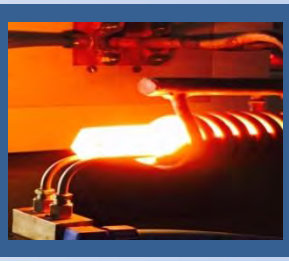
BEE's National Program

on

Energy Efficiency and Technology Up-gradation in SMEs

Ludhiana Forging Cluster

Post Implementation Audit Report
Allied Engineers

Submitted to

Submitted by

InsPIRE Network for Environment

June 2016

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Preface

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

There are more than 1500 Small and Medium Enterprise (SME) forging units operating in the various industrial pockets in and around Ludhiana, manufacturing products suitable for automotive, industrial and agricultural sector. The project aims to initially diffuse energy efficient technologies in selected units in the cluster. These units will act as demonstration units for long term and sustainable penetration of energy efficient technologies in the entire cluster. InsPIRE Network for Environment, New Delhi has been appointed as the executing agency to carry out the following activities in the cluster:

- Conducting pre-activity cluster workshop in the cluster.
- Conducting initial walk through audits in 5 representative units of the cluster.
- Identify and proposes BEE on energy efficient process technologies, relevant to the cluster, with highest energy saving and replication potential, and their cost benefit analysis.
- Identify local technology/service providers (LSP) for the above technologies in the cluster
- Identify SME units willing to implement and demonstrate the energy efficient technologies
- Assist BEE to enter into a contract with each of the shortlisted SME units to enable implementation and showcasing of Energy Efficient technology.
- Conduct comprehensive Baseline Energy Audits in the shortlisted SME units wherein these technologies can be implemented and document the findings in the form of a report.
- Develop technology specific case studies (Audio-Visual and print) for each technology
- Prepare Best Operating Practices (BOP) document for the top 5 energy using equipment / process in the industry cluster
- Enumeration of common regularly monitorable parameter at the process level which have impact on energy performance, and listing of appropriate instrumentation for the same with options including make, supplier, indicative cost specifications and accuracy of measurements.
- Carry out post implementation energy audit in the implemented units to verify energy savings as a result of EE technology implementation.
- Verify and submit to BEE all the relevant documents of each participating unit owner indicating his complete credentials, proof of purchasing the equipment, evidence of implementation and commissioning of the EE technology in the unit.

Based on the confirmation on installation from a unit, a 5 member team consisting of Shri Tarun Dixit, Project Engineer, BEE; Shri Madhur Gupta, Financial Expert, Ludhiana Forging Cluster, Shri Arindam Mukherjee, Sr. Program Officer; Shri S. Vamsi Krishna, Program Officer and Shri Chaman Shukla, Sr. Program Associate from InsPIRE Network for Environment carried out a cross-verification of the implementation. As part of the activities under the energy efficiency program in Ludhiana Forging cluster, post implementation energy audits in 8 forging units under Ludhiana cluster was conducted in the month of June'2016. This specific audit report details the findings of the post implementation energy audit study carried out at ***Allied Engineers.***

Executive Summary

1. Unit Details

Unit Name	:	**Allied Engineers**
Address	:	C-64, Phase –V, Focal Point, Ludhiana -10
Contact Person	:	Smt. Parvinder Kaur Narual & Mr. Gursharan Singh Narula (Cell No. 9814089881 / 9876589881)
Products	:	Bolts, Nuts and Auto Parts
Production	:	800 Kgs per day
DIC Number	:	030091200431 (Part-II)
Bank Details	:	Bank of Baroda, Clock Tower, Ludhiana Account Number: 01030200000099
TIN / PAN No.	:	PAN: AAEFA9107A; TAN: JLDA01211A
Contract demand	:	164 kVA

2. Energy Efficient Technologies implemented vis-à-vis baseline energy audit recommendation

Technology recommended as per baseline energy audit (as approved by steering committee)	Technology implementation and cross-verified during post implementation energy audit
Induction Heater (50 kW)	Induction Heater (50 kW)
SPM - Turning Machine (2 No's)	Not Implemented

3. Cost Economics Analysis: Projected (as per baseline) vs. Actual

Technology	Estimated Energy Savings (%)	Savings	Investment	Simple Payback period (Years)
Installation of Induction Heater (50 KW)				
Baseline (Projected)	62	1,25,353	936,510	1.9 years
Post Implementation (Actual)	81	1,490,400	731,745	0.49 years

4. Project Impacts

Energy Efficient Technology implemented	Percentage Savings in specific energy consumption from baseline (%)	Annual Energy Savings (TOE)	Annual CO_2 emission reduction (tCO_2/year)
Induction Heater	81	37.16	40.11

Assumptions / conversion factors:

- Calorific Value of FO has been considered as 10,200 kcal / kg
- 1 TOE (tonnes of oil equivalent) = 0.0148 TJ (Tera Joule)
- Emission factor LPG has been taken as 72.93 t CO 2 per TJ (IPCC Guideline)
- CO_2 emission reduction calculation has been done based on equivalent reduction in annual energy consumption.

Introduction

1.1 MSME SECTOR – AN OVERVIEW

The MSME sector is an important pillar of Indian economy as it contributes greatly to growth of Indian economy with a vast network of around 30 million units, creating employment of about 70 million, manufacturing more than 6000 products, contributing about 45% to manufacturing output and about 40% of exports, directly and indirectly. This sector even assumes greater importance now as the country moves towards a faster and inclusive growth agenda. Moreover, it is the MSME sector which can help realize the target of proposed National Manufacturing Policy of raising the share of manufacturing sector in GDP from 16% at present to 25% by the end of 2022. However, owing to the recent insecure market conditions and escalating energy expense, the economic scenario of MSME sector, is transpiring gloomier endangering the long term profitability, competitiveness and sustainability.

However, a significant portion of the MSME units are energy-intensive where the cost of energy is 20-40% of the production cost, which implies huge energy saving potential. A study by BEE appraises the total energy efficiency market in India as INR 74,603 crore out of which, the share for MSME sector has been estimated at INR 12100 crore. But, in spite of huge energy efficiency potential in MSME sector, it is hurdled largely by following major barriers:

- Obsolete technology and lack of access to modern technological solutions resulting in low productivity.
- Very few programs to support technology development.
- Lack of local service providers to sustain energy efficient technologies.
- Lack of knowledge, financing and dedicated personnel for identifying energy efficiency improvements & opportunities.
- 90% of units are proprietorship concerns, which are limited on their managerial skills as well as amenability to new ideas.
- Perceptions of Energy efficiency measures are financially unviable.
- MSME units are reluctant to change & seek external technical assistance.

In the wake of the need, Government of India has set ambitious target of energy saving of 44.85 BU at consumer side by the terminal year 2016-17 of 12th Five year Plan which is equivalent to 60.17 BU on Bus bar side translating into 12,350 MW avoided capacity. In addition, total thermal energy saving equivalent to 21.30 Mtoe is targeted.

1.2 BEE-SME PROJECT AT A GLANCE

Under the 12th Five Year Plan, the Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India, has taken an ambitious program on energy efficiency and technology up gradation in SME clusters in India. The program titled "BEE's National Program on Energy Efficiency and Technology Up gradation in SMEs" is being implemented by BEE with support from Ministry of MSME in five selected clusters in India. These clusters include Ludhiana, Punjab; Pali, Rajasthan; Kochi, Kerala; Indore, Madhya Pradesh and Varanasi, Uttar Pradesh. The project aims to set up demonstration units in these clusters, wherein energy efficient technologies will be implemented. Efforts will also be made to replicate the successful technologies and wider penetration of energy efficient technologies in the sector as a whole. The key components of the project include:

- Conducting pre-activity cluster workshop in the cluster.
- Conducting initial walk through audits in 5 representative units of the cluster.
- Approve energy efficient process technologies, relevant to the cluster, with highest energy saving and replication potential, and establish their cost benefit analysis.
- Identify local technology/service providers (LSP) for the above technologies in the cluster
- Identify SME units willing to implement and demonstrate the energy efficient technologies
- Enter into a contract with each of the shortlisted SME units to enable implementation and showcasing of Energy Efficient technology.
- Conduct comprehensive Baseline Energy Audits in the shortlisted SME units wherein these technologies can be implemented and document the findings in the form of a report.
- Support the units towards implementation of energy efficient technologies.
- Carry out post implementation energy audit in the implemented units to verify energy savings as a result of EE technology implementation.
- Develop technology specific case studies (Audio-Visual and print) for each technology
- Prepare Best Operating Practices (BOP) document for the top 5 energy using equipment / process in the industry cluster
- Enumeration of common regularly monitorable parameter at the process level which have impact on energy performance, and listing of appropriate instrumentation for the same with options including make, supplier, indicative cost specifications and accuracy of measurements.
- Release of financial incentive to units on submission of the relevant documents of each participating unit owner indicating his complete credentials, proof of purchasing the equipment, evidence of implementation and commissioning of the EE technology in the unit.

The forging cluster located at Ludhiana, Punjab is one of the selected clusters under the BEE-SME program.

1.3 LUDHIANA FORGING CLUSTER – AN INSIGHT

Ludhiana is one among the biggest forging cluster in India consisting of over 1500 units, manufacturing a wide range of products, suitable for the use of automotive, agricultural and other engineering industry. A significant portion of the manufactured goods are also exported from the cluster. The units usually get raw materials in the form of steel and other ferrous products from the local industries and process the same using forging, machining and finishing process. The finished product is directly dispatched for the use of the target industry. The units are located in clusters in areas such as Focal Point (Ludhiana), Industrial Area (Jalandhar City), Industrial Area (Phagwara) and Industrial Area (Moga). Electricity is the main source of energy in these units. Majority of the units uses free hammer to forge the heated steel. The temperature required for forging is around 1150 - 1200 ^{o}C.

Despite being in large numbers, most of the units in the clusters are un-organized, using obsolete and high energy consuming equipment. Also, the cluster has seen limited development in terms of technology up gradation and automation, over the years. Some of the important barriers towards accelerated adoption of energy efficient technologies have been lack of knowledge, lack of government scheme to support technology up gradation, lack of skill manpower and lack of financing options available with these units. Because of the lower penetration about the knowledge of energy efficient technologies in the cluster, the units has been using age old practices of manual lathes for machining and batch furnaces for heating operations.

Twenty (20) units were selected from the cluster with the purpose of conducting baseline audit. Out of these, eight (8) nos. of units has completed implementation, within the stipulated time period and as per the guidelines of implementation.

1.2 ABOUT THE UNIT

Allied Engineers is engaged in manufacturing of different types of nuts, bolts, and auto parts in various sizes as per the customer requirement. The manufacturing unit is located at 1st Lane, Partap Chowk, Sangeet Cinema, Ludhiana - 141001, Punjab.

The raw material procured by the unit for making bolts and other auto components include Mild Steel, EN8, EN15 etc.

The daily production lies in the range of 800-850 per day). Allied Engineers is using energy in the form of electricity supply from Punjab State Electricity Board, for various process and utility applications in its premises. The average monthly FO consumption in the unit (during baseline study) was 1,800 liters. During baseline energy audit, it was observed that the average monthly electricity consumption was 81,589 kWh.

1.3 PROJECT IMPLEMENTATION METHODOLOGY

The BEE's National Program on Energy Efficiency and Technology Up gradation at Ludhiana Forging Cluster followed the following implementation methodology:

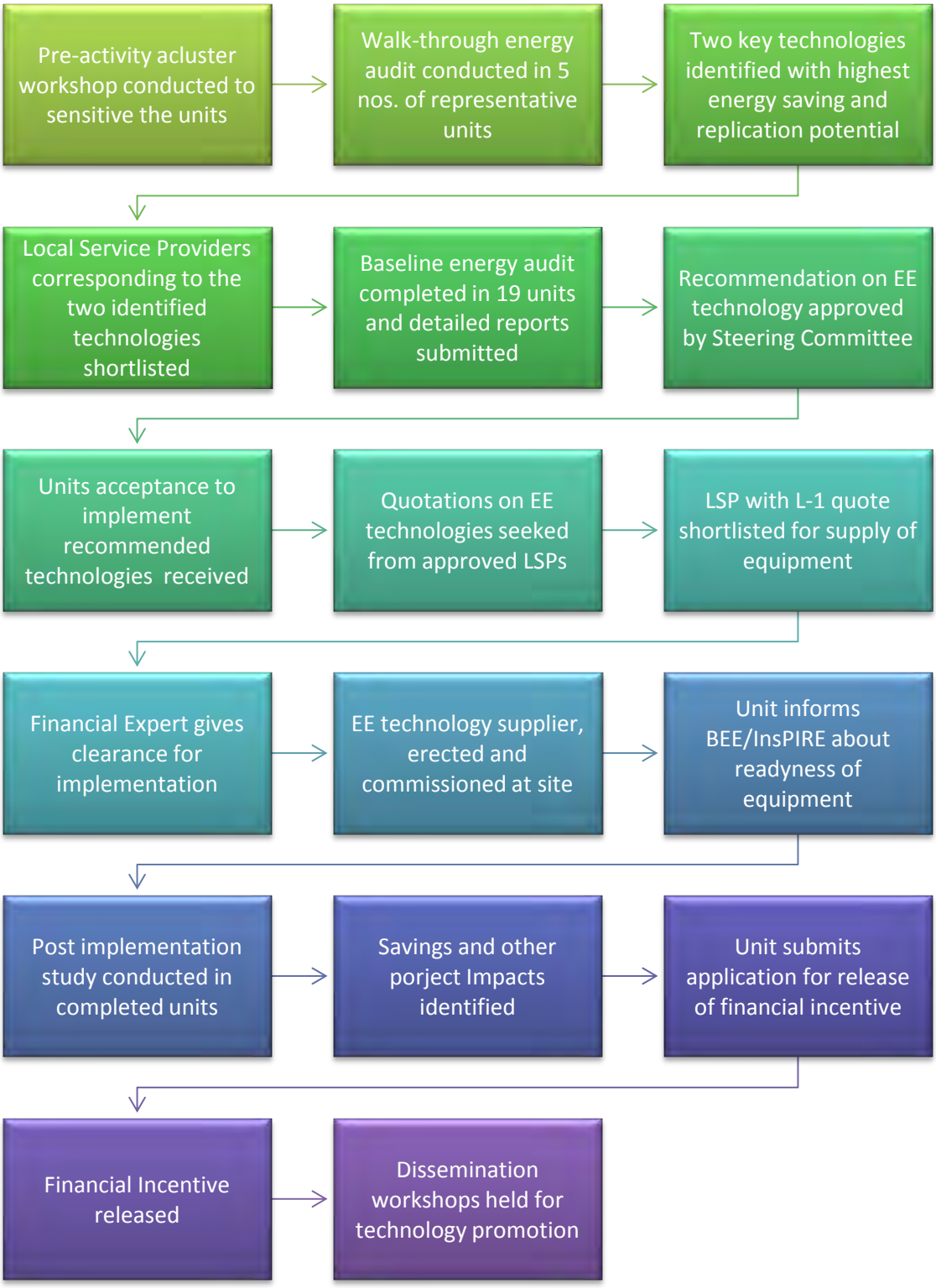


Figure 1.1: ***Project Implementation Methodology***

1.4 PRODUCTION PROCESS OF PLANT

The following figure shows the typical process employed at manufacturing of forged products at Allied Engineers, Ludhiana:

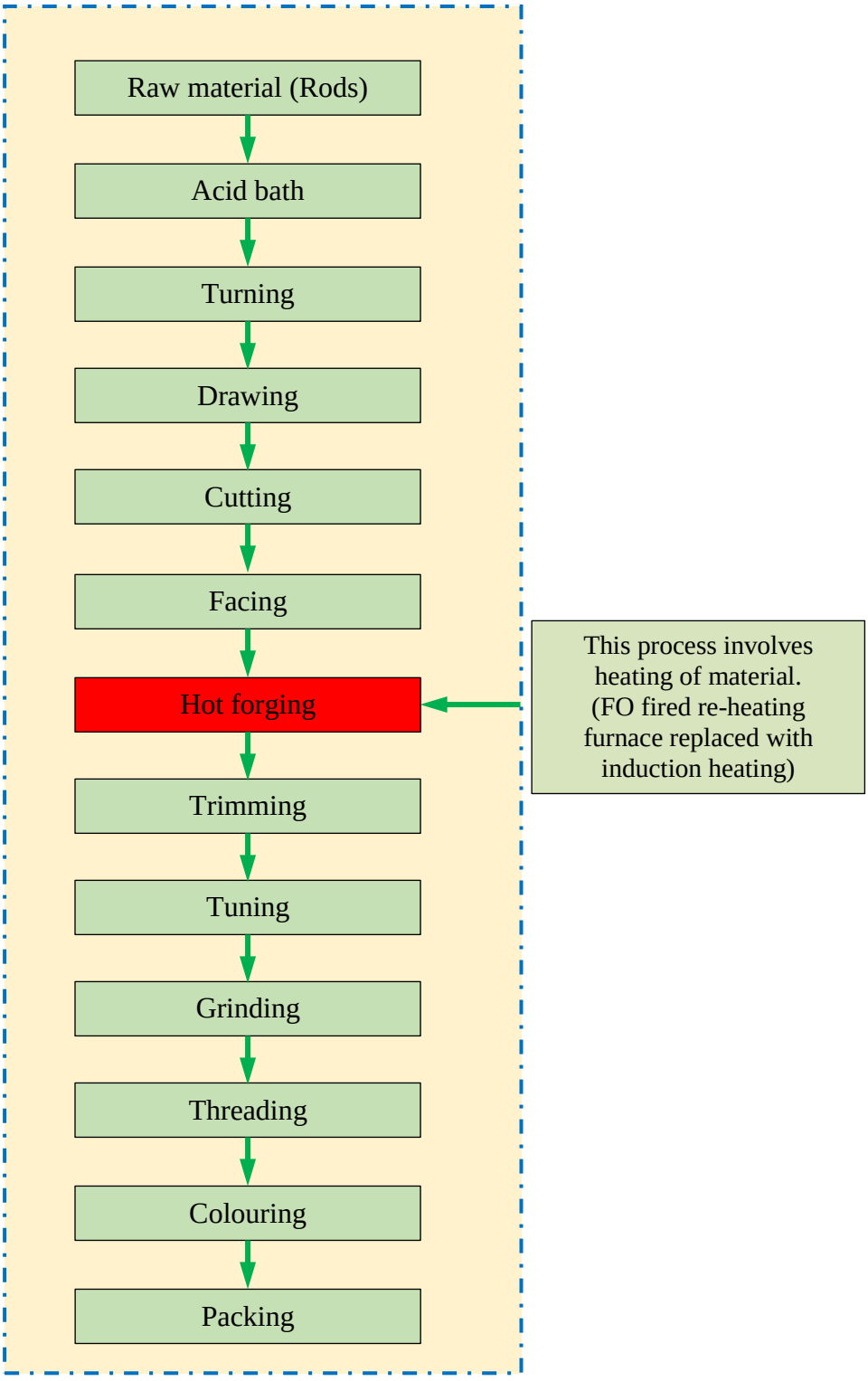


Figure 1.2: ***Production process***

1.5 ENERGY AUDIT METHODOLOGY

The primary objective of the baseline energy audit was to quantify the baseline energy consumption pattern and identify technologies which can lead to reduction in energy consumption. Based on the suggestions under the baseline audit, the units have implemented the technologies. The primary objective of the post implementation energy audit is cross-verify the implementation and document the impact. The key points targeted through energy audits were determination of specific energy consumption, both thermal and electrical, productivity etc. Pre – planned methodology was followed to conduct the energy audits. The energy audit methodology followed for baseline and post implementation energy audits is depicted in **Figure 1.3** below:

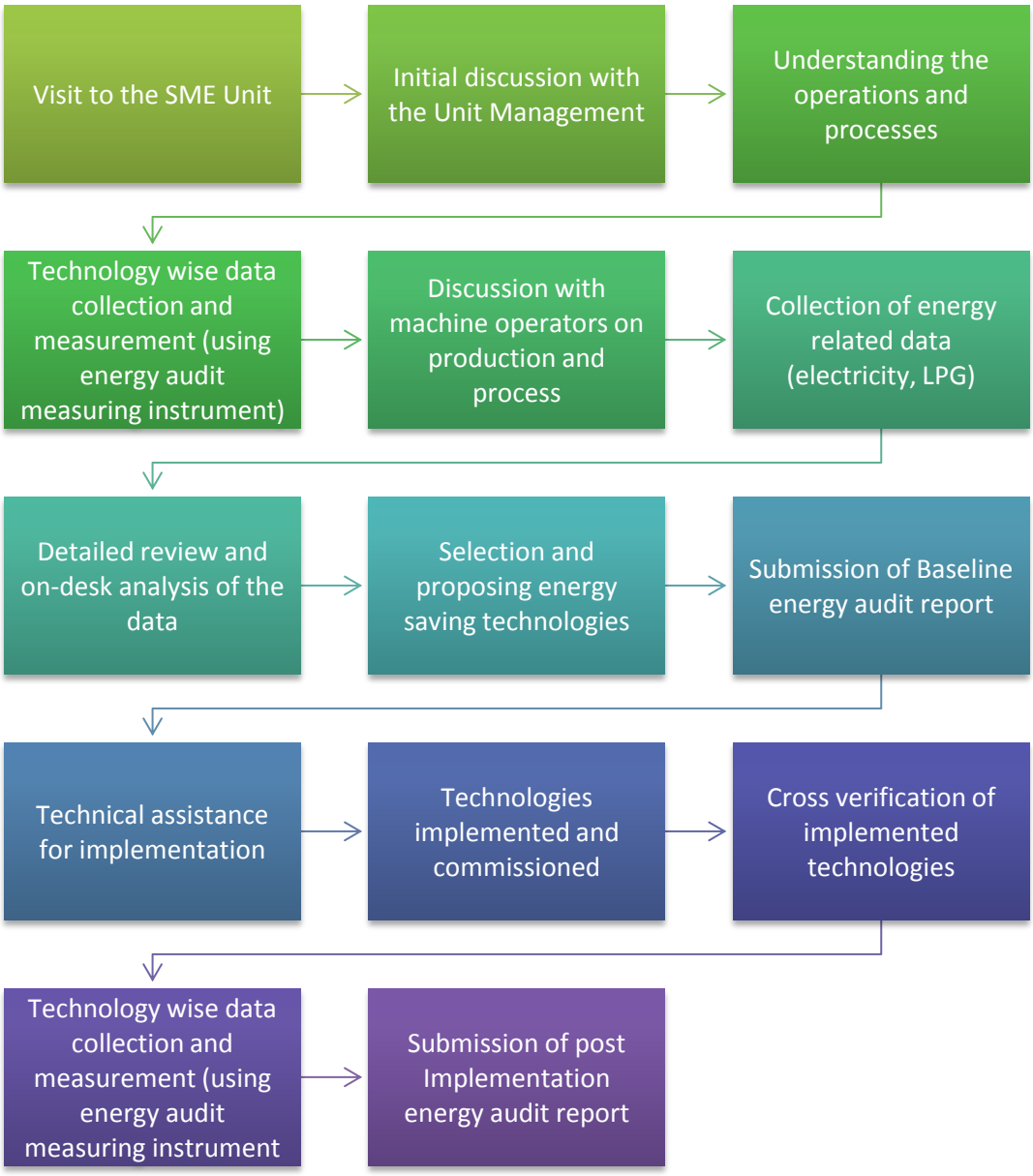


Figure 1.3: ***Energy audit methodology***

Post implementation energy audit outcome and results

2.1 INSTALLATION OF INDUCTION HEATER (50 KW)

2.1.1 Baseline Scenario

Allied engineers has installed three furnaces Oil (FO) fired heating furnace to heat the metal pieces for forging process. The metal pieces to be forged are heated to a temperature of 1150 - 1200 ◦ C. After that, the heated metal piece is then kept on the forging die having the cavity of the product to be formed. The hot metal piece then forged on the forging press into the product.

The exiting furnace is old having conventional design with manual control option for fuel firing. Since, the efficiency of such furnace is lower, new technology induction furnaces maybe installed for re-heating process. Further, since the flame of the furnace directly hits the surface of the metal during the heating period varying from 20 – 30 minutes deteriorates the atomic/ grain structure of the piece and also leads to the higher scale formation due the oxidation of the metal at high temperature ultimately leading to material/ production loss. In order to attain the exact temperature profile of the material in less time, 3Ts has to be followed, Time, Turbulence and Temperature, if these three parameters can be followed in a right manner proper temperature can be archive in a minimum time, which would help in reducing the excessive heating of the material and reduction in scale loss.

2.1.2 Present Scenario

FO based re-heating furnace has been replaced by induction heating system of capacity 50 kW. As the Induction heater attains instant heating the metal can be able to reach the desired temperature within 6- 8 sec, thereby increasing the productivity by 3 to 4 times. The operating principle and benefits of using an induction heating system has been summarized below:

Induction heating is the process of heating an electrically conducting object by electromagnetic induction, where eddy currents are generated within the metal and resistance leads to Joule heating of the metal. So it is possible to heat a metal without direct contact and without open flames or other heat sources (like IR).

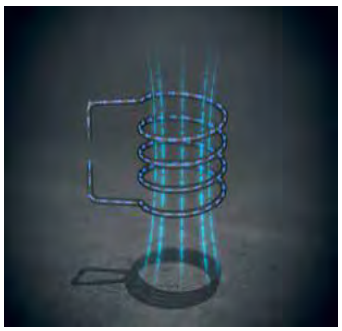


Figure 2.1: ***Induction heating coil***

An induction heater consists of an electromagnet (coil), through which a high-frequency alternating current (AC) is passed. The frequency of AC used depends on the object size,

material type, coupling (between the work coil and the object to be heated) and the penetration depth. An induction heating system is composed by an inductor (to generate the magnetic field) and a converter (to supply the inductor with a time-varying electrical current).

- **Operating Principle:**

Alternating current flowing through an electro-magnetic coil generates a magnetic field. The strength of the field varies in relation to the strength of the current passing through the coil. The field is concentrated in the area enclosed by the coil;

Eddy currents are induced in any electrically conductive object—a metal bar, for example—placed inside the coil. The phenomenon of resistance generates heat in the area where the eddy currents are flowing. Increasing the strength of the magnetic field increases the heating effect. However, the total heating effect is also influenced by the magnetic properties of the object and the distance between it and the coil. In case of the forging process, the induction heating system is used to heat the metal bar to the forging temperature which is typically 1150-1200 0C depending on the material.

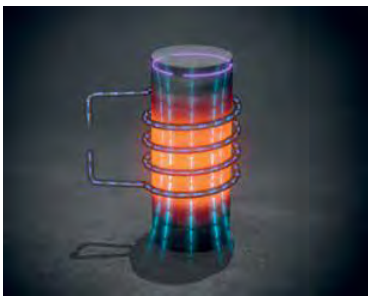


Figure 2.2: ***Induction heating coil***

- **Use of Induction Heating in Forging Process:**

Forging is a process where metal is formed into shape using pressure applied by an impact hammer or press. It is one of the oldest known metal working processes. Metals can be forged cold, warm or hot. Cold forging is used for forming softer materials and smaller steel parts, but this process hardens the material making it brittle and difficult to process after forging.

Hot forging is a process where the part is heated above the material recrystallization temperature before forging, typically 1100°C (2012°F) for steel. Hot forging allows a part to be formed with less pressure, creating finished parts with reduced residual stress that are easier to machine or heat treat. Warm forging is forging a part below the recrystallization temperature, typically below 700°C (1292°F). As a superior alternative to furnace heating, induction heating provides faster, more efficient heat in forging applications. The process relies on electrical currents to produce heat within the part that remains confined to precisely targeted areas. High power density means extremely rapid heating, with exacting control over the heated area.

Recent advances in solid-state technology have made induction heating a remarkably simple and cost-effective heating method. Benefits of using Induction heating for forging are:

- Rapid heating for improved productivity and higher volumes
- Precise, even heating of all or only a portion of the part
- A clean, non-contact method of heating
- Safe and reliable – instant on, instant off heating
- Cost-effective, reduces energy consumption compared to other heating methods
- Easy to integrate into production cells

- Reduced scaling

2.1.3 Energy saving and Cost Economics Analysis (baseline vis-à-vis post implementation)

The table below summarizes the post implementation energy consumption figures of the unit vis-à-vis the baseline energy audit data.

Parameter	Unit	Value
Baseline Scenario		
Furnace oil consumption on re-heating furnace	Ltr/hr	9.00
Productivity in terms of Kg	Kg/hour	100
Specific energy consumption on FO based re-heating furnace	Ltr/Kg	0.09
Specific fuel consumption in terms of kcal	kcal/kg	918.00
Cost of energy consumption	Rs./Kg	4.50
Annual production (based on baseline productivity)	Kg/annum	240000
Post Implementation Scenario		
Power consumed by induction heater (based on on-site measurement) Note: Induction heater was observed to be running at 80 % loading during post implementation study	kWh	42.00
Productivity in terms of Kg	Kg/hr	208
Specific energy consumption on induction heater	kWh/Kg	0.20
Specific fuel consumption in terms of kcal	kcal/kg	173.65
Cost of energy consumption	Rs/kg	1.51
Annual production (based on post implementation productivity)	Kg/annum	499200
Savings		
Reduction in cost of energy	Rs/kg	3.0
Reduction in specific energy consumption in kcal	kcal/kg	744.3
Annual Cost Savings (in terms of post implementation productivity)	Rs	1490400
Annual Reduction in Energy Consumption	toe	37.16
Percentage reduction in energy consumption	%	81.08
Investment made Induction Heater (50 kW)	Rs	731745
Simple payback period	years	0.49
Annual CO_2 emission reduction	t CO_2/year	40.11

Assumption / conversion factors:

- Specific gross calorific value of FO has been considered as 10,200 kcal /kg
- 1 TOE (tonnes of oil equivalent) = 0.0148 TJ (Tera Joule)
- Emission factor FO has been considered as 72.93 t CO_2 per TJ (as per IPCC guideline)
- CO_2 emission reduction calculation has been considered based on equivalent reduction in CO_2 emission

The energy cost saved per kg of forged material is Rs. 3.0. The actual investment made to implement the energy efficient induction heater technology is Rs 7.31 lakhs with annual saving of Rs. 14.90 Lakhs. Thus, the investment made will be recovered within 0.49 years.

2.1.4 Snap-shot of implementation (before and after)

A comparison of the snap-shots of FO based re-heating furnace used during the baseline vis-à-vis the induction heating system used in the post implementation study has been shown below:

Figure 2.3: ***Snap shot of FO based re-heating furnace at Allied engineers***

Figure 2.4: ***Induction heater of 50 kW capacity at Allied engineers***

Base Executive Summary

Executive Summary

1. Unit Details

Unit Name	:	**Allied Engineers**
Address	:	C-64, Phase-V, Focal Point, Ludhiana-10
Contact Person	:	Smt. Parvinder Kaur Narual & Mr. Gursharan Singh Narula (Cell No: 9814089881/9876589881)
Products	:	Bolts, Nuts and Auto Parts
Production	:	800 Kgs per day
DIC Number	:	030091200431 (Part – II)
Bank Details	:	Bank of Baroda, Clock Tower, Ludhiana Account Number: 01030200000099
TAN / PAN No.	:	PAN: AAEFA9107A; TAN: JLDA01211A
Contract demand	:	164 kVA

2. Existing Major Energy Consuming Technology

FO Based re-heating technology

- Conventional Technology with higher losses
- Prevailing energy consumption is 0.09 liters of FO per kg of the production

Lathe Machine

- Manually operated lathe machines for machining job work including threading, turning, grinding, drilling etc.
- Electrical motor rating of 3 HP with production of 50-60 pieces per hour per set of lathe machine.

3. Proposed Energy Saving Technologies with Cost Economics

Proposed Energy Saving Measures

- Replacement of FO fired re-heating furnace with 50 kW induction re-heating furnace
- Replacement of manual lathe machines by two numbers of CNC based Special Purpose Machine (SPM) for turning operation

Table 1: *Cost Economic Analysis*

Proposed Technology	Estimated Energy Savings (%)	Savings (in Rs.)	Investment (in Rs.)	Simple Payback period (Years)
Induction re-heating furnace (50 kW)	62	125,353	936,510	1.9
SPM - Turning Machine (2 Nos)	76	544,504	1,100,000	2.0
Total		**669,858**	**2,036,510**	

Clearance by CA

MADHUR GUPTA
CHARTERED ACCOUNTANT
687 PREM NAGAR
CIVIL LINES, LUDHIANA
+99155-12967, 0161-5053340

NOTARY GOVT. OF INDIA

To
M/s Allied Engineers
C-64, Focal Point
Ludhiana

Subject:- Recommendation to place an order for procurement of Machinery.

Sir

This is in reference to your request letter, in which your goodself has asked for clearance to place an order with least amount quoted supplier to purchase an energy efficiency equipment.

The details of quotations submitted by you are mentioned in below table:-

Suggested Technology Measures	Summary of Quotation (L-1)	Summary of Quotation (L-2)	Summary of Quotation (L-3)
Induction Heating Machine	50KW Induction Heating Machine with Heat Exchanger & Cooling Tower amounting Rs. 6,90,000	50KW Induction Heating Machine with Heat Exchanger & Cooling Tower amounting to Rs. 7,30,000.00	50KVA Induction Heating amounting to Rs. 7,20,000
Name of Service Provider	**G R D Induction**	**Akal Induction**	**Sohal Electirc Works**

Note:- The above said prices are ex-works prices and taxes are not included in it. However taxes are levied on as is basis i.e.rate prevailing at time of dispatch of machine hence their impact can not be judged today. Thus comparison of quotations has been done on bases of tax excluded prices

Accordingly we recommend to place and order SPM with M/s G.R.D Induction, being lowest among all.

You are requested to intimate us once the procurement and installation process is complete

Thanking You

Madhur Gupta
Chartered Accountant

Madhur Gupta M.No. 518148 Chartered Accountant

I knowthe deponent/executant/identifie
Personaly His/her signed/Thumb
marked in my presence

Signature Attested
16/7/16
NOTARY PUBLIC
Ludhiana (Punjab)

GRD INDUCTION

G.R.D. INDUCTION

Manufacturer of :
H.F. & M.F. INDUCTION HEATERS

QUOTATION

To

Date:- 07/03/2016.

M/S Allied Engineers,

Phase 4,Focal Point,

Ludhiana.

OFFER FOR SUPPLY OF 50KW INDUCTION HEATER AND CHILLER.

Sr. No.	Particular	Qty.	Amount
1	50KW Induction Heater	1	4,50,000.00
2	Cooling pump @7500.00	2	15,000.00
3	Chiller 5Ton Danfoss 200 Ltr. Tank With Pump	1	2,25,000.00
	TOTAL		6,90,000.00
	Vat @ 6.05%		41,745.00
	Grand Total		**7,31,745.00**

(Rs. Seven Lac Thirty One Thousand Seven Hundred Forty Five Only)

Term & Condition

1. Taxes will be charged extra as applicable at the time of delivery.
2. Packaging and forwarding and insurance charges extra.
3. Delivery after one and half month from the date of confirmation of order along with 40% advance payment.
4. Quotation is valid for 30 days.
5. Delivery EX our works at Jalandhar.

NOTARY Vipan Kumar Sobti ADVOCATE LUDHIANA Regd. No 75 GOVT Of

Certified to be true Photo COP
NOTARY PUBLIC LUDHIANA

For ALLIED ENGINEERS

Partner

G.T. ROAD, OPP HOTEL COUNTRY INN, JALANDHAR 144 001

GRD INDUCTION

G.R.D. INDUCTION | Manufacturer of : H.F. & M.F. INDUCTION HEATERS

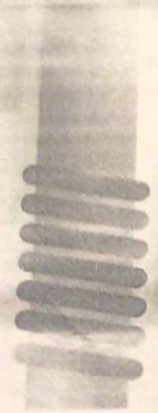
Warranty

50KW Induction Heater is covered under one year warranty after dispatch against any defect caused by faulty material or workmanship. Company will replace /repair such part free of charge as required to rectify the problem.

Power semiconductors (IGBTs) are covered under six month warranty.

Condition of warranty.

1. The machine is installed and operated in accordance with our recommendation.
2. No repair or alteration should be conducted without our approval.
3. Defective parts replaced by us are our property.



For GRD Induction

Prop.

Certified to be true Photo copy

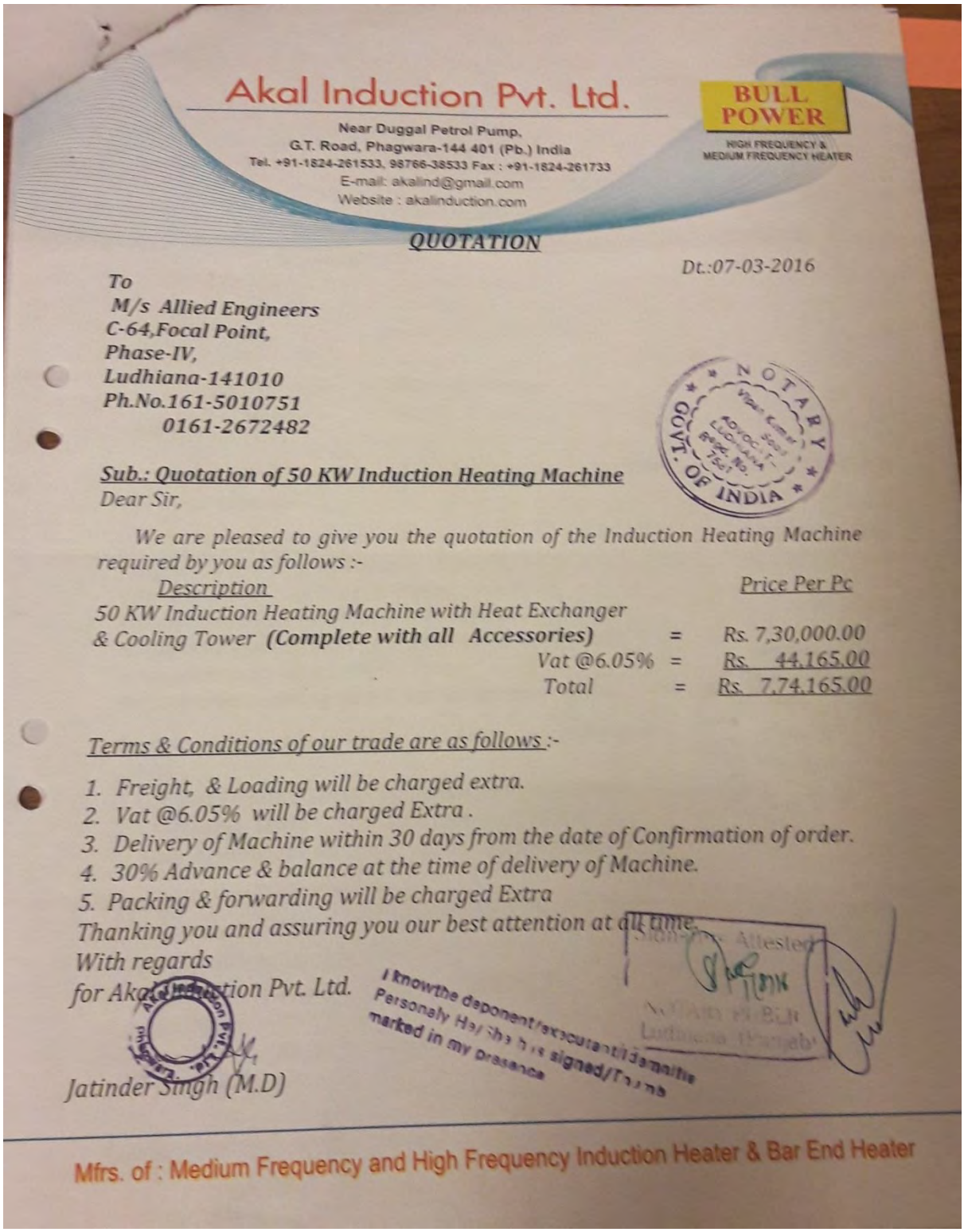
NOTARY PUBLIC, LUDHIANA

NOTARY Vipan Kumar Sood ADVOCATE LUDHIANA Regd. No. 7503 GOVT. OF INDIA

For ALLIED ENGINEERS

G.T. ROAD, OPP. HOTEL COUNTRY INN, JALANDHAR 144 001

Ph. 0181-5016150



Akal Induction Pvt. Ltd.

Near Duggal Petrol Pump,
G.T. Road, Phagwara-144 401 (Pb.) India
Tel. +91-1824-261533, 98766-38533 Fax : +91-1824-261733
E-mail: akalind@gmail.com
Website : akalinduction.com

BULL POWER
HIGH FREQUENCY & MEDIUM FREQUENCY HEATER

QUOTATION

Dt.:07-03-2016

To
M/s Allied Engineers
C-64,Focal Point,
Phase-IV,
Ludhiana-141010
Ph.No.161-5010751
0161-2672482

NOTARY Advocate Ludhiana Regd. No. 7561 GOVT. OF INDIA

Sub.: Quotation of 50 KW Induction Heating Machine

Dear Sir,

We are pleased to give you the quotation of the Induction Heating Machine required by you as follows :-

Description		Price Per Pc
50 KW Induction Heating Machine with Heat Exchanger & Cooling Tower **(Complete with all Accessories)**	=	Rs. 7,30,000.00
Vat @6.05%	=	Rs. 44,165.00
Total	=	Rs. 7,74,165.00

Terms & Conditions of our trade are as follows :-

1. Freight, & Loading will be charged extra.
2. Vat @6.05% will be charged Extra .
3. Delivery of Machine within 30 days from the date of Confirmation of order.
4. 30% Advance & balance at the time of delivery of Machine.
5. Packing & forwarding will be charged Extra

Thanking you and assuring you our best attention at all time.

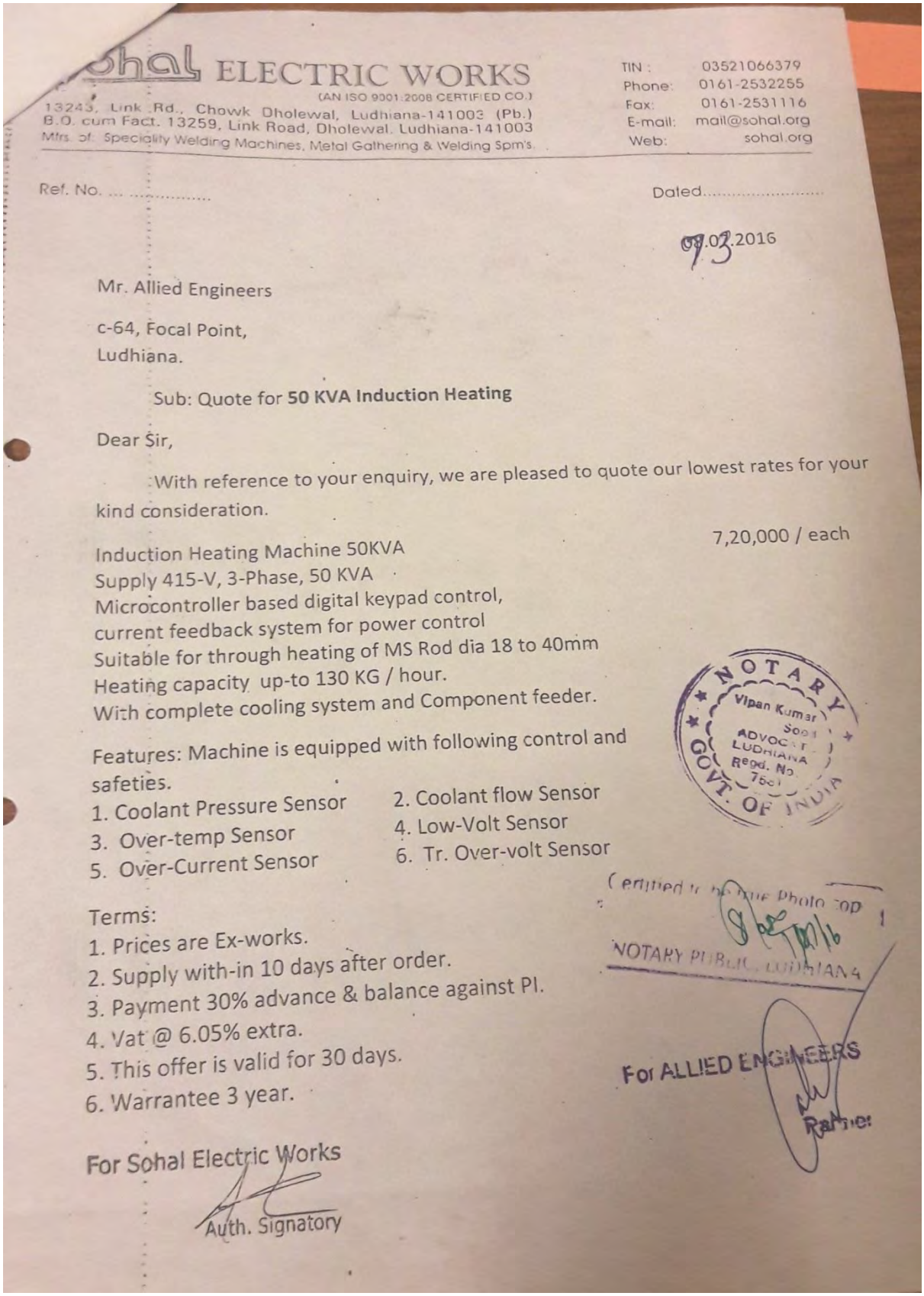
With regards

for Akal Induction Pvt. Ltd.

Jatinder Singh (M.D)

Signature Attested
I know the deponent/executant personally He/She has signed/Thumb marked in my presence

Mfrs. of : Medium Frequency and High Frequency Induction Heater & Bar End Heater



ohal ELECTRIC WORKS

(AN ISO 9001:2008 CERTIFIED CO.)

13243, Link Rd., Chowk Dholewal, Ludhiana-141003 (Pb.)
B.O. cum Fact. 13259, Link Road, Dholewal, Ludhiana-141003
Mfrs. of: Speciality Welding Machines, Metal Gathering & Welding Spm's.

TIN : 03521066379
Phone: 0161-2532255
Fax: 0161-2531116
E-mail: mail@sohal.org
Web: sohal.org

Ref. No. ... .

Dated.....

07.03.2016

Mr. Allied Engineers

c-64, Focal Point,
Ludhiana.

Sub: Quote for **50 KVA Induction Heating**

Dear Sir,

With reference to your enquiry, we are pleased to quote our lowest rates for your kind consideration.

7,20,000 / each

Induction Heating Machine 50KVA
Supply 415-V, 3-Phase, 50 KVA
Microcontroller based digital keypad control,
current feedback system for power control
Suitable for through heating of MS Rod dia 18 to 40mm
Heating capacity up-to 130 KG / hour.
With complete cooling system and Component feeder.

NOTARY Vipan Kumar Soni ADVOCATE LUDHIANA Regd. No. 7561 GOVT. OF INDIA

Features: Machine is equipped with following control and safeties.

1. Coolant Pressure Sensor
2. Coolant flow Sensor
3. Over-temp Sensor
4. Low-Volt Sensor
5. Over-Current Sensor
6. Tr. Over-volt Sensor

Certified true Photo copy
NOTARY PUBLIC, LUDHIANA

Terms:

1. Prices are Ex-works.
2. Supply with-in 10 days after order.
3. Payment 30% advance & balance against PI.
4. Vat @ 6.05% extra.
5. This offer is valid for 30 days.
6. Warrantee 3 year.

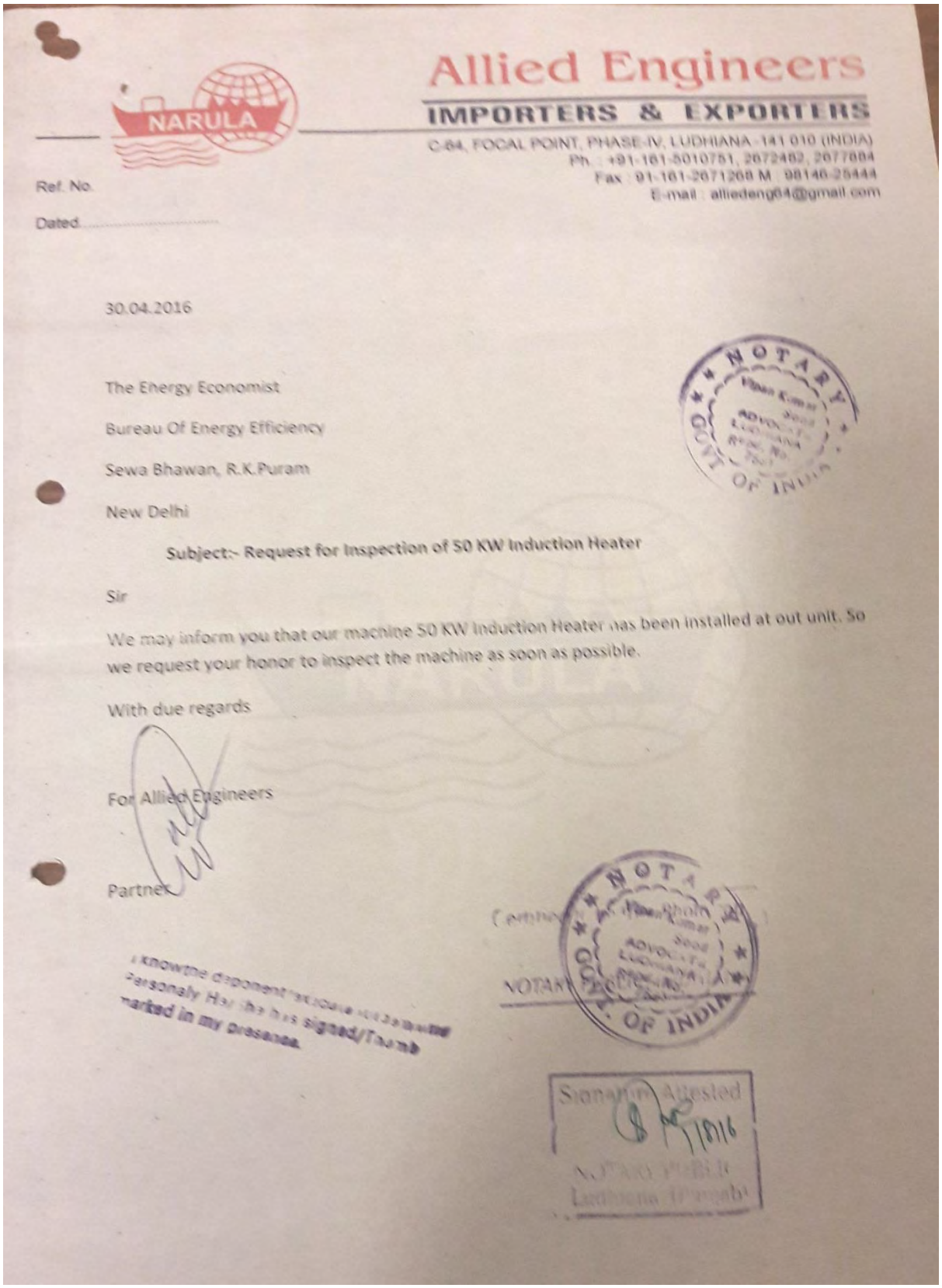
For Sohal Electric Works

Auth. Signatory

For ALLIED ENGINEERS

Partner

Completion Letter



Allied Engineers

IMPORTERS & EXPORTERS

C-64, FOCAL POINT, PHASE-IV, LUDHIANA-141 010 (INDIA)
Ph. : +91-161-5010751, 2672482, 2677884
Fax : 91-161-2671268 M : 98146-25444
E-mail : alliedeng64@gmail.com

Ref. No.

Dated.....

30.04.2016

The Energy Economist

Bureau Of Energy Efficiency

Sewa Bhawan, R.K.Puram

New Delhi

Subject:- Request for Inspection of 50 KW Induction Heater

Sir

We may inform you that our machine 50 KW Induction Heater has been installed at out unit. So we request your honor to inspect the machine as soon as possible.

With due regards

For Allied Engineers

Partner

I know the deponent personally He/She has signed/Thumb marked in my presence.

Signature Attested

Energy Saving Calculation for Induction Heating

Parameter	Unit	Value
Baseline Scenario		
Furnace oil consumption on re-heating furnace	ltr/hr	9.00
Productivity in terms of Kg	kg/hour	100
Specific energy consumption on FO based re-heating furnace	Ltr/Kg	0.09
Specific fuel consumption in terms of kcal	kcal/kg	918.00
Cost of energy consumption	Rs./Kg	4.50
Annual production (based on baseline productivity)	Kg/annum	240000
Post Implementation Scenario		
Power consumed by induction heater(based on on-site measurement) Note: Induction heater was observed to be running at 80 % loading	kWh	42.00
Productivity in terms of Kg	Kg/hr	208
Specific energy consumption on induction heater	kWh/Kg	0.20
Specific fuel consumption in terms of kcal	kcal/kg	173.65
Cost of energy consumption	Rs/kg	1.51
Annual production (based on post implementation productivity)	Kg/annum	499200
Savings		
Reduction in cost of energy	Rs/kg	3.0
Reduction in specific energy consumption in kcal	kcal/kg	744.3
Annual Cost Savings (in terms of post implementation productivity)	Rs	1490400
Annual Reduction in Energy Consumption (based on post implementation productivity)	toe	37.16
Percentage reduction in energy consumption	%	81.08
Investment made Induction heater (50 kW)	Rs	731745
Simple payback period	years	0.49
Annual CO_2 emission reduction	t CO2/year	40.11

Annexure 5

GHG Emission Factor

Emission Factors for Greenhouse Gas Inventories

Last Modified: 4 April 2014

Red text indicates an update from the 2011 version of this document.

Typically, greenhouse gas emissions are reported in units of carbon dioxide equivalent (CO_2e). Gases are converted to CO_2e by multiplying by their global warming potential (GWP). The emission factors listed in this document have not been converted to CO_2e. To do so, multiply the emissions by the corresponding GWP listed in the table below.

Gas	100-year GWP
CH_4	25
N_2O	298

Source: Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report (AR4), 2007. See the source note to Table 9 for further explanation.

Table 1 Stationary Combustion Emission Factors

Fuel Type	Heating Value	CO_2 Factor	CH_4 Factor	N_2O Factor	CO_2 Factor	CH_4 Factor	N_2O Factor	Unit
	mmBtu per short ton	kg CO_2 per mmBtu	g CH_4 per mmBtu	g N_2O per mmBtu	kg CO_2 per short ton	g CH_4 per short ton	g N_2O per short ton	
Coal and Coke								
Anthracite Coal	25.09	103.69	11	1.6	2,602	276	40	short tons
Bituminous Coal	24.93	93.28	11	1.6	2,325	274	40	short tons
Sub-bituminous Coal	17.25	97.17	11	1.6	1,676	190	28	short tons
Lignite Coal	14.21	97.72	11	1.6	1,389	156	23	short tons
Mixed (Commercial Sector)	21.39	94.27	11	1.6	2,016	235	34	short tons
Mixed (Electric Power Sector)	19.73	95.52	11	1.6	1,885	217	32	short tons
Mixed (Industrial Coking)	26.28	93.90	11	1.6	2,468	289	42	short tons
Mixed (Industrial Sector)	22.35	94.67	11	1.6	2,116	246	36	short tons
Coal Coke	24.80	113.67	11	1.6	2,819	273	40	short tons
Fossil Fuel-derived Fuels (Solid)								
Municipal Solid Waste	9.95	90.70	32	4.2	902	318	42	short tons
Petroleum Coke (Solid)	30.00	102.41	32	4.2	3,072	960	126	short tons
Plastics	38.00	75.00	32	4.2	2,850	1,216	160	short tons
Tires	28.00	85.97	32	4.2	2,407	896	118	short tons
Biomass Fuels (Solid)								
Agricultural Byproducts	8.25	118.17	32	4.2	975	264	35	short tons
Peat	8.00	111.84	32	4.2	895	256	34	short tons
Solid Byproducts	10.39	105.51	32	4.2	1,096	332	44	short tons
Wood and Wood Residuals	17.48	93.80	7.2	3.6	1,640	126	63	short tons
	mmBtu per scf	kg CO_2 per mmBtu	g CH_4 per mmBtu	g N_2O per mmBtu	kg CO_2 per scf	g CH_4 per scf	g N_2O per scf	
Natural Gas								
Natural Gas (per scf)	0.001026	53.06	1.0	0.10	0.05444	0.00103	0.00010	scf
Fossil-derived Fuels (Gaseous)								
Blast Furnace Gas	0.000092	274.32	0.022	0.10	0.02524	0.000002	0.000009	scf
Coke Oven Gas	0.000599	46.85	0.48	0.10	0.02806	0.000288	0.000060	scf
Fuel Gas	0.001388	59.00	3.0	0.60	0.08189	0.004164	0.000833	scf
Propane Gas	0.002516	61.46	0.022	0.10	0.15463	0.000055	0.000252	scf
Biomass Fuels (Gaseous)								
Landfill Gas	0.000485	52.07	3.2	0.63	0.025254	0.001552	0.000306	scf
Other Biomass Gases	0.000655	52.07	3.2	0.63	0.034106	0.002096	0.000413	scf
	mmBtu per gallon	kg CO_2 per mmBtu	g CH_4 per mmBtu	g N_2O per mmBtu	kg CO_2 per gallon	g CH_4 per gallon	g N_2O per gallon	
Petroleum Products								
Asphalt and Road Oil	0.158	75.36	3.0	0.60	11.91	0.47	0.09	gallon
Aviation Gasoline	0.120	69.25	3.0	0.60	8.31	0.36	0.07	gallon
Butane	0.103	64.77	3.0	0.60	6.67	0.31	0.06	gallon
Butylene	0.105	68.72	3.0	0.60	7.22	0.32	0.06	gallon
Crude Oil	0.138	74.54	3.0	0.60	10.29	0.41	0.08	gallon
Distillate Fuel Oil No. 1	0.139	73.25	3.0	0.60	10.18	0.42	0.08	gallon
Distillate Fuel Oil No. 2	0.138	73.96	3.0	0.60	10.21	0.41	0.08	gallon
Distillate Fuel Oil No. 4	0.146	75.04	3.0	0.60	10.96	0.44	0.09	gallon
Ethane	0.068	59.60	3.0	0.60	4.05	0.20	0.04	gallon
Ethylene	0.058	65.96	3.0	0.60	3.83	0.17	0.03	gallon
Heavy Gas Oils	0.148	74.92	3.0	0.60	11.09	0.44	0.09	gallon
Isobutane	0.099	64.94	3.0	0.60	6.43	0.30	0.06	gallon
Isobutylene	0.103	68.86	3.0	0.60	7.09	0.31	0.06	gallon
Kerosene	0.135	75.20	3.0	0.60	10.15	0.41	0.08	gallon
Kerosene-type Jet Fuel	0.135	72.22	3.0	0.60	9.75	0.41	0.08	gallon
Liquefied Petroleum Gases (LPG)	0.092	61.71	3.0	0.60	5.68	0.28	0.06	gallon
Lubricants	0.144	74.27	3.0	0.60	10.69	0.43	0.09	gallon
Motor Gasoline	0.125	70.22	3.0	0.60	8.78	0.38	0.08	gallon
Naphtha (<401 deg F)	0.125	68.02	3.0	0.60	8.50	0.38	0.08	gallon
Natural Gasoline	0.110	66.88	3.0	0.60	7.36	0.33	0.07	gallon
Other Oil (>401 deg F)	0.139	76.22	3.0	0.60	10.59	0.42	0.08	gallon
Pentanes Plus	0.110	70.02	3.0	0.60	7.70	0.33	0.07	gallon
Petrochemical Feedstocks	0.125	71.02	3.0	0.60	8.88	0.38	0.08	gallon
Petroleum Coke	0.143	102.41	3.0	0.60	14.64	0.43	0.09	gallon
Propane	0.091	62.87	3.0	0.60	5.72	0.27	0.05	gallon
Propylene	0.091	65.95	3.0	0.60	6.00	0.27	0.05	gallon
Residual Fuel Oil No. 5	0.140	72.93	3.0	0.60	10.21	0.42	0.08	gallon
Residual Fuel Oil No. 6	0.150	75.10	3.0	0.60	11.27	0.45	0.09	gallon
Special Naphtha	0.125	72.34	3.0	0.60	9.04	0.38	0.08	gallon
Still Gas	0.143	66.72	3.0	0.60	9.54	0.43	0.09	gallon
Unfinished Oils	0.139	74.54	3.0	0.60	10.36	0.42	0.08	gallon
Used Oil	0.138	74.00	3.0	0.60	10.21	0.41	0.08	gallon
Biomass Fuels (Liquid)								
Biodiesel (100%)	0.128	73.84	1.1	0.11	9.45	0.14	0.01	gallon
Ethanol (100%)	0.084	68.44	1.1	0.11	5.75	0.09	0.01	gallon
Rendered Animal Fat	0.125	71.06	1.1	0.11	8.88	0.14	0.01	gallon
Vegetable Oil	0.120	81.55	1.1	0.11	9.79	0.13	0.01	gallon
	mmBtu per gallon	kg CO_2 per mmBtu	g CH_4 per mmBtu	g N_2O per mmBtu				
Steam and Hot Water								
Steam and Hot Water		66.33	1.250	0.125				mmBtu

Source:

Solid, gaseous, liquid and biomass fuels: Federal Register (2009) EPA; *40 CFR Parts 86, 87, 89 et al; Mandatory Reporting of Greenhouse Gases; Final Rule*, 30Oct09, 261 pp. Tables C-1 and C-2 at FR pp. 56409-56410. Revised emission factors for selected fuels: Federal Register (2010) EPA; 40 CFR Part 98; Mandatory Reporting of Greenhouse Gases; Final Rule, 17Dec10, 81 pp. With Amendments from Memo: Table of Final 2013 Revisions to the Greenhouse Gas Reporting Rule (PDF) to 40 CFR part 98, subpart C: Table C-1 to Subpart C—Default CO2 Emission Factors and High Heat Values for Various Types of Fuel and Table C-2 to Subpart C—Default CH4 and N2O Emission Factors for Various Types of Fuel.

Steam and Hot Water: EPA (2008) *Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance - Indirect Emissions from Purchases/Sales of Electricity and Steam*. Assumption: 80% boiler efficiency and fuel type assumed natural gas. Factors are per mmBtu of steam or hot water purchased.

http://www.epa.gov/ghgreporting/documents/pdf/2013/documents/memo-2013-technical-revisions.pdf
http://www.epa.gov/ghgreporting/reporters/subpart/c.html