# BEE's National Program

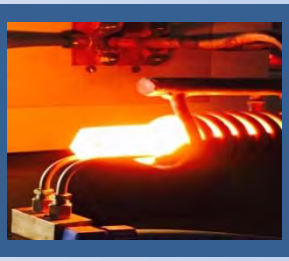
*on*

# Energy Efficiency and Technology Up-gradation in SMEs

## Ludhiana Forging Cluster

## Post Implementation Audit Report

## Mehram Industries

*Submitted to*

*Submitted by*

**InsPIRE Network for Environment**

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# contents

**Preface** ..... **i**
**Executive Summary** ..... **ii**

**Chapter 1: Introduction** ..... **1**
1.1 MSME sector – An overview ..... 1
1.2 BEE-SME project at a glance ..... 2
1.3 Ludhiana forging cluster – An Insight ..... 3
1.4 About the unit ..... 3
1.5 Project implementation methodology ..... 4
1.6 Production Process of plant ..... 5
1.7 Energy audit methodology ..... 5

**Chapter 2: Post implementation energy audit outcome and results** ..... **7**
2.1 Installation of special purpose machine ..... 7
2.1.1 Baseline Scenario ..... 7
2.1.2 Present Scenario ..... 7
2.1.3 Energy saving and Cost Economics Analysis (baseline vis-à-vis post implementation) ..... 8
2.1.4 Snap-shot of implementation (before and after) ..... 9
2.1.5 Energy saving and Cost Economics Analysis (baseline vis-à-vis post implementation) ..... 10
2.1.6 Snap-shot of implementation (before and after) ..... 11

## List of Annexures

Annexure 1: Base Executive Summary ..... 12
Annexure 2: Clearance by CA ..... 13
Annexure 3: Completion Letter ..... 18
Annexure 4: Energy Saving calculation for SPM-turning ..... 19
Annexure 5: GHG Emission Factor ..... 21

# 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 Mehram Industries.

# Executive Summary

## 1. Unit Details

| | | |
|---|---|---|
| Unit Name | : | **Mehram Industries** |
| Address | : | Plot No. K-30, Phase-VII, Focal Point, Ludhiana |
| Contact Person | : | Smt. Surjeet Kaur (Cell No. 9878410234) |
| Products | : | BB Axle, Barrel Hinge, cycle and other auto parts |
| Production | : | 500-700 Kgs |
| DIC Number | : | 030091103069 |
| Bank Details | : | HDFC Bank, Account Number: 50200000569102 |
| TIN / PAN No. | : | PAN: ACCPK4429M |
| Contract demand | : | 78.61 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 |
|---|---|
| SPM –Turning Machine -2no's | SPM – Turning Machine -2no's |

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

| Technology | Estimated Energy Savings (%) | Savings | Investment | Simple Payback period (years) |
|---|---|---|---|---|
| Baseline (Projected) SPM – Turning Machine - 1 | 84 | 283,804 | 550,000 | 1.90 years |
| Post Implementation (Actual) SPM – Turning Machine - 1 | 88 | 435,338 | 572,670 | 1.32 years |
| Baseline (Projected) SPM – Turning Machine -2 | 84 | 283,804 | 550,000 | 1.90 years |
| Post Implementation (Actual) SPM – Turning Machine -2 | 88 | 414,658 | 572,670 | 1.38 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) |
|---|---|---|---|
| SPM – Turning Machine - 1 | 88 | 4.99 | 52.24 |
| SPM – Turning Machine - 2 | 88 | 4.75 | 49.76 |

**Assumptions / conversion factors:**

- 1 toe = 1 x 10 ^-7
- Emission factor power is 0.9 $tCO_2$ per MWh
- $CO_2$ emission reduction calculation has been considered based on equivalent reduction in 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 12$^{th}$ 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.

## 1.4 ABOUT THE UNIT

Mehram Industries is engaged in manufacturing of different types of BB Axle, Barrel hings, Cycle and other auto parts. The manufacturing unit is located at Plot No K-30, Phase –VIII, Focal Point, Ludhiana.

The daily production lies in the range of 500 -700 kg of bags. Mehram Industries is using energy in the form of electricity supply from Punjab State Electricity Board, for various process and utility applications in its premises. During baseline energy audit, it was observed that the average monthly electricity consumption was 9114 kWh.

## 1.5 PROJECT IMPLEMENTATION METHODOLOGY

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


Figure 1.1: ***Production process***

## 1.6 PRODUCTION PROCESS OF PLANT

The following figure shows the typical process employed at manufacturing of forged products at Global Exports India, Jalandhar:

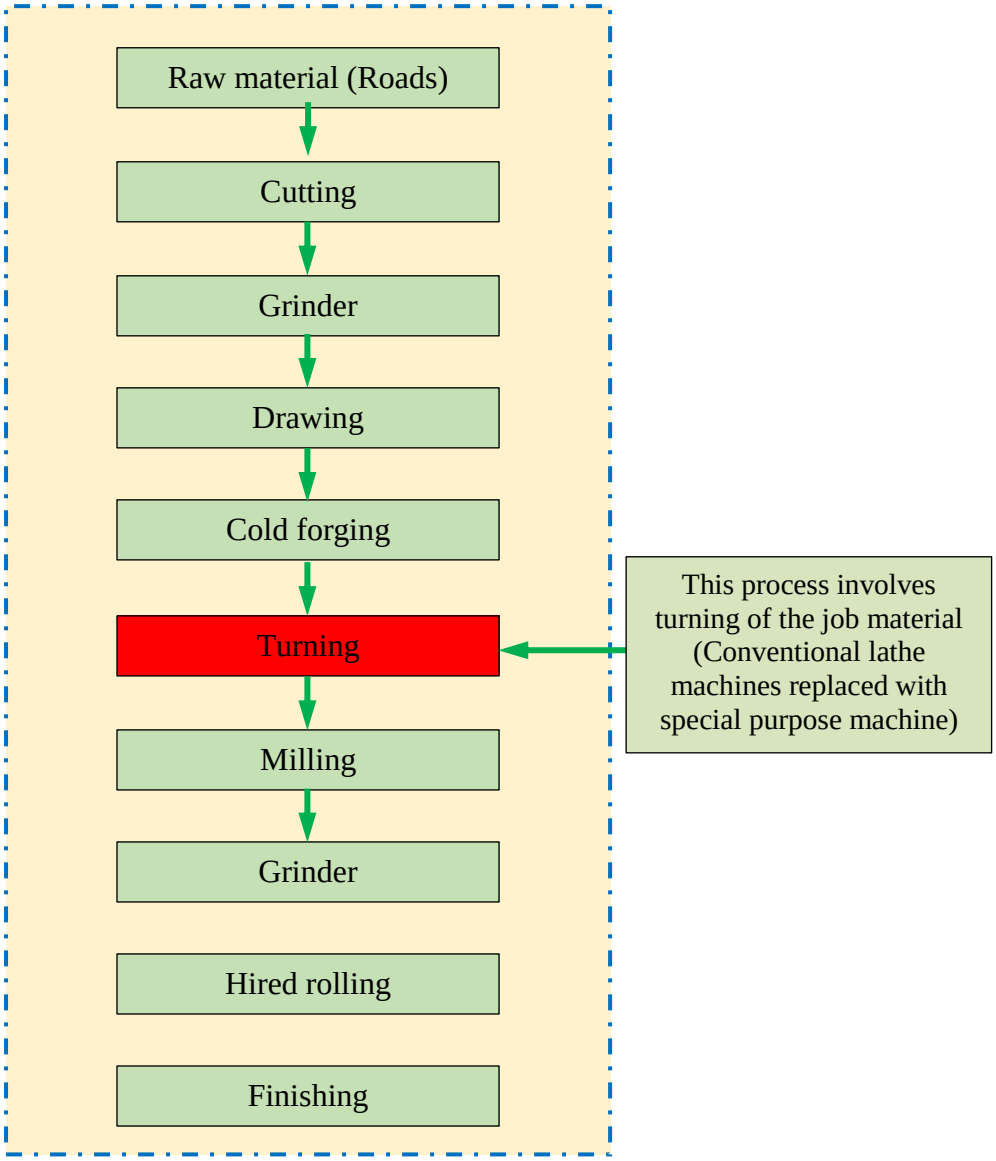



Figure 1.2: ***Production process***

## 1.7 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:

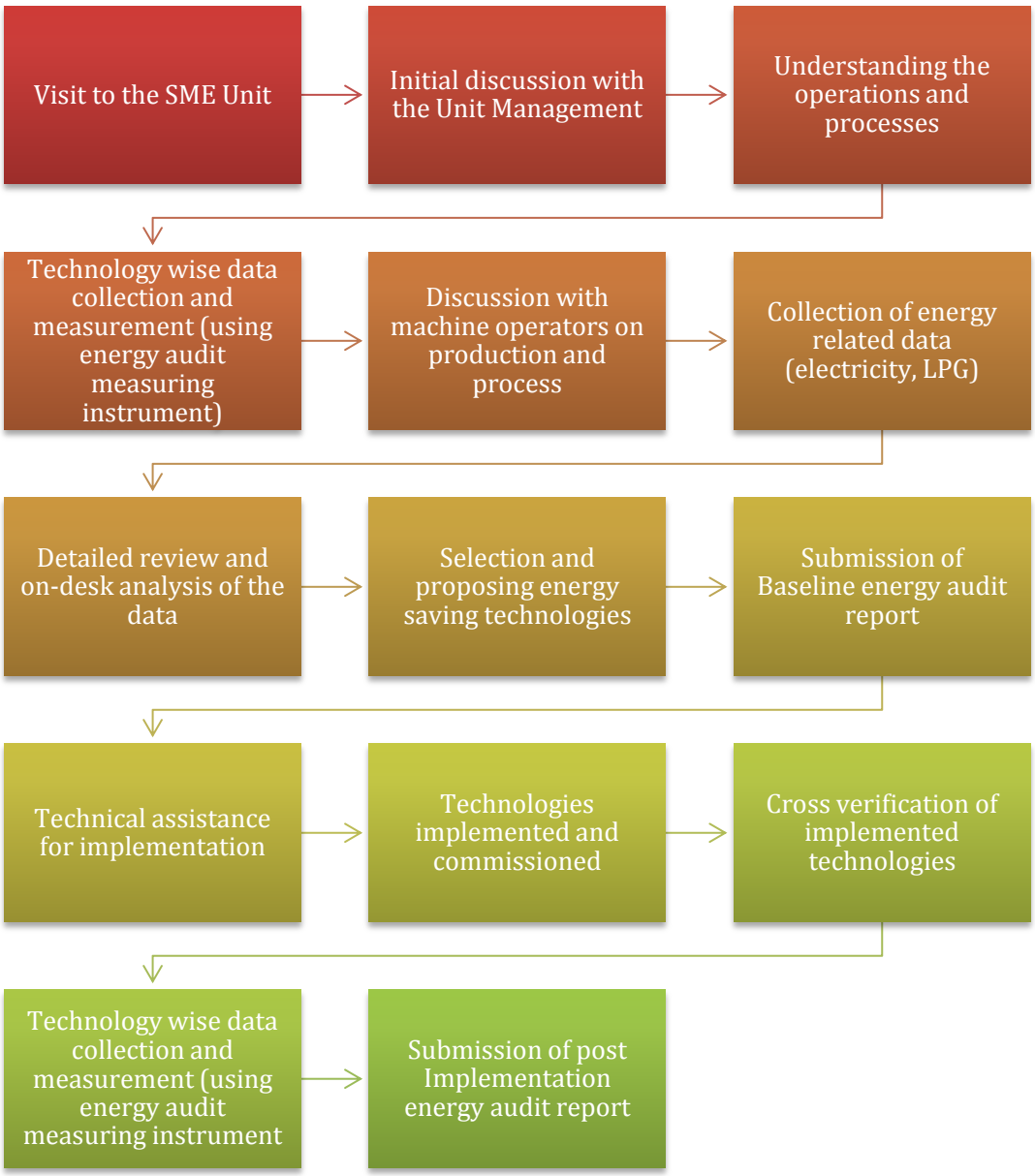



Figure 1.3: ***Energy audit methodology***

# Post implementation energy audit outcome and results

## 2.1 INSTALLATION OF SPECIAL PURPOSE MACHINE

### 2.1.1 Baseline Scenario

Mehram Industries has installed manually operated lathe machines for various components machining job work like facing, turning, grinding, drilling etc. These machine runs on electrical motors having the capacity of 3 hp with production/ machining of 130-150 pcs/hr.

Since these machines are manually operated, the process through which components are manufactured is very slow and time consuming. Apart from the slow process, the components manufactured are not very precise, identical and of high quality. Some times what happens that the machine keeps on running even there is no component on the machine or the operator is busy in some other work. All these factors lead to the loss of energy and production of low quality components.

### 2.1.2 Present Scenario

The conventional lathe machines are replaced by automatic special purpose machine (The conventional lathe machine has been replaced by automatic special purpose machine (SPMs). These machines run on pre-installed programs, and are equipped to carry out multi-tasking at a single time. Thus, consumption of electricity only happens when there is a function or operation required on the component. In the ideal condition the machine remains in dead mode/ no operation mode. The machine also has an automatic feeder to automatically load the component for machining. The cycle time of the each component is fixed in the business logic of the PLC / SPM; therefore each component will take specific time for processing or machining. The SPM machines results in 30-50% percent of the energy savings depending upon the type of component, operation, material, cycle time. The details and operating principle of SPM has been summarized below.

A **Special Purpose Machine (SPM)** is a kind of multi-tasking machine used for machining purpose. A special purpose machine is used as a replacement to conventional machines like lathe, drilling or trimming machine. A special purpose machine is designed based on the customized requirement of a unit and may be used for one or multiple task as per the design. For example, a conventional lathe machine takes 3 mins (say) to machine (turn) a metal piece. Thereafter it is transferred to another machine for facing and trimming operations. In some cases, a third machine is used for threading operations. A special purpose machine specifically designed can replace all the three machines with a single machine. The replaced special purpose machine can perform all the four activities i.e. turning, facing, trimming, and threading on sequential manner. The sequence of operation is pre-set using timers and sensors. The entire operation is

maintained using pneumatic and mechanical control. For ease of operation, each special purpose machine is equipped with an automatic feeder. Replacement of conventional machines with special purpose machines usually increases machine productivity by 5 times, easing the life of the operators by avoiding manual intervention during each operation.

### ▶ Operating Principle

A special purpose machine (SPM) is usually customized based on the specific requirement of a unit. A SPM is used for multi-task operation, which are typically performed in more than one conventional machine. The sequence of operation in a SPM is pre-set using timers and sensors. Usually, a SPM is equipped with two or more machine tools fitted in different axis. The operations are carried out in sequential manner. The axial motion of the machine tool is usually powered by pneumatic controls, whereas positioning of the tool is done using sensors. A particular operation e.g. turning operation in a metal piece of 400 mm is pre-set using timers. Once the operation is over, the sensor directs the next sequence of operations, which are also pre-fed programs in the machine. Thus, manual intervention in each operation can be prevented. Also, two or more operational can be performed simultaneously in a SPM.

Figure 2.1: ***Special Purpose Machine- Turning***

Similar is the case for SPM-drilling machine, where the time taken in conventional drilling machine which performs one drilling operation at a time, can be significant reduced by simultaneously performing two or more drilling operations at a time.

## 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** | | |
| Power consumed by conventional turning machine (3 machines of 4 hp each) | kW | 8.952 |
| Productivity on conventional lathe machine (turning operation) | Pcs/hr | 140 |
| Specific power consumption on conventional machine | kWh/Pcs | 0.064 |
| Specific fuel consumption in terms of kcal | kcal/pcs | 54.991 |
| Cost of energy consumption | Rs/pcs | 0.480 |
| Annual production (based on baseline productivity) | pcs/annum | 336000 |
| **Post Implementation Scenario** | | |
| Power consumed by 2 nos. of SPM turning machine (based on actual on-site measurement) | | |
| Note: Each SPM machine was observed to be running at 80% loading) | kW | 6.49 |

| Parameter | Unit | Value |
|---|---|---|
| Productivity on SPM turning machine | Pcs/hr | 3.31 |
| Specific power consumption on conventional machine | kWh/Pcs | |
| Specific fuel consumption in terms of kcal | kcal/pcs | 430 |
| Cost of energy consumption | Rs/pcs | 0.008 |
| Annual production (based on post implementation productivity) | pcs/annum | 6.620 |
| **Savings** | | |
| Reduction in cost of energy | Rs/pcs | 0.42 |
| Reduction in specific energy consumption in kcal | kcal/pcs | 48.4 |
| Annual Cost Savings (in terms of post implementation production) | Rs | 435338 |
| Annual Reduction in Energy Consumption (in terms of post implementation production) | toe | 4.99 |
| Percentage reduction in energy consumption | % | 87.96 |
| SPM turning machine | Rs | 572670 |
| Simple payback period | years | 1.32 |
| Annual $CO_2$ emission reduction | t $CO_2$/year | 52.24 |

**Assumption / conversion factors:**

- 1 toe = 0.0148 TJ
- Emission factor power is 0.9 tCO2 per MWh
  $CO_2$ emission reduction calculation has been considered based on equivalent reduction in energy consumption

The energy cost saved per piece of forged material is Rs. 0.42. The actual investment made to implement the energy efficient SPM technology is Rs 5.72 lakhs with annual saving of Rs. 4.35 Lakhs. Thus, the investment made will be recovered within 1.32 years.

### 2.1.4 Snap-shot of implementation (before and after)

A comparison of the snap-shots of conventional lathe machine used during the baseline vis-à-vis the Special Purpose Machine used in the post implementation study has been shown below:


Figure 2.2: ***Snap shot of conventional lathe machine at Mehram Industries***

Figure 2.3: ***Special Purpose Machine installed at Mehram Industries***

### 2.1.5 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** | | |
| Power consumed by conventional turning machine (3 machines of 4 hp each) | kW | 8.952 |
| Productivity on conventional lathe machine (turning operation) | Pcs/hr | 140 |
| Specific power consumption on conventional machine | kWh/Pcs | 0.064 |
| Specific fuel consumption in terms of kcal | kcal/pcs | 54.991 |
| Cost of energy consumption | Rs/pcs | 0.480 |
| Annual production (based on baseline productivity) | pcs/annum | 336000 |
| **Post Implementation Scenario** | | |
| Power consumed by 2 nos. of SPM turning machine (based on actual on-site measurement) Note: Each SPM machine was observed to be running at 80% loading) | kW | 3.18 |
| Productivity on SPM turning machine | Pcs/hr | 410 |
| Specific power consumption on conventional machine | kWh/Pcs | 0.008 |
| Specific fuel consumption in terms of kcal | kcal/pcs | 6.670 |
| Cost of energy consumption | Rs/pcs | 0.058 |
| Annual production (based on post implementation productivity) | pcs/annum | 984000 |
| **Savings** | | |
| Reduction in cost of energy | Rs/pcs | 0.42 |
| Reduction in specific energy consumption in kcal | kcal/pcs | 48.3 |
| Annual Cost Savings (in terms of post implementation production) | Rs | 414658 |
| Annual Reduction in Energy Consumption (in terms of post implementation production) | toe | 4.75 |
| Percentage reduction in energy consumption | % | 87.87 |
| SPM turning machine | Rs | 572670 |
| Simple payback period | years | 1.38 |
| Annual $CO_2$ emission reduction | t $CO_2$/year | 49.76 |

**Assumption / conversion factors:**

- 1 toe = 0.0148 TJ
- Emission factor power is 0.9 tCO2 per MWh
  $CO_2$ emission reduction calculation has been considered based on equivalent reduction in energy consumption

The energy cost saved per piece of forged material is Rs. 0.42. The actual investment made to implement the energy efficient SPM technology is Rs 5.72 lakhs with annual saving of Rs. 4.14 Lakhs. Thus, the investment made will be recovered within 1.38 years.

### 2.1.6 Snap-shot of implementation (before and after)

A comparison of the snap-shots of conventional lathe machine used during the baseline vis-à-vis the Special Purpose Machine used in the post implementation study has been shown below:


Figure 2.4: ***Snap shot of conventional lathe machine at Mehram Industries***

Figure 2.5: ***Special Purpose Machine installed at Mehram Industries***

# Base Executive Summary

## Executive Summary

### 1. Unit Details

| | | |
|---|---|---|
| Unit Name | : | **Mehram Industries** |
| Address | : | Plot No. K-30, Phase-VII, Focal Point, Ludhiana |
| Contact Person | : | Smt. Surjeet Kaur (Cell No. 9878410234) |
| Products | : | BB Axle, Barrel Hinge, cycle and other auto parts |
| Production | : | 500-700 Kgs |
| DIC Number | : | 030091103069 |
| Bank Details | : | HDFC Bank, Account Number: 50200000569102 |
| TAN / PAN No. | : | PAN: ACCPK4429M |
| Contract demand | : | 78.61 kVA |

### 2. Existing Major Energy Consuming Technology

**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 130 – 150 pieces per hour per set of lathe machine.

### 3. Proposed Energy Saving Technologies with Cost Economics

**Proposed Energy Saving Measures**

- 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) |
|---|---|---|---|---|
| SPM - Turning Machine (2Nos.) | 83.9 | 567,608 | 1,100,000 | 1.9 |
| **Total** | | **567,608** | **1,100,000** | |

# Clearance by CA

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

To
M/s Mehram Industries
K-28-29, Phase VII, 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) |
|---|---|---|---|
| Special Purpose Machine (SPM) | Special Purpose Machine (Forging Turning Machine) - 2 in No. amounting to Rs.10.80 lacs | Special Purpose Machine (Forging Turning Machine) - 2 in No. amounting to Rs.11.00 lacs | Special Purpose Machine (Forging Turning Machine) - 2 in No. amounting to Rs.11.50 lacs |
| **Name of Service Provider** | **Bhambar Engineers (Regd)** | **M/s Harkaram Enterprises** | **Harjit Turner** |

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 Bhambar Engineers (Regd.), 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 * Chartered Accountant *

# MEHRAM INDUSTRIES

Dated: 16.2.2016

Sh. Madhur Gupta,
Chartered Accountant,
Nominated Financial Expert for BEE,
Civil Lines, Ludhiana.

Subject:- Implementation of demonstration projects in Ludhiana (Forging) Cluster –reg.

Dear Sir,

With reference to above it is to inform you that we have received quotations from the following parties against the proposed EE equipments. The same are enclosed for your perusal please.

1. M/s Harkaram Enterprises, Ludhiana.
2. M/s Harjit Turners, Ludhiana.
3. M/s Bhamber Engineers (Regd.), Ludhiana.

We are willing to place order to the supplier quoted least amount. Please do the needful and give us clearance, so that needful further action may be taken accordingly.

Thanking you,

Yours faithfully,
For Mehram Industries,

Surjit Kaur

Auth.Sign./Prop.

Prop.

**Encl: Quotations.**

**Mfrs. & Exporters of : CYCLE & AUTO PARTS**
SPECIALIST IN : B.B. FITTINGS
K-28-29, Phase-VII, Focal Point, LUDHIANA-10.
Ph. : 0161-5033234 Cell : 98725-00234, 98784-10234 E-mail : mehramind2829@gmail.com

VAT No. : 03481034391
C.ST.No. 46518919, Dt. 17-6-95

HC-TRACE®

Tele Fax : 0161-5027178
Ph. : 0161-5076178
(M) : 93169 - 17985

# HARKARAM ENTERPRISES

Specialist In : Hydraulic Copying Attachment And Auto Lathes

Mfrs. & Suppliers of :TURNNING MACHINERY, SPECIAL PURPOSE MACHINERY & COPY MILLING MACHINES

10529, St. No: 10, Partap Nagar, Bhagwan Chowk, Industrial Area-B, Ludhiana-141003.
Head Off. St. No. 15, Plot No.7166, New Janta Nagar, Daba Road, LUDHIANA-141003.

Ref. No. .....

Dated.....
Dated: 4.2.2016

M/s Mehram Industries,
K-28-29, Phase-VII, Focal Point,
Ludhiana.

Dear Sirs,

## QUOTATION

| Detail of machine & specification. | Qty. | Rate per machine | Amount |
|---|---|---|---|
| Special Purpose Machine (Forging Turning Machine) complete in all respect (Set of Two machines) | 2 Nos. | 5,50,000/- | 11,00,000/- |

**Terms & conditions:**

- FOR ex-works at Ludhiana.
- VAT @ 6.05% will be charged extra.
- Delivery within 40 days after receipt of confirmed order with 40% advance payment.

Thanking you,

Yours faithfully,
For Harkaram Enterprises,

Authorized Signatory

For Mehram Industries

Auth. Sign./Prop.

VAT No. 03531060990

97797-31313
93179-91313

# HARJIT TURNERS

J. B. Industrial Estate, Near Sunny Kharay Dharam Kanda,
Jaspal Bangar Road, Ludhiana.
E-mail : harjitturners@gmail.com, Web : www.harjitturners.com

Ref. No

Dated: 11.2.2016
Dated

## QUOTATION

M/s Mehram Industries,
K-28-29, Phase-VII, Focal Point,
Ludhiana.

Dear Sirs,

We are pleased to quote our lowest possible rates as under, as per your telephonic request.

| Detail of machine & specification. | Qty. | Rate per machine | Amount |
|---|---|---|---|
| **Special Purpose Machine (Forging Turning Machine) complete in all respect (Set of Two machines)** | 2 Nos. | 5,75,000/- | 11,50,000/- |

**Terms & conditions:**

- FOR ex-works at Ludhiana.
- VAT and other taxes, as applicable, will be charged extra.
- Delivery within 40 days after receipt of confirmed order with 35% advance payment.
- The above rates are valid up tc 50 days only.

We hope that you will find our rates quite reasonable and competitive. Please favour us with your valued order, so that the machines may be supplied accordingly.

Thanking you,

Yours faithfully,
For Harjit Turners,

Manager

For Mehram Industries

Auth. Sign./Prop.

Subject to Ludhiana Jurisdiction only

# BHAMBAR ENGINEERS (Regd.)

1208, G.T. Road, Dhandari Khurd, Ludhiana-141010 (Pb.) INDIA Tel. +91-161-2515183
Telefax +91-161-2510222 E-mail info@bhambar.in Visit us at www.bhambar.in

Registered Trade Mark No. 669498

Mfrs. & Exporters All Geared & Universal, Vertical, Ram Turret, & Special Purpose Slotting Machines

Dated: 03.03.2016

M/s Mehram Industries,
K-28-29, Phase-VII, Focal Point,
Ludhiana.

Dear Sirs,

We are pleased to quote our revised minimum possible rates of the following machines:-

| Description of machine | Qty. | Rate per machine | Amount |
|---|---|---|---|
| Special Purpose Machine (Forging Turning Machine) complete with all standard accessories and electrical. | 2 Nos. | 5,40,000/- | 10,80,000/- |

Terms & conditions:

1. FOR ex-works at Ludhiana.
2. Vat will be charged extra as applicable.
3. Delivery within 30 days after receipt of confirmed order with 40% advance payment.
4. Rates are valid up to 3 months only.

Thanking you and awaiting your valued order accordingly,

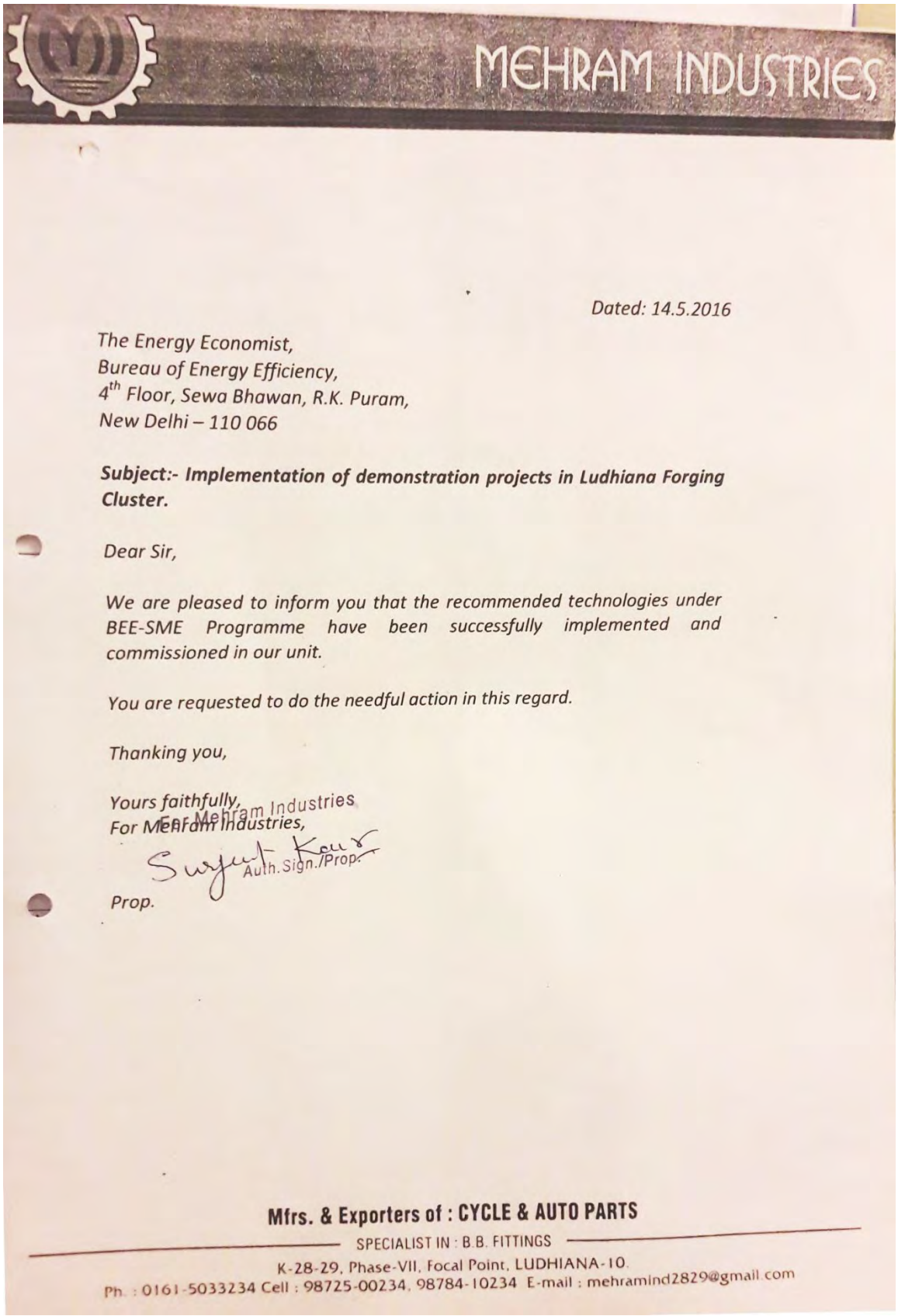
Yours faithfully,
For Bhambar Engineers (Regd.),

Authorized Signatory.

For Mehram Industries

Auth. Sign./Prop.

# Completion Letter



MEHRAM INDUSTRIES

Dated: 14.5.2016

The Energy Economist,
Bureau of Energy Efficiency,
4th Floor, Sewa Bhawan, R.K. Puram,
New Delhi – 110 066

**Subject:- Implementation of demonstration projects in Ludhiana Forging Cluster.**

Dear Sir,

We are pleased to inform you that the recommended technologies under BEE-SME Programme have been successfully implemented and commissioned in our unit.

You are requested to do the needful action in this regard.

Thanking you,

Yours faithfully,
For Mehram Industries,
For Mehram Industries
Auth.Sign./Prop.
Prop.

Mfrs. & Exporters of : CYCLE & AUTO PARTS
SPECIALIST IN : B.B. FITTINGS
K-28-29, Phase-VII, Focal Point, LUDHIANA-10.
Ph. : 0161-5033234 Cell : 98725-00234, 98784-10234 E-mail : mehramind2829@gmail.com

# Energy Saving calculation for SPM-turning

| Parameter | Unit | Value |
|---|---|---|
| **Baseline Scenario** | | |
| Power consumed by conventional turning machine (4 machines of 3 hp each) | kW | 8.952 |
| Productivity on conventional lathe machine (turning operation) | Pcs/hr | 140 |
| Specific power consumption on conventional machine | kWh/Pcs | 0.064 |
| Specific fuel consumption in terms of kcal | kcal/pcs | 54.991 |
| Cost of energy consumption | Rs/pcs | 0.480 |
| Annual production (based on baseline productivity) | pcs/annum | 336000 |
| **Post Implementation Scenario** | | |
| Power consumed by 2 nos. of SPM turning machine (based on actual on-site measurement)<br>Note: Each SPM machine was observed to be running at 80% loading) | kW | 6.49 |
| Productivity on SPM turning machine | Pcs/hr | 840 |
| Specific power consumption on conventional machine | kWh/Pcs | 0.008 |
| Specific fuel consumption in terms of kcal | kcal/pcs | 6.645 |
| Cost of energy consumption | Rs/pcs | 0.058 |
| Annual production (based on post implementation productivity) | pcs/annum | 2016000 |
| **Savings** | | |
| Reduction in cost of energy | Rs/pcs | 0.42 |
| Reduction in specific energy consumption in kcal | kcal/pcs | 48.3 |
| Annual Cost Savings (in terms of post implementation production) | Rs | 849996 |
| Annual Reduction in Energy Consumption (in terms of post implementation production) | Toe | 9.75 |
| Percentage reduction in energy consumption | % | 87.92 |
| SPM turning machine | Rs | 1145340 |
| Simple payback period | years | 1.35 |
| Annual $CO_2$ emission reduction | t $CO_2$/year | 102.00 |

| Baseline Scenario | | |
|---|---|---|
| Power consumed by conventional turning machine (3 machines of 4 hp each) | kW | 8.952 |
| Productivity on conventional lathe machine (turning operation) | Pcs/hr | 140 |
| Specific power consumption on conventional machine | kWh/Pcs | 0.064 |
| Specific fuel consumption in terms of kcal | kcal/pcs | 54.991 |
| Cost of energy consumption | Rs/pcs | 0.480 |
| Annual production (based on baseline productivity) | pcs/annum | 336000 |
| **Post Implementation Scenario** | | |
| Power consumed by 2 nos. of SPM turning machine (based on actual on-site measurement)<br>Note: Each SPM machine was observed to be running at 80% loading) | kW | 3.18 |
| Productivity on SPM turning machine | Pcs/hr | 410 |
| Specific power consumption on conventional machine | kWh/Pcs | 0.008 |
| Specific fuel consumption in terms of kcal | kcal/pcs | 6.670 |
| Cost of energy consumption | Rs/pcs | 0.058 |
| Annual production (based on post implementation productivity) | pcs/annum | 984000 |
| **Savings** | | |
| Reduction in cost of energy | Rs/pcs | 0.42 |
| Reduction in specific energy consumption in kcal | kcal/pcs | 48.3 |
| Annual Cost Savings (in terms of post implementation production) | Rs | 414658 |
| Annual Reduction in Energy Consumption (in terms of post implementation production) | Toe | 4.75 |
| Percentage reduction in energy consumption | % | 87.87 |
| SPM turning machine | Rs | 572670 |
| Simple payback period | years | 1.38 |
| Annual $CO_2$ emission reduction | t $CO_2$/year | 49.76 |

# 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/subpartc.html