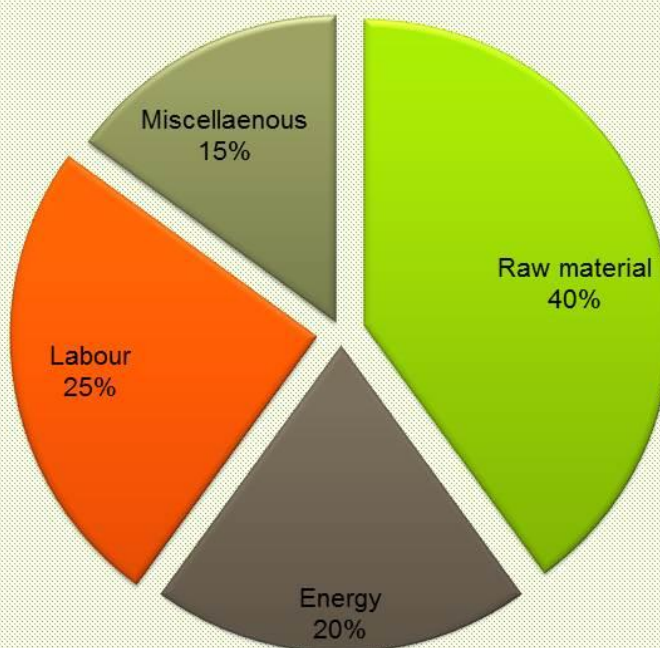


## Utilities and input energy

Process	Connect equipment / utilities	Input energy
Crushing	Crusher	Electrical
Grinding/milling	Ball mill and blungger	Electrical
Slurry preparation	Silos	Electrical
Filtration	Press filter	Thermal and electrical
Pugging or mixing	Pan or pug mill	Electrical
Shaping	Press, Jigger	Electrical
Drying	Vertical / horizontal kiln car	Thermal and electrical
Glazing	Compressor	Electrical
Firing/sintering	Kiln	Thermal and electrical



## Share of energy cost in production

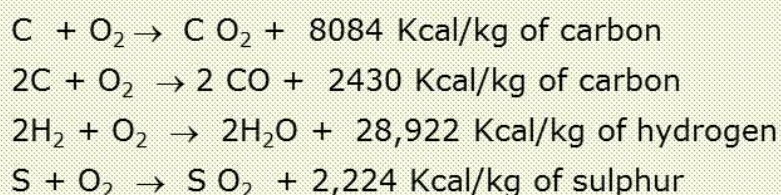




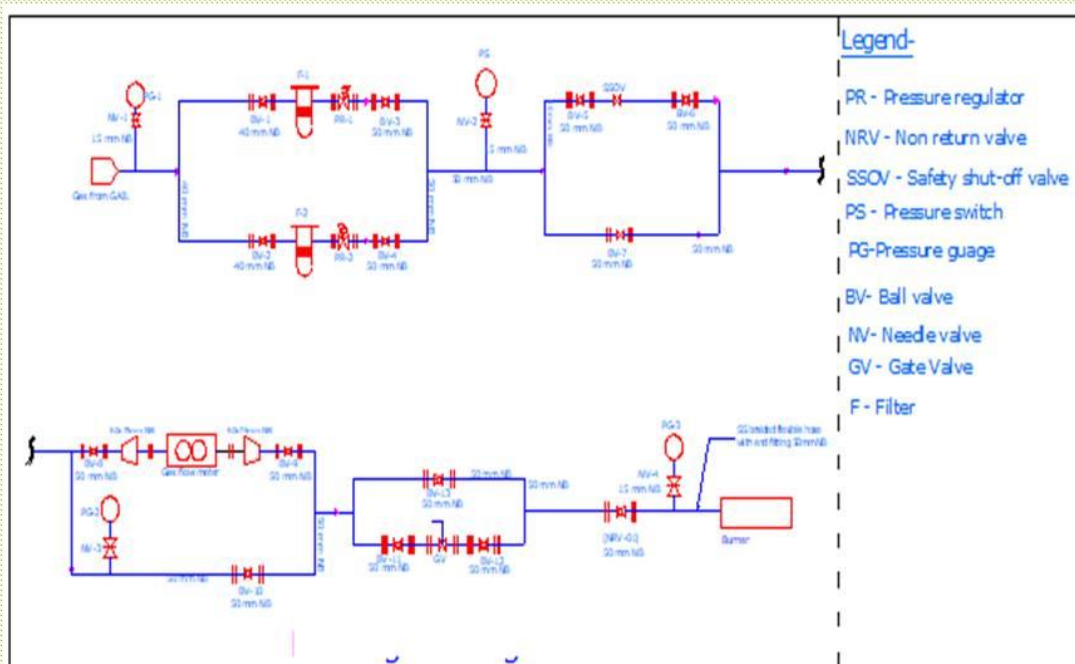
## Combustion of fuel

- **Perfect combustion** occurs when theoretical air is used in process (*actually not possible in reality-low efficiency*)
- **Complete combustion** occurs when minimal amount of air is used in process above theoretical limit (*to be the goal for highest efficiency*)
- **Incomplete combustion** occurs when **carbon monoxide and soot** produces due to unburnts

### Combustion products from fuel oxidation



## Gas train – schematic view

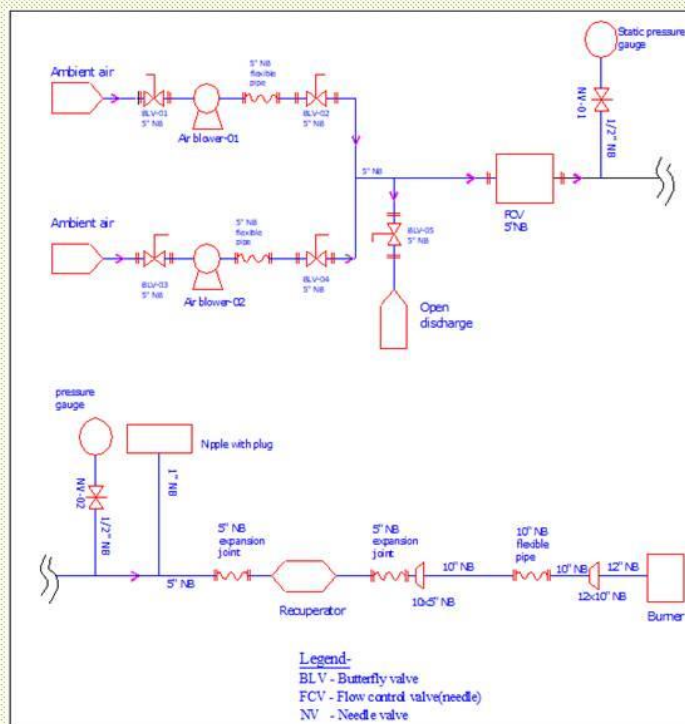




## Air train – schematic view

### Air train components:

- ☐ ID/ FD blowers
- ☐ Pressure gauge
- ☐ Air flow meter
- ☐ Control valves
- ☐ By-pass lines



teri

## Combustion controls

- ☐ **On-off control:** Firing either at full rating or switched off when not required
- ☐ **High-low-off control:** The burner can operate at full firing or low firing depending on load requirements
- ☐ **Modulating control:** This operates on the principle of matching furnace load by altering firing rate on the entire operating range. It controls combustion air supply as well as fuel supply to the burner.

### Fuel saving tips:

- **Follow 3-R principle - Reduce, Recover and Recycle to reduce fuel consumption.**
- **Every 22 °C reduction in flue gas temperature or preheating combustion air by 20 °C leads to 1% fuel saving**
- **Regular maintenance and cleaning of WHR system to be scheduled when the preheat temperature drops by 50 °C**

teri



## Instrumentation in firing kilns

Instrument	Purpose
Gas flow meter	Gas consumption rate of the kiln
Air flow meter	Air flow rate which will be used to ensure required air to gas ratio
On-line temperature indicator	Monitor and control temperature of kiln in different zones
Non-contact temperature indicator	Surface temperature of kiln structure to assess insulation status



## Potential options for energy conservation

- ☐ Use of low thermal mass kiln car and furniture
- ☐ Conversion of kiln from oil to gas fired system
- ☐ Complete combustion with minimum excess air
- ☐ Operating the kiln at desired temperature.
- ☐ Reducing heat losses from the openings
- ☐ Minimizing wall losses by improving kiln insulation.
- ☐ Recovery and reuse of waste heat from fuel gasses
- ☐ Control of Chimney draught and kiln pressure
- ☐ Adoption of automation in kiln operation
- ☐ Use of variable frequency drives
- ☐ Replacement of flat belt with cogged V-belt in drive system
- ☐ Rooftop solar system





## Low thermal mass car

Parameter	Existing	Option
KF Ratio	3:1	1:1
Material	Heavy Refractory	SiC and Cordierite
Tray	More width	less width
Pillar	Solid	Hollow and perforated
Push time	45 – 60 minutes	15 – 25 minutes
Productivity	100%	200-300%



## View of LTM car



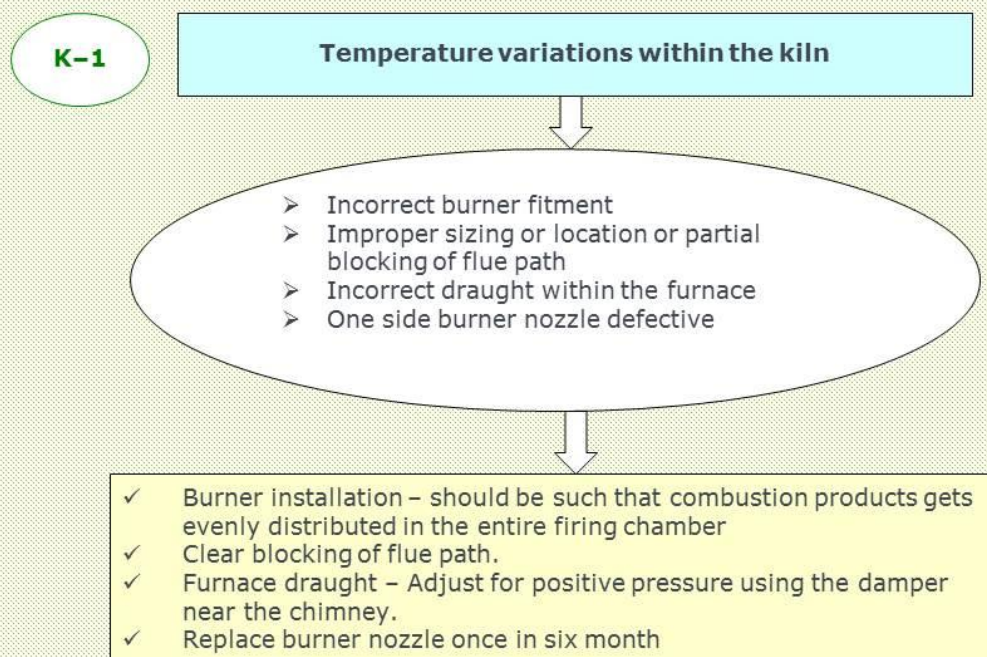


## BOPs for gas based kiln

Area	Target	Approach	Benefits
Kiln top and side walls	Reduction of average surface temperature	Routine measurement of surface temperature Improve insulation	Potential scope to reduce NG consumption Low workplace temperature
Kiln internal temperature	Maintain optimum temperature	Monitor kiln temperature at regular interval Gradually control gas and air flows	Achievement of optimum gas consumption
Excess air flow	Maintain optimum air-fuel ratio for complete combustion	Routine monitoring of oxygen level in flue gas	Reduction in flue gas losses
Kiln furniture	Kiln cars	Low thermal mass cars	Increased productivity



## Troubleshooting for gas based kiln





## Troubleshooting for gas based kiln

K-3

### Incorrect kiln temperature

- Faulty temperature indicator
- Improper furnace draught
- Incorrect air and gas flow

- Cross check temperature indicator. Use different indicator/ compensating cable. Repair/ replace the faulty meter.
- Ensure slightly positive furnace draught. You will observe furnace temperature start rising immediately.
- Slowly increase gas and air flows. Maintaining pre-set air to gas ratio. Re-adjust the furnace draught.



## Troubleshooting for gas based kiln

K-4

### Delay in firing schedule

- Extra-long flame emerging from car entry
- Improper filling of kiln car, blocking of burner nozzle
- Incorrect furnace temperature/ draught
- Change of chemicals in batch requiring higher temperatures

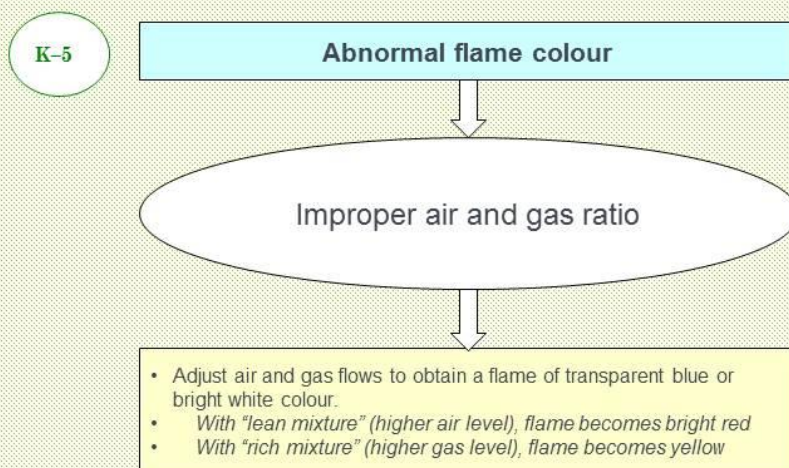


- Check with Problems 2 & 3 to adjust furnace temperature
- Adjust damper and ensure slightly positive draught as per Problem K-2.
- Check and follow routine car loading practices
- Replace nozzle once in six month



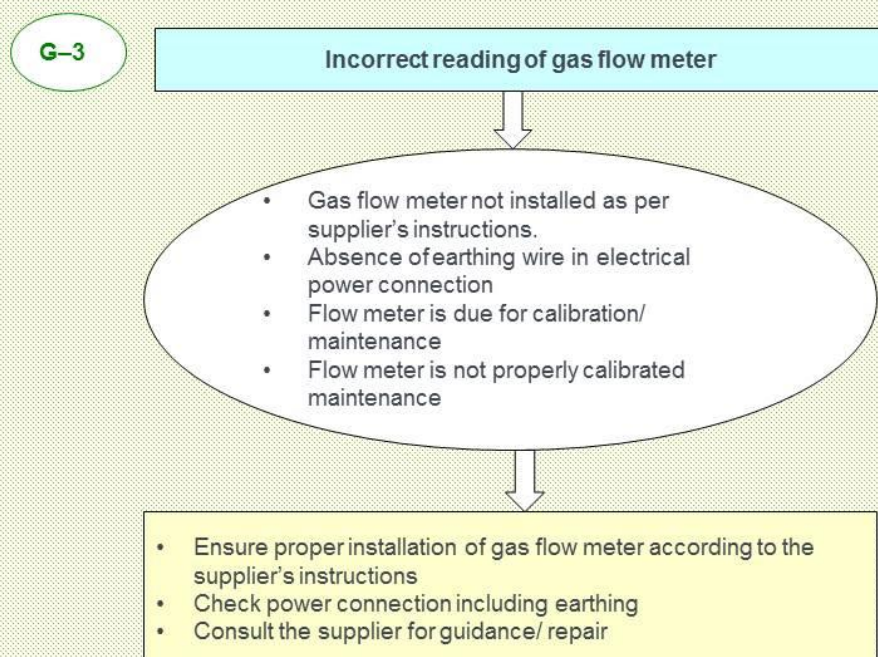


## Troubleshooting for gas based kiln



teri

## Troubleshooting for gas based kiln



teri



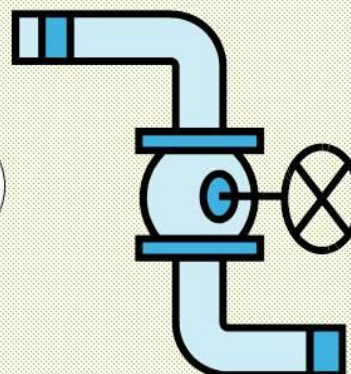
## Troubleshooting for gas based kiln

G-4

### High pressure drop in gas line

- Improper functioning of Pressure Reducing Valve (PRV)
- Higher resistance of gas piping due to burrs, choking and improper lining
- Leakage from joints/flange/welding points

- Check PRV with a calibrated pressure gauge for proper functioning. If required, reset or repair PRV
- Carry out leak test, check for choking or blockage in gas line



teri

## Troubleshooting for gas based kiln

A-1

### No air flow in spite of motor operating

Faulty power connection  
Faulty impeller/ coupling

- Check power connection
- Check the direction of rotation of impeller and change by correcting the polarity of connection
- Contact supplier in case impeller does not rotate or incorrect rotation



teri



## Troubleshooting for gas based kiln

A-2

High vibration of motor

Improper balancing of impeller  
Loose foundation and fittings



Contact supplier for rectification or replacement  
Repair foundation and fittings

teri

## Troubleshooting for gas based kiln

A-4

Incorrect reading of air flow meter

- Suppliers' instruction not followed during installation of air flow meter
- Improper power connection/ earthing
- Improper calibration of air flow meter
- Air flow meter is due for scheduled maintenance



- Ensure installation of air flow meter as per supplier's instructions
- Correct power connection/grounding
- Calibrate air flow meter
- Contact supplier for repair and maintenance

teri



Thank you





# Capacity Building of Local Service Providers (LSPs)

## Energy Conservation

Ashish Sakhare  
The Energy and Resources Institute (TERI)  
New Delhi

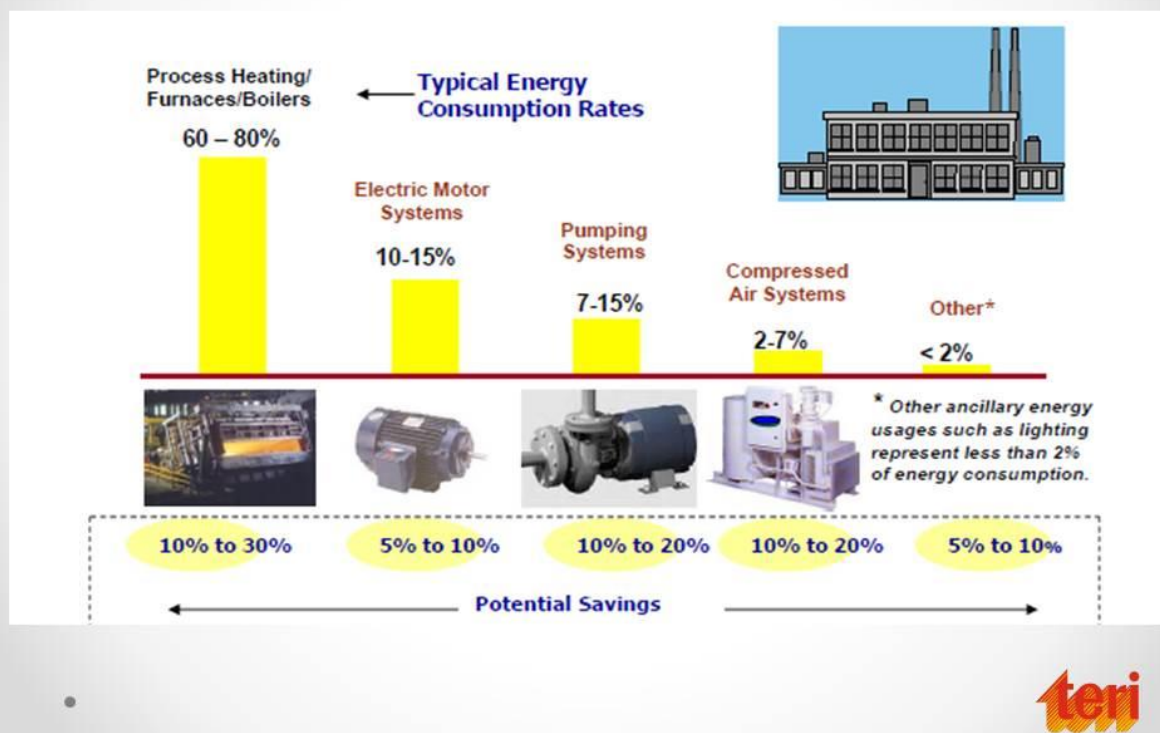
Supported by:

GEF-UNIDO-BEE Project  
Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India

08 March 2018



## Typical Energy consumption by different utilities in a plant





## Major systems/equipment

Process	Connect equipment / utilities	Input energy
Crushing	Crusher	Electrical
Grinding/milling	Ball mill and blungger	Electrical
Slurry preparation	Silos	Electrical
Filtration	Press filter	Thermal and Electrical
Pugging or mixing	Pan or pug mill	Electrical
Shaping	Press, Jigger	Electrical
Drying	Vertical / horizontal kiln car	Thermal and electrical
Glazing	Compressor	Electrical
Firing/sintering	Kiln	Thermal and electrical



## Electrical Motors



- Motors provide motive load for various applications
- Locally procured & Less efficient motors are commonly used
- Rewinding is also common; Efficiency reduces during every rewinding (2-3%)
- Energy efficient motors can reduce energy consumption by up to 15%



## Motor loading

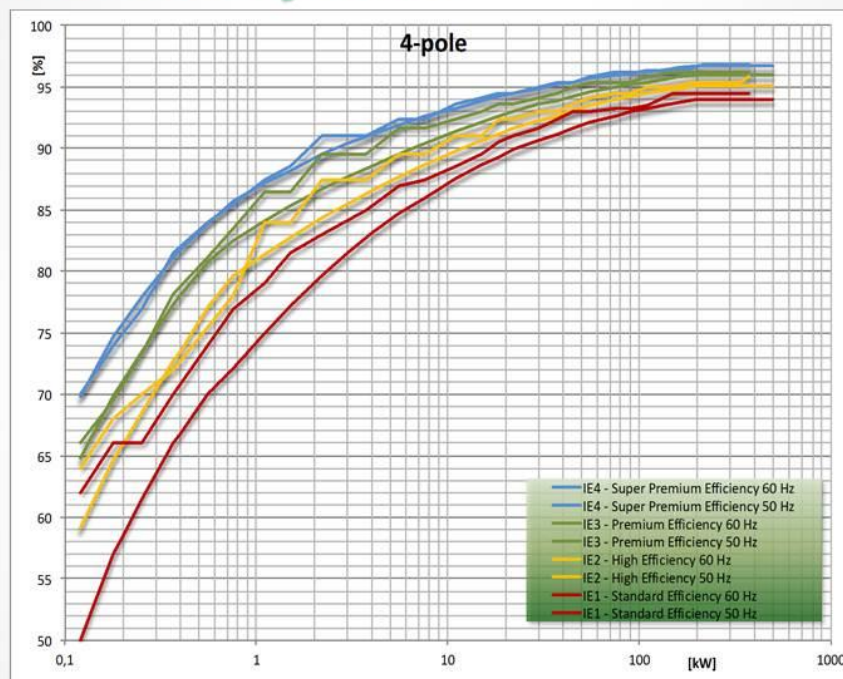
$$\text{Motor loading (\%)} = \frac{\text{Input to motor (kW)} \times \text{motor design efficiency} \times 100}{\text{Rated HP} \times 0.746}$$



## Common Motor for multiple Ball mills



## Motor Efficiency class



## Electric motors



### Power consumption (kW)

- Usually lower than rated power
- Near to or higher than rated if re-winded

### Loading (%)

- Once motor fails, it is replaced with same/higher HP motor
- Leads to under loading

### Maintenance of motor

- Keeping it dust free
- Periodic lubrication, gear-box alignment

### For example

- Existing motor: 15 HP
- Rated efficiency = 85%
- Operating efficiency = 75%
- Rated efficiency of IE3 motor: 91%
- Saving potential: 9,000 kWh/year
- Saving potential: Rs. 61,776/year
- Investment : Rs. 60,000/year
- Simple Payback: ~1 year





## Saving from EE motor

$$\text{Expected saving (Rs/Year)} = hp \times Lf \times 0.746 \times T \times R \times \left[ \frac{100}{E_{std}} - \frac{100}{E_{ee}} \right]$$

Where,

hp = Motor rated horse power

Lf = Load factor (percentage of full load/100)

T = Annual operating hours

R = Average energy rate (Rs/kWh)

E<sub>std</sub> = Efficiency of standard motor in percentage (%)

E<sub>ee</sub> = Efficiency of alternative energy-efficient motor in percentage (%)

0.746 = Conversion from horsepower to kW units



## Cogged V belt



## Energy Efficiency Opportunities

1. Use energy efficient motors
2. Reduce under-loading (and avoid over-sized motors)
3. Size to variable load
4. Improve power quality
5. Rewinding
6. Power factor correction by capacitors
7. Improve maintenance
8. Speed control of induction motor



## Lighting



## Day lighting



teri

## Energy efficient lighting-Indoor



T-12

T-8

T-5



teri



## Energy efficient lighting-Industrial



teri

## Energy Efficient Lighting System

### For Example:

- T12 FTL to T5 FTL / LED tube light
  - Saving potential: ~50%
  - Higher luminous efficacy
- MVL/HPSV to LED lamp
  - Saving potential: ~50%
  - Higher luminous efficacy

### For Example:

- Existing lighting fixtures
  - 15 T12 FTL of 40W
  - 12 MVL of 250W
- Proposed lighting fixtures
  - 15 LED tube lights of 18/20W
  - 12 LED of 80/100W
- Simple Payback: Less than 1 year

teri

# Thank You!

Ashish Sakhare  
Research Associate  
The Energy & Resources Institute (TERI)  
New Delhi.  
Email: [ashish.sakhare@teri.res.in](mailto:ashish.sakhare@teri.res.in)

•

