

**BEE's National Program**  
*on*  
**Energy Efficiency and Technology  
Up-gradation in SMEs**

**Ludhiana Forging Cluster**

**Baseline Energy Audit Report  
Global Exports India**

*Submitted to*



*Submitted by*



**InsPIRE Network for Environment**

*September 2015*

# Contents

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<b>About The Project.....</b>	<b>i</b>
<b>Executive Summary .....</b>	<b>ii</b>
<b>Chapter 1: Introduction.....</b>	<b>1</b>
1.1 About the unit.....	1
1.2 Production Process of plant .....	3
1.3 Energy audit methodology.....	3
<b>Chapter 2: Present Process, Observations and Proposed Technology.....</b>	<b>5</b>
2.1 Re heating Furnace (LPG) .....	5
2.1.1 Present Process .....	5
2.1.2 Observations.....	5
2.1.4 Cost Economics Analysis .....	6

## ANNEXES

Annexure 1: Basic details and energy utilization pattern of M/s Global Exports India.....	7
Annexure 2: Induction furnace capacity and heating cycle time calculation .....	8
Annexure 3: Energy Saving Calculation for Induction furnace.....	9

## List of Tables

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Table 1: Cost Economic Analysis.....	ii
Table 1.1: Details of Global Enterprises .....	2
Table 2.1: Cost Economic Analysis of proposed induction furnace.....	6

## List of Figures

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Figure 1.1: Electricity consumption and production details .....	2
Figure 1.2: Flow chart of the production process .....	3
Figure 1.3: Energy audit process.....	4

## About The Project

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The project BEE's National Program on "Energy Efficiency and Technology Up gradation in SMEs - Ludhiana Forging Cluster" supported by Bureau of Energy Efficiency (BEE), Ministry of MSME and Ludhiana Auto Parts Manufacturers Association aims to bring down the energy demand of forging industries located at Ludhiana by supporting them to implement Energy Efficient Technologies in the SME units.

# Executive Summary

## 1. Unit Details

Unit Name	:	Global Exports India
Address	:	C-145, Near Canara Bank, Industrial Area, Jalandhar-04
Contact Person	:	Mr. Narindarpal Singh (Cell No: 9814061278)
Products	:	Various types of auto parts, Scaffolding
Production	:	1 Ton/day
DIC No.	:	030041100120
Bank Details	:	Canara bank; SME branch, Industrial Area, Jalandhar, Account Number: 2508766000028
TIN / PAN No.	:	PAN: AAFFG9183M
Contract demand	:	300 kVA

## 2. Existing Major Energy Consuming Technology

### LPG Based re-heating technology

- ▶ Less efficient as well as inefficient burning leading to higher losses
- ▶ Prevailing energy consumption is 0.53 kg of LPG per kg of the production

## 3. Proposed Energy Saving Technologies with Cost Economics

### Proposed Energy Measures

- ▶ Replacement of LPG fired re-heating furnace with 100 kW induction re-heating furnace

Table 1: *Cost Economic Analysis*

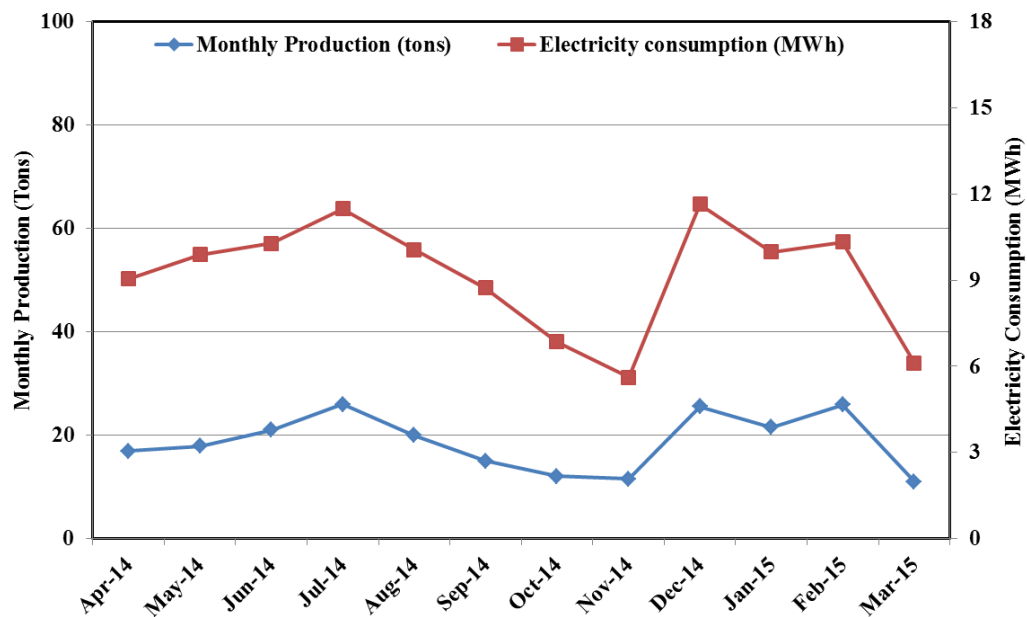
Proposed Technology	Estimated Energy Savings (%)	Savings (in Rs.)	Investment (in Rs.)	Simple Payback period (Years)
Induction re-heating furnace (200 kW)	44	1,846,901	1,947,706	1.05 years
<b>Total</b>		<b>1,846,901</b>	<b>1,947,706</b>	

# Introduction

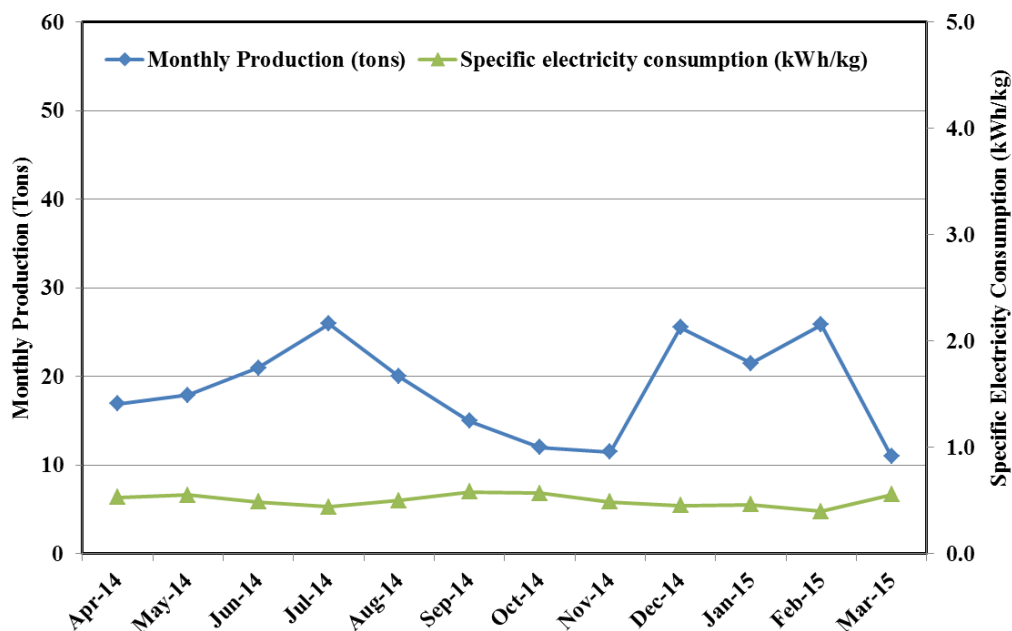
## 1.1 ABOUT THE UNIT

Global Exports India is engaged in manufacturing of various auto parts of different sizes as per the customer requirement. The raw material procured by the unit for making bolts and other auto components include Mild Steel, EN8 etc.

The daily production of the unit is around 1000 kgs per day. Global Exports India is using primary energy, namely, LPG and Electricity supply from SEBs for various process and utility applications in premises. The average monthly LPG consumption in the unit is 950 kgs. It was observed that the average monthly electricity consumption is 39878 kWh. Figure 1.1 depicts monthly electricity consumption vis-à-vis total monthly production of the unit for last one year.



(a) Monthly variation of production and electricity consumption



(b) Monthly variation of production and specific electricity consumption

Figure 1.1: *Electricity consumption and production details*

According to the assessment of the energy consumption data collected, the specific thermal energy consumption and specific electrical energy consumption is 0.026 L/kg (267 kcal/kg) of product and 0.49 kWh/kg (422.08) of product respectively. The total specific energy consumption (in kCal) is 689.2 kCal/ kg of product. Details of annual electrical and thermal energy consumption and specific energy consumption details in Global Exports India are presented in table below:

Table 1.1: *Details of Global Enterprises*

SN	Parameter	Value	Unit
1	Name and address of unit	M/s Global Exports India	
2	Contact person	Mr. Narindarpal Singh	
3	Manufacturing product	Various types of auto parts; Scaffolding	
4	Daily Production	1 Ton/day	
<b>Energy utilization</b>			
5	Average monthly electrical energy consumption	39878	kWh per month
6	Average monthly thermal (LPG) energy consumption	11400	kgs per month
7	Average specific thermal energy consumption <sup>1</sup>	0.053	kg /kg of product
		628	kCal/kg of product
8	Specific electrical energy consumption <sup>2</sup>	0.16	kWh/Kg of product
		137.18	kCal/kg of product
9	Specific energy consumption	765.18	kCal/kg of product
10	Electrical energy cost	1.20	Rs/Kg of product
11	Thermal energy cost	4.5	Rs/kg of product
12	Total energy cost	5.70	Rs/kg of product

**Note:**

^1: Specific gross calorific value of LPG is considered as 11,900 kcal / liters

^2: Thermal equivalent for one unit of electricity is 860 kCal/kWh.

The unit operates for 25 days a month (1 shift of 8 effective hours per day).

## 1.2 PRODUCTION PROCESS OF PLANT

The following figure shows the typical process employed at manufacturing of forged products at Global Exports India are presented below:

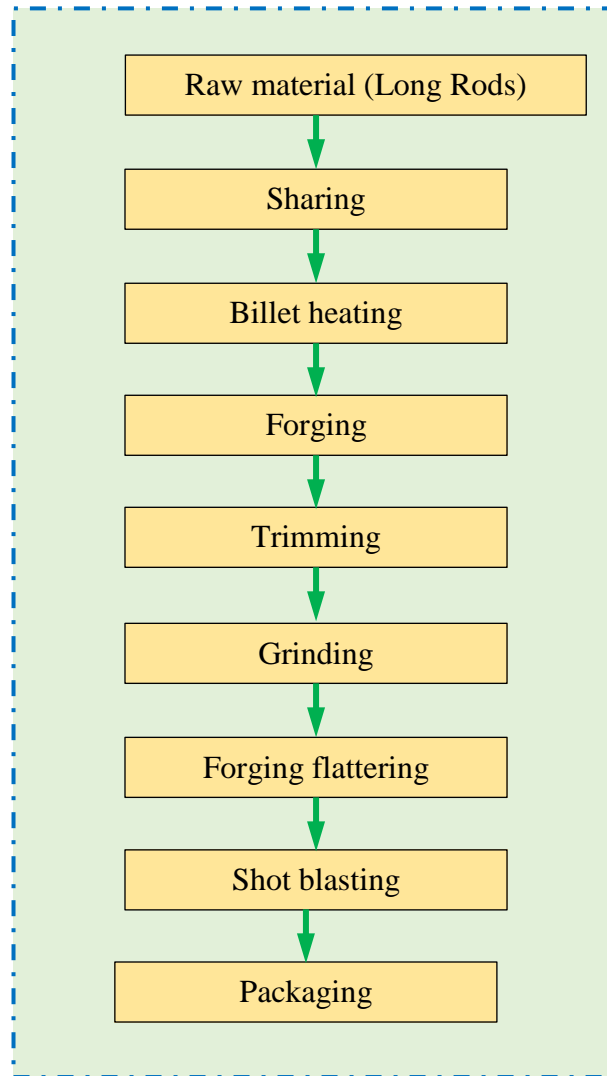


Figure 1.2: *Flow chart of the production process*

## 1.3 ENERGY AUDIT METHODOLOGY

The primary objective of the energy audit was to quantify the existing fuel consumption pattern and to determine the operating efficiencies of existing systems. The key points targeted through energy audits were determination of specific fuel consumption, various losses, operation practices like hot metal temperature, production, fuel consumption, scale formation etc. Pre – planned methodology was followed to conduct the energy audits. Data collected at all above steps was used to calculate various other



operating parameters like material feeding rate (Kg/hr), fuel firing rate, specific fuel consumption (kg/tons), etc.

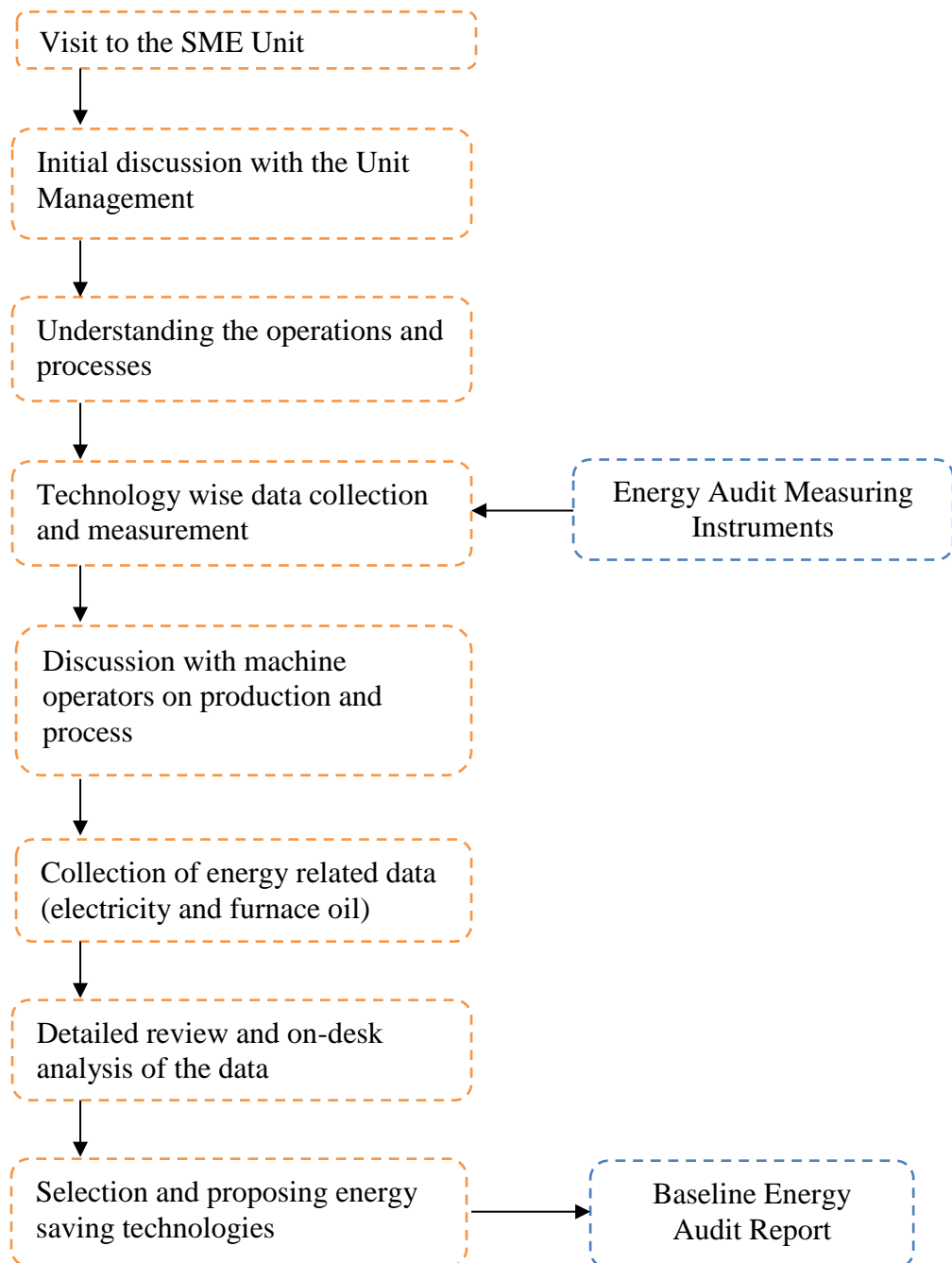


Figure 1.3: *Energy audit process*

## Present Process, Observations and Proposed Technology

### 2.1 RE HEATING FURNACE (LPG)

#### 2.1.1 Present Process

Global Exports India has installed LPG based heating furnace to heat the metal pieces for forging process. After heating the pieces at desired temperature, the heated metal piece is then kept on the forging die having the cavity of the product to be formed. The hot metal piece is then forged on the forging press into the product.



#### 2.1.2 Observations

The existing LPG heating furnace is observed to be less efficient. Since, the efficiency of such furnace is lower, new technology induction furnaces may be installed for re-heating process. The specific energy consumption of existing furnace is observed to be around 0.875 kWh per kg of the production which is higher in comparison to the latest technologies available for carrying out the same purpose.

**Conclusion:**

As per the past studies conducted in forging industries, the replacement of electrical resistive based heating furnace with an induction re-heating furnace saves some 60% of the energy cost. The production rate of the furnace observed during study is observed to be low and varies with the product size (Ref Table 2.1). Therefore, it is proposed to replace both these existing electrical resistive based heating furnace with energy efficient induction reheating furnaces.

This replacement would provide following benefits:

- Reduces Specific Energy Consumption
- User friendly technology
- Improved quality of the product output

**2.1.4 Cost Economics Analysis**

The comparison of electrical resistive based heating furnace and induction technology, specific energy consumption, cost savings, investment required and simple payback period of the investment on induction technology is given in Table 2.1. The detailed calculation to finalize the size of induction furnace is provided as **Annexure 2**.

Table 2.1: *Cost Economic Analysis of proposed induction furnace*

Parameter	Unit	Value
LPG consumption on existing re-heating furnace	kg/hr	4.75
Production in terms of Kg	Kg/hour	90
Specific energy consumption on LPG based re-heating furnace	kg/Kg	0.053
Cost of energy consumption using LPG	Rs./Kg	5.018
Power consumed by proposed induction furnace (rated capacity 200 kW operating at 165 kW)	kW	165
Production rate in terms of Kg/hr	Kg/hr	400
Specific energy consumption on induction reheating furnace	kWh/Kg	0.413
Cost of energy consumption using induction furnace	Rs./Kg	3.0938
Reduction in cost of energy required	Rs./Kg	1.924
Daily operating hours	Hrs	8
Annual operating days	Days	300
Annual cost savings	Rs	1,846,901
Investment required for Induction furnace (200 kW)	Rs	1,947,706
Simple payback period	Years	1.05

As per the detailed calculations done, it is proposed to install an induction based re-heating furnace of capacity 200 kW for carrying out heating of heavier metal pieces. Based on the discussion with unit management, it came out that maximum weight of the individual piece would be around 1.5 kgs and the cycle time required to re-heat the metal piece (approx. 40 piece batch) would be completed within 60 secs.

The cost of energy saved per Kg of material forged is calculated as Rs. 3.09. The investment required for implementing the induction technology is estimated to about Rs 19.47 Lakhs with annual saving of Rs.18.46 Lakhs. The simple payback period of the technology is 1.05 years.

## Annexure 1

### Basic details and energy utilization pattern of M/s Global Exports India

SN	Parameter	Value	Unit
1	Name and address of unit	Global Exports India	
2	Contact person	Mr. Narinder Pal Singh	
3	Manufacturing product	Various types of auto parts (Scaffolding)	
4	Daily Production	1 Ton/day	
<b>Energy utilization</b>			
6	Average monthly electrical energy consumption	39878	kWh per month
7	Average monthly thermal (LPG) energy consumption	11400	kg per month
8	Average specific thermal energy consumption <sup>^1</sup>	0.053	Liter /kg of product
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13	Total energy cost	5.70	Rs/kg of product

**Note:**

<sup>^1</sup>: Specific gross calorific value of LPG is considered as 11,900 kcal / liters

<sup>^2</sup>: Thermal equivalent for one unit of electricity is 860 kCal/kWh.

The unit operates for 25 days a month.

## Induction furnace capacity and heating cycle time calculation

### ***Induction furnace capacity calculations:***

#### **Induction furnace design standard: 2.7 – 3 kg/ kW/hr**

Hourly material to be heated = 400 Kg

Induction furnace capacity requirement (theoretical) =  $400/2.7$  kW/hr  
= 148.14 kW/hr

As discussed with technology manufacturer, we have taken the lower value 2.7 kg/kW/hr for calculations.

Induction furnace capacity requirement (actual) (efficiency = 90%) =  $148.14$  kW/hr /0.90  
= 164.90 kW/hr  
=200 kW approximately

### ***Heating cycle time calculation:***

Hourly material to be heated = 400 kg  
Weight of the metal pieces = 1.5 kg  
No. of pieces to be heated in an hour = 266 pieces  
Heating time required per piece = 1 minute approximately

Keeping in mind the variety of products manufactured by Global Exports India having variable weight, size, geometry, composition etc. induction furnace of 200 kW is proposed.

#### **Note:**

*\*\* For more accurate capacity options, induction furnace manufacturer should be consulted prior to the implementation*

### Energy Saving Calculation for Induction furnace

Parameter	Unit	Value
LPG consumption on existing re-heating furnace	kW	4.75
Production in terms of Kg	Kg/hour	90
Specific energy consumption on LPG based re-heating furnace	kWh/Kg	0.053
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Annual cost savings	Rs	1,846,901
Investment required for Induction furnace (200 kW)	Rs	1,947,706
Simple payback period	Years	1.05

**Note:**

*\*\* The cost of induction furnace is an indicative value gathered from quotations provided by furnace suppliers. It may vary according to the heating requirement and the material to be heated.*