Parameter	Units	Value
efficient reheating furnace		
Annual monetary saving @ Rs. 28/liter	Rs.lakh	1.93
Implementation cost	Rs.lakh	4.00
Simple payback period	years	2.07

From the above table it is clear that replacement of conventional reheating system with energy efficient reheating system is financially attractive.

➲ Issues in implementation

- ➥ Lack of awareness on proposed energy conservation measure
- ➥ Cost of implementation

3.4.2 Installation of Air-fuel control system in conventional reheating furnace

➲ Background

From energy use and technology audit study, it was observed that high level of excess air was present in the flue gas. Though a representative amount of excess air is required for proper combustion, but larger quantities of excess air result in excessive heat loss through flue gases, as well as cooling of the combustion chamber due to excess air. In a few cases it was observed that excess air present in reheating furnace is less than excess air required for complete combustion. Both the abovementioned cases lead to improper fuel combustion, which automatically leads to poor furnace efficiency. It is recommended to install proper air-fuel control system in conventional reheating furnace system.

➲ Technical specifications of proposal

This ratio controller comes under the brand Ratiotrol and the model no. Ratiotrol – 7052 – 0 was selected for the single burner and heavy oil parameters. Details of ratio trolls are presented below:

➲ Benefits of proposals

Major advantages of installing Air fuel controllers in reheating furnace are presented below:

- Improved product quality
- Saving in reheating time, it automatically leads to energy savings
- Improved working environment
- Productivity improvements

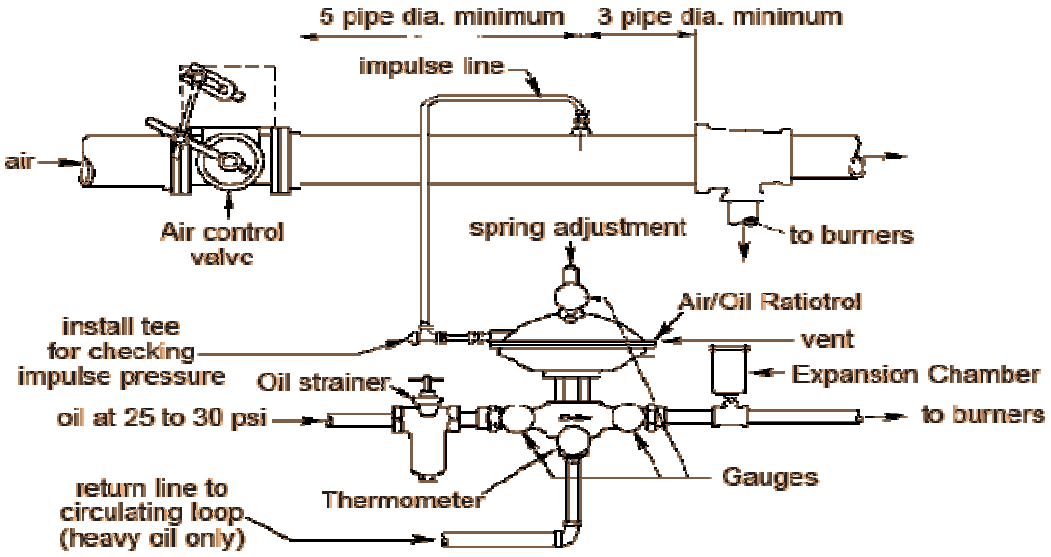

Figure 3.9: ***Details of Ratio trolls 7052-0 model***

➲ Cost benefits analysis

Cost benefits analysis of installing the Air-fuel controller's i.e. ratiotrols in conventional reheating furnace system in typical Brass industry is presented in table below:

Table 3.3: ***Cost benefits analysis of installing the Air-Fuel controller's i.e. ratiotrols in conventional reheating furnace***

Parameter	Units	Value
Efficiency of existing reheating furnace without ratio controllers	%	17.59
Specific fuel consumption in reheating furnace without ratio controllers	liters/tonne	37.03
Specific fuel consumption	mkCal/Tonne	0.32
Existing excess air levels in reheating furnace	%	9.41
Efficiency of existing reheating furnaces after installation of ratio controllers and avoiding air infiltration in reheating furnace	%	20.99
Specific fuel consumption in reheating furnace with ratio controllers	liters/tonne	31.03
Savings in furnace oil consumption after installation of Air-fuel controllers	liters/tonne	6
Annual production capacity	tonnes	500
Annual fuel savings due to installation of ratio controllers in reheating furnace	liters/annum	3,000
Annual monetary saving @ Rs. 28/Liter	Rs.lakh	0.84
Implementation cost	Rs.lakh	0.30
Simple payback period	years	0.34

From the above table it is clear that installation of ratio controllers in reheating system is attractive in energy, economic and environmental point of view.

➲ **Issues in implementation**

- ➥ Lack of awareness on proposed energy conservation measures
- ➥ Cost of implementation

3.4.3 Improving the insulation of reheating furnaces

➲ **Background**

From energy use and technology studies it was observed that, proper insulation seemed to be a forgotten factor in majority of Brass extrusion units. As a result, skin temperatures as high as 100 deg C on furnace walls and 130 deg C on furnace roofs. This led to high radiation losses through the furnace, which sometimes accounted as high as 3-7 % of the overall losses. To overcome this shortcoming, the insulation thickness and quality were reconsidered in various zones of furnace. A separate lining for each part of the body of the furnace like the hearth, walls, roof, heating and soaking zone and preheating zone was designed and laid down.

Use of insulation materials like Hysil sheet, ceramic blanket etc was introduced to the furnace makers, who till now did not use these materials either due to lack of awareness or to bring down the cost of construction of the furnace. Brick lining in the existing furnace varied from 12 inches to 14 inches in thickness and comprised mainly of the inferior grade firebricks and a single layer of insulation bricks. Also, same type of refractory material and insulation material was used for main chamber as well as preheating zone irrespective of the temperature difference. It is recommended to use the proposed insulation and refractory material for proper insulation of furnace and technical specification of same is presented in table below:

➲ **Technical specification**

Technical specifications of refractory and lining in the proposed reheating furnace are presented in table below:

Table 3.4: ***Technical specifications of refractory and lining in the proposed reheating furnace***

Wall	Soaking & Heating Zone	230mm refractory (70% Alumina)
		115 mm insulation (Hot face insulation)
		50 mm (Hysil Sheet)
		75 mm Ceramic blanket (50 mm 128 kg/m3 + 25 mm 96 kg/m3 density)

	Pre-heating Zone	230mm refractory (60% Alumina)
		115 mm insulation (Hot face Insulation)
		50 mm (Hysil Sheet)
		75 mm Ceramic blanket (96 kg/m3)
Hearth	Soaking & Heating Zone	230mm refractory (80% Alumina)
		115 mm insulation (Hot face insulation)
		75 mm (Hysil Sheet)
		25 mm Ceramic blanket (128 kg/m3)
	Pre-heating Zone	230mm refractory (60% Alumina)
		115 mm insulation (Hot face insulation)
		50 mm (Hysil Sheet)
		50 mm Ceramic blanket (96 kg/m3)
Roof	Soaking & Heating Zone	230mm refractory (70% Alumina)
		115 mm insulation (Hot face insulation)
		100 mm Ceramic blanket (50 mm 128 kg/m3 + 50 mm 96 kg/m3 density)
		75 mm insulation Tile (Cold face)
	Pre-heating Zone	230mm refractory (60% Alumina)
		115 mm insulation (Hot face insulation)
		100 mm Ceramic blanket (50 mm 128 kg/m3 + 50 mm 96 kg/m3 density)
		75 mm insulation Tile (Cold face).
Burner		115 mm refractory (70% Alumina) +
		115 mm Hot Face insulation
		100mm ceramic blanket (128 density)
		75 mm insulation tile (Cold face).

➲ Benefits of proposals

Major advantages of use proper refractory and lining in energy efficient reheating furnace are presented below:

- ➥ Saving in reheating time, it automatically leads to energy savings
- ➥ Improved working environment
- ➥ Productivity improvements

➲ Cost benefits analysis

Cost benefits analysis of the installing the suitable refractory and lining in reheating furnace is presented in table below:

Table 3.5: ***Cost benefits analysis of installing the suitable refractory and lining in reheating furnace***

Parameter	Units	Value
Average surface temperature of Reheating furnace with existing insulation	deg C	112
Specific fuel consumption with existing insulation	Liters/tonne	39
Average surface temperature of Reheating furnace with proposed refractory and lining	deg C	55
Specific fuel consumption after installation of proposed insulation	liter/tonne	35.3
Savings in fuel consumption	Liters/tonne	3.7
Annual production capacity	tonne	500
Annual fuel savings due to installation of suitable refractory & lining	liters/annum	1,850
Annual monetary saving @ Rs. 28/Liter	Rs. lakh	0.52
Implementation cost	Rs. lakh	0.75
Simple payback period	years	1.4

From the above table it is clear that installation of suitable refractory and lining system in place of conventional refractory and lining system is financially attractive.

➲ Issues in implementation

- ➥ Lack of awareness on proposed energy conservation measure
- ➥ Non availability of suitable local service providers

3.4.4 Installation of temperature gauges in Reheating furnace

➲ Background

In the existing reheating furnace operation billet temperature is being measured by operator's experience. Most of units it was observed that billet temperature is more than required temperature for pressing operation; this will increases fuel consumption in reheating furnaces. Apart from that, this reduces the quality of material. It is recommended to install temperature gauges in reheating furnaces for proper temperature control.

➲ Technical specification

Recommended reheating temperatures of different type of material in reheating furnace are presented in table below:

Table 3.6: ***Recommended reheating temperatures different materials***

S. No	Type of material	Temperature (deg C)
1	Free cutting brass	700/750
2	Forging brass	700/750
3	Modify forging brass	600/650
4	High tensile brass	700/750
5	Lead free brass	800/850
6	IS319-II	800/850
7	DTP	800/850
8	SVF	800/850
9	CuZn40Pb2	800/850
10	C-3602	800/850
11	C-345	800/850

➲ Benefits of proposals

Major advantages of use of temperature controllers are presented below:

- ➥ Quality improvements
- ➥ Reduction of reheating time, it automatically leads to energy savings
- ➥ Productivity improvements

➲ Cost benefits analysis

Cost benefits analysis of the installing the temperature gauges in reheating furnace is presented in table below:

Table 3.7: ***Cost benefits analysis of installing temperature gauges in reheating furnace***

Parameter	Units	Value
Temperature of billet without temperature gauges in reheating furnace	deg C	795
Specific fuel consumption without temperature gauges in reheating furnace	liters/tonne	39
Actual temperature required for pressing operation of billet	Deg C	750

Parameter	Units	Value
Specific fuel consumption after installation of temperature gauges	liters/tonne	37.20
Savings in fuel consumption after installation of temperature gauges	liters/tonne	1.80
Annual production capacity	tonnes	500
Annual fuel savings due to installation of temperature gauges	liters/annum	900
Annual monetary saving @ Rs. 28/Liter	Rs.lakh	0.25
Implementation cost	Rs.lakh	0.20
Simple payback period	years	0.80

From the above table it is clear that installation of suitable temperature gauges in reheating system is financially attractive.

➲ Issues in implementation

- ➥ Lack of awareness on proposed energy conservation measure
- ➥ Non availability of suitable local service providers

3.4.5 Improving the insulation of coal fired brass melting furnace

➲ Background

From energy use and technology studies it was obsseved that insulation was forgotten factor and in many units in Jamnagar, as a result, skin temperatures of melting furnaces as high as 110 deg C. This led to high radiation losses through the furnace, which sometimes accounted as high as 3-7 % of the overall losses. To overcome this shortcoming, the insulation thickness and its layering quality were reconsidered.

Figure 3.10: *Insulation in conventional coal fired pit furnace*

It is recommended to install suitable refractor lining and insulation system to plug the heat losses from melting furnace.

➲ Benefits of proposals

Major advantages of improving the insulation of coal fired brass melting furnace are presented below:

- ➥ Reduction of melting time, it automatically leads to energy savings
- ➥ Productivity improvements
- ➥ Improved working environment

➲ Cost benefits analysis

Cost benefits analysis of the improving the insulation of Bras melting furnace is presented in table below:

Table 3.8: ***Cost benefits analysis of improving the insulation of Brass melting furnace***

Parameter	Units	Value
Average surface temperature of melting furnace with existing insulation	deg c	110
Specific coal consumption in melting furnace with existing insulation	Kg/tonne	195
Specific coal consumption in melting furnace with existing insulation	mkCal/tonne	1.08
Efficiency of melting furnace with existing insulation	%	11
Efficiency of melting furnace with improved insulation	%	12.20
Savings in coal consumption	Kg/tonne	19
Annual production capacity	tonne	300
Annual coal savings due to installation of suitable insulation in melting furnace	Kg/annum	5,700
Annual monetary saving @ Rs. 18/Kg	Rs.lakh	1.02
Implementation cost	Rs.lakh	0.30
Simple payback period	years	0.30

From the above table it is clear that installation of suitable lining and refractory system in melting furnace is financially attractive.

➲ Issues in implementation

- ➥ Lack of awareness on proposed energy conservation measure
- ➥ Non availability of suitable local service providers

3.4.6 Replacement of conventional coal fired furnace with gas fired furnace:

➲ Background

Presently brass melting units are being used high grade coal as fuel for melting purpose. From energy use and technology audit studies it was observed that conventional coal fired has efficiency of around 11% due to various reasons mentioned in technology assessment report. It is recommended to replace conventional coal fired furnace with gas fired furnace.

Figure 3.11: ***Operation of coal fired brass furnace melting operation in typical bras unit***

➲ Benefits of proposals

Major advantages of replacing the conventional coal fired brass melting furnace with gas fired melting furnace was presented below:

- ➥ Specific fuel cost in gas fired melting furnace is low compared to coal fired melting furnace
- ➥ Environment friendly
- ➥ Productivity improvements
- ➥ Improved working environment

➲ Cost benefits analysis

Cost benefits analysis of the replacing conventional coal fired Brass melting furnace with energy efficient gas fired melting furnace is presented in table below:

Table 3.9: ***Cost benefits analysis of replacing the conventional coal fired brass melting furnace with energy efficient gas fired melting furnace***

Parameter	Units	Value
Efficiency of existing coal fired furnace	%	11
Specific coal consumption in conventional coal fired melting furnace	Kg/tonne	195
Specific fuel consumption in conventional coal fired melting furnace	mkCal/tonne	1.08
Specific fuel cost in conventional coal fired melting furnace	Rs./Kg	3.50
Efficiency of the proposed gas fired melting furnace	%	17
Specific energy consumption in energy efficient gas fired melting furnace	Nm^3/tonne	72
Specific fuel consumption in gas fired melting furnace	mkCal/tonne	0.69
Specific fuel cost in Energy efficient gas fired melting furnace (@24Rs/Nm^3)	Rs./Kg	1.80
Savings in specific fuel cost by using energy efficient gas furnace in place of conventional coal fired furnace	Rs./tonne	1700
Annual production capacity	tonnes	200
Annual monetary savings due to installation of energy efficient gas fired inplace of conventional coal fired melting furnace	Rs.lakh/annum	3.40
Implementation cost of gas fired melting furnace	Rs.lakh	2.50
Simple payback period	years	0.74

From the above table it is clear that replacement of conventional coal fired Brass melting furnace with energy efficient gas fired melting furnace is attractive in energy, economic and environmental point of view.

➲ Issues in implementation

- ➥ Lack of awareness on proposed energy conservation measure
- ➥ Non availability of suitable local service providers
- ➥ New development in cluster

3.4.7 Replacement of conventional coal fired pit furnace with Rotary furnace

➲ Background

Presently a majority of Brass melting units in Jamnagar are using high grade coal as fuel for melting purpose. From energy use and technology audit studies it was observed that conventional coal fired has efficiency of around 11% due to various

reasons mentioned in technology assessment report. Apart from poor furnace efficiency, coal fired pit type of furnace has melting loss of around 4-5% and more operational& maintenance cost. It is recommended to replace conventional coal fired furnace with gas fired rotary furnace.

➲ Benefits of proposals

Major advantages of replacing the conventional coal fired brass melting furnace with gas fired rotary melting furnace was presented below:

- Specific fuel cost in gas fired melting furnace is low compared to coal fired melting furnace
- Environment friendly
- Productivity improvements
- Improved working environment
- Utilization of waste heat
- Uniform heating due to rotary movement
- Reduction of burning loss compared to conventional pit furnace
- Regular operation & maintenance is avoided
- Preheating of charge, this will reduces the fuel consumption
- Automatic pouring system

➲ Cost benefits analysis

Cost benefits analysis of the replacing conventional coal fired melting furnace with energy efficient rotary fired melting furnace is presented in table below:

Table 3.10: ***Cost benefits analysis of replacing the conventional coal fired brass melting furnace with energy efficient rotary gas fired melting furnace***

Parameter	Units	Value
Efficiency of existing coal fired furnace	%	11
Specific coal consumption in conventional coal fired melting furnace	Kg/tonne	195
Specific fuel consumption in conventional coal fired melting furnace	mkCal/tonne	1.08
Specific fuel cost in conventional coal fired melting furnace	Rs./Kg	3.50
Efficiency of the proposed rotary gas fired melting furnace	%	21
Specific energy consumption in energy efficient gas fired melting furnace	Nm^3/tonne	58
Specific fuel consumption in gas fired melting furnace	mkCal/tonne	0.57
Specific fuel cost in Energy efficient gas fired melting furnace (@24Rs/Nm^3)	Rs./Kg	1.40

Parameter	Units	Value
Savings in specific fuel cost by using energy efficient rotary gas furnace in place of conventional coal fired furnace	Rs./tonne	2100
Annual production capacity	tonnes	200
Annual monetary savings due to installation of energy efficient rotary based gas fired in place of conventional coal fired melting furnace	Rs.lakh/annum	4.20
Implementation cost of Rotary based gas fired melting furnace	Rs.lakh	12
Simple payback period	years	2.9

From the above table it is clear that replacement of conventional coal fired Brass melting furnace with energy efficient rotary gas fired melting furnace is attractive in energy, economic and environmental point of view.

➲ Issues in implementation

- ➥ Lack of awareness on proposed energy conservation measure
- ➥ Non availability of suitable local service providers
- ➥ New technology development

3.4.8 Replacement of conventional oil fired pit furnace with energy efficient oil fired furnace

➲ Background

From energy use and technology audit studies it was observed that conventional oil fired pit furnace has poor efficiency due to poor combustion space, improper location & size of burners and improper capacity of blower system etc. It is recommended to replace conventional oil fired furnace with energy efficient oil fired furnace.

➲ Benefits of proposals

Major advantages of replacing the conventional oil fired brass melting furnace with energy efficient oil fired melting furnace was presented below:

- ➥ Specific energy cost reduction
- ➥ Productivity improvements
- ➥ Improved working environment
- ➥ Utilization of waste heat
- ➥ Preheating of charge - this will reduces the fuel consumption

➲ Cost benefits analysis

Cost benefits analysis of replacing conventional oil fired Bras melting furnace with energy efficient oil fired brass melting furnace is presented in table below:

Table 3.11: ***Cost benefits analysis of replacing the conventional oil fired brass melting furnace with energy efficient oil fired melting furnace***

Parameter	Units	Value
Specific fuel consumption of conventional oil fired melting furnace	liters/tonne	130
Efficiency of existing oil fired furnace	%	10.20
Specific fuel consumption in conventional oil fired melting furnace	mkCal/tonne	1.21
Specific fuel cost in conventional oil fired melting furnace	Rs./Kg	3.60
Efficiency of energy efficient oil fired furnace	%	13.96
Specific fuel consumption in energy efficient oil fired melting furnace	liters/tonne	95
Specific fuel consumption in energy efficient oil fired melting furnace	mkCal/tonne	0.88
Specific fuel cost in Energy efficient gas fired melting furnace (@28Rs/liter)	Rs./Kg	2.66
Savings in specific fuel cost by using energy efficient oil fired furnace in place of conventional oil fired furnace	Rs./tonne	940
Annual production capacity	tonnes	200
Annual monetary savings due to installation of energy efficient oil fired melting furnace in place of conventional oil fired melting furnace	Rs.lakh/annum	1.88
Implementation cost of energy efficient oil fired furnace	Rs.lakh	4.00
Simple payback period	years	2.20

From the above table it is clear that replacement of conventional oil fired Brass melting furnace with energy efficient oil fired melting furnace is attractive in energy, economic and environmental point of view.

➲ Issues in implementation

- ➥ Lack of awareness on proposed energy conservation measure
- ➥ Non availability of suitable local service providers

3.4.9 Replacement of conventional rectifiers with energy efficient in electro plating units

➲ Background

From energy use and technology audit studies it was observed that presently a majority of electro plating units are using inefficient AC-DC rectifier for electro plating purpose. It is recommended to replace conventional inefficient rectifier with energy efficient rectifier.

Figure 3.12: *Operation of energy efficient rectifier in electroplating unit*

➲ Benefits of proposals

Major advantages of replacing the conventional rectifier with energy efficient rectifier in electroplating units are presented below:

- ➥ Reduction of energy cost
- ➥ More energy efficient
- ➥ Improved power factor
- ➥ Compact in size

➲ Cost benefits analysis

Cost benefits analysis of the replacing conventional rectifier with energy efficient rectifier in electroplating units is presented in table below:

Table 3.12: *Cost benefits analysis of replacing the conventional rectifier with energy efficient rectifier*

Parameter	Units	Value
Energy consumption of conventional rectifier with full load operation	kWh	7
Energy consumption of energy efficient rectifier	kWh	4.20
Energy saving due to replacing conventional rectifier with energy efficient rectifier	kWh	2.80
Annual operational hours of Rectifier	hours	1500
Annual energy saving due to replacement of conventional rectifier with energy efficient one	kWh	4,200
Annual monetary saving due to replacement of conventional rectifier with energy efficient one (@ Rs 6/kWh)	Rs. lakh/annum	0.25
Implementation cost of Energy efficient rectifier	Rs. lakh	0.4
Simple payback period	years	1.6

From the above table it is clear that replacement of conventional rectifier system with energy efficient rectifier system is attractive in energy and economic point of view.

➲ Issues in implementation

- ➥ Lack of awareness on proposed energy conservation measure
- ➥ Non availability of suitable local service providers

3.4.10 Replacement of conventional under loaded motors with suitable rating energy efficient motor in Hydraulic press

➲ Background

From energy use and technology audit studies it was observed that loading of motors installed in hydraulic press in majority of units is around 40-60%. Efficiency and power factor of under loaded motors is poor compared to full load of motor. It is recommended to replace the under loaded conventional motors with energy efficient motors of appropriate rating of motor.

➲ Benefits of proposals

Major advantages of replacing the conventional under loaded motors with suitable energy efficient motor in hydraulic press is presented below:

- ➥ Improved efficiency of hydraulic press
- ➥ Improved power factor

➲ Cost benefits analysis

Cost benefit analysis of replacing the conventional under loaded motors with suitable size of energy efficient motors in Hydraulic press is presented in table below:

Table 3.13: *Cost benefit analysis of replacing under loaded conventional motors with energy efficient motors of suitable rating in hydraulic press*

Parameter	Units	Value
Rating of motor in Hydraulic press	hp	150
Rated full load efficiency of existing motor	%	91
Full load rated efficiency of energy efficient motor (Eff1)	%	94.3
Energy consumption of conventional motors at existing load	kW	67
Power saving due to replacement of conventional motors with appropriate rating energy efficient motors	kW	2.34
Annual operational hours	hours	3,000
Annual energy savings	kWh	7,020

Parameter	Units	Value
Annual monetary savings (@6 Rs/kWh)	Rs.lakh	0.42
Investment required for replacement of conventional motors with energy efficient motors	Rs.lakh	1.5
Simple payback period	Years	3.57

From the above table it is clear that replacement of conventional under loaded motors with suitable size energy efficient motors is attractive in Energy, and Economic point of view.

➲ Issues in implementation

- ➥ Lack of awareness on proposed energy conservation measure

3.4.11 Replacement of conventional v belts with synchronous belts in various drives

➲ Background

V-belts have power transmission efficiency of only 93% resulting in a loss of 7% energy input due to inherent design problems of V-belts. It is recommended to replace the V-belts with energy efficient synchronous transmission belts, which have higher transmission efficiency of 98% compared to V-belts. The increase in efficiency of flat belts is due to superior material properties and operational characteristics.

➲ Benefits of proposals

- ➥ Synchronous belts offer longer life than conventional v belt system
- ➥ 20-50% narrower pulley widths compared to v belts pulleys
- ➥ High tensile strength and very high modulus viscosity
- ➥ Reliability of flat belts is good
- ➥ Less wear pulleys in flat belt system compared to V-belt system

➲ Cost Benefit analysis of proposal

Cost benefit analysis of replacing conventional V belts with energy efficient belts are presented in table below:

Table 3.14: ***Cost benefit analysis of replacing of conventional v belts with synchronous belts***

Parameters	Units	Value
Rating of the motor	hp	15
Input power consumption of the motor with conventional V belts	kW	10.20
Input power consumption of the motor with energy	kW	9.78

Parameters	Units	Value
efficient synchronous belts		
Electrical power saving after replacing the conventional V belts system with synchronous belts	kW	0.43
Annual operational hours of the motors	hours	4000
Energy savings due to installation of the synchronous belts in place of conventional belts	kWh	1700
Monetary savings (@ Rs. 6/kWh)	Rs.lakh	0.10
Investment required for replacing conventional v belts with energy efficient ones	Rs.lakh	0.10
Simple payback period	years	1

➲ Issues/barriers in implementation

- ➥ Lack of awareness on energy conservation measure
- ➥ Non availability of products in local market
- ➥ High cost in implementation

3.4.12 Installation of timers in cooling towers

➲ Background

From Energy use and technology audit studies it was observed that a majority of the cooling towers in extrusion plants are operates continuously irrespective of water temperature. It is recommended to install timers in cooling towers. These timers will switch on/off the cooling tower fans depending on water temperature.

Figure 3.13: ***Operation of cooling tower in typical Brass extrusion unit****Error! Bookmark not defined.*

➲ Benefits of proposals

Benefits of installing the timers in cooling tower system are presented below:

- ➥ Energy saving
- ➥ Uniform temperature of cooling water

➲ Cost Benefit analysis of proposal

Cost benefit analysis of installing timers in cooling tower system is presented in table below

Table 3.15: *Cost benefit analysis of installation of timers in cooling tower system*

Parameter	Units	Value
Rating of motor installed in cooling tower fans	kW	5
Operational hours per day without timer system	hours	10
Motor input power	kW	4.2
Operational hours per day with timer system	hours	8
Power saving due to installation of timers in cooling tower fan system	kWh/day	8.40
Annual energy saving due to installation of timers in cooling tower system	kWh/annum	2,520
Annual monetary saving after installation of timers in cooling tower system (@ Rs 6/kWh)	Rs. lakh/annum	0.15
Implementation cost	Rs.lakh	0.10
Simple payback period	years	0.67

From the above table it is clear that installation of timers in cooling tower system is financially attractive.

➲ Issues/barriers in implementation

- ➥ Lack of awareness on energy conservation measure

3.4.13 Replacement of conventional cooling tower system with energy efficient cooling tower system

➲ Background

From Energy use and technology audit studies it was observed that majority of the cooling towers fans are being used with Aluminium as material for manufacturing of

fan blades. It is recommended to replace the conventional cooling towers with energy efficient one.

➲ Benefits of proposals

Benefits of replacing the conventional cooling tower system with energy efficient cooling tower system is presented below:

- ➥ Energy saving
- ➥ Less noisy

➲ Cost Benefit analysis of proposal

Cost benefit analysis of replacing conventional cooling towers with energy efficient cooling tower system is presented in table below

Table 3.16: ***Cost benefit analysis of replacing conventional cooling tower system with energy efficient cooling tower system***

Parameter	Units	Value
Rating of motor installed in cooling tower fan	kW	5
Input power of cooling tower fan with conventional cooling tower blades	kW	4.20
Input power of cooling tower fan with energy efficient blades	kW	3.10
Annual operational hours	hours	3,000
Power saving due to energy efficient cooling tower inplace of conventional cooling tower	kW	1.10
Annual energy saving due to replacement of conventional cooling tower with energy efficient cooling tower	kWh/annum	3,300
Annual monetary saving after Replacing conventional cooling tower system with energy efficient one (@ Rs 6/kWh)	Rs. lakh/annum	0.20
Implementation cost	Rs.lakh	0.30
Simple payback period	years	1.50

From the above table it is clear that replacement of conventional cooling tower system with energy efficient cooling tower system is financially attractive.

➲ Issues/barriers in implementation

- ➥ Lack of awareness on energy conservation measure

3.5 AVAILABILITY OF TECHNLOGY SUPPLIERS/LOCAL SERVICE PROVIDERS FOR IDENTIFIED ENERGY CONSERVATION PROPOSALS

Technology suppliers/local service providers for identified major energy saving proposals mentioned in above sections in cluster are available in cluster, except few of the new developed proposals.

Details of the identified technology supplier/local service providers in Jamnagar Brass cluster are furnished in Annexure-2 and same is attached along with this report.

3.6 IDENTIFIED TECHNOLOGIES FOR DPR PREPARATION

From energy use and technology audit studies carried out in Jamnagar Brass cluster, it became apparent that the equipments/utilities installed are of inefficient, inferior quality, poor safety and consuming more energy. There is considerable potential in all cluster units for energy conservation by replacing the old/obsolete technology/equipments with energy efficient technologies/equipments.

As the process and equipments are more or less similar in all cluster units in Jamnagar Brass cluster, all the technologies/equipments identified can be replicated as per the requirement of the units and detailed project reports for the specific technologies prepared also can be replicated in different chemical units as per the capacity requirement. The following technologies/equipments were considered for preparation of detailed project report.

- Coal fired melting furnace
- Reheating furnace
- Oil fired melting furnace
- Moulding system
- Fuel switching options in melting
- Fuel switching option in Reheating furnace

3.6.1 Justification for technologies/equipments identified for DPR preparation

Energy saving potential and replication potential in percentage of number of units of identified technology up gradation projects are presented in table below.

Table 3.17: ***Energy saving potential and replicability of identified technology up gradation projects***

Area for Technology up gradation	Existing technology	Technology up gradation measure	Energy saving potential (%)	Replicability potential in no of units	Replicability potential in cluster of total units (%)
Melting system	Conventional coal fired pit furnace	Energy efficient gas fired furnace	25-35	595	17
		Rotary based gas fired furnace	30-50	140	4
Reheating furnace	Conventional reheating furnace system	Energy efficient oil fired redesigned reheating furnace	30	105	3
		Energy efficient gas fired reheating furnace	30-40	140	4
Moulding system	Sand gravity based casting system	Continuous casting system	15-25	525	15
		Low pressure die casting system	20-30	105	3
Melting system	Conventional oil fired pit furnace	Energy efficient oil fired pit furnace	30-40	35	1

Environmental Benefits

In this chapter various environmental benefits after implementation of proposed energy conservation measures are discussed in this chapter.

4.1 GHGS REDUCTION

All proposed energy conservation measures will have less energy consumption or fuel consumption compared to conventional/existing system; this automatically leads to reduction of GHGs emissions. Reduction of GHGs emissions leads to improved environment and better compliance with environmental regulations

Major GHGs emission reduction due to saving of grid electricity and fuels is CO_2, reduction of other GHGs are negligible. Annual GHGs reduction potential identified in cluster is around 90142 tonnes of CO_2.

4.2 IMPROVED WORKING ENVIRONEMNT

Due to overall improvement in working condition, as no direct exposure to heat & poisonous fumes would reduce the health issues of working environment and surrounding population would improve substantially.

Conclusion

5.1 SUMMARY

In this section summary of outcome of energy use and technology studies conducted in Jamnagar Brass cluster is discussed, which include identified energy conservation measures, its energy & monetary benefits, payback period, issues in implementation are discussed. Details of the same are furnished in table below:

Table 5.1: *Summary of energy saving proposals in Jamnagar Brass cluster*

S. No	Energy conservation measure	Annual Energy/Fuel saving	Annual Monetary saving (Rs. lakhs)	Implementation cost (Rs. Lakhs)	Simple payback period (Years)	Issues in implementation	Short listed for DPR preparation (Yes/No)	No of units this can be implemented	Annual energy saving potential in cluster
1	Replacement of conventional Reheating furnace with energy efficient reheating furnace	7,000 liters of furnace oil	1.96	4	2.04	▪ Lack of awareness on EC measure ▪ Cost of implementation	Yes	120	840,000 liters of furnace oil
2	Installation of Air-fuel control system in conventional reheating furnace	3000 liters of furnace oil	0.84	0.3	0.34	▪ Lack of awareness EC measure ▪ Cost of implementation	No	90	270,000 liters of furnace oil
3	Improving the insulation of reheating furnaces	1,850 liters of furnace oil	0.52	0.75	1.4	▪ Lack of awareness EC measure	No	80	148,000 liters of furnace oil
4	Installation of temperature gauges in reheating furnace	900 liters of furnace oil	0.25	0.2	0.8	▪ Lack of awareness EC measure ▪ Non availability of local service provider	No	100	90,000 liters of furnace oil

S. No	Energy conservation measure	Annual Energy/Fuel saving	Annual Monetary saving (Rs. lakhs)	Implementation cost (Rs. Lakhs)	Simple payback period (Years)	Issues in implementation	Short listed for DPR preparation (Yes/No)	No of units this can be implemented	Annual energy saving potential in cluster
5	Improving the insulation of coal fired brass melting furnace	5,700 Kg of coal	1.02	0.3	0.3	▪ Lack of awareness EC measure ▪ Non availability of suitable local service provider	No	700	3,990,000 Kg of coal
6	Replacement of conventional coal fired furnace with gas fired furnace	76.4 mkCal	3.4	2.5	0.74	▪ Lack of awareness EC measure ▪ Non availability of suitable LSP ▪ New development	Yes	595	45,458 mkCal
7	Replacement of conventional coal fired pit furnace with Rotary furnace	114 mkCal	4.2	12	2.9	▪ Lack of awareness EC measure ▪ Non availability of suitable LSP ▪ New technology development	Yes	140	15,960 mkCal
8	Replacement of conventional oil fired pit furnace with energy efficient oil fired furnace	7,000 liters of Furnace oil	1.88	4	2.2	▪ Lack of awareness EC measure ▪ Non availability of LSP	Yes	35	245,000 of furnace oil
9	Replacement of conventional rectifiers with energy efficient in electro plating units:	4,200 kWh	0.25	0.4	1.6	▪ Lack of awareness EC measure ▪ Non availability of suitable LSP	No	200	840,000 kWh
10	Replacement of conventional under loaded motors with suitable rating energy efficient motor in Hydraulic press	7,026 kWh	0.42	1.5	3.57	▪ Lack of awareness EC measure ▪ Non availability of suitable LSP	No	120	843,120 kWh
11	Replacement of conventional	1,700 kWh	0.102	0.1	1	▪ Lack of awareness EC	No	1500	2,550,000 kWh

S. No	Energy conservation measure	Annual Energy/Fuel saving	Annual Monetary saving (Rs. lakhs)	Implementation cost (Rs. Lakhs)	Simple payback period (Years)	Issues in implementation	Short listed for DPR preparation (Yes/No)	No of units this can be implemented	Annual energy saving potential in cluster
	v belts with synchronous belts in various drives					measure ▪ Non availability of suitable LSP			
12	Installation of timers in cooling towers	2,520	0.15	0.1	0.67	▪ Lack of awareness EC measure	No	120	302,400 kWh
13	Replacement of conventional cooling tower system with energy efficient cooling tower system	3,300	0.2	0.3	1.5	▪ Lack of awareness EC measure ▪ Non availability of LSP	No	120	396,000 kWh

5.2 SUMMARY OF LEVEL OF AWARENESS ON ENERGY EFFICIENCY AND ENERGY CONSERVATION PRODUCTS IN THE CLUSTER

Level of awareness on energy efficiency and energy conservation products in the Jamnagar Brass cluster is poor, due to below mentioned reasons.

- Lack of awareness on the Energy efficiency
- Lack of organizational commitment
- Narrow focus on Energy
- Not clear about their existing level of operations and efficiency, due to lack of instrumentation & non availability of Energy consumption data
- Limited manpower
- Lack of trained manpower
- Limited information on new technologies
- Cost of Energy conservation options

Major energy sources being used in cluster are Coal, Furnace oil and Electrical energy. Annual energy consumption of above mentioned sources in different type of operations in Jamnagar cluster is presented in table below:

Table 5.2: *Annual energy consumption of various energy sources in Jamnagar Brass cluster*

S. No	Type of Unit	Electrical energy consumption (kWh/annum)	Coal consumption (tpa)	Furnace oil consumption (liters per annum)
1	Extrusion	118,872,125	Not Applicable	5,520,000
2	Foundry	465,920	44,132	Not Applicable
3	Machining	56,702,100	Not Applicable	Not Applicable
4	Electroplating	10,490,550	Not Applicable	Not Applicable
	Total	186,530,695	44,132	5,520,000

Total Annual energy consumption in the cluster is around 66,775 MTOE (Tonnes of Oil Equivalent). After implementation of proposed energy conservation measures will save the 4,931,520 kWh of electrical energy, 44,132 tonne of coal and 1,085,000 liters of furnace oil. **Annual energy saving potential identified in cluster is around 8,005 MTOE, which is around 11.9% of total energy consumption.**

Detailed Technology Assessment Report

Most of the chemical industries in Jamnagar Brass cluster has these characteristics, those are low engineering, limited technology innovation and poor R&D base as well as low level of human resource on knowledge of technology, operational skill etc. This sector also faces deficiencies such as the lack of access to technology and technology sharing and the inadequacies of strong organizational structure, professional attitude etc.

Comprehensive Study conducted at different types of Brass units in Jamnagar Brass cluster to assess the technology gap in different processes and utilities. Following technical gaps are observed during our study:

- The state of art of technology of the unit for some of the equipments installed is poor as compared to technologies available in market. There are various technological gaps were identified in Brass units as under technology audit studies and these may be due to lack awareness on the technologies available, quantum of energy loss and its monetary benefit, lack of awareness among workforce etc.
- There is tremendous need for this industry to modernize/upgrade its technology and adopt energy efficient technologies in some of the areas. Further, as per the discussions made with the management, they are interested in improve the efficiency of the plant by adopting this type of technology instead of going for retrofit options in the existing equipments.

The various factors which influence the management towards implementation energy efficiency and energy conservation projects in Brass units in Jamnagar Brass cluster are:

- Energy efficiency and energy conservation is a low cost investment option which reduces energy consumption
- Low capital investment
- The energy efficiency improvement will enhance the plant management to be competitive in local and global markets by reducing production cost
- To conserve depleting fossil fuels
- The energy efficiency and conservation reduces GHG emissions because of low carbon dioxide and particulate emissions
- Energy efficiency and conservation is a viable strategy to meet future energy needs of the expanding plans in the industry
- The energy efficiency and conservation places no financial and administrative burden as no separate manpower is required and only training of operation and maintenance of the technologies adopted is envisaged
- The return on investment is attractive with lower pay back periods.

From technology audit studies conducted in Jamnagar Brass cluster, below mentioned areas were identified for technology up gradations; those are:

- Conventional pit furnaces for Brass melting
- Conventional reheating furnaces
- Moulding system
- Fuel switching options in melting furnaces
- Fuel switching options in reheating furnaces

Technical gap analysis in above mentioned areas is presented in below sections:

➲ *Conventional Oil fired pit furnaces*

Technology gaps/design flaws in conventional coal fired pit furnace system are identified and described the details below:

- **Waste heat recovery system**: in energy use and technology audit studies it was observed that, there is no waste heat recovery system to recover the heat losses from hot flue gasses in pit furnaces. Major percentage of heat is lost in flue gasses in pit furnaces, this amount to around 40% of total energy input.
- **Preheating of charge/air**: In majority of the systems it was observed that, there is no system for preheat of charge/air. By preheating of charge to around 200-300 deg c will reduce the energy consumption by 5-8%.
- **Use of poor insulating material:** Furnace lining of the existing furnace was done with the locally available firebricks. The firebricks with low alumina content tend to get worn out in a short duration to a high extent. Also, the insulation required for plugging heat loss through the pit furnace was usually done with locally available red bricks, which do not serve the purpose of insulation.
- **Inadequate volume for combustion and hot gases:** In majority of the units are observed combustion space in existing system is not sufficient for proper combustion, which causes poor combustion system efficiency**.**
- **Improper location of burner**
- **Poor capacity and scientifically designed burner:** Majority of units are using locally fabricated burners for the combustion of fuel oil. These burners were either a far copy of a properly designed burner or sometimes substandard and locally designed. Many a times, oil could be seen leaking from the burner joints. Same types of burners were used for a large range of fuel flow rates irrespective of fuel flow requirement.
- **Poor mixing of material in crucible:** In Majority of the cases it was observed that, due to air pockets between dust &ware; heat transfer between metal to metal contact is poor, this cause's thermal ingredient top and bottom portion. This is affecting the efficiency as well as burning loss in furnace.

- **Poor selection and size of Blower system:** A proper capacity blower is necessary for combustion air to be delivered at correct pressure and in appropriate volume. The existing blowers in the Majority of the units are either locally fabricated without any proper design parameters or are under/over- sized without any consideration for correct air pressure.
- **Inadequate sizing of heating and pumping unit:** In most of the units it was observed that heating and pumping system are not designed properly. This is mainly due to lack of awareness about the standard oil temperature and pressure at the combustion stage and the benefits thereof.

➲ *Conventional coal fired Pit furnaces*

Technology gaps/design flaws in conventional coal fired pit furnace system are identified and described the details below:

- **No heat recovery system**: From energy use and technology studies it was observed that, there is no heat recovery system to recover the heat from hot flue gasses in coal fired pit furnaces. Major percentage of heat is lost in flue gasses in pit furnaces, which amounts to 35-45% of total input energy; which causes the poor efficiency of pit furnaces.
- **Use of poor insulating material:** Furnace lining of the existing furnace was done with the locally available firebricks. The firebricks with low alumina content tend to get worn out in a short duration to a high extent; which do not serve the purpose of insulation.
- **Preheating of charge/air**: In majority of the systems it was observed that, there is no system for preheat of charge/air. By preheating of charge to around 200-300 deg c will reduce the energy consumption by 5-8%.
- **Poor mixing of material in crucible:** In majority of the cases it was observed that, due to air pockets between dust &ware; metal to metal contact and transfer of heat is poor, this cause's thermal ingredient top and bottom portion. This is affecting the efficiency as well as burning loss in furnace.
- **Working environment is not safe:** During pouring operation operators are directly exposed to high temperature furnace**.**
- **No dust collection system**

➲ *Conventional oil fired reheating furnaces (Billet heaters)*

Technology gaps/design flaws in conventional oil fired reheating furnace system are identified and details are described below:

- **Poor Air-Fuel ratios:** From energy use and technology studies it was observed that, air fuel ratio is not proper. Due to poor designed control system of air-fuel ratios. It is effacing the furnace efficiency.

- **Location of chimney:** In majority of industries, chimney was located at centre of reheating furnaces; this causes the poor heat transfer between Flue gasses and charge; this automatically leads to poor heat transfer efficiency between flue gas and reheating material.
- **Waste heat recovery system**: This is the one of the area where major amount of heat energy is lost, in majority of the units are not installed waste heat recovery system to recover the heat from flue gasses. Few cases it was observed that efficiency of existing waste heat recovery system is poor. Around 35% of heat input energy is loss in the flue gasses.
- **Preheating of charge/air**: In majority of the systems it was observed that, there is no system for preheat of charge/air.
- **Use of poor insulating material:** Furnace lining of the existing furnace was done with the locally available firebricks. The firebricks with low alumina content tend to get worn out in a short duration to a high extent. Also, the insulation required for plugging heat loss through the pit furnace was usually done with locally available red bricks, which do not serve the purpose of insulation.
- **Improper location of burner**
- **Poor capacity and scientifically designed burner:** Majority of units are using locally fabricated burners for the combustion of fuel oil. These burners were either a far copy of a properly designed burner or sometimes substandard and locally designed. Many a times, oil could be seen leaking from the burner joints. Same types of burners were used for a large range of fuel flow rates.
- **Poor selection and size of Blower system:** A proper capacity blower is necessary for combustion air to be delivered at correct pressure and in appropriate volume. The existing blowers in the majority of the units are either locally fabricated without any proper design parameters or are under/over- sized without any consideration for correct air pressure.
- **Inadequate sizing of heating and pumping unit:** In most of the units it was observed that heating and pumping system are not designed properly. This is mainly due to lack of awareness about the standard oil temperature and pressure at the combustion stage and the benefits thereof.

➲ *Sand gravity based moulding system*

- **Poor quality of product**: In Energy use and technology audit studies it was observed that quality of product from sand gravity based molding system is poor compared other technologies available in market.

- **Rejection of material is more:** Around 10-20% of final casting is rejected due to Improper mixing of sand, variation moisture content in sand, improper making of Moulding system etc.
- **Limitation in product manufactured from sand gravity based casting system**:
- **Pouring time is more:** This reduces the productivity
- **More metal loss:** Manual pouring of molten material in molding system will take around 45min; this will increases fuel consumption and metal loss.
- **Working environment is not safe:** During pouring operation operators are directly exposed to high temperature furnace**.**

Annexure 2

Details of Technology / Service Providers in Jamnagar Brass Cluster

S. No	Name of company	Contact person	Address of company	Technology / service provider for
1.	Sujata Machine tools	Dayaljibhai P.Nakum	Opp: Ravi Petrol Pump, Rajkot Highway, Jamnagar	❖ All kinds of machine tools and machines used in Machining operation
2	Wesman Thermal Engineering Processes Private Limited	Shyamalesh Kar	503-504 Eros Apartment, 56 Nehru Place, New Delhi-India	❖ Oil & Gas fired Burners ❖ Blower ❖ Heating& Pumping unit ❖ Reheating furnace
3	Parshottam Dayalji & Co.	Atul/Kiran	Sp shed no55, Shankar tekri, Udyognagar, Jamnagar	❖ Ancillary for all kinds of Brass foundry units ❖ Moulding and pouring equipments
4	Vishnu Crucible Pvt Ltd (Vesuvius)	Suresh Khattar	A-38, GIDC,S.T Udyognagar, Jamnagar	❖ Silicon Graphite crucible
5	Applied machine tools	M.K. Dudhaiya	Plot no. 500/D, G.I.D.C, Shankar tekri, Udyognagar, Jamnagar	❖ All kinds of machine tools and machines used in Machining operation
6	REW Rolex Engineering works	Rameshbhai P. Parmar	Plot no, 515/3, Nr. Bank of Baroda, Shankar tekri, Udyognagar, Jamnagar	❖ Mould systems
7	Coal trader	Navin bhai	Shankar Tekri, Udyognagar, Jamnagar	❖ Coal
8	MICO Hydraulics	Prakash R.Parti	215/2, GIDC, Phase-II, DARED, Jamnagar	❖ Hydraulic system ❖ Reheating furnace
9	AVANI Electronics	Ramesh Bhai	27, shreeji Industrial Estate, Near Ajanta Clock, Rajkot Highway, Morbi-363641	❖ Digital Rectifier
10	Kelvin Machine tools	Krishnakanthbhai/ Bharat bhai	Shankar Tekri, Udyognagar, Jamnagar	❖ All kinds of machine tools and machines used in Machining operation
11	M/s Supersonic	Prashant Vanjare	H.O.26, 27, 50 New Satguru Nanik Industrial Estate Western Express Highway, Goregaon (E) Mumbai: 400063 Fax: 26854296 Tel: 26854322/4926/5212	❖ Ultrasonic cleaning machine

Techno Commercial Bids from Service/Technology Provider

1. Gas fired Pit furnace:

EM EM ENGINEERS

Address: A-4/235, Paschim Vihar, New Delhi-110063 (INDIA)

Ref: Date: 24-May-10

M/s Winrock International India,
788, UV-Phase V, Gurgaon,
Haryana, India.

Kind Attn: Mr. Sripal Rao

Subject: Gas Fired Brass Melting Furnace.

Dear Sir,

As per our discussions please find attached our offer for Gas heated Brass Melting Furnace

TECHNICAL DATA

Capacity	:	To accommodate Crucible of capacity 250 – 300 Kgs of Brass.
Max. temperature	:	1050 Deg. C
Normal	:	950 Deg. C
Fuel	:	Gas (Pl specify NG or LPG)
Thickness of outer shell	:	5 mm M.S.
Thickness of top plate	:	12 mm
Type of Insulation	:	Energy saving Ceramic Fibre Blankets along with refractory bricks at bottom of the furnace and element holding bricks.
Price with Silicon Carbide Crucible and Automatic Temperature Control Panel.	:	Rs.2,60,000/- (Rs. Two Lac Sixty thousand only) each, ex-our works, New Delhi

DESCRIPTION

The Furnace consists of Indigenous Silicon carbide Crucible enclosed with a refractory / ceramic fibre chamber.

The outer casings of the equipment is made out of substantial steel framework with welding and screw joints wherever required.

SCOPE OF SUPPLY

FURNACE DULY LINED WITH CERAMIC FIBRE BLANKETS, REFRACTORIES, FITTED WITH 1 NO. AUTOMATIC TEMPERATURE CONTROL PANEL, 1 NO. SILICON CARBIDE CRUCIBLE.

Trust you will find our offer in line with your requirement. However if you need any further information / clarification, please get in touch with us and we would be pleased to attend to the same.

We assure you of our best services at all times.

Thanking you

Yours Truly

For **EM ENGINEERS**

(MANISH KUMAR SOOTA)
BE (MECH), MBA

GENERAL TERMS & CONDITIONS

PRICES

Prices quoted by us are ex-our works, Delhi

PAYMENT

50% value of the order will be payable as advance along with the order and balance upto 100% value of each consignments along with full value of taxes, duties and any other levies as applicable at the time of dispatch will be payable against the Performa invoice prior to dispatch.

PACKING & FORWARDING

The charges shall be extra at actual.

INSURANCE

If desire by the customer we can cover the goods to be dispatched against transit insurance at an additional charge of 0.75% of the insured value.

TAXES & DUTIES

Central / State Government Sales Tax, Octroi and /or other statutory levies as applicable at the time of delivery will be charged extra and to be borne by the client. At present Central sales tax in is 2% against form 'C' OR 12.5% VAT whichever is applicable.

EXCLUSIONS

Our services does not include any civil engineering works such as Water Tank, Baskets, cabling from main to panel, panel to transformer, transformer to furnace, Water connections, other utility connections, pipe lines etc. although consultancy regarding the above jobs can be given or any other item not specifically mentioned in our offer.

ERECTION & COMMISSIONING

The equipment will be completely assembled and will be ready for use prior to dispatch from our works. There are only to be installed at client's premises with the various utility connections like power, oil line, water etc. as applicable. These connections will have to be done by the client we shall however, provide necessary drawings, instructions and manuals. In case the client desires the visit of our engineer for the commissioning of these ready assembled equipment we can dispatch our Engineer on chargeable basis. Our charges for the visit of our Engineer will be Rs. 1,500/- per day, including his days of travel, both To & fro Third AC Railways fare, both ways, local conveyance, lodging boarding expenses at actual.

For safety and better performance of our equipment, we recommend making use of our engineer's services.

DELIVERY

The delivery will be done within 4-6 weeks, subject to delays due to reasons beyond our control. All delivery schedule subject to delays by customers for payment, drawing approval and other obligations by customer.

During erection and commissioning of equipment, the services of unskilled labour, gas cutting /welding sets, standard tools, chain pulley /crane, suitable material handling facilities, water supply, power and /or other utility, oil/gas supply have to be provided free of cost by the client.

2. QUOTATION FOR ULTRASONIC CLEANING SYSTEM MODEL – 1000 WATTS

1.	Power Input	:	230V Single Phase AC supply.
2.	Ultrasonic Power	:	1000 watts.
3.	Frequency	:	25 ± 3 KHZ.
4.	Ultrasonic Generator	:	Solid state module in the machine structure. Cooling is achieved by inbuilt cooling fans. The Circuit is having safety protections like movs & diodes. Control panel is having safety fuses along with indication for generators & switches. Panels are duly powder coated.
5.	Transducer	:	PZT sandwiched type, bonded at the front of the tank with a special weldbond technique.
6.	Tank dimension	:	16”x 16” x 26” (LxBxH)
7.	Tank capacity	:	102 liters
8.	Tank Material	:	Stainless steel 316 grade 16 s.w.g sheet metal fabrication of high quality, round corners, buffed & polished surfaces. All joints are argon arc welded.
9.	Heater	:	1.5 kw x 2nos. heaters are provided. controlled thermostatically.
10.	Tank cabinet	:	Panels are powder coated.
11.	Lid	:	Lid fabricated out of stainless steel sheet is provided on top of the tank.
12.	Drain	:	1” BSP Ball valve is provided for draining of the tank.

BUSINESS TERMS

Basic Price	:	Rs. 1,05,000/- (Rs. One Lakh Five Thousand Only)

QUOTATION FOR ULTRASONIC CLEANING SYSTEM – 1500 WATTS

1.	Power Input	:	415 V Three Phase AC Supply.
2.	Ultrasonic Power	:	1500 Watts.
3.	Frequency	:	22 ± 3 KHz.
4.	Ultrasonic Generator	:	Solid state module in the machine structure cooling is achieved by inbuilt cooling fans. The circuit is having safety protections like Moves and diodes. Control panel is having Safety fuses along with indication for Generators and switches. Panels are duly powder coated.
5.	Transducer	:	PZT sandwiched type, bonded at the front & back side of the tank with a special weld bond technique.
6.	Tank dimension	:	18” x 18” x 30” (LxBxH)
7.	Tank capacity	:	150 Liters
8.	Tank material	:	Stainless Steel 316 grade 16 s.w.g. sheet metal fabrication of high quality, round corners, buffed and polished surface. All joints are argon arc welded.
9.	Tank cabinet	:	Panels are duly powder coated.
10.	Heater	:	2 KW x 2 nos heaters are provided, controlled thermostatically.
11.	Lid	:	Lid fabricated out of stainless steel sheet is provided on top of the tank.
12.	Drain	:	Ball valve is provided for draining of the tank.

BUSINESS TERMS

Basic Price	:	Rs. 1,48,000/- (Rs. One Lakh Forty Eight Thousand Only)

Policy guidelines/subsidy schemes available with State governments for improving energy efficiency in cluster

1. Energy audit subsidy scheme by GEDA (Gujarat Energy Development Agency)

The Gujarat Energy Development Agency (GEDA), is nodal Agency established by the Government of Gujarat for promoting use of renewable energy sources and energy conservation in Gujarat. GEDA is also the State Designated Agency for implementing the Energy Conservation Act-2001(EC Act) enacted by the Govt. of India. Promotion of energy efficiency in the industrial and buildings sector form one of the major mandates of the EC Act as it has tremendous potential for improvement.

There is a potential for conserving 30-40% energy in some key industrial clusters. Absence of systematic energy monitoring mechanism is a major factor that is responsible for a large amount of unproductive energy utilisation in industries. GEDA's Energy Audit Scheme provides financial assistance as well as technical expertise through trained & experienced energy expert, to industries and building owners for analysing their energy usage and to increase their profits through achievement of higher energy efficiency.

Energy audits of industrial units, commercial complexes, hotels and hospitals are covered under this subsidy scheme. The subsidy will cover upto 50 % cost of the Energy Audit Study (EAS), upto a maximum of Rs.20, 000/-. Industries with a electrical CD of less than 200 kVA and commercial complexes with a electrical CD less than 75 kW would only be eligible for subsidy under this Scheme.

During the year 2009-10 subsidy shall be provided to 250 industries and commercial buildings , qualifying the eligibility norms of the scheme, on first-come-first-served basis.

Procedures for Applying For Subsidy

1. An industry willing to avail subsidy is required to apply in the format in Form I. Services of GEDA authorized Energy Audit Consultant engaged may be taken for applying procedures.

2. Application should be submitted to GEDA office alongwith
   - Proposal of the Energy Audit consultant engaged by the industry - financial offer & scope of study.
   - Latest Annual Report of the Industry applying for subsidy.

3. Subsidy sanction issued by GEDA would indicate subsidy amount; elaborate scope of study; duration of study (with last date for report submission) and Terms & conditions of sanction.

Procedures for Claiming Subsidy

1. Submission of one copy of draft Energy Audit Report, alongwith industry's comment, to GEDA before the specified last date.
2. Formal presentation of the report by the Consultant, in presence of GEDA representative and the concerned executives from the industry. The presentation to be arranged in the premises of the Industry, with prior intimation, on a mutually convenient date.
3. Acceptance of the EA Report, with modifications, if any, after the formal presentation.
4. Submission of 2 copies Final Report, spirally or comb bound, alongwith the Declaration (as per Form II) duly signed/sealed, proof of payment made to the Energy Audit Consultant for the EA study and implementation energy conservation measures suggested in the report with time schedule, estimates of savings and investments required.

Terms and Conditions of EAS Subsidy Sanction

1. The scope of the EA Study would be as specified by GEDA in its sanction.
2. The work eligible for the EAS subsidy would include assessment of energy use in the industry, outline of cost-effective measures, scope of energy saving, estimates of investments for implementation of corrective measures suggested, payback periods and reporting of results of these activities. Other works, in particular tariff comparison and analysis, preparation of tender specifications and tender evaluation, detailed design work, work connected with implementation of measures and long term Consultancy work **are not eligible for subsidy under the scheme.**
3. Any industry within the Gujarat will be eligible for availing subsidy under this scheme 'once' provided the industry has not availed subsidy under any other government scheme.
4. Energy audits conducted by GEDA authorized energy audit consultants will only be valid for availing subsidy under this scheme.
5. The energy audit must be conducted as per the scope defined in GEDA's sanction letter. Any deviation in the specified scope of study will result in cancellation of the subsidy.
6. The industry must forward the draft report to GEDA with its comments. A formal presentation of the report by the energy audit consultant, in the premises of the industry should be arranged in the presence of GEDA official(s) and concerned executives from within the industry. **Only after the Presentation and discussion the report will be accepted.**

7. The claim for subsidy is subject to the sanction issued by GEDA. Any claim without a prior sanction of GEDA would not be entertained. All payments made by the industry to the Energy Audit Consultant should be done so by cheque or demand draft only.

8. It is mandatory for the industry to implement EC measures so as to achieve atleast 20% of the financial saving projected in the Final Report.

9. GEDA shall follow up on the post-audit implementation by the industry, with either a written communication or a personal visit by its representative to the industry. The industry would be obliged to respond positively to such visits and/or correspondences.

10. GEDA reserves the right to reject an application for EAS subsidy without giving reasons and to change the terms and conditions of the scheme and to terminate the scheme at any time.

11. The Energy Audit Report would be a confidential document. However, GEDA reserves the right to use and publish data and information generated during the study, for dissemination to other similar industries. The industry may have the option of not indicating its name on the Report. In such cases GEDA's sanction number & date should be mentioned in the Report.

12. If the study is not completed within the specified time limit, GEDA may decide to cancel the subsidy. However, extension, if required, may be requested, before the due date of reporting, stating reasons for the extension.

13. **Terms of Payment of Energy Audit Subsidy**

GEDA shall release subsidy amount directly to the industry against submission of two copies of the Final Report. The industry shall submit the subsidy claim letter alongwith `Declaration' (Form II) and proof of payment released to the Energy Audit Consultant. The subsidy would be disbursed as follows:

- 50% against submission of Final Report
- 50 % against submission of the post-audit Feedback Report, duly certified jointly by the industry and the Energy Audit Consultant. Payment can be claimed a within one month from the date of submission of the Final Report

For further assistance please contact:
Sr. Project Executive / Project Executive,
Gujarat Energy Development Agency,
4th Floor, Block No 11-12, Udyog Bhavan,
Sector-11, Gandhinagar.

2. Assistance for Environment Management to MSMEs

Assistance for environment Management to MSMEs

1 Name of the Scheme

Scheme of assistance for Environment Management to MSMEs.

2 Operative Period

From 11/06/2009 to 10/06/2014

3 Who is eligible to get the benefit ?

Any MSME unit engaged in manufacturing and who intends to set up facilities for waste management/ pollution prevention and abatement will be eligible for assistance under this Scheme.

4 Eligible Activities

The following facilities setup with application of Innovative / State of art technology will be considered as an eligible activity:

- Substitution & Optimization of raw material including catalysts
- Rainwater harvesting
- Any other pre-identified environment management project
- Implementation of cleaner production and clean technology measures, etc.

5 Assistance available

The following quantum of assistance shall be provided:

S.N	Eligible Activity	Quantum of Assistance per project
A	Substitution & Optimization of raw material including catalysts	Upto 25% of cost of plant & machinery; ceiling of Rs 10 lakh per project.
B	Rainwater harvesting	Upto 50% of cost of fixed capital investment ; ceiling of Rs 5 lakh per project
C	Any other pre-identified environment management project	Upto 25% of cost of plant & machinery; ceiling of Rs 10 lakh per project
D	Implementation of cleaner production and clean technology measures, etc.	Upto 50% of cost of plant & machinery; ceiling of Rs 10 lakh per project.

The quantum of assistance under activity at sr. no A and D would be decided by State Level Committee, on the basis of scrutiny of the project report of the eligible activity to be carried out by the Gujarat Cleaner Production Center (GCPC). The quantum of

assistance under activity at sr. no C would be decided by State Level Committee, and the quantum of assistance of activity at sr. no. B will be decided by District Level Committee.

6 Check List

S. N	Particulars	Remarks
1.	Copy of legal status of applicant such as memorandum of article and company registration certificate or partnership deed or registration under society act / trust act etc. and list of directors/partners with addresses.	
2.	Copy of land allotment by GIDC/ sale deed land & copy of 7/12	
3.	Copy of IEM NO. /EM No./Regn.No.	
4.	GPCB NOC/ CONSENT for establishing project	
5.	Please submit detailed project report as applicable.	
6.	Process Diagram of proposed Project.	
7.	Implementation Schedule	
8.	Copy of any other financial assistance granted by GoG and/or GoI for same component or project	
9.	Declaration as per application	
10.	Affidavits regarding any outstanding Government dues and any pending court case against Govt.	

7 Procedure

1. The unit will have to apply to IC/concerned DIC prior to the implementation of the project in prescribed format for assistance along with documents as specified in check list, within one year from the date of issue of quality certificate.
2. On receipt of application with all details, IC/DIC Office will scrutinize the application and submit to the committee for decision within 60 days.
3. After the decision of the committee IC Office will convey the decision within 8 days.
4. The applicant will submit detail expenditure to IC office and/or concerned DIC. DIC will carry out site visit, verify the assets and expenditure incurred and submit the report to IC office within 30 days.
5. IC Office will issue pay order within 15 days and amount will be disburse as per availability of grant.

8 Contact officer for further details /query

Name : MR. N.M. Trivedi
Designation: Dy. Commissioner of Industries (Incentive)
Address : Block No. 1, 6th Floor, Udyog Bhavan, Sector 11, Gandhinagar-382 017
Phone : + 91 79 23252594, 23252588
E-mail : icinc@gujarat.gov.in

Assistance to encouraging Green practice and environmental audit to MSMEs

1 Name of the Scheme

Scheme for assistance to encouraging "Green" practices and environmental audit to MSMEs.

2 Operative Period

From 11/06/2009 to 10/06/2014

3 Who is eligible to get the benefit ?

Eligible Unit means any MSME engaged in manufacturing and who intends to encourage green practices in its unit.

4 Eligible Activities

1. Use of Clean, Efficient and Innovative Pollution Control Equipments in industries
2. Periodic Environmental Audits except those covered under Rules and Judgments
3. Encouraging Environment Management System – setting up of Environment Management Cell
4. Purchase of new equipments/ systems related to safety, occupational health for a cluster of industries (minimum 10 industries in a cluster)
5. Installation of Solar System leading to at least 5% energy saving

5 Assistance available

The following quantum of assistance shall be provided:

S.N	Eligible Activity	Quantum of Assistance per project
A	Use of Clean, Efficient and Innovative Pollution Control Equipments in industries	Upto 25% of cost of equipments; or maximum Rs. 2.5 lakh/ Units
B	Periodic Environmental Audits except those covered under Rules and Judgments	Upto 50% of fees of audit services; or maximum Rs.25,000/ audit

C	Encouraging Environment Management System – setting up of Environment Management Cell	Upto 25% of cost of equipments; or maximum Rs 5 lakh/ plant once in a lifetime
D	Purchase of new equipments/ systems related to safety, occupational health for a cluster of industries (minimum 10 industries in a cluster)	Upto 25% of cost of equipments; or maximum Rs 25 lakh/ cluster. The assistance under the scheme will be provided to industrial association or SPV formed by the Industrial Units.
E	Installation of Solar System leading to atleast 5% energy saving	Upto 25% of cost of system; Rs 2.5 lakh / plant

6 Check List

S. N	Particulars	Remarks
1.	Copy of legal status of applicant such as memorandum of article and company registration certificate or partnership deed or registration under society act / trust act etc. and list of directors/partners with addresses.	
2.	Copy of land allotment by GIDC/ sale deed land & copy of 7/12	
3.	Copy of IEM NO./EM No./Regn.No.	
4.	GPCB NOC/ CONSENT for establishing project	
5.	Please submit as applicable, • Equipment wise list with cost and justification for purchase of particular equipment. • Equipment wise cost along with the use of particular equipment • Give details of average present and past consumption of energy/electricity and energy/ electricity saving by installation new equipment with cost	
6.	Copy of Audit report along with payment made to auditor for scheme - B	
7.	Detail justification to setup environment management cell in the unit and its proposed expenditure for scheme - C	
8.	List of beneficiaries of project for scheme - D	
9.	Process Diagram of proposed Project.	
10.	Implementation Schedule	
11.	Copy of any other financial assistance granted by GoG and/or GoI for same component or project	
12.	Declaration as per application	

7 Procedure

- The unit will have to apply to concerned DIC prior to the implementation of the project in prescribed format for assistance along with documents as specified in check list, within one year from the date of issue of quality certificate.
- On receipt of application with all details, DIC will carry out inspection for verification of document and eligible expenditure. The inspection will be completed within 15 working days.
- DIC GM will scrutinize the inspection report and will sanction /reject the application within 10 days.
- After issuance of sanction letter payment will be made within 10 days, subject to availability of grant.

8 Contact officer for further details /query

Name : MR. N.M. Trivedi
Designation: Dy. Commissioner of Industries (Incentive)
Address : Block No. 1, 6th Floor, Udyog Bhavan, Sector 11, Gandhinagar-382 017
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Financial schemes available with local banks for improving energy efficiency in cluster

1. Credit linked capital Subsidy scheme(CLCSS)

Under this scheme, the ministry of MSME is providing subsidy to upgrade technology (Machinery/plant equipments). Subsidy limit per unit is Rs. 15 lakh or 15% of investment in eligible machinery/Plant equipments whichever is lower. For more details of the scheme visit:
www.laghu-udyog.com/scheme/sccredit.htm

2. SIDBI Financing Scheme for Energy Saving Projects in MSME sector under JICA Line of Credit

The Japan International Corporation Agency (JICA) has extended a line of credit to SIDBI for financing Energy Saving projects in Micro, Small and Medium Enterprises (MSMEs). This project is expected to encourage MSME units to undertake energy saving investment in plant and machinery to reduce energy consumption, enhance energy efficiency, reduce CO_2 emissions, and improve the profitability of units in the long run.

Eligible Sub Projects/ Energy Saving Equipment List under JICA line of Credit:

- Acquisition (including lease and rental) of energy saving equipments, including newly installing, remodeling and upgrading of those existing
- Replacement of obsolete equipments and/or introduction of additional equipment which would improve performance
- Equipments/ Machinery that meets energy performance standards/Acts
- Introduction of equipments that utilize alternative energy sources such as natural gas, renewable energy etc., instead of fossil fuels such as Oil and Coal etc.
- Clean Development Mechanism (CDM) projects at cluster level that involves change in process and technologies as a whole, duly supported by technical consultancy will be eligible for coverage.

Financial parameters:

The financial parameters for appraising the project are:

Parameter	Norms
Minimum Assistance	Rs. 10 lakh
Minimum promoters contribution	25% for existing units; 33% for new units
Interest rate	The project expenditure eligible for coverage under the line will

Parameter	Norms
	carry a rate of interest rate of 9.5-10% p.a
Upfront fee	Nonrefundable upfront fee of 1% of sanctioned loan plus applicable service tax
Repayment period	Need based. Normally the repayment period does not extend beyond 7 years. However, a longer repayment period of more than 7 years can be considered under the line if necessary

Eligibility criteria for units (Direct assistance):

- Existing units should have satisfactory track record of past performance and sound financial position.
- Projects will be screened as per Energy Saving List, which is available in SIDBI website.
- Units should have minimum investment grade rating of SIDBI.
- Projects which may result environmental impacts and negative social impacts are also not eligible under this scheme.

For further details eligible energy saving equipments/machinery, projects can be financed under this scheme and details of scheme, please contact the nearest SIDBI branch office or refer to SIDBI website (**www.sidbi.in**)

3. Scheme for Financing Energy Efficiency Projects

PURPOSE:

- Financing SMEs for acquisition of equipments, services and adopting measures for enhancement of energy efficiency/conservation of energy.

ELIGIBILITY

- SME units financed by bank as also other units desirous of shifting their account to Bank of Baroda.

LIMIT:

- Upto 75% of the total project cost, subject to maximum of Rs. 1/- crore. (Minimum amount of loan Rs. 5/- Lakhs).

Project cost may include the following:

- Cost of acquisition/modification/renovation of equipment/software.
- Cost of alterations to existing machinery.
- Cost of structural / layout changes.
- Cost of energy audit/consultancy.
- Preparation of Detailed Project Report (DPR).

RATE OF INTEREST:

- Bank's BPLR from time to time.

REPAYMENT :

- Maximum 5 years, including moratorium, if any.

SECURITY :

a. For Sole Banking Accounts :
   Extension of first charge on all fixed assets.
b. For Consortium/Multiple Banking Accounts :
   first charge on equipments acquired out of loan and collateral, if any, with the total security coverage being not less than 1.25.

Grant from IREDA:

- IRDEA, at present, gives a grant of Rs. 25,000/- for projects costing Rs. 1/- crore or below to meet partial cost of Energy Audit. This grant is available for the first 100 projects (SME Sectors only) approved by them.

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