

Detailed Project Report On Kiln automation system

Anchor Sanitarywares Pvt Ltd
Thangadh (Gujarat)

Prepared for

Bureau of Energy Efficiency
(13/GEF-UNIDO-BEE/LSP/14/4562)



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GEF-UNIDO-BEE Project, Bureau of Energy Efficiency, 2018

“Capacity Building of Local Service Providers”

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Acknowledgement

The Energy and Resources Institute (TERI) places on record its sincere thanks to Global Environment Facility (GEF), United Nations Industrial Development Organization (UNIDO) and Bureau of Energy Efficiency (BEE) for giving opportunity to partner in this prestigious assignment on Capacity Building of Local Service Providers (LSPs) under the GEF-UNIDO-BEE project 'Promoting energy efficiency and renewable energy in selected MSME clusters in India'.

TERI is particularly grateful to Mr Milind Deore, Director, Bureau of Energy Efficiency, Mr Sanjay Shrestha, Industrial Development Officer, Industrial Energy Efficiency Unit, Energy and Climate Branch, UNIDO, Mr Suresh Kennit, National Project Coordinator, UNIDO, Mr Niranjana Rao Devela, National Technology Coordinator, UNIDO, Mr P. Vora, Cluster Leader, Thangadh Foundry Cluster, UNIDO, Mr Suresh P Sompura, M/s Anchor Sanitary wares Pvt Ltd and Panchal Ceramic Association Vikas Trust for their support and guidance during the project.

Last but not least, the interactions and deliberations with numerous foundry units, industry associations, technology providers and who were directly or indirectly involved throughout the study were exemplary and the whole exercise was thoroughly a rewarding experience for TERI.

The Energy and Resources Institute (TERI)
New Delhi

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List of abbreviations

BEE	:	Bureau of Energy Efficiency
CO ₂	:	Carbon Dioxide
D/E	:	Debt /Equity
DPR	:	Detailed Project Report
DSCR	:	Debt Service Coverage Ratio
EE	:	Energy Efficient
GEF	:	Global Environmental Facility
GHG	:	Green House Gas
HSD	:	High Speed Diesel
IDC	:	Investment without interest defer credit
IGBT	:	Insulated-gate Bipolar Transistor
IGDPR	:	Investment Grade Detailed Project Report
IRR	:	Internal Rate of Return
kW	:	Kilo Watt
kWh	:	Kilo Watt Hour
LSPs	:	Local Service Providers
MSME	:	Micro, Small and Medium Enterprises
MT	:	Metric Tonne
NG	:	Natural Gas
NPV	:	Net Present Value
O&M	:	Operation and Maintenance
PCB	:	Pollution control board
RE	:	Renewable Energy
ROI	:	Return On Investment
SCM	:	Standard Cubic Meter
SME	:	Small and Medium Enterprises
SPP	:	Simple Payback Period
TERI	:	The Energy and Resources Institute
Toe	:	Tonnes of oil equivalent
UNIDO	:	United Nations Industrial Development Organization
WACC	:	Weighted Average Cost of Capital

Executive summary

The overall aim of the GEF-UNIDO-BEE project 'Promoting Energy Efficiency (EE) and Renewable Energy (RE) in selected MSME clusters in India' is to develop and promote a market environment for introducing energy efficiency and enhancing the use of renewable energy technologies in process applications in selected energy-intensive MSME clusters in India. This would help in improving the productivity and competitiveness of the MSME units, as well as in reducing the overall carbon emissions and improving the local environment.

Under the GEF-UNIDO-BEE Project, TERI has been entrusted to undertake Capacity building of Local Service Providers (LSPs) to BEE. The Scope of Work under the project,

- Organizing 4 one-day training/ capacity building workshops for LSPs in each cluster.
- Development of 10 bankable DPRs for each cluster, based on mapping technology needs with capacities of local technology suppliers/service providers, and also replication potential and applications to banks in each cluster.

Brief introduction of the MSME unit

Name of the unit	M/s Anchor Sanitary wares Pvt Ltd
Constitution	Private Limited
MSME Classification	Medium
No. of years in operation	1978
Address: Registered Office:	Tarnetar Road, Thangadh Gujarat - 363530
Industry-sector	Ceramic
Products manufactured	Sanitary ware
Name(s) of the promoters/ directors	Mr Suresh P Sompura Mr. Dushyant S Sompura
Existing banking arrangements along with the details of facilities availed	State Bank of India

Brief highlights of the past financial position of the MSME unit

		(Rs lakh)
S. No	Particulars	FY 2018 (Audited)
1	Total income	13.57
2	Net profit	149.0

A detailed assessment study was undertaken in the identified area with the use of the sophisticated handheld instruments. Energy consumption pattern and production data were collected to estimate the specific energy consumption of the unit. The unit level baseline of the unit was also estimated using the historical data. The plant is consuming about 1,195,257 kWh of electricity per year. The annual consumption of the CNG is 719,952 SCM and HSD is 2,400 litre. The total energy consumption of the unit during last 12 months is estimated to be

727 toe which is equivalent to 272 lakh rupees. The total CO₂ emission during this period is estimated to be 2,246 tonnes. Electricity, HSD and NG were considered for CO₂ emission estimation.

Accepted/ recommended technology implementation

The recommended technology considered after discussion with the plant personnel for implementation in the unit is given below.

S. No	Energy conservation measure	Annual energy saving NG (SCM)	Investment ¹ (Rs. Lakh)	Monetary savings (Rs. Lakh per year)	Simple payback period (Yrs)	Emission reduction (tonnes of CO ₂)
1	Kiln surface insulation and kiln cart automation	42,033	7.0	11.5	0.6	74.0

Other benefits

- The proposed project is not expected to bring in any change in process step or operating practices therefore no change expected in the product quality.
- Implementation of the selected technology in the unit may result in reduction in CO₂ emissions.

Cost of project & means of finance

S. No.	Particulars	Unit	100% equity	D/E- 70:30	D/E- 50:50
1	Cost of Project	Rs. In Lakh	7.0	7.0	7.0
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	129.3	125.0	126.2
4	NPV	Rs. In Lakh	23.6	22.3	22.6
5	DSCR	-	-	2.1	0.9

¹ Investment including (i) insulation material and handling charges Rs 3.1 lakh (ii) Kiln car automation Rs. 2.5 lakh and (iii) taxes and miscellaneous – Rs. 1.4 lakh

1.0 Details of the unit

1.1 Particulars of unit

Table 1.1: Particulars of the unit

1	Name of the unit	M/s Anchore Sanitarywares Pvt Ltd	
2	Constitution	Private Limited	
3	MSME Registration No/UAN	24-008-12-0226	
4	PCB consent No.	PCB ID: 81821	
5	Date of incorporation / commencement of business	1978	
6	Name of the Contact Person	Mr Rana Pradyumansinh	
7	Mobile / Ph. No	+91-9909973360	
8	Email	Choice_traders@yahoo.com	
9	Address: Registered Office	Tarnetar Road, Thangadh Gujarat - 363530	Owned
10	Factory	Tarnetar Road, Thangadh Gujarat - 363530	Owned
11	Industry / Sector	MSME/Ceramic	
12	Products Manufactured	Sanitaryware	
13	No of hours of operation/ shift	12	
14	No of shifts/ day	02	
15	No of days/year	350	
16	Installed Capacity	540 MT per month	
17	Whether the unit is exporting its products (Yes/ No)	Yes	
18	Quality Certification, if any	ISO 9001:2000	

2.0 Energy profile

2.1 Process flow diagram

Manufacturing of ceramic item uses wide range of raw material combination to produce different shape, size and colour. It requires both electrical and thermal energy at different stages of the process to operate the ball mill, casting/moulding, kilns, cutting & finishing machines and utilities such as motors, pumps air compressor etc. Ceramic manufacturing process primarily consists of mould preparation, body material preparation, shaping, drying and firing. Typical process flow chart is shown with figure 2.1.

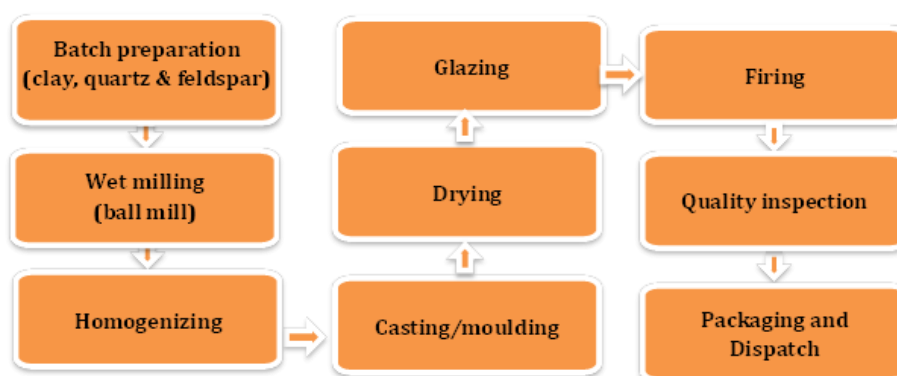


Figure 2.1: Process flow chart

2.2 Details of technology identified

The details of the kiln in the unit are given in Table 2.2.

Table 2.2: Details of kiln

Parameters/ Equipment ID	Value
Equipment	Tunnel kiln
Fuel type	PNG
Make	Local fabrication
Purpose/Application	Firing
Rated capacity, tpd	15
Dimensions	PHZ - 24.5 meter Firing Zone - 8.6 meter Cooling Zone - 29.95 meter
Nos of kiln cart	45
Mode of operation (batch/continuous)	Continuous

2.3 Energy used and brief description of their usage pattern

The unit uses grid power supplied by Paschim Gujarat Vij Company Ltd. under the tariff category HTP-I Table 2.3 provides the details of energy uses.

Table 2.3: Energy used and description of use

S No	Energy source	Description of use
1	Electricity	Motive power for different drives in different process sections and utilities
3	NG	Kiln

2.4 Energy sources, availability & tariff details

Different energy sources, availability of listed energy types and their respective tariffs are given in table 2.4.

Table 2.4: Energy sources, availability and tariffs

Particular	HTP-I
Electricity: Supplied by PGVCL Connection category: HTP - 1	<p>Demand charges:</p> <ul style="list-style-type: none"> For first 500 kVA of billing demand: Rs. 150/- per kVA per month For next 500 kVA of billing demand: Rs. 260/- per kVA per month <p>Energy charges: 420 paise per unit</p> <p>Penalty:</p> <ul style="list-style-type: none"> 1% of energy charges for every point drop in PF between 0.85 to 0.90 2% of energy charges for every point drop in PF below 0.85 <p>Rebate 0.5% of energy charges for every point increase in PF over 0.95</p> <p>TOU Pricing: For energy consumption during the two peak periods, viz., 0700 Hrs to 1100 Hrs and 1800 Hrs to 2200 Hrs</p> <ul style="list-style-type: none"> For Billing Demand up to 500kVA: 35 Paise per unit For Billing Demand above 500kVA: 75 Paise per unit.
Natural gas : Supplied by Gujarat Gas Limited	<ul style="list-style-type: none"> Rs. 27.3 per SCM

2.5 Analysis of electricity consumption

Table 2.5: Electricity consumption profile

Month & Year	Total electricity consumption (kWh)	Sanctioned load/demand (kVA)	Power factor	Recorded demand (kVA)	Demand charges (Rs)	Energy charges (Rs)	Monthly bill (Rs)
Jan-18	1,04,635	400	0.99	316	51,000	4,18,540	6,46,376
Feb-18	1,04,513	400	0.99	300	51,000	4,18,052	6,38,054
Mar-18	87,208	400	0.99	299	51,000	3,48,832	5,43,406
Apr-18	1,02,063	400	0.99	309	51,000	4,08,252	6,27,170
Average	99,605	400	0.99	306	51,000	3,98,419	6,13,752
Total	11,95,257	-	-	-	6,12,000	47,81,028	73,65,018

Figure 2.5 presents contract demand, recorded maximum demand and the energy consumption of the unit.

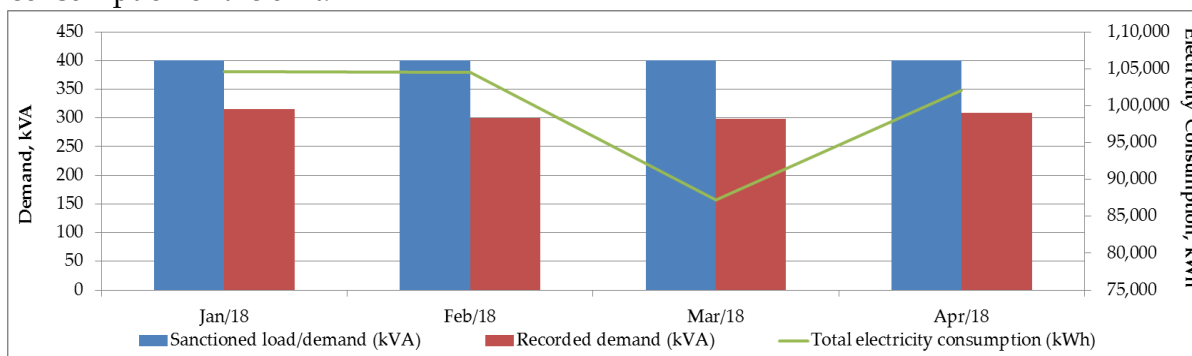


Figure 2.5: Demand pattern and energy consumption profile

2.6 Analysis of other energy forms/ fuels

The analysis of the other fuels/forms of energy used in the unit is given in table 2.6.

Table 2.6: Analysis of other energy/ fuel consumption

Parameters	NG (SCM)	HSD (Litre)
Consumption unit/year	7,19,952	2,400
Calorific value per unit	8,650	9,202
Equivalent toe per year	622.8	2.2
Price (Rs per unit)	27.3	60.5
Total price per year	1,96,76,288	1,45,200

The share of various energy forms used in the unit is given in figure 2.6.

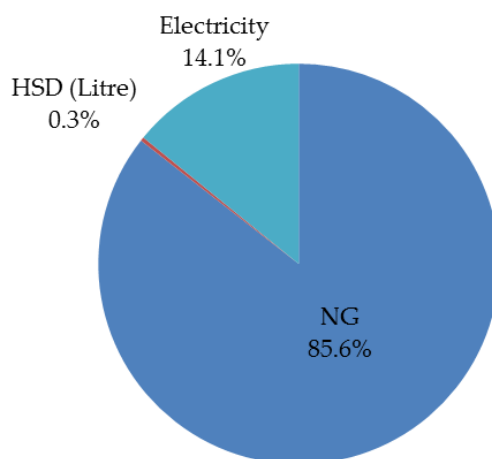


Figure 2.6: Percentage share of various fuel types in the unit

The plant is consuming about 1,195,257 kWh of electricity per year. The annual consumption of the CNG is 719,952 SCM and HSD is 2,400 litre. The total energy consumption of the unit during last 12 months is estimated to be 727 toe which is equivalent to 272 lakh rupees. The total CO₂ emission during this period is estimated to be 2,246 tonnes. Electricity, HSD and NG were considered for CO₂ emission estimation.

3.0 Proposed technology for energy efficiency

Based on the measurements, observations/ findings during detailed assessment study conducted in the unit, the following technology has been identified for energy efficiency improvement. The detail is given below.

3.1 Kiln surface insulation and kiln cart automation

3.1.1 Background

The unit is manufactures of sanitary ware which includes pedestal wash basin, water closet, etc. To dry the glazed product in the sanitary ware units, the tunnel kiln is most commonly used in which the heat for the drying is mainly supplied by the combustion of natural gas and hot air recovered from the preheating zone of the kiln. The details of the kiln in the unit are given in table 3.1.1.

Table 3.1.1: Details of kiln

Parameters/ Equipment ID	Value
Equipment	Tunnel kiln
Fuel type	PNG
Make	Local fabrication
Purpose/ Application	Firing
Rated capacity, tpd	15
Dimensions	PHZ - 24.5 meter Firing Zone - 8.6 meter Cooling Zone - 29.95 meter
No.s of kiln cart	45
Mode of operation (batch/continuous)	Continuous

The operational parameters of the kiln including the temperature profiling in various zones, flue gas analysis, surface imaging and fuel and electricity consumption were measured during the detailed assessment study and analysis of the past one year data.

3.1.2 Observations and analysis

The tunnel kiln consists of three zones; pre-heating, firing and cooling zone as shown in Figure 3.1.2a. The firing zone is sub-divided into three zones; oxidizing, reducing and neutral flame zones. The temperature, pressure and atmosphere in each zone should be kept constant.

The combustion gas and air always flow from the kiln exit to the entrance such that the adjustment of one firebox affects not only the firing zone but also the pre-heating zone. Particularly at reducing firing, the adjustment requires the most care and experience considering various factors; the border of oxidizing and reducing zones and that

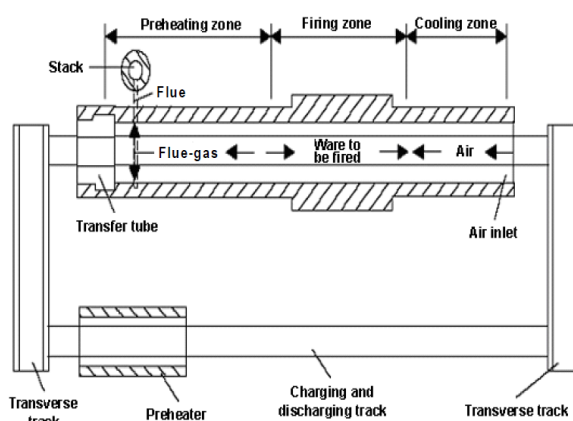
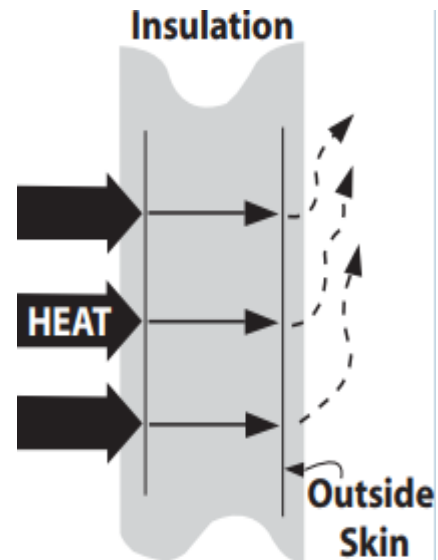


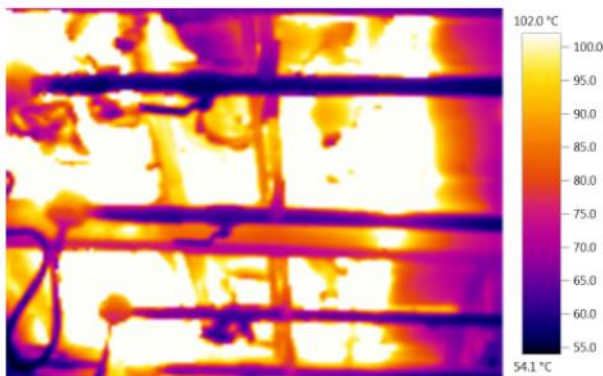
Figure 3.1.2a: Schematic view of tunnel kiln

of reducing and neutral zones, the effect of cooling air to firing zone, the relation between the temperature and atmosphere in reducing zones, etc.

The firing zone is placed in the middle of the kiln. There are a large number of burners on both sides of the firing zones. The burners are set symmetrically. The combustion gas, which is produced by the burner, heats the ware on the kiln car and is drawn to the pre-heating zone. In this preheating zone, the green ware is heated up gradually by the combustion gas coming from the firing zone and the organic substances in the clay are burnt out and the moisture is vaporized. In the pre-heating zone, the heat capacity of the car-top is large, so that the difference of temperature between the upper and lower portions of the kiln is rather high. The cars are pushed through the kiln at set interval which is mainly performed by kiln operator.



To assess surface heat loss of the kiln, an insulation survey (using thermal imager) was conducted. Kiln surface temperature was measured to be 123-177°C. The highest temperature was observed on the front and back panel (firing zone) which is about 150°C. The total heat loss due to surface is estimated to be 59,665 kcal per hour. The hot spots observed in the furnaces are shown in thermal images in figure 3.1.2b.



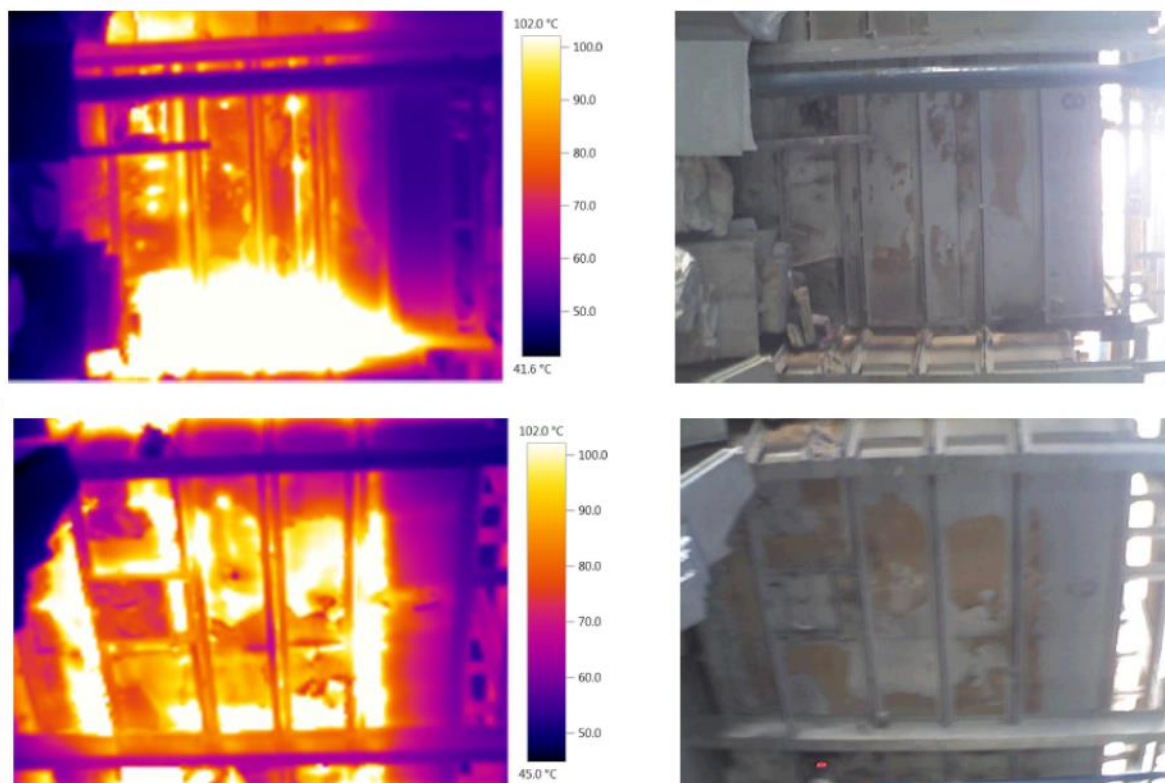


Figure 3.1.2b: Thermal imaging of kiln

In continuous kilns, the manufacturer sets the temperatures throughout the kiln depending on the ceramic material. When a trolley enters the kiln, it passes through a preheating zone where it heats up to 600 °C. After that, in the firing zone, it heats up to its maximum temperature, which is about 1200 °C. To cool down the ceramic substance, it passes through three cooling zones which help to cool down the ceramic to room temperature. In the existing operational practices of the kiln, units face the following issues:

- Each kiln car needs to be inserted into the kiln manually, and human negligence during the night may lead to an overstay of the kiln car in a particular temperature zone.
- Each ceramic substance needs to undergo a heat-treatment process for a particular temperature and time; deviation in any of these two parameters causes a degradation of product quality.

3.1.3 Recommendation

The improvement in the radiation heat loss from furnace surfaces can be achieved by reinforcing its insulation. This includes (i) covering of the internal wall surface with ceramic fiber insulation, and (ii) covering of the external wall surface with ceramic fiber or rock wool insulation.

The automation system installed in the kiln helps to increase the quality of the product by monitoring the time taken for each trolley to enter and exit from the kiln and the temperature ranges it was passed through when it was in the kiln. So if any of the ceramic substance placed on the trolley was not heated up for the expected time and/or temperature, it can be rejected as a cause of low quality. This system indicates the variation in temperature by graph.

And it alerts the operator if temperature of particular heater crosses the alarm limits. The basic features are

- Temperature monitoring
- Temperature graph plotting
- Trolley position monitoring
- Alarm limits for variation in temperature
- Temperature and trolley graph tables

3.2 Cost benefit analysis

The estimated annual energy savings by improvement in kiln surface insulation and kiln cart automation is estimated be 42,033 SCM equivalents to a monetary saving of Rs 11.5 lakh. The investment requirement is Rs 7.0 lakh with a simple payback period of 0.6 year. The detailed calculations of the recommended energy conservation measures for DPR are provided in table 3.2.

Table 3.2: Cost benefit analysis for recommended energy savings measures

Parameters	Unit	Existing	Proposed
Kiln capacity	tonne	15	15
Average fuel consumption	SCM/Hr	71.1	66.1
Average surface temperature	°C	134	90
Heat loss from surface	kCal/Hr	47,300	22,476
Reduction in heat loss from surface	kCal/Hr	-	24,824
Average reduction in fuel consumption	SCM/Hr	-	2.9
Tunnel cart mobilization system	-	Manual	Manual
Cart level time/temperature monitoring	-	No	Yes
Average reduction in fuel by time/temperature optimization system	SCM/Hr	0	2.1
Reduction in fuel consumption	SCM/Hr	-	5.00
Annual operating hours	Hours/Year	-	8400
Annual reduction in fuel consumption	SCM/Yr	-	42,033
Annual monetary benefits	Rs lakh./Yr	-	11.5
Investment toward proper insulation	Rs lakh	-	3.1
Investment toward automation of kiln cart system	Rs lakh	-	2.5
Applicable taxes and other misc.	Rs lakh	-	1.4
Total investment ²	Rs lakh	-	7.0
Simple payback period	Years	-	0.6

3.3 Pre-training requirements

Not envisaged

3.4 Process down time for implementation

Not envisaged

² Quotation - 1 and 2 has been considered for estimation of investments

3.5 Environmental benefits

3.5.1 CO₂ reduction³

Implementation of the selected energy conservation measures in the unit may result in reduction in CO₂ emissions due to reduction in overall energy consumption. The estimated reduction in GHG emission by implementation of the recommended energy conservation measures is 74 tonne of CO₂ per year.

3.5.2 Reduction in other pollution parameters (gas, liquid and solid)

There is not significant impact on the reduction in other pollution parameters including gas, liquid and solid.

³ Source for emission factor: 2006 IPCC Guidelines for National Greenhouse Gas Inventories & electricity: CO₂ Baseline Database for the Indian Power Sector, user guide version 12.0, May 2017 (CEA)

4.0 Project financials

4.1 Cost of project and means of finance

4.1.1 Particulars of machinery proposed for the project

The particulars of machinery proposed for the project is given in table 4.1.1.

Table 4.1.1: Particulars of machinery proposed for the project

Quotation no.	Name of machinery (Model/ specification)	Name of manufacturer, contact person	Advantage
1	Ceramic modules	Altoni Union J-384, MIDC, Near Quality Circle, Bhosari, Pune – 411026 Maharashtra, India.	Reliable service
2	Trolley Tracking and Temperature Monitoring System for Tunnel Kiln.	VBTECH Automation 54, Akshar Industrial Park, Nr. Hathijan Circle, Vatva GIDC, Vinzol, Ahmedabad- 382445, Gujarat T: +91 98250 49845, E: info@vbtechautomation.com, W: www.vbtecautomation.com	Local Supplier and experience in this sector

4.1.2 Means of finance

The means of finance for the project is shown in table 4.1.2.

Table 4.1.2: Means of finance

S. No.	Details	100% equity	D/E- 70:30	D/E- 50:50
1	Additional (Share) Capital	7.0	2.1	3.5
2	Internal Accruals	-	-	-
3	Interest free unsecured loans	-	-	-
4	Term loan proposed (Banks/FIs)	-	4.9	3.5
5	Others	-	-	-
	Total	7.0	7.0	7.0

4.2 Financial statement (project)

4.2.1 Assumptions

The assumptions made are provided in table 4.2.1.

Table 4.2.1: Assumptions made

Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
General about unit				
No of working days	Days		300	
No of shifts per day	Shifts		2	
Annual operating hours	Hrs/year		7,200	
Installed production capacity	tonnes/year		5,400	
Production in last financial years	tonnes/year		-	

Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
Capacity utilization factor	%		-	
Proposed investment (Project)				
Total cost of the project	Rs. (in Lakh)	7.0	7.0	7.0
Investment without interest defer credit (IDC)	Rs. (in Lakh)	7.0	7.0	7.0
Implementation time	Months	3.0	3.0	3.0
Interest during the implementation phase	Rs. in lakhs	-	0.03	0.02
Total investment	Rs. in lakhs	7.0	7.0	7.0
Financing pattern				
Own funds	Rs. in lakhs	7.0	2.1	3.5
Loan funds (term loan)	Rs. in lakhs	-	4.9	3.5
Loan tenure	Years	-	5.0	5.0
Moratorium period (No EMI (interest and principal amount))	Months	-	3.0	3.0
Total repayment period	Months	-	60.0	60.0
Interest rate	%	-	10.5	10.5
Estimation of costs				
Operation & maintenance costs	%		5.0	
Annual escalation rate of O&M	%		5.0	
Estimation of revenue				
Reduction in energy cost	Rs. (in lakh)/year		11.5	
Total saving	(Rs Lakh/year)		11.5	
Straight line depreciation	%		16.21	
IT depreciation	%		80.0	
Income tax	%		33.99	
Period of cash flow analysis	Years		5.0	

4.2.2 Payback

The simple payback period on the investments made are shown in table 4.2.2.

Table 4.2.2: Payback

Details	100% equity	D/E- 70:30	D/E- 50:50
Total project cost (Rs. In lakh)	7.0	7.0	7.0
Cash flow as annual saving (Rs. In lakh/year)	11.5	11.5	11.5
O&M Expenses for first year (Rs. In lakh/year)	0.3	0.3	0.3
Net Cash flow (Rs. In lakh/year)	11.1	11.1	11.1
SPP (months)	7.5	7.5	7.5
Considered (month)	7.5	7.5	7.5

4.2.3 NPV and IRR

The NPV and IRR calculations are shown in table 4.2.3.

Table 4.2.3a: NPV and IRR (100% equity)

Particulars/ years	0	1	2	3	4	5
	(Rs. in lakhs)					
Profit after tax	-	10.01	4.70	6.28	6.20	6.18
Depreciation	-	1.13	1.13	1.13	1.13	1.13
Cash outflow	6.96	-	-	-	-	-
Net cash flow	-6.96	11.14	5.83	7.41	7.33	7.31
Discount rate % @ WACC	9.30	9.30	9.30	9.30	9.30	9.30
Discount factor	1.00	0.92	0.84	0.77	0.70	0.64
Present value	-6.96	10.20	4.88	5.68	5.15	4.69
Net present value	23.64					
Simple IRR considering regular cash flow	129.34%					

Table 4.2.3b: NPV and IRR (D/E- 70:30)

Particulars/ years	0	1	2	3	4	5
	(Rs. in lakhs)					
Profit after tax	-	9.76	4.50	6.05	6.04	6.09
Depreciation	-	1.13	1.13	1.13	1.13	1.13
Cash outflow	6.99	-	-	-	-	-
Net cash flow	-6.99	10.89	5.63	7.18	7.17	7.22
Discount rate % @ WACC	10.10	10.10	10.10	10.10	10.10	10.10
Discount factor	1.00	0.91	0.83	0.75	0.68	0.62
Present value	-6.99	9.89	4.65	5.38	4.88	4.46
Net present value	22.26					
Simple IRR considering regular cash flow	125.00%					

Table 4.2.3c: NPV and IRR (D/E- 50:50)

Particulars/ years	0	1	2	3	4	5
	(Rs. in lakhs)					
Profit after tax	-	9.83	4.56	6.11	6.09	6.11
Depreciation	-	1.13	1.13	1.13	1.13	1.13
Cash outflow	6.98	-	-	-	-	-
Net cash flow	-6.98	10.96	5.69	7.24	7.22	7.25
Discount rate % @ WACC	9.90	9.90	9.90	9.90	9.90	9.90
Discount factor	1.00	0.91	0.83	0.75	0.69	0.63
Present value	-6.98	9.98	4.71	5.46	4.95	4.52
Net present value	22.65					
Simple IRR considering regular cash flow	126.24%					

4.3 Marketing & selling arrangement

The marketing and selling arrangements of the unit are given in table 4.3.

Table 4.3: Marketing & selling arrangements

Items	Remarks
Main Markets (locations)	Pan India and international
Locational advantages	-
Indicate competitors	Other manufacturing units
Any USP or specific market strength	-
Whether product has multiple applications	NA
Distribution channels (e.g. direct sales, retail network, distribution network)	Direct sales
Marketing team details, if any.	NA

4.4 Risk analysis and mitigation

The risk analysis and mitigation for the proposed options are given in table 4.4.

Table 4.4: Risk analysis and mitigation

Type of risk	Description	Mitigation
Technology	The equipment/technology provided by the supplier may not be of high quality, which may result in underperformance.	The equipment/technology should be procured from standard/reputed vendors only.
Market /Product	Demand of the product manufactured by the unit may change resulting in lower capacity utilization.	Regular vigilance/tab on the market scenario by the SME will help in better understanding of new substitute product. The unit may modify the product line based on the emerging market trend.
Policy/Regulatory	Changes in government regulation/policy related to pollution and taxes & duties can affect the viability of the unit.	Local industrial association may play a role in discussing these issues with the relevant governmental bodies on a regular basis, so that any concerns of the unit are brought to their notice.

4.5 Sensitivity analysis

A sensitivity analysis for various scenarios which may affect the return on investment is given in table 4.5.

Table 4.5: Sensitivity analysis

S. No.	Scenario	D/E ratio	Payback period (months)	NPV (Rs lakh)	IRR (%)	DSCR	ROI (%)
1	10% increase in estimated savings	100% equity	2.2	11.6	489.1	-	44.2
		70:30	2.2	11.2	483.1	2.1	47.0
		50:50	2.2	11.3	484.9	0.9	46.2
2	10% reduction in estimated savings	100% equity	2.7	9.3	392.7	-	43.3
		70:30	2.7	9.0	387.1	2.1	46.6
		50:50	2.7	9.1	388.7	0.9	45.6
3	10% rise in interest rates	70:30	2.4	9.9	434.4	2.1	46.8
		50:50	2.4	10.1	436.3	0.9	45.9
4	10% reduction in interest rates	70:30	2.4	10.3	435.6	2.1	46.8
		50:50	2.4	10.4	437.1	0.9	45.9

5.0 Conclusions & recommendations

The IGDP prepared for the improvement in kiln surface insulation and kiln cart automation based on the performance assessment study conducted at unit and the acceptance of the unit management. The brief of selected energy conservation measure is given below.

5.1 List of energy conservation measures

The brief summary of the energy conservation measures are given in table 5.1.

Table 5.1: Summary of the energy conservation measures

S. No	Energy conservation measure	Annual energy saving NG (SCM)	Investment (Rs. Lakh)	Monetary savings (Rs. Lakh per year)	Simple payback period (Yrs)	Emission reduction (tonnes of CO ₂)
1	Kiln surface insulation and kiln cart automation	42,033	7.0	11.5	0.6	74

The measure has an estimated investment of 7.0 lakh rupees and can yield a savings of 11.5 lakh rupees per year. The total annual reduction in emission by implementation of recommended measure is estimated to be 74 tonnes of CO₂. The financial indicators provided above in the table shows the project is financially viable and technically feasible.

5.2 Summary of the project

The summary of the project is given in table 5.2.

Table 5.2: Summary of the project

S. No.	Particulars	Unit	100% equity	D/E- 70:30	D/E- 50:50
1	Cost of Project	Rs. In Lakh	7.0	7.0	7.0
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	129.3	125.0	126.2
4	NPV	Rs. In Lakh	23.6	22.3	22.6
5	DSCR	-	-	2.1	0.9

5.3 Recommendations

The financial indicators provided above show the project is financially viable and technically feasible. It is recommended that the implementation of the identified the energy conservation measures may be undertaken by the unit.

6.0 Financing schemes for EE investments for MSME sector

Government of India has many schemes to provide concessional finance for EE technologies among MSMEs. Some major government schemes are summarised in table 6.1.

Table 6.1: Major government schemes

Name of the scheme	Brief Description and key benefits
ZED assessment and certification	<p>Assessment process, fee and subsidy are as follows: Online (e-Platform) self-assessment: Nil fee Desk Top assessment : Rs 10,000 per SME Complete assessment : Rs 80,000 ZED rating per SME; Rs 40,000 for additional ZED defence rating; Rs 40,000 for re-rating The rating costs will include cost of Rs 10,000/- as certification cost by QCI. Subsidy for Micro, Small and Medium Enterprises are 80%, 60% and 50% respectively.</p>
Credit Linked Capital Subsidy Scheme (CLCSS) (2000-ongoing)	<p>15% capital subsidy of cost of eligible plant and machinery / equipment for adoption of proven technologies for approved products / sub-sectors for MSE units subject to ceiling of INR 15 lakhs</p>
Credit Guarantee Fund Scheme for Micro and small Enterprises (in partnership with SIDBI) (2000-ongoing)	<p>This scheme was launched by MoMSME and SIDBI to alleviate the problem of collateral security and enable micro and small scale units to easily adopt new technologies. Under the scheme, collateral free loans up to Rs 1 crore can be provided to micro and small scale units. Additionally, in the event of a failure of the SME unit which availed collateral free credit facilities to discharge its liabilities to the lender, the Guarantee Trust would guarantee the loss incurred by the lender up to 75 / 80/ 85 per cent of the credit facility.</p>
Technology and Quality Up gradation Support to MSMEs (TEQUP) (2010-ongoing)	<p>The benefits available to SMEs under TEQUP include – technical assistance for energy audits, preparation of DPRs and significant capital subsidy on technologies yielding an energy savings of over 15%. The scheme offers a subsidy of 25% of the project cost, subject to a maximum of Rs. 10 lakhs. TEQUP, a scheme under NMCP, focuses on the two important issues in enhancing competitiveness of the SME sector, through EE and Product Quality Certification.</p>
Technology Upgradation Fund Scheme (TUFS) (1999-ongoing)	<p>Interest subsidy and /or capital subsidy for Textile and Jute Industry only.</p> <ol style="list-style-type: none"> To facilitate Technology Up gradation of Small Scale (SSE) units in the textile and jute industries. Key features being: <ul style="list-style-type: none"> Promoter’s margin -15%; Subsidy - 15% available on investment in TUF compatible machinery subject to ceiling of Rs 45 lakh; Loan amount - 70% of the cost of the machinery by way of Term Loan

Name of the scheme	Brief Description and key benefits
	<ul style="list-style-type: none"> • Interest rate: Reimbursement of 5% on the interest charged by the lending agency on a project of technology upgradation in conformity with the Scheme • Cover under Credit Guarantee Fund Scheme for Micro and Small Enterprises (CGMSE) available <p>2. To enable technology upgradation in micro and small power looms to improve their productivity, quality of products and/ or environmental conditions</p> <ul style="list-style-type: none"> • 20% margin subsidy on investment in TUF compatible specified machinery subject to a ceiling of Rs 60 lakhs or Rs 1crore (whichever is applicable) on subsidy amount to each unit - released directly to the machinery manufacturer.
Tax incentives	<ul style="list-style-type: none"> • Accelerated depreciation is provided to the customers / users of the energy saving or renewable energy devises under the direct tax laws. • Under indirect taxes, specific concessional rates of duty are only available to CFLs and not to all energy efficient products • A further waiver of import tariffs and taxes for EE technology imports are dealt on a case to case basis, meaning higher costs for those imported technologies that are not available in the domestic markets at present.

Two financing schemes have been created by Bureau of Energy Efficiency (BEE) under The National Mission for Enhanced Energy Efficiency (NMEEE) for financing of energy efficiency projects - Venture Capital for Energy Efficiency (VCFEE) and Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE). These funds seek to provide appropriate fiscal instruments to supplement the efforts of the government for creation of energy efficiency market. Highlights of these two schemes are provided in the table 6.2.

Table 6.2: BEE’s VCFEE and PRGFEE scheme

Venture Capital for Energy Efficiency (VCFEE)	<ul style="list-style-type: none"> • This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase. • A single investment by the fund shall not exceed Rs 2 crore • Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicle (SPV) or Rs 2 crore, whichever is less
Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE)	<ul style="list-style-type: none"> • A PRGF is a risk sharing mechanism lowering the risk to the lender by substituting part of the risk of the borrower by granting guarantees ensuring repayment of part of the loan upon a default event. • Guarantees a maximum 50% of the loan (only principal). In case of default, the fund will: <ul style="list-style-type: none"> ○ Cover the first loss subject to maximum of 10% of the total guaranteed amount ○ Cover the remaining default (outstanding principal) amount on

Venture Capital for Energy Efficiency (VCFEE)	<ul style="list-style-type: none"> This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase. A single investment by the fund shall not exceed Rs 2 crore Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicle (SPV) or Rs 2 crore, whichever is less
	<p>partial basis upto the maximum guaranteed amount</p> <ul style="list-style-type: none"> PFI shall take guarantee from the PRGFEE before disbursement of loan to the borrower. The Guarantee will not exceed Rs 300 lakh per project or 50% of loan amount, whichever is less. Maximum tenure of the guarantee will be 5 years from the date of issue of the guarantee

Indian Renewable Energy Development Agency (IREDA), a non-banking financial institution established by the government also extends financial assistance for setting up projects relating to new and renewable sources of energy and energy efficiency/conservation. The detailed financing guidelines for energy efficiency projects are provided in table 6.3.

Table 6.3: IREDA's financing guidelines

Eligible companies who can apply	Private Sector Companies/ firms, Central Public Sector Undertaking (CPSU), State Utilities/ Discoms/ Transcos/ Gencos/ Corporations, Joint Sector Companies which are not loss making.
Minimum loan amount	<ul style="list-style-type: none"> Rs. 50 lakh
Type of projects considered for term loans	<ul style="list-style-type: none"> Replacement / retrofit of selected equipment with energy efficient equipment Modification of entire manufacturing processing Recovery of waste heat for power generation
Incentive available	<ul style="list-style-type: none"> Rebate in central excise duty Rebate in interest rate on term loan Rebate in prompt payment of loan instalment
Interest rate	<ul style="list-style-type: none"> 10.60% to 11.90% depending upon the grading of the applicant with prompt payment rebate of 15 bps if payment is made on / before due dates Interest rates are floating and would be reset on commissioning of the project or two years from the date of first disbursement. Thereafter, the rates will be reset after every two years. Rebate of 0.5% in interest rates are available for projects set up in North Eastern States, Sikkim, J&K, Islands, Estuaries. Rebates of 0.5% in interest rates are also available for projects being set up by SC/ST, Women, Ex Servicemen and Handicapped categories involving project cost of upto Rs. 75.00 lakh.
Loan	Upto 70% of the total project cost. Promoter's contribution should be Minimum 30% of the total project cost
Maximum debt	3:1

equity ratio	The project cash flow should have a minimum average Debt Service Coverage Ratio of 1.3
Maximum repayment period	12 years with moratorium of maximum 12 months
Procurement procedures	The borrower is required to follow the established market practices for procurement and shall demonstrate that the quality goods and services are being purchased at reasonable and competitive prices. Wherever the loan is sanctioned against international lines of credit such as the World Bank, Asian Development Bank, KfW, etc., the relevant procedures will have to be followed and requisite documents will have to be submitted by the borrower

Small Industries Development Bank of India (SIDBI) has several schemes and focused lines of credit for providing financial assistance for energy efficiency and cleaner production projects for SMEs. Highlights of some of the major financial assistance schemes/projects managed by SIDBI are given in table 6.4.

Table 6.4: Major EE financing schemes/initiatives of SIDBI

End to End Energy Efficiency (4E) Program	<p>Support for technical / advisory services such as:</p> <ul style="list-style-type: none"> • Detailed Energy Audit • Support for implementation • Measurement & Verification <p>Financing terms:</p> <ul style="list-style-type: none"> • Terms loans upto 90% • Interest rate upto 3% below normal lending rate.
TIFAC-SIDBI Revolving Fund for Technology Innovation (Srijan Scheme)	<p>To support SMEs for up-scaling and commercialization of innovative technology based project at flexible terms and interest rate.</p> <p>Preference accorded to sustainable technologies / products. Soft term loan with an interest of not more than 5%.</p>
Partial Risk Sharing Facility for Energy Efficiency (PRSF) Project (supported by World Bank)	<p>Sectors covered:</p> <ul style="list-style-type: none"> • Large industries (excluding thermal power plants) • SMEs • Municipalities (including street lighting) • Buildings <p>Coverage:</p> <ul style="list-style-type: none"> • The minimum loan amount Rs 10 lakh and maximum loan amount of Rs 15 crore per project. • The extent of guarantee is 75% of the loan amount
JICA-SIDBI Financing Scheme	<ul style="list-style-type: none"> • The loan is used to provide SMEs with funds necessary to invest in energy-saving equipment (and some medical equipment) in the form of two-step loans through SIDBI or three-step loans through intermediary financial institutions.

	<ul style="list-style-type: none"> • Project uses an Energy Saving Equipment List approach • Equipment/machinery with energy saving potential less than 10% is not eligible. • Interest rate: As per credit rating and 1% below the normal lending rate • Separate technical assistance component which is used for wetting of loan applications, holding seminars to raise awareness of energy saving among SMEs and to improve the ability of financial institutions to screen loan applications for energy-saving efforts
KfW-SIDBI Financing Scheme	<p>Coverage</p> <ol style="list-style-type: none"> a) SMEs for energy efficiency projects b) SMEs and clusters for cleaner production and emission reduction measures, waste management and Common Effluent Treatment Plant (CETP) facilities <p>Interest rate</p> <p>As per credit rating and 1% below the normal lending rate</p> <p>Eligible criteria</p> <p>3 t CO₂ emission reduction per year per lakh invested</p> <p>List of eligible equipment/technology and potential suppliers developed for guidance</p>

State Bank of India (SBI) has been provided a green line of credit by Japan Bank for International Cooperation (JBIC) for financing of energy efficiency investments. Highlights of the line of credit are given in table 6.5.

Table 6.5: JBIC-SBI Green Line

<p><u>Key Features</u></p> <ul style="list-style-type: none"> • Amount : USD 90 million • Repayment Schedule: First repayment on May 30, 2017 and final repayment date May 30, 2025 (equal instalment) <p><u>Eligibility Criteria</u></p> <ul style="list-style-type: none"> • Projects contributing to preservation of global environment, i.e. significant reduction of GHG emissions • Acceptance of JBIC-MRV (“J-MRV”) by the project proponent in terms of the numerical effect of the environment preservation. To ensure effective GHG reduction emissions in Green financed projects, JBIC reviews such effects through simple and practical Measurement Reporting Verification (MRV) process both in (a) prior estimation and (b) ex-post monitoring. • Procurement in line with the “Guidelines for Procurement under Untied Loans by Japan Bank for International Cooperation”
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Canara bank has a dedicated scheme for financing EE investment among SME sector as mentioned in table 6.6.

Table 6.6: Canara bank scheme of EE SME loans

Purpose	For acquiring/adopting energy conservation/savings equipment/ measures by SMEs
Eligibility	Units under Small and Medium Enterprises Cost of energy for the unit should constitute not less than 20% of the total cost of production Unit should possess energy audit report issued by an approved energy Consultant/ Auditor. Borrowal a/cs-ASCC code S1 or S2 during previous review. Current account holders having dealings exclusively with us satisfactorily for a period of last one year
Maximum loan	Maximum Rs 100 lakhs in the form of term loan
Security	Prime: Assets created out of loan Collateral: Upto Rs.5 lakhs – NIL Above Rs.5 lakhs, as determined by the bank
Repayment	Maximum 5-7 years including moratorium of 6 months
Guarantee cover	Cover available under CGMSE of CGTMSE available for eligible loans
Margin	10% of the project cost
Rate of interest	1% less than the applicable rate
Upfront fee	1% of the loan
Insurance cover	Assets acquired and charged as security to Bank to be insured
Special offer, if any	Grants : Bank provides 25% of the cost of Energy Audit / Consultancy charges with a maximum of Rs 25000/- to the first 100 units on a first come first served basis which is in addition to the grant of Rs 25000/- being provided by IREDA(First 100 units)

Among the private sector banks in India, Yes Bank is also active in financing of renewable energy and energy efficiency projects. The bank has an MOU with SIDBI for providing funding for EE through PRSF.

Most commercial banks charge interest rate between from 11% to 13% from MSMEs depending upon general criteria such as credit ratings, references, past lending record, balance sheet for last 3 years and so on. Interest rebate is offered for a few customers whose collateral value is around 125% of the loan amount. Further 0.5% concession in interest rate was offered to women entrepreneurs.

Annexures

Annexure 1: Copy of certificates from the competent authorities



Annexure 2: Budgetary offers / quotations

Quotation - 1: Altoni Union

J-384, M.I.D.C., BHOSARI, PUNE - 411 026. PHONE : 27130135 FAX : 020-27130151
E-mail : altoniunion@gmail.com Website : www.refractorysolutions.in



COMPLETE REFRACTORY SOLUTIONS

UNION

QUOTATION NO: AU/18-19/0128

Date: 19/04/2018

To : The Energy & Resources Institute

Kind Attn : Mr. Vivek Sharma

Sub : Quotation for tempering furnace

Dear Sir,

With reference to the above, we are pleased to quote our prices and terms of sales here below for your kind consideration.

(A) Material

Sr.No.	Description	Quantity	Unit	Price/Unit (Rs)
1.	MODULES Density: 160 Kg/M3, Grade: S (1300 Deg.C.) 'UNIFRAX' Make Size: 305 x 305 x 75mm	-	Nos	225.00
2.	MORTAR 'UNIFRAX' Make	-	Kgs	110.00
3.	COATING ZL	-	Kgs	520.00

(B) Labour Charges

Sr.No.	Description	Quantity	Unit	Price/Unit (RS)
1.	Application charges for Module lining	1	LumSum	40429.00

TERMS OF SALES

Price basis: The prices quoted are on the basis of Ex-our works at J-384, M.I.D.C., Bhosari, Pune-411026.

Taxes: VAT 12.5% on item no 1 and 3 & VAT 5% on item no 2 will be charged extra. For Labour Charges Service Tax 12.36% will be charged extra.

Delivery: Within 15 To 20 days from the date of receipt of your confirmed order.

Payment: 50% advance along with PO and remaining 50% against proforma invoice prior to dispatch.

Time Period: 7 days to complete the work.

Validity: 30 days. Thereafter subject to our confirmation.

We trust, you will find our offer suitable and quite competitive for the quality product offered and await your valued response.

Thanking You.

Yours Faithfully,
For ALTONI UNION.,

Authorized Signatory.



Quotation – 2: Vbtech Automation



Proposal No.: VBA/K/18-19/24

Date: - 10-05-2018

To,
Anchor Sanitarywares Pvt. Ltd.
Tarnetar Road, Thangadh- 363530

Kind Attn.: Mr. Pawan Tiwari
Subject: Trolley Tracking and Temperature Monitoring System for Tunnel Kiln.

Dear Sir,

This is with reference to our discussion to provide trolley tracking and temperature data monitoring system in tunnel kiln for ceramic heating process. We are submitting our techno-commercial proposal for the same in below.

In case you have any query, please contact us on Mobile No: 88668 14530, 9825049845. We hope that this will be suitable to your requirement and favour us for your valued order to serve you.

Thanking You,

Yours Truly,
Mr. Smit Bhavsar
VBTECH AUTOMATION

54, Akshar Industrial Park, Nr. Hathijan Circle, Vatva GIDC, Vinzol, Ahmedabad- 382445, Gujarat, INDIA.
T: +91 98250 49845, E: info@vbtechautomation.com, W: www.vbtechautomation.com



Proposal No.: VBA/K/18-19/24

1. Introduction

1.1 Company Background

VBTECH AUTOMATION was established by Mr. Himanshu Bhavsar in the year 2002 with a charter to provide niche IT enabled Industrial Automation Solutions and services. He has more than 25 years of global IT and Automation experience at Multi-National Company in INDIA and Abroad. VBTECH is a automation solutions provider company using State Of The Art hardware and software technology from [National Instruments-USA](#).

VBTECH undertakes onshore and offshore software development projects on National Instruments LabVIEW platform. VBTECH also undertakes turnkey automation projects for various industries in the area of automated Test Equipment, Quality control, Hi-speed data Acquisition, Vision-motion, PLC, SCADA, and many more. We provide niche Communication, Networking, Process Control and Automation solutions. We have in-depth technical skills in Business Intelligence products in the areas of DSS (Decision Support Systems) and EIS (Executive Information Systems). We provide professional services like planning, consulting, development, implementations, customization and training.

VBTECH's industry experience gives it the depth and breadth of knowledge needed to determine the best solutions for business needs and an edge in creative problem solving. VBTECH's consultants, developers and engineers have multiple cross platform skills and industry knowledge to match business needs with the technology solutions.

VBTECH Automation has strong skill sets to provide IT enabled solutions in the area of Management Information System, Production Planning & Control, Statistical Analysis, Security Solutions and Enterprise wide software solutions & many more.

1.2 Area of Expertise

Automation

Besides Communication, the genesis of VBTECH has been from its strengths in providing complete integrated solutions for the manufacturing industry. VBTECH has to its credit a significant number of successfully executed Process Control and Process Automation Projects. The Various areas of functional expertise include:

- PLC based machine automation
- SCADA projects for process Industries
- Machine Interface with computer and Data Bases
- Automated Test Equipment
- Production, Planning and Control Systems
- Energy Management Systems
- Management Information Systems
- Laboratory Automation
- Process control
- Motion control and Synchronization
- Weighing and Packaging control.

Consultancy

- Information Systems strategic planning
- Project Planning and Project Management
- Statistical data analysis and process control
- Hardware sizing, Tender Preparation and Evaluation
- 24x7 Service Call

54, Akshar Industrial Park, Nr. Hathijan Circle, Vatva GIDC, Vinzol, Ahmedabad- 382445, Gujarat, INDIA.
T: +91 9825049845, E: info@vbtechautomation.com, W: www.vbtechautomation.com

Proposal No.: VBA/K/18-19/24

1.3 VBTECH Advantage

India has established itself as a source of high quality software professionals offering significant cost advantage. To this natural location advantage, VBTECH brings its unique capabilities, philosophy and entrepreneurship.

VBTECH offers the commitment to "build long term relationships" --relationships built on trust and customer satisfaction

Specific to dairy, the VBTECH advantage is that it has rich experience and capabilities in all the areas relevant to data acquisition & control system and hence VBTECH is one-stop solution partner for madhur dairy.

VBTECH's enriched experience in process control and automation allows us to suggest a practical and efficient solution for thermo-vac system.

VBTECH's experience in the field of communication and protocol development knowledge allows us to work out the software for communicating various third party instruments which has either rs 232 or rs 485 port on board.

VBTECH's communication and networking experience allows us to provide the open system connectivity and network based architecture.

1. CONVENTIONAL CERAMIC MANUFACTURING PROCESS

The traditional ceramic process generally follows this sequence: Milling → Batching → Mixing → Forming → Drying → Firing → Assembly.

In firing process ceramic substance undergo through tunnel kiln for heat treatment process. Kilns are basically containers for heat. In firing process the dried parts pass through a controlled heating process and the oxides are chemically changed to cause sintering and bonding. The fired part will be smaller than the dried part.



Basically there are two types of kiln- 1. Continuous 2. Periodic

Continuous kilns are always firing; they never cool. The ceramic to be fired is loaded into trolleys and slowly goes through the kiln on a track or rail. After cooling, the still-moving cars are unloaded and reloaded to begin the circuit again.

Periodic kilns are the ones most familiar to potters. They are fired on an intermittent schedule; the kilns are loaded, brought to temperature, cooled, and then unloaded. The kiln is not firing all the time.

VBTECH provides automation solution for Continuous kiln. In continuous kilns, the manufacturer set the temperatures throughout the kiln depending on ceramic material. When trolley enter in kiln its pass through pre-heating zone where it gets heat up to 600°C. After that in firing zone it gets heat up to its maximum temperature which is about 1200°C degree. And to cool down the ceramic substance it passes through three cooling zones which help to cool down the ceramic to room temperature.



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1.1 Problems with firing process in tunnel kiln

Our clients faced some problems in conventional firing process of kiln which describe as below

- Each trolley needs to insert in kiln manually. At night, operator slept for some hours, during that time installed trolley overheated. And in the morning, they insert numbers of trolley together and take it out from kiln in very short time. So, ceramic on those trolleys under heated. And the trolleys which were in kiln for more than required time got overheated. Time for which trolley should undergo into kiln for heat treatment process is not according to volume. Cause of that quality of ceramics become low which manufactured during those hours.
- Each ceramic substance needs to undergo heat-treatment process for a particular temperature and time, deviation in any of these two parameters cause a degradation of product quality.

By installing automation system in manufacturing process it track and generate real time reports for further plan of action.

1.2 Solution

The automation system installed in kiln helps to increase the quality of product by monitoring the time taken for each trolley to enter and exit from kiln and from which temperature ranges it was passed through when it was in kiln. So if any of the ceramic substance placed on trolley was not heated up for expected time and/or temperature it can be reject cause of low quality. This system indicates the variation in temperature by graph. And it alerts the operator if temperature of particular heater crosses the alarm limits.

The software based controls, monitors & Data acquisition of system.

This system has following features:

- Temperature monitoring
- Temperature graph plotting
- Trolley position monitoring
- Alarm limits for variation in temperature
- Temperature and trolley graph tables

1.3 Advantages

- Optimized quality control
- Optimized setting patterns
- Lower breakage rates
- Major saving in staffing costs
- Stage vice implementation
- Manufacturing record of ceramic substance

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2. SYSTEM OVERVIEW

2.1 Data Acquisition

Data acquisition is the process of sampling of real world physical conditions and conversion of the resulting samples into digital numeric values that can be manipulated by a computer. A data acquisition and data acquisition system typically involves the conversion of analog signals into digital values for processing. The components of data acquisition systems include:

- Sensors that convert physical parameters to electrical signals.
- Signal conditioning device to convert sensor signals into a stander form that can be converted to digital values.
- Analog-to-digital converters, which convert conditioned sensor signals to digital values.
- Digitized data can be transfer to PC by different means & ways using on board PCI / PCI-Express Bus or Serial Communication or Ethernet Communication or Wi-Fi Communication.
- Acquired data by PC can be presented in graphical or tabular format as well as at the same time it can be saved in different format like spreadsheet or text or any open database like Access, My SQL, and MS SQL...



Fig. 2 COMMUNICATIONS BASED DATA ACQUISITION

2.2 KILN DATA ACQUISITION SYSTEM

VBTECH is offering solution for Kiln data acquisition by using state of the art hardware & communication technology. This system acquires two kinds of data.

3.2.1 Hardware

Temperature Data Acquisition Hardware:

To perform this task, VBTECH provides Universal Temperature Indicator with RS 485 serial communication facility. Refer our detail catalogue for more information. Each Thermocouple/ RTD sensor will be connected to individual devices. These entire devices will be linked through daisy chain network on RS 485 serial communication and finally connected to PC using RS 485 to USB converter.

Trolley Position Data Acquisition Hardware:

To perform this task, VBTECH provides state of the art digital Input device at the front side of Kiln and at the back side of kiln. This device will monitor array of proximity sensors and decode the trolley number depending upon the ON/OFF position of proximity while entering trolley into kiln or while exiting trolley from the kiln. These Digital input devices are connected one to one with the PC on RS 485 serial communication facility using RS 485 to USB converter.

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2.2.2 Software:

Online

This module provides features like,

- Online Temperature monitoring & Temperature data logging
- Online Temperature graph plotting
- Online Trolley/Temperature position monitoring
- Alarm limit settings

Online Temperature monitoring and Data Logging

Data will be acquired through communication base data acquisition, then this data will be scaled and after that temperature data will be shown in temperature indicator. This scaled data will also be written in Standard (Ms-Access) database. Temperature Monitor screen will be as per Fig.3 shown below.

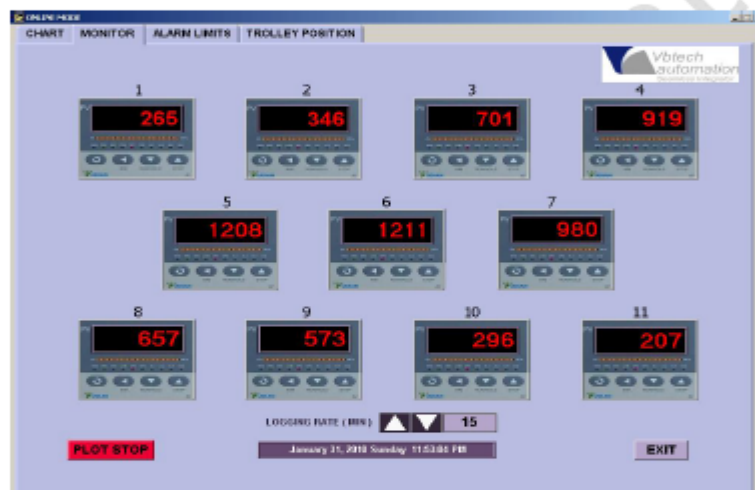


Fig. 4 Temperature Monitor

NOTE: The above screen shot is just an example, which indicates temperature on different temperature indicators Number of indicators can be increase and decrease according to requirement.

User has to select Logging rate as required. The data logging will be start only after pressing plot start button. Data will be written in database as per logging rate selected.

Online Temperature Graph plotting

The scaled data will be plotted in graph with respect to real time. Graph will be start after pressing plot start button from monitoring screen as shown in fig.3. Graph will be updated after the minutes selected in logging rate. Graph's X and Y scale Min and Max value will be automatically adjusted. User can select or hide any plot by using buttons in plot selector. Temperature Chart screen will be as per Fig.4 shown below.

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Fig. 5 Temperature Graph (Chart)

Online Trolley/Temperature Position Monitoring

Trolley enter and exit position will be acquired from the sensor mounted on start and end position. These enter and exit data with trolley no. will be recorded in database with timestamp. Online Trolley position screen will be as per Fig. 5 shown below.



Fig. 6 Trolley Position Monitor.

Graph shown with Trolley Monitor shows Temperature Data with respect to Distance in Inch. Through this graph user can verify the Temperature of trolley at particular distance. Using cursor labeled 12; user can get the value of temperature in any point on graph.

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Alarm limit setting

User can set high alarm and low alarm limits online through this screen. Any changed in this value will be overwritten and will be restored when application starts again. Depends on this alarm values alarm indication will be appear on temperature monitor screen. Alarm limit setting screen will be as per Fig. 6 shown below.



Fig. 7 Alarm limit setting

Offline

Temperature Graph

By entering From Date & Time and To Date & Time, and then pressing plot data user can get the previous data which was stored in database. User can select or hide any of plots through plot selector. User zoom-in or zoom-out through graph palettes as shown in fig. 8.



Fig. 8 Temperature Graph

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Temperature Table

By entering date and time user can get the temperature data of the selected date in tabular format. Fig. 8 shown below is Temperature table screen. This tabular format can also be printed by pressing print button on this screen.

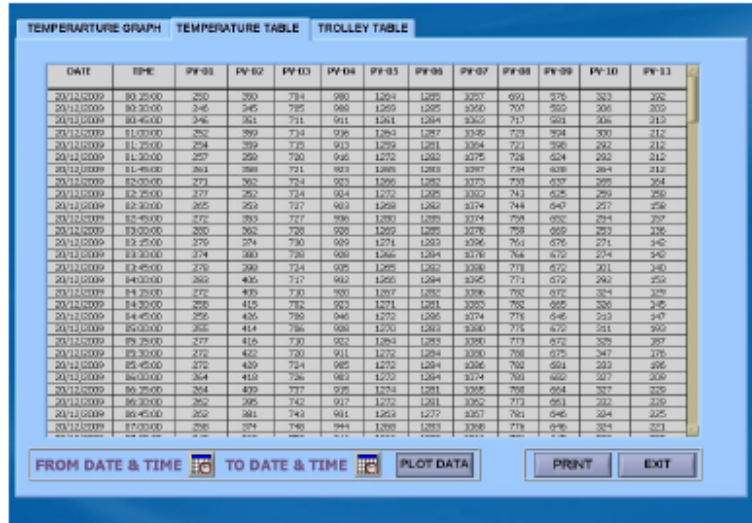


Fig. 9 Temperature Table

Trolley Table

By entering date & time user can get the status of trolley enter time, exit time for particular trolley no. for the selected date & time. Fig. 9 shown below is Trolley table screen. This tabular format can also be printed by pressing print button on this screen.

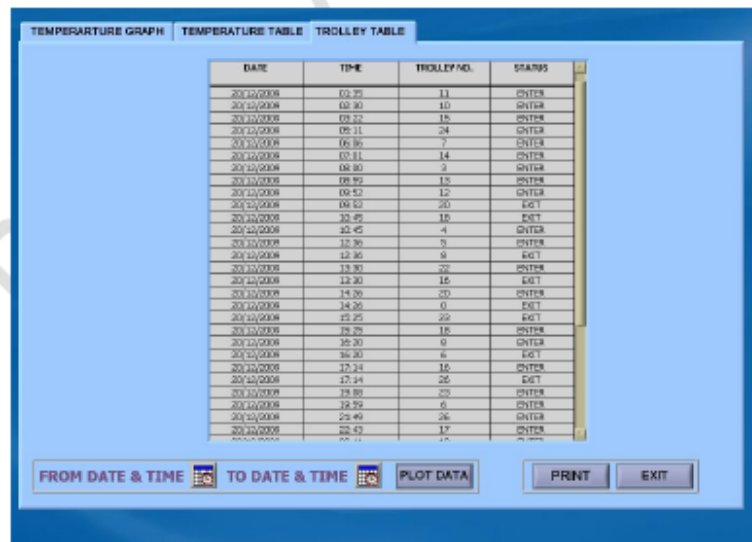
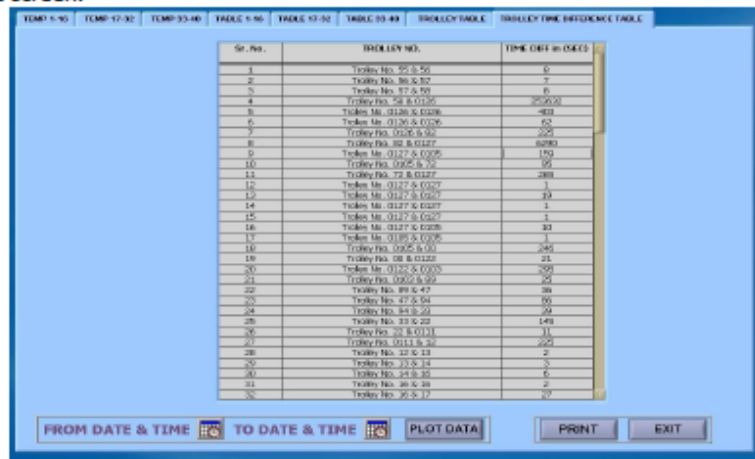


Fig. 10 Trolley Table

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Trolley Time Difference Table

By entering date & time user can get the time for which trolley was within kiln. This can be done by substituting the entered time and exit time for particular trolley no. for the selected date & time. Fig. 10 shown below is Trolley time difference screen. This tabular format can also be printed by pressing print button on this screen.



Sl. No.	TROLLEY NO.	TIME DIFF IN SECS
1	Trolley No. 35 & 56	0
2	Trolley No. 36 & 57	7
3	Trolley No. 37 & 58	6
4	Trolley No. 38 & 59	250758
5	Trolley No. 0130 & 0131	453
6	Trolley No. 0130 & 0132	62
7	Trolley No. 0130 & 56	232
8	Trolley No. 01 & 0127	30893
9	Trolley No. 0127 & 0128	152
10	Trolley No. 0128 & 52	35
11	Trolley No. 17 & 0127	388
12	Trolley No. 0127 & 0127	3
13	Trolley No. 0127 & 0127	33
14	Trolley No. 0127 & 52	1
15	Trolley No. 0127 & 0127	1
16	Trolley No. 0127 & 0128	33
17	Trolley No. 0130 & 0130	1
18	Trolley No. 0128 & 50	240
19	Trolley No. 08 & 0128	24
20	Trolley No. 0128 & 0133	239
21	Trolley No. 0128 & 50	25
22	Trolley No. 49 & 47	38
23	Trolley No. 47 & 54	66
24	Trolley No. 44 & 21	29
25	Trolley No. 23 & 22	144
26	Trolley No. 22 & 0131	31
27	Trolley No. 0111 & 32	224
28	Trolley No. 22 & 23	2
29	Trolley No. 13 & 14	3
30	Trolley No. 24 & 25	6
31	Trolley No. 26 & 26	2
32	Trolley No. 35 & 17	27

Fig. 9 Trolley time difference table

Project execution methodology

1. Pre site inspection visit will be done after getting purchase order. During visit kiln technician or kiln in-charge person from customer side require to be present.
2. During pre-visit, Planning for installation of detection plate and cable laying and panel mounting will be finalized together.
3. VBTECH will provide dimensional drawings for detection plates need to install below trolley as well as proximity mounting arrangement drawings.
4. After fabricating and installing detection plate from customer site. Proximity and cabling material from VBTECH will be delivered at customer site.
5. After completing field cabling from customer side, VBTECH will start testing and installation of control panel in control room. Meanwhile software installation in computer provided by customer.
6. VBTECH will provide system validation with 50 Nos. of trolley data and Project sign off report will be signed by customer.

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3. COMMERCIAL OFFER

Sr. No	Description	Set	Amount
01	VBT MONITORING TECHNOLOGY for Sanitary Tunnel Kiln <ul style="list-style-type: none"> ○ Licensed Application Operational Interface to monitor kiln and trolley data (With all function as mentioned above)	1	2,50,000/-
02	High Speed Digital Controller	1	
03	Digital Isolator	16	
04	Serial to TCP convertor	1	
05	Proximity Sensor	16	
06	Gateway Convertor	1	
07	Electrical panel with safety switchgear	1	
08	10 Core Cable (90 Meter)	1	
09	CAT6 Cable (10 Meter)	1	
10	Services <ul style="list-style-type: none"> ● Application testing and Installation ● Engineering, Installation, Commissioning & Training of Monitoring System ● User & Trouble Shooting Documentation Manual 	1	

Note:

- Above offer is valid for automating kiln system on below terms:
 - Fabrication and installation of detection plate will be done from customer side. However VBTECH AUTOMATION will provide drawing.
 - Field cabling and junction box wiring will be done from customer side. However VBTECH AUTOMATION will provide instruction and electrical drawings.
 - Above offer is made assuming all temperature indicator and controller have Modbus RTU or Yudian communication protocol card available already. If not than customer have to purchase and replace new indicator with communication.
 - Standard computer to run application software will be in scope of customer. PC with below minimum specification
 - 15" Monitor



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- Intel Celeron or Core 2 Duo Processor
 - 2 GB RAM
 - 250 GB HDD
 - Fan-Less CPU
 - 4 USB port
 - 1 Serial Port
 - 1 LAN Port
- Computer must be placed in normal atmospheric temperature controlled room.
- Above Offer is valid for system supplied within Indian Territory. For Overseas, Offer will be submitted on request.
 - Price will very subject to change in scope.

4. TECHNO-COMMERCIAL TERMS & CONDITIONS

1. Payment terms:
 - 50% along with techno-commercial confirm purchase order
 - 50% against Performa Invoice prior to material delivery at your factory.
2. Payment will be made by Net Banking/ Cheque in favour of VBTECH Automation/ VBTECH Engineers payable at Ahmedabad.
3. GST 18% will be charge extra on above prices for all hardware – software component as per government policies at the time of invoicing.
4. VBTECH will provide free training for installing, troubleshooting and maintenance of the system at your site to one of your engineer.
5. Per day 3000/- INR will be charge extra for any extra work related to this project at customer site. Days count will start from the day of departure from Ahmedabad till arrival back to Ahmedabad.
6. First class to & fro conveyance as well as lodging & boarding will be provided by customer for further travel from Ahmedabad to customer site for any other work related to projects as per given below slab.
 - Within 500 Km by Road In any AC class.
 - Above 500 Km by Air from destination to destination
7. Delivery within 4 to 6 weeks after getting P.O. and advance subject to availability of mechanical kiln with installed automation components.
8. VBTECH is offering one-year remote service over internet for application system related issue.
9. Cancellation of Order: -
 - Order Once Placed cannot be cancelled and advance will be forfeited.
 - Any amendments of orders should be intimated to VBTECH within 7 days of order date in writing. No refunds will be entertained after 7 days of order date.

54, Akshar Industrial Park, Nr. Hathijan Circle, Vatva GIDC, Vinzol, Ahmedabad- 382445, Gujarat, INDIA.
T: +91 98250 49845, E: info@vbtechautomation.com, W: www.vbtechautomation.com

10. Force Majeure: -

Seller shall not be liable for delay in or failure of performance of contracts caused by or due to any causes beyond the Seller's control including fire, strikes, pestilence, disputes with work men, war, riots, civil commotion, epidemics, floods, accidental damages or accidents to the machinery, transportation delays, shortage of fuel or other material, shortage of labour, acts, demands or requirements of Governments force majeure or to any other circumstances beyond the control of the seller or the manufacturer whether due to or in consequence of the afore said causes or not and the existence of such causes or consequences shall extend the time of performance on the part of seller to such extent as may be necessary to enable them to make delivery after the cause of delay have been removed. Should Seller so determine they shall at any time on notice to the purchaser be entitled to cancel any contracts the performance of which is likely to be delayed by the causes afore said and in such cases, the purchaser shall have no right to claim of any description.

11. All disputes and different arising connected with this order, failing amicable settlements, shall be referred to arbitration under the Indian Arbitration Act 1940 or any statutory modification thereof for the time being in force and such arbitration shall take place 'only' in Ahmedabad (India). The purchaser and supplier will select the arbitrator by mutual consent.

12. Illegal use of the system or goods in not the responsibility of VBTECH Automation and the purchaser will be fully responsible for the same.

13. This offer is valid for 30 days from the date of submission.

Looking forward for Long Term Business Relations.

For VBTECH AUTOMATION

Mr. Smit Bhavsar

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E: smit@vbtechautomation.com

Annexure 3: Instruments used

Instruments	Model/ Make	Application	Accuracy
Power analysers	Fluke: 435, Fluke: 43B,	Electrical Parameters Harmonics analysis, power logging	± 0.5%
Flue gas analyser	Testo: 330-2LL	Flue gas O ₂ , CO, CO ₂ & Temperature	±0.1vol%, 1ppm, 1ppm, 0.1°C
Thermal imager	875-2/Testo	Surface Temperature & Image	± 2%
Digital Temperature indicator	Comark: N1001, Testo: 925	Temperature	± 1%
Anemometer	Testo: 425, Airflow: TA45	Air Velocity	±(0.03 m/s +5% of mv)
Differential pressure meter	Testo: 512	Air pressure	0.5% full-scale value / ±1 digit
Temperature data logger	175-T3/Testo	Temperature	± 0.5%