Capacity Building workshop

Advanced technologies for pottery industries

5th April 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

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Workshop summary

Overview of training programme

The 4th capacity building workshop of "Local Service Providers" (LSPs) on "Advanced technologies for pottery industries" was organized at Khurja by TERI on 5th April 2018 in association with the Central Glass and Ceramic Research Institute (CGCRI), Khurja under the GEF-UNIDO-BEE project. A total of 58 people participated in the training programme. A field visit to a ceramic unit in the cluster was organised as part of the training programme. The agenda of the training programme and the list of participants are enclosed as annexure 1 and annexure 2 respectively.

Summary of points discussed in the meeting

Mr K C Singh, Central Glass and Ceramic Research Institute (CGCRI) welcomed UNIDO-BEE team and the participants for the workshop. Mr Suresh Kennit, National Project Manager, UNIDO briefed about the UNIDO-BEE-GEF project being undertaken in which Khurja potteries is one of the identified clusters. Mr Kennit talked about the need for resource efficiency in industries. He requested the industries to avail benefits from the on-going energy efficiency initiatives in the cluster.

Mr N Vasudevan, TERI in his opening remarks summarised about the previous training programs completed in the cluster that include (1) Challenges and issues in fuel shift, (2) Energy conservation opportunities in Khurja potteries and (3) Construction of gas fired tunnel kilns. He emphasised that the industry should look forward to adoption of newer and advanced technologies to remain competitive. He reminded all participants that change is a recurring process. He added that over a period of time, the local ceramic units had shifted from inefficient and more polluting coal-fired downdraft (DD) kilns to tunnel kiln technology. However, studies pertaining to energy efficiency at the cluster level clearly indicate that there is a wide scope for enhancing energy efficiency. He further added that the "detailed project reports" (DPRs) would be prepared under the project on various energy efficient (EE) technologies pertaiing to Khurja cluster for technology upgradation.

Mr Ananda Mohan Ghosh, TERI made a background presentation on "Advanced Technologies" for potential adoption by the industries in Khurja. He presented that about 80% of energy used in pottery units is for thermal application in kiln and balance 20% of energy is used as electricity for raw material preparation and in other utilities. The options discussed include (1) Low thermal mass car and kiln furniture, (2) Alternate insulation material, (3) Gas fired roller hearth kiln, (4) High alumina ball mills, (5) Automatic roller jigger machine and (6) Kiln automation. On the utilities side, it included energy efficient motors, energy efficient fans and solar photovoltaic (SPV) for in-house power generation. He explained the cost benefit analysis for each of these technologies with case studies

Mr Someshwar Jha, Adani Gas Limited provided an overview of Natural Gas (NG) supply chain and production to end-use of NG. Mr Jha told a large number of pottery units have either adopted or applied for NG connection for their process applications. He briefed about various issues and challenges pertaining to adoption of NG in pottery units. He provided ball-parked figures on investment required for fuel shift such as gas meter, internal piping, burner and safety arrangements, which have an attractive payback period of less than one

year. He further told that the pottery units have been provided with the gas use plan of "No Minimum Guaranteed Off-take", which will be beneficial to the industries. While he briefed the participants that it is safe to use NG, he stressed on the importance of incorporating various safety aspects as well as kiln automation that would help in better operation of the kiln. Mr Jha felt that there is a need to enhance skills of the operators/ supervisors on NG handling, which can be facilitated by Adani Gas Limited.

Dr C S Prasad, CGCRI presented on the pilot Roller Hearth kiln demonstrated by CGCRI and its salient features. He pointed out that use of kiln car is eliminated in Roller Hearth kilns as rollers are used thereby resulting in better energy performance of the furnace. Dr Prasad also thanked all the participants and speakers for active participation in the training program.

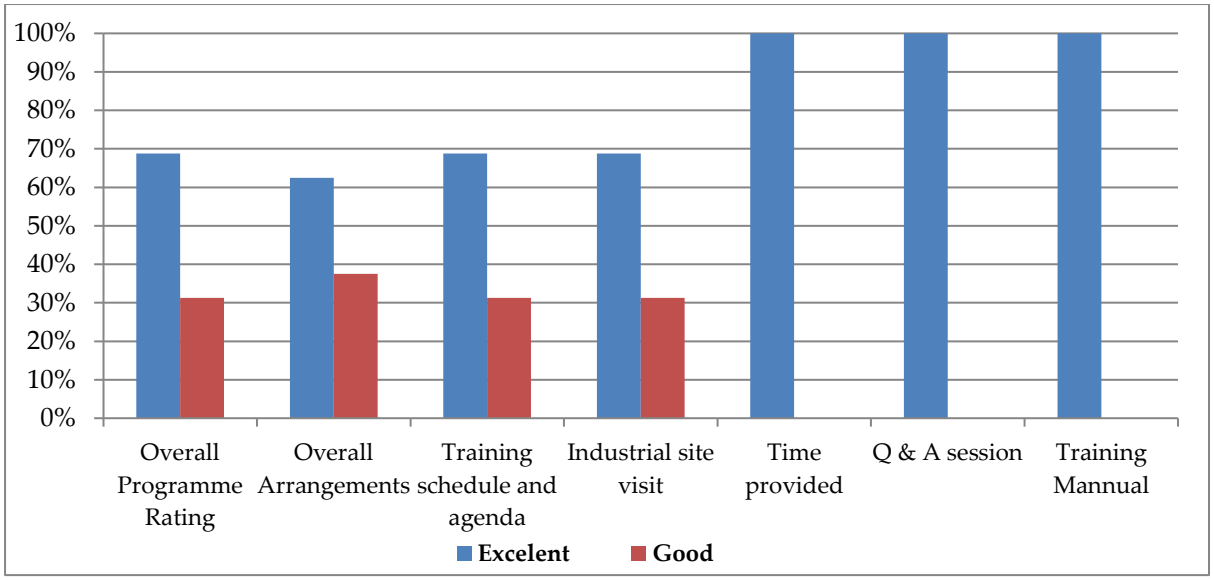
A field visit was organised by TERI to local industry which uses traditional oil fired tunnel for firing their products. The participants were shown the existing system and told the data monitoring gap due to lack of instrument in place. Mr Someshwar Jha of Adani gas explained the participants the potential changes would require while changing the existing system to gas based system. Selected photos of the workshop are provided with the annexure 3.

Feedback forms

The workshop was well received by the participants. The programme was more interactive with relevant queries on new gas connection and estimated financial liabilities. UNIDO representative also indicated interest to demonstrate a few select advance technologies from the potential list presented during the day. The participants felt that the coverage in the sessions were very useful and have suggested carrying forward the awareness programme to field level technology demonstration. Mr Jha added that Adani Gas is interested in organizing specific awareness programme on safety issues in handling natural gas within the plant premises. The participants were also satisfied with site visit. Scanned copies of a few sample feedback forms are attached in the annexure 4. In general, most of the participants felt that the coverage of the training programme was very relevant as Khurja cluster is going to switch over to gas based system from oil based system.

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 69% participants have rated overall program as "Excellent" while rest of them have rated it as "Good". More than 63% 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) Regular awareness programmes on safety issues
2) Need for demonstration on advanced technologies at cluster level

Learnings by participants

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

1) Auto jigger head machine and its benefits
2) Awareness on gas connections and financial liabilities

Annexures

Annexure 1: Agenda of the program

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05th April 2018

Conference Hall, CGCRI, Khurja ceramic Cluster

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Agenda

10:00 – 10:30	**Registration**
10:30 – 10:35	**Welcome Address** Dr K C Singh, Central Glass and Ceramic Research Institute
10:35 – 10:40	**Briefing about UNIDO – BEE – GEF project** Mr Suresh Kennit, National Project Manager, UNIDO
10:40 – 10:45	**Opening Remarks** Mr N Vasudevan, TERI, New Delhi
10:45 – 11:30	**Advance technologies for pottery industries** Mr Ananda Mohan Ghosh, TERI
11:30-12:15	**Fuel shift (oil to natural gas) in kiln: issues and contract assessment** Somesh Jha, Deputy Manager, Projects PNG, Adani Gas ltd, Khurja
12:15-13:00	**Gas fired roller hearth kiln technology** Dr. C S Prasad, Central Glass and Ceramic Research Institute
13.00 – 13:30	**Q&A**
13:30-14:30	**Lunch**
14:30 – 16:00	**Site Visit / On-site training** Visit to a pottery unit, Khurja
16.00 – 16:30	Feedback from participants
16:30 – 16:40	**Vote of thanks** Dr C S Prasad, Central Glass and Ceramic Research Institute

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Annexure 2: List of participants

S.No	Name	Organization	Mobile No	Email ID
1	R. Roy	H.C	9690011866	
2	Km-Divya	Saraswati Pottery, Khurja	9738173304	
3	Komal Singh	R. R. Industries, Khurja	7310716143	
4	Dharmendra Singh	Shiv Potteries, Khurja	9045927626	
5	Amar Nath Verma	Chandra Pottery Works, Khurja	9058608541	Amarpatel289@gmail.com
6	Atul Agarwal	Dharm Pottery	8449887199	
7	D P Karmakar	CGCRI, Khurja	9412227625	
8	A M Ghosh	TERI	9811836693	amghosh@teri.res.in
9	Akansha Sharma	Patna Ceramics, Khurja	8077265853	Akanshadoll2000@gmail.com
10	N Vasudevan	TERI	9871974187	nvasu@teri.res.in
11	Paras Nagaich	Minwas Pottery	9012174105	nagaich@gmail.com
12	Munesh Devi	Anupam Pottery, Khurja	9917930062	
13	Nirmal	CGCRI	9837845476	
14	Viresh Chandra	Technical advisor	9639010425	
15	Ravi Shankar Arya	Daya Ceramics, Khurja	9045373457	Raviarya161094@gmail.com
16	Mohit Sharma	C-5 Khurja	7457017615	Mohitsharma96904@gmail.com
17	Piyush Sharma	Consultant, TERI	9412162688	glasscoengg@rediffmail.com
18	Akhilesh Kumar	Pratap Ceramics, Khurja	8755118416	
19	Abuzar Zaheer	Atlas Ceramics, Khurja	9958419485	
20	Umar Malik	Roshni Ceramics, Khurja	9152179637	
21	Kishupal Singh	Durga Ceramics, Khurja	9759952596	
22	Rajesh Singh	Dream World Ind. Khurja	8859253323	
23	Vijaydeep	G.K. Ind. Khurja	7018185302	
24	Amarjeet	Jai Bharat Ind. Khurja	8006224034	
25	Bhikariand	Kamal Ceramics Khurja	9897129630	
26	C S Prasad	CGCRI, Khurja	9412227617	
27	Mukul Saxena	Contrive Ceramics	9536105448	
28	Harkesh Singh	Jai Laxmi Pottery, Khurja	9654176919	
29	Shalabh Singania	R K Potteries	9897178122	
30	Suresh Kenwit	UNIDO		
31	Viresh Kumar	Hitesh Ceramics, Khurja	8057575540	
32	Somesh Jha	AGL, Khurja	8954888450	
33	Rajeev Pandey	AGL, Khurja	8954888752	
34	Ravindra Kumar	Rahul Ceramics	9897162915	
35	Samshaed Ali	Golden Potteries	9870920323	
36	Vishwesh Tripathi	Maya Potteries, Khurja	8423842221	
37	Sourabh Kumar Yadav	Pratap Ceramics, Khurja	7078785221	
38	Ajay Kumar	C.P Ceramics & Decorators, Khurja	9044458198	
39	Zahir u ddin	Maya Industries	8358607495	

S.No	Name	Organization	Mobile No	Email ID
40	Samuel K	Brite Industries	9758891661	
41	Ameen Ul Islam	Brite Industries	9259593444	
42	Rajeev Kalra	Kalra Cera Products	9837093975	kalracere@yahoo.com
43	Rajendra Agarwal	Agarwal Trading Company	9897592236	Rajendraagrawal52@yahoo.com
44	Heeralal	Heera Electricals	9922289402	
45	Sheer Singh	Electrician	8937052189	
46	Ajeet Singh	UNIDO	8980371090	cl.khurjacluster@gmail.com
47	Vandana Sharma	Shiva Potteries, khurja	7078558874	
48	Shamsudhin	Rajeev Pottery	9927064215	
49	Raju Kumar	Rajeev Pottery	9830746797	
50	Girish Agarwal	Jagdish Udyog	9837134628	
51	Mohmd. Zakhir	Narang Pottery	9045965767	
52	Parvesh Ansari	Ahmed Saied	9368992697	
53	Raj Kumar	Raj Engineering Works	9719196175	
54	Ashok Kumar	Raj Engineering Works	9410673754	
55	Waseem Ahmed	Gulati Ceramics Industry	9520477754	Ahmedwaseem379@gamil.com
56	Manoj Kumar Maurya	Neelkanth Decorator	7983521679	Kgm8853@gamil.com
57	Phoolchand Verma	Hehata Industry	9690194814	Phoolchandverma178@gamil.com
58	P K Dubey	BMW Steel Ltd	9457561426	

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Capacity building workshop

Advanced technologies for pottery industries

05th April 20018, Conference Hall, CGCRI, Khurja ceramic cluster

S. No	Name	Organization	Mobile No	Email ID	Signature
1.	R. Roy	H.C	9690611866		
2.	Km- Divya	Saraswati Pottery, Khurja	9758173304		Km-Divya
3.	Komal Singh	R.R. Industries Khurja	7310716143		
4.	DHARMENDRA SINGH	Shiv Potteries Khurja	9045927626		
5.	Amar Nath Verma	Chandra Pottery Works Khurja	9058608541	amarpatel289@gmail.com	Amar
6.	Atul. Agarwal	[illegible]	8449887179	[illegible]	
7.	D. P. Kanungo	CGCRI Khurja	9412227625		

S. No	Name	Organization	Mobile No	Email ID	Signature
8.	AM Ghosh	TERI	9811836693	amghosh@teri.res.in	
9.	Akansha Sharma	Patna Ceramics Khurja	8077265853	akanksha[illegible]@gmail.com	
10	N. Vasudevan	TERI	9871974187	nvasu@teri.res.in	
11	PARAS NARAICH	MINHAS POTTERY	9012174105	Nyarchsingh@gmail.com	
12	सुनेश देवी	Anupam Pottery Khurja	9917930062		सुनेश देवी
13	Neeraj Rai	C.G.C.R.I.	9837845476		
14	Vinesh Chandra	Technical advisor	9639010425		
15	Ravi Shankar Arya	Daya Ceramics, Khurja	9045373452	raviaarya161094@gmail.com	
16	Mohit Sharma	C-5 Khurja.	7457017615	mohitsharma[illegible]@gmail..	
17	Sujoy Sharma	Consultant TERI	9412162688	[illegible]@rediffmail.com	

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19	Abuzar Zaheer	Atlas Ceramics Khurja	9958419485		
20	UMAR Malik	Roshni Ceramics Khurja	9152179637		
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22	Rajesh Singh	Dream world Ind. Khurja	8859253323		
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26	Dr. C.S. Prasad	C.G.C.R.I, Khurja	9412227617		
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32	S. JHA	AGL, Khurja	9954888752		
33	Rajeev Pandey	AGL, Khurja	8954888752		
34	रवीन्द्र कुमार	राजकीय सिरेमिक खुर्जा	9897162915		
35	Shamshad Alv	Golden Potteries	9870920523		
36	Vishwesh Tripathi	Maya Potteries Khurja	8923842221		
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39	Maya Industries	Maya Industries	9358607495		
40		Berite Industries	9358891CCI		
41	Qamar ul Islam	Berite Industries	9259893444		
42	RAJEEV KALRA	Kalra Ceramic Products	9837093975	Kalraceramic@yahoo.com	
43	Rajendra Agrawal	Agarwal Trading Co.	9897592236	rajendraagrawal57@yahoo.com	
44	Heera	Heera Ceramics.	9922[illegible]		Heera
45	Shiva Singh	Ceramics	89370521[illegible]		
46	Ajeet Singh	UNIDO	8958037109[illegible]	cc.khurjacluster@gmail.com.	Ajeet
47	Vaching Shaking	Shiva Potteries. Khurja.	7078558874		

S. No	Name	Organization	Mobile No	Email ID	Signature
48	[illegible]	[illegible]	9927064215		[illegible]
49	[illegible]	" "	9870746[illegible]		[illegible]
50	Gnish Agarwal	Jagdish udyog	9837134628		Gnish
51	Mohd zakir	[illegible]	9045965767		Mohd Zakir
52	परवेज अंसारी	[illegible]	9368992697		परवेज अंसारी
53	राजकुमार	[illegible]	9719196175		राजकुमार
54	अशोक कुमार	[illegible]	9410673754		अशोक कुमार
55	Waseem Ahmed	Gulati ceramic industry	9520477754	ahmedwaseem3790 gmail.com	Waseem Ahmed
56	Manoj Kumar maurya	Neelkanth decorator	7983521679	kgm8853@gmail.com	Manoj
57	Phoolchand Verma	Mutaka Industry.	9690199814	phoolchandverma078@gmail.com	PK
58	[illegible]	[illegible]	[illegible]		

Annexure 3: Selected photographs of the event




Annexure 4: Sample feedback forms

Capacity building workshop

Advanced technologies for pottery industries

Thursday, 05th April 2018

Conference Hall, CGCRI, Khurja ceramic Cluster

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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:			
1) Aware people about Safety precautions 2) Aware about the all) perfect moisture for firing & controlling			
Name two learning, which from this programme you will be able to implement in your plant?			
1) Safety precautions			
Signature:			
Name of participant: Rajeev Pandey			
Organization: AGL			
Mobile No: 8954888752			
Email ID: rajeev.ranjan.p.pandey@adani.com			

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Capacity building workshop

Advanced technologies for pottery industries

Thursday, 05th April 2018

Conference Hall, CGCRI, Khurja ceramic Cluster

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Feedback Form for Participants			
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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?			
① Water saving and ② Energy Saving.			
Yes, I am agree this statement.			
Signature: Manoj			
Name of participant: Manoj Kumar Mawyar.			
Organization: Nandkanthi decorator			
Mobile No: 7983521679			
Email ID: kgm8853@gmail.com.			

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Parameter	*Feedback*		
	Excellent	Good	Average
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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:

1) Safety & Automation in firing system.
2) Heat distribution in firing zone.
3) More efficient ceramic fiber for insulation.

Name two learning, which from this programme you will be able to implement in your plant?

Safety in firing system.
Use efficient Elect. Motors

Signature:	
Name of participant:	R. Roy
Organization:	Hindustan - Chemicals
Mobile No:	9690011866
Email ID:	chem hind @ gmail. come

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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:	Phoolchand
Name of participant:	~~Mehata Industry~~ Phoolchand Verma
Organization:	Mehata Industry.
Mobile No:	9690194814
Email ID:	phoolchandverma0178@gmail.com

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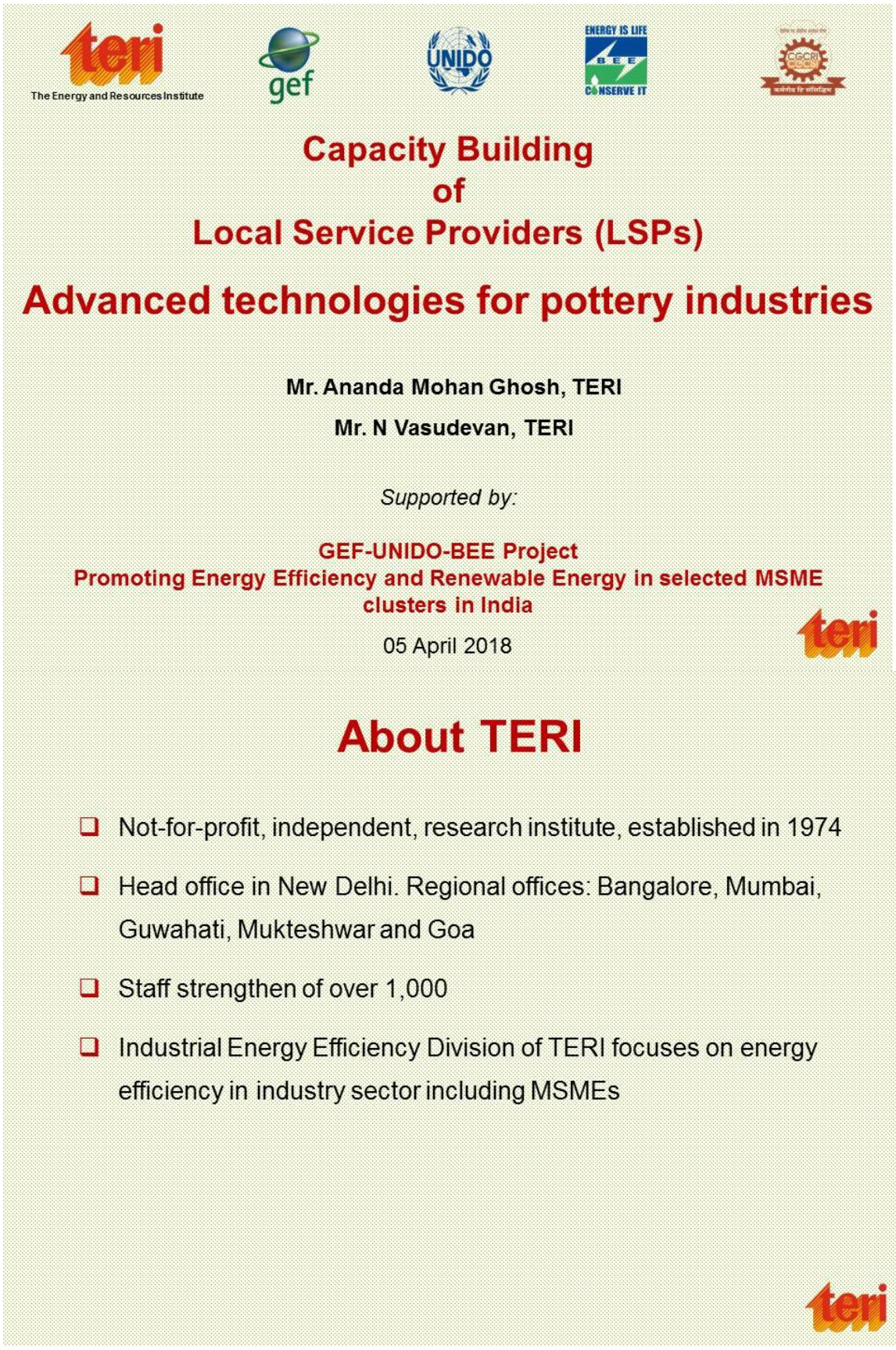
Annexure 5: Copy of presentations



About Khurja pottery cluster

- No of units: > 250
- Product material: stoneware and bone china
- Primary products:
  - Table wares, decorative wares, and porcelain insulators(both HT - high tension and LT - low tension), hospital ware, chemical porcelain, electro ceramics, kiln furniture, special ceramics, toys and non-china crockery products.

Technologies in use

Type	Mode of operation	Fuel used
Shuttle kiln	Batch	light diesel oil (LDO) and rubber processed oil (RPO)
Tunnel kiln	Continuous	Light diesel oil (LDO) and rubber processed oil (RPO)
Tunnel kiln	Continuous	Natural gas

Evolution:

- Shift towards batch to continuous process (tunnel kiln)
- Adoption of cleaner fuel (coal to gas)

Technologies and practices

- Outdated and inefficient technologies
- Use of liquid fuels such as Rubber Process Oil (RPO)
- Limited instrumentation to monitor process parameters
- Lack of automation of process operations
  - Absence of inter-linkage with
- Inefficient utilities e.g. ball mill, rewound standard motors
- High thermal mass cars and kiln furniture (dead weight ratio)
- Manual moulding process
- Less skilled and untrained workforce

Potential technology options

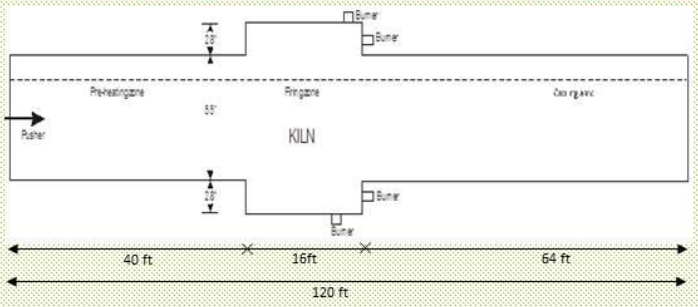
- Low thermal mass car and kiln furniture
- Alternate insulation material
- Auotmation and safety
- Roller hearth furnace
- High alumina ball mill
- Automatic roller jigger machine
- IE3 motor
- EE fans
- Solar photovoltaic (SPV system)

Low thermal mass kiln car and furniture

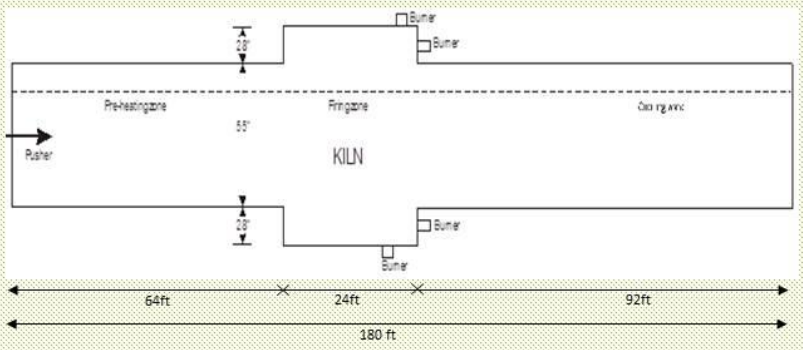
Parameter	Value
Material	Silicon carbide with hollow beam
Batt size	Reduced thickness and width
Car to product ratio	Reduced from 3:1 to 1: 1
Energy saving	20%
Push time of cars	Reduced from 45-50 min to about 20 min
Production	Can be enhance by more than 100%
Rejections	Reduced from 10-15% to about 5%
Yield	95% class-1 product
Furnace dimensions	Increased length to accommodate cooling (120 ft to 180 ft)
Recurring maintenance cost	Low

Low thermal mass kiln contd.

Low thermal mass kiln car…



Tunnel kiln length with conventional kiln car



Case study – Low thermal mass cars

Conventional kiln car vs low thermal mass kiln car

Parameter	Conventional kiln car	Low thermal mass kiln car
Kiln length (feet)	120	180
Kiln car : Product weight ratio	3:1	1:1
Push rate of car (minute)	50-60	20
Production (no. of pieces/day)	50,000	70,000
LDO consumption (lit/day)	500	500
Energy saving		20%
Investment (Rs lakh)	20	25

Limitation with existing insulation

- Low density ceramic blankets used
- Manual folding practices lead to higher gaps
- More joints used for higher thickness of insulation
- Sub-optimal performance
- Large variations in thickness of insulation
- Use of folded blankets in side walls as well as roof

Selection of alternate insulation

- Use of compatible insulation for different temperature zones
- Avoid manual folding at site
- Select and use monolithic pre-fabricated insulation (e.g. pyrobloc insulation)

Alternative insulation

Folded ceramic fibre blanket

Pyrobloc module

Benefits of pyrobloc insulation

- Available in higher density (more than 240 kg/m3)
- Low thermal conductivity
- Eliminates air gaps between layers
- Low shrinkage at higher temperatures
- Reduces formation of local hotspots
- Machine compression ensures effective compression from all sides
- Higher life
- Easy to cut, shape and install

Kiln automation and controls

Temperature control

- Existing: Manual control and less monitoring points
- Alternate
  - Install multiple sensors in different zones
  - Use temperature inputs to PLC system for auto correction
  - Ensure inter-linking and intra-locking for air and gas flow

Kiln automation and controls… contd

Ratio controller

- Existing: Manual control based on eye judgement and flame colour
  - Improper air-fuel ratio
  - High excess air/ high unburnts
  - High flue gas losses
- Alternate
  - PID controller with O2 analyser to alter NG and air flow based on O2 content set operating temperatures

Kiln automation and … contd.

Cooling zone trimmer

- Existing: Follow cause and effect principle based by manual operated isolation valves in air line
  - Production loss
- Alternate
  - PID control of cooling air flow by actuating motorized valve based by restricting allowable cooling rate

Safety in gas train

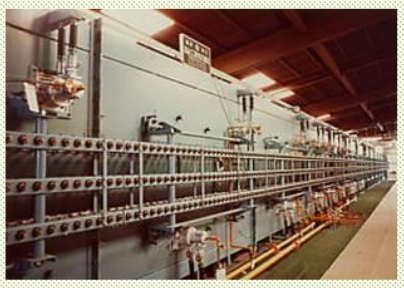
- Need for safety systems
  - Flame out (detected by UV sensor)
    - High or low NG pressure - PRV
    - High or low air pressure – Pressure transducer
    - Electrical failure – Safety shut-off valve
- Safety shut-off valve
  - Locks of NG supply as blower switches off avoiding NG accumulation inside furnace
- NRV
  - Avoids back travel of flame with air supply disturbance

Roller hearth kiln

Parameter	Tunnel kiln	Roller hearth kiln
Moving body	Both product and car	Only product
Moving direction	Along the length	Rotates on its axis
Firing cycle	18-20 hr	About 6 hr
Push time	45-50 min	20 min
Heat load	High	Low
In-built automation	Low	High
Energy consumption	High	Low

Roller hearth kiln

Roller hearth kiln



High alumina ball mill

Parameter	Conventional ball mill	High alumina ball mill
Material used for outer shell	Mild steel	Mild steel
Lining material	Refractory	Alumina
Effective lining thickness	5 inch	2.5 inch
Mortar	Silica sand and white sand	alumina
Grinding media	Mined pebbles	High alumina ball
Energy saving	-	20%
Productivity	Low	High
Replacement of stone/yr	150%	40%
First cost	Low	High
Lining life	6 year	12 year
Payback period		~ 2 year

High alumina ball mill

View of ball mill

Pebbles in conventional ball mill

High alumina balls

Case study – Ball mill (7 ft X 8 ft)

Benefits of high alumina ball mill and refractory lining

The existing pebble-refractory lining based ball mill can be replaced with a high alumina ball and refractory lining based ball mills, which would result in significant monetary savings.
Basis:

Ball mill processing a raw material of 3 tonne per batch connected with a 15 hp (11.2 kW) motor, considering 18 hour operation per day for 300 days.

Electricity consumption with conventional system = 48, 384 kWh/yr
Electricity consumption with high alumina system = 38, 707 kWh/yr
Energy saving = 9,677 kWh/yr
Energy cost saving = Rs 64,835 per year
Monetary saving with better grinding medium = Rs 58,500 per year
Monetary saving with improved lining = Rs 5,583 per year
Total monetary saving = Rs 1,28,918 per year
Incremental investment for high alumina ball mill = Rs 2,58,000
Simple payback period = 2 years

Automatic roller jigger machine

Parameter	Conventional	Automatic roller
Connected load	1 hp	3 hp
Production rate	3000 piece/8 hr	3500 piece/8 hr
Yield	95%	100%

Energy efficient motors

- Use IE-3 motors in place of Standard (IE-2) motors
- Efficiency higher by about 5-6%
- Avoid use of rewound motors, if more than done 3 times as efficiency drops by about 2% per rewinding

Energy efficient motors

kW	2-Pole			4-Pole			6-Pole		
	Frame size	Efficiency%		Frame size	Efficiency %		Frame size	Efficiency %	
		IE2	IE3		IE2	IE3		IE3	IE3
0.37	71	72.2	75.5	71	70.1	73	80	69	71.9
0.55	71	74.8	78.1	80	75.1	78	80	72.9	75.9
0.75	80	77.4	80.7	80	79.6	82.5	90S	75.9	78.9
1.1	80	79.6	82.7	90S	81.4	84.1	90L	78.1	81
1.5	90S	81.3	84.2	90L	82.8	85.3	100L	79.8	82.5
2.2	90L	83.2	85.9	100L	84.3	86.7	112M	81.8	84.3
3.7	100L	85.5	887.8	112M	86.3	88.4	132S	84.3	86.5
5.5	132S	87	89.2	132S	87.7	89.6	132M	86	88
7.5	132S	88.1	90.1	132M	88.7	90.4	160M	87.2	89.1
11	160M	89.4	91.2	160M	89.8	91.4	160L	88.7	90.3
15	160M	90.3	91.9	160L	90.6	92.1	180L	89.7	91.2
18.5	160L	90.9	92.4	180M	91.2	92.6	200L	90.4	91.7
22	180M	91.3	92.7	180L	91.6	93	200L	90.9	92.2
30	200L	92	93.3	200L	92.3	93.6	225M	91.7	92.9

Energy efficient motors – Case study

Savings with energy efficient motors in ball mill

Parameter	Unit	Standard	IE3 motor
Rated capacity	(kW)	15	15
Efficiency of motor	(%)	90.6%	92.1%
Loading of motor	(%)	70.0%	70.0%
Operating duration	(hr)	6000	6000
Energy consumption	(kWh/yr)	69,536	68,404
Energy saving	(kWh/yr)	1,133 (1.6%)	
Price of electricity	(Rs/kWh)	8.00	8.00
Energy cost saving	(Rs/yr)		9060
Investment for EE motor	(Rs)		20570
Payback period	(year)		2.3

Energy efficient fans

- Lighter in weight
- No slip due to synchronous type
- Smart remote control with sleep and timer mode
- No humming noise and heating
- Longer life as they can sustain hot and dusty environment
- About 60% energy saving

Energy efficient fans

Monetary benefits with energy efficient ceiling fans

Parameter	Conventional fan	Energy efficient fan
Power rating (watt)	80	28
Energy consumption (kWh/yr)	168	480
Energy saving (kWh/yr)		312
Energy costs (Rs/yr)	1344	3840
Monetary saving (Rs/yr)		2496
Investment (Rs)	1700	3500
Incremental investment (Rs)		1800
Payback period (month)		9

300 days @ 20 hours per day

Solar photovoltaic system

- Types : off-grid and on-grid system
- Investment – 45,000-50,000 per kW

On-grid system	Off-grid system
No battery backup required	Requires batter backup
Low overall investments	Expensive
Net metering is available so that the excess electricity generated can be exported to grid	No net metering
Preferred system where grid is available	Suitable for non-access to grid
Low replacement costs as no recurring costs for battery replacement on a periodical basis	High maintenance costs

Thank you

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Resources Logistics Energy

Issues and challenges

- Lack of awareness and willingness among customers
- High rate of Taxation(26% VAT on the Natural Gas in UP)
- Exorbitantly high RO charges of Municipal board
- Delay in permissions from various bodies such as Municipal board, forest dept., irrigation dept etc.
- Automation in Combustion Technology
- Shortage of skilled manpower

Khurja CGD, AGL

1

City Gate Station at Shivali

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Khurja CGD, AGL 1

Laying of MS Pipeline

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Investors Presentation
15 April 2012 2

Laying of MDPE Pipeline

Metering & Regulating Skid (MRS) for Industrial Unit

Continued...

Firing in Gas Fired Roller Hearth Kiln

Dr. C.S. Prasad
CGCRI, Khurja Centre

Objective

- Fuel cost is increasing day by day therefore CGCRI felt a need to develop 3-4hrs fast firing (Cool to cool) Stoneware Body
  - Firing fuel should be clean therefore LPG was chosen.
  - GFRHK was available with CGCRI
  - UNIDO came forward to help Khurja cluster as their national programme on Energy for Ceramic Industries is in progress

Stoneware Body?

- It contains generally
  - » Feldspar
  - » Quartz
  - » China clays
  - » Ball Clays
- These raw materials when fired cool to cool for 3-4 hrs generally have very high rejections depending on
  - » Ware thickness
  - » Firing fuel
  - » Composition

Action Plan

- Selection of raw materials
- Control on thermal expansion through raw material
- Matching glaze
- Suitability in firing for GFRHK

Raw Materials (Wt %)

- Ahmedabad China Clay (Supra) 33
- Bikaner Ball Clay 17
- Quartz Powder (-300 mesh) 23
- Potash Feldspar Powder (-250 mesh) 27
- Talc Powder(-300 mesh) 04

Green Properties of Fast Fired body

- Residue on 300 # sieve, % 0.24
- Water of Plasticity, % 26.2
- Dry Linear Shrinkage, % 4.42
- Dry M.O.R. (Kg/cm2) 17

Products of Traditional Body Fired for Comparative Study

S. No.	Name of Unit
1	M/s Dadoo Pottery
2	M/s Chhatwal Ceramic
3	M/s New Adarsh Pottery

Fired Properties of Fast Fired Body

Properties	Results			
	1180°C	1200°C	1220°C	1240°C
Fired Linear Shrinkage, %	7.18	8.81	9.41	8.93
Fired M.O.R. (Kg/cm2)	380	468	695	638
Water Absorption, %	4.42	0.34	0	0.34
Bulk Density, g/cc	2.16	2.32	3.34	2.29

Chemical Composition of Traditional Stoneware and F.F. Bodies

Constituents	Constituents (% by wt.)			
	Body of Unit –A	Body of Unit –B	Body of Unit - C	F.F.B
Al2O3	20.11	20.16	20.56	20.32
SiO2	68.40	69.48	69.21	65.53
Fe2O3	1.03	1.00	0.92	1.10
TiO2	0.45	0.41	0.36	0.43
CaO	0.52	0.29	0.52	0.79
MgO	0.25	0.30	0.28	1.41
K2O	2.11	2.33	2.36	2.40
Na2O	0.98	1.10	1.08	1.10
LOI	6.15	4.91	4.69	6.90
Total	100	99.98	99.98	99.98

Water Absorption of Traditional Stoneware and F.F. Bodies made Products Fired in Roller Hearth Kiln

Time (in Minutes)	Water Absorption (%)			
	Body of Unit –A	Body of Unit –B	Body of Unit - C	F. F. Body
270	3.75	3.24	0.95	0.10
240	3.70	3.16	0.95	0.16
210	5.24	4.68	1.62	0.86
180	5.66	4.80	2.36	1.42

Bulk Density of Stoneware and F.F. Bodies made Products Fired in Roller Hearth Kiln

Time (in Minutes)	Bulk Density (g/cc)			
	Body of Unit –A	Body of Unit –B	Body of Unit - C	F. F. Body
270	2.27	2.29	2.33	2.37
240	2.27	2.28	2.33	2.37
210	2.25	2.27	2.31	2.36
180	2.24	2.26	2.29	2.35

Fired Rejection of Stoneware and F.F. Bodies made Products Fired in Roller Hearth Kiln

Time (in Minutes)	Fired Rejection (%)			
	Body of Unit –A	Body of Unit –B	Body of Unit - C	F.F.Body
270	16.6	18.8	9.8	5.8
240	18.5	19.5	10.6	6.4
210	20.3	21.3	10.8	7.2
180	22.8	22.3	13.4	6.9

Reason of Rejection of Stonewareand F.F. Bodies made Products Fired in Roller Hearth Kiln in 180 mins. (cool to cool)

S. No.	Reason of Rejection	Unit A	Unit B	Unit C	F.F.Body
1	Cracks after firing (dunting)	8.66	8.47	5.09	2.62
2	Pin holes	5.92	5.79	3.48	1.79
3	Crawling	3.64	3.56	2.14	1.10
4	Warpage	2.05	2.00	1.20	0.62
5	Green Cracks in preheating	1.59	1.56	0.93	0.48
6	Others on handling	0.91	0.89	0.53	0.27
	Total	22.77	22.27	13.37	6.88

Details of Firing of Stoneware Products in Gas Fired Roller Hearth Kiln

Firing No.	Firing Time Cool to Cool in minutes	Wt. of Green Products	Wt. of Fired Products	Gas Consumed in kg/kg products	Cost of LPG (Ind.) @ Rs. 53/Kg
1	270	1008	891	0.520	57.56
2	240	1025	906	0.490	25.97
3	210	1752	1537	0.320	16.96
4	180	1600	1400	0.321	17.01
5	180	1800	1580	0.284	15.05

Fuel Consumption in Existing Tunnel Kiln

Firing No.	Name of Unit	Fuel Consumption, HSD (Litr. / 24 hrs.)	Wt. of fired product (Kg./24hrs)	Fuel Consumption, (Litr./Kg. Product)	Cost of Fuel/kg @Rs.65/-
1	M/s Dadoo Pottery	600	2,801	0.214	13.91
2	M/s Chhatwal Ceramic	768	6,194	0.124	8.08
3	M/s New Adarsh Pottery	580	3,719	0.156	10.14

Conclusion

- Developed Body has water absorption 0.10 to 1.42 %.
- Developed body has rejection of 5.8 to 6.9 %
- The developed body has shown the vitrification below 2% at 1200oC with 180 minutes firing cycle (cool to cool).
- Addition of Talc showed lowest water absorption i.e. 3%
- Gas consumption was observed 0.52 Kg. for firing of 1 Kg. wares with firing time 270 minutes (cool to cool) where as gas consumption was observed 0.284 Kg. per kg. of ware with the firing time 180 minutes (cool to cool).
- Fuel consumption was observed higher side in comparison to firing in existing tunnel kiln.

Energy Saving & Environmental Protection

- Energy efficiency increase by recovering waste air and waste gas flow
- Less consumption means lower energy costs as well as less CO2 emissions
- Reduction of pollutant emissions by firing technology
- Optimised measuring control technology
- Special burner system to achieve the best customized firing solution.

ThanQ