

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

Ludhiana Forging Cluster

Baseline Energy Audit Report
Advance Auto Engineers

Submitted to



Submitted by



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Brief about the project

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	:	Advance Auto Engineers
Address	:	Plot No 10083, Kot Mangal Singh Chowk, Janta Nagar, Ludhiana – 141003, Punjab
Contact Person	:	Mr. Sukhwinder Singh (Cell No: 9855359581)
Products	:	Bolts, Nuts, Industrial Fasteners and Auto parts
Production	:	1 Ton/day
DIC Number	:	030091100824 (Part – II)
Bank Details	:	Tamilnadu Mercantile Bank, Miller Ganj, Ludhiana Account Number, 169150310875365
TAN / PAN No.	:	PAN: ADVPS7829M
Contract demand	:	90.97 kVA

2. Existing Major Energy Consuming Technology

Lathes Machine

- ▶ Manually operated lathe machines for machining job work including threading, turning, grinding, drilling etc.
- ▶ Electrical motor rating of 3 HP with production of 80-100 pieces per hour per set of lathe machine

3. Proposed Energy Saving Technologies with Cost Economics

Proposed Energy Measures

- ▶ Replacement of manual lathe machines by four numbers of CNC based Special Purpose Machine (SPM), two for turning and two for facing operation

Table 1: *Cost Economic Analysis*

Proposed Technology	Estimated Energy Savings (%)	Savings (in Rs.)	Investment (in Rs.)	Simple Payback period (Years)
SPM – Turning Machine (2 Nos)	81	508,204	1,100,000	2.0
SPM – Facing Machine (2 Nos)	80	365,176	1,100,000	3.0
Total		873,380	2,200,000	

Introduction

1.1 ABOUT THE UNIT

M/s Advance Auto Engineers was started in the year 1990 and is engaged in manufacturing of different types of wheel nuts, bolts, industrial fasteners and auto parts in various sizes as per the customer requirement. The manufacturing unit is located at Plot No 10084/1, Kot Mangal Singh Chowk, Janta Nagar, Ludhiana - 141003, Punjab.

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

The production of M/s Advance Auto Engineers is 1.0 tonnes/ day approximately. The unit is using two different forms of energy for various process and utility applications in premises, those are:

↪ Electricity

The average electricity consumption of the unit is 5676 kWh. The average electricity bill of the unit is Rs. 42,570 per month. The electricity is taken from Punjab State Power Corporation Limited.

The unit basically involved in processing and machining of the forged material. It procures the material from one its sister concern and do the machining. The unit has installed grinding, facing, turning, trimming machines, threading machine, punching machine, nut making machines etc.

According to the assessment of the energy consumption data collected, the specific electrical energy consumption is 0.22 kWh/kg (195.25 kCal/kg) of product. The units operates for approximately 25 days a month. The annual energy consumption and specific energy consumption details of M/s Advance Auto Engineers is presented in table below:

Table 1.1: *Details of M/s Advance Auto Engineers*

S. No	Parameter	Value	Unit
1	Name and address of unit	M/s. Advance Auto Engineers, Plot No 10084/1, Kot Mangal Singh Chowk, Janta Nagar, Ludhiana - 141003, Punjab	
2	Contact person	Ms. Sukhwinder Singh	
3	Manufacturing product	Bolts, Nuts, Industrial Fasteners and Auto parts	
4	Daily Production	1 Tonnes/ day	
	Energy utilization		
5	Average monthly electrical energy consumption	5676	kWh per month
8	Electrical specific energy	0.22704	kWh/Kg of product

S. No	Parameter	Value	Unit
	consumption	195.2544	kCal/kg of product
10	Electrical energy cost	1.7028	Rs/Kg of product

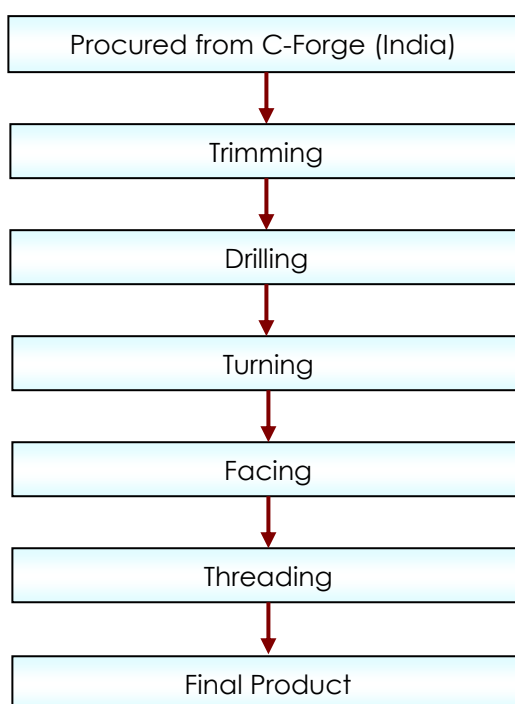
Note:

^1: Thermal equivalent for one unit of electricity is 860 kCal/kWh.

^2: The unit operates for 25 days a month.

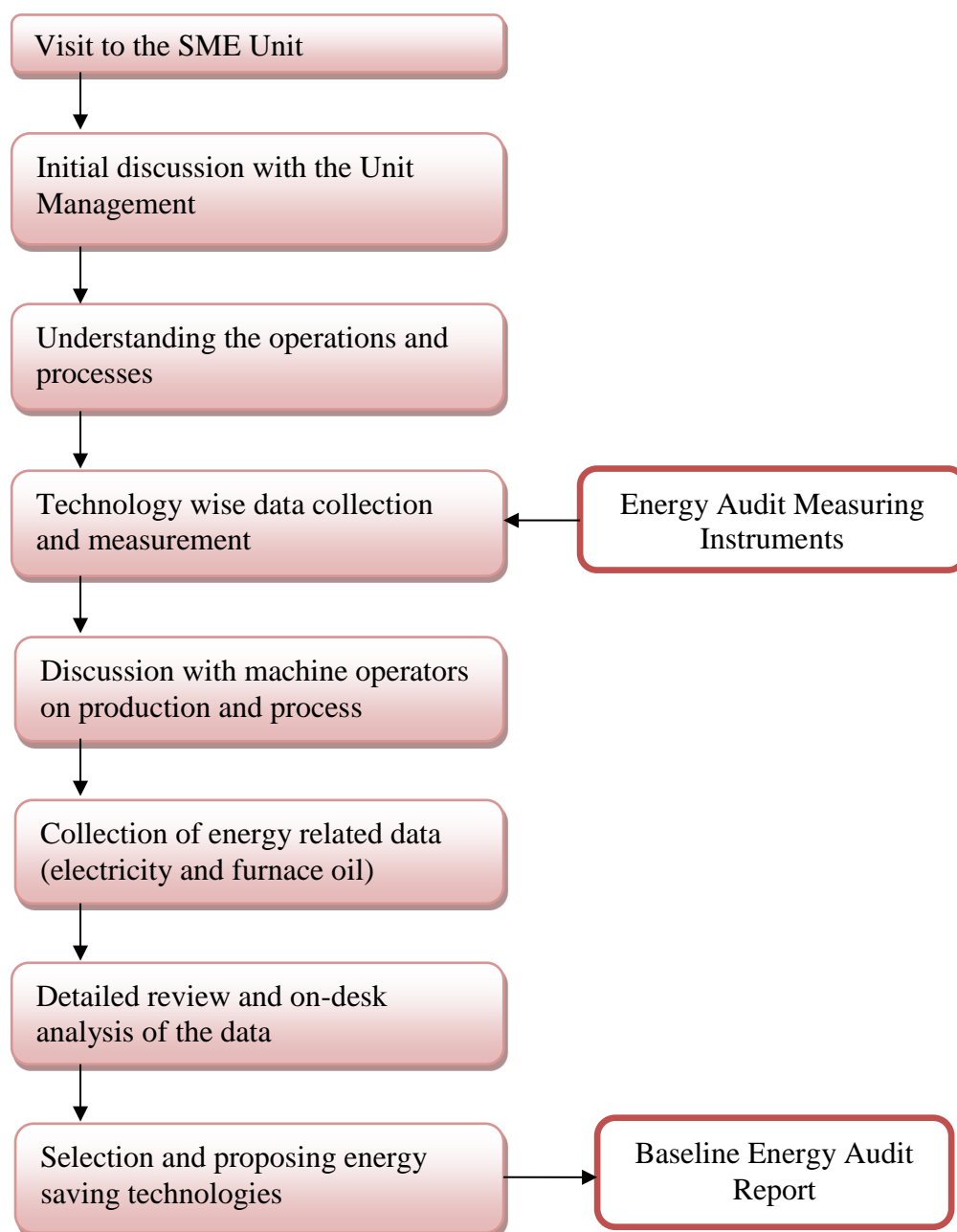
1.2 PRODUCTION PROCESS OF PLANT

The following figure shows the typical process employed at manufacturing of forged products at M/s Advance Auto Engineers are presented below:



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/tonne), etc.



1.4 PRESENT TECHNOLOGIES ADOPTED

The list energy consuming installed in Advance Auto Engineers and used for forging process are as follows:

S.N.	Equipment	Energy Source	Energy consumption	Year of Installation
1	Trimming press	Electricity	3 HP	1990
2	Drilling machine (4 nos.)	Electricity	3 HP	1990
3	Turning machine (4 nos.)	Electricity	3 HP	1990
4	Facing machine (4 nos.)	Electricity	3 HP	1990
5	Threading machine (4 nos.)	Electricity	3 HP	1990
6	Air Compressor (3 Nos.)	Electricity	7.5 HP, 5 HP, 5 HP	-

Study and Observations

2.1 SPECIAL PURPOSE MACHINES (SPM)

2.1.1 Present Process

M/s Advance Auto Engineers has installed manually operated conventional machines for various components machining job work like turning, facing, drilling, nut threading etc. These machine runs on electrical motors having capacity of 3 HP with production/ machining of 1000- 2000 pcs/day.

Table 2.3: *List of conventional machine proposed for replacement / modification*

Machine	Numbers	Motor rating
Turning machines	4	3 HP
Facing machines	4	3 HP
Drilling machines	4	3 HP
Threading machines	4	3 HP

2.1.2 Observations

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 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.

2.1.3 Conclusion

In order to promote the energy efficiency and reduction in the overall energy cost in the factory, it is recommended to covert the existing manual machines into automatic special purpose machine (SPMs) by implementing PLC control mechanism or CNC machines. Since the modified machines will run on the pre-installed programming technique, the consumption of electricity will only happen when there is a function or operation required on the component. In the ideal condition the machine will remain in dead mode/ no operation mode.

Apart from the operation, the machine automatically loads the component for machining. The cycle time of the each component will be fixed in the business logic of the PLC / SPM machine therefore each component will take specific time for processing or machining. The SPM machines results in 40-70% percent of the energy savings depending upon the type of component, operation, material, cycle time etc.

Benefits of the Automatic SPM/ CNC machines:

- ➔ Reduced energy consumption
- ➔ Faster operation and reduced down time
- ➔ Improved product quality and symmetrical product dimensions
- ➔ Higher productivity
- ➔ Environment friendly technology

2.1.4 Cost Economics Analysis

The comparison of production on old manual/ conventional lathe machine and modified SPM machine, specific energy consumption, cost savings, investment required and simple payback period of the investment on SPM machines is given in table 2.4.

Table 2.4 *Energy saving calculation for SPM Turning machine*

Parameter	Unit	Value
Power consumed by conventional turning machine	kW	2.2
Production on conventional turning machine	Pcs/hr	200
Specific power consumption on conventional machine	kWh/Pcs	0.011
Power consumed by SPM turning machine (motor capacity 3HP) @ 60% Loading	kW	1.34
Production on SPM turning machine (Projected)	Pcs/hr	350
Specific power consumption on SPM machine	kWh/Pcs	0.0038
Reduction in specific power consumption	kWh/Pcs	0.0071
Percentage savings	%	65.19
Operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	6,024
Annual cost savings	Rs.	254,102
Investment required	Rs.	550,000
Simple payback period	Years	2

As per the detailed calculations done, it is proposed to convert/ replace existing manual turning machines to automatic Special Purpose Machines (SPMs). The specific power consumption on a manual machine is 0.011 kWh/ pcs whereas the specific power consumption in SPM machine would be around 0.0038 kWh/pcs resulting in 65.19% savings in electrical energy. The investment required for making an SPM machine would be around Rs 5.5 Lakhs with annual saving of Rs 254,102. The simple payback period of the technology is 2 years.

Table 2.5: *Energy saving calculation for SPM facing machine*

Parameter	Unit	Value
Power consumed by conventional facing machine	kW	2.2
Production on conventional facing machine	Pcs/hr	100

Parameter	Unit	Value
Specific power consumption on conventional machine	kWh/Pcs	0.022
Power consumed by SPM facing machine (motor capacity 3HP) @ 60% Loading	kW	1.34
Production on SPM facing machine (Projected)	Pcs/hr	300
Specific power consumption on SPM machine	kWh/Pcs	0.0044
Reduction in specific power consumption	kWh/Pcs	0.0175
Percentage savings	%	79.70
Operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	12,624
Annual cost savings	Rs.	182,588
Investment required	Rs.	550,000
Simple payback period	Years	3.0

As per the detailed calculations done, it is proposed to convert/ replace existing manual facing machines to automatic Special Purpose Machines (SPMs). The specific power consumption on a manual machine is 0.022 kWh/ pcs whereas the specific power consumption in SPM machine would be around 0.0044 kWh/pcs resulting in 79.70% savings in electrical energy. The investment required for making an SPM machine would be around Rs 5.5 Lakhs with annual saving of Rs 1.8 lakhs. The simple payback period of the technology is 3.0 years.

Annexure 1

Basic details and energy utilization pattern of Advance Auto Engineers

S. No	Parameter	Value	Unit
1	Name and address of unit	M/s. Advance Auto Engineers, Plot No. 331-A, Industrial area -A, Near Cheema Chowk, Ludhiana - 141003, Punjab	
2	Contact person	Ms. Sharanjeet Singh	
3	Manufacturing product	Bolts, Nuts, Industrial Fasteners and Auto parts	
4	Daily Production	1 Tonnes/ day	
Energy utilization			
5	Average monthly electrical energy consumption	20193	kWh per month
6	Average monthly thermal (FO) energy consumption	3000	Liters per month
7	Average thermal specific energy consumption	0.12	Liter /kg of product
		1224	kCal/kg of product
8	Electrical specific energy consumption	0.80772	kWh/Kg of product
		694.6392	kCal/kg of product
9	Specific energy consumption	1918.6392	kCal/kg of product
10	Electrical energy cost	6.0579	Rs/Kg of product
11	Thermal energy cost	6	Rs/kg of product
12	Total energy cost	12.0579	Rs/kg of product

Energy Saving Calculation for SPM turning machine

Parameter	Unit	Value
Power consumed by conventional turning machine	kW	2.2
Production on conventional turning machine	Pcs/hr	200
Specific power consumption on conventional machine	kWh/Pcs	0.011
Power consumed by SPM turning machine (motor capacity 3HP) @ 60% Loading	kW	1.34
Production on SPM turning machine (Projected)	Pcs/hr	350
Specific power consumption on SPM machine	kWh/Pcs	0.0038
Reduction in specific power consumption	kWh/Pcs	0.0071
Percentage savings	%	65.19
Operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	6,024
Annual cost savings	Rs.	254,102
Investment required	Rs.	550,000
Simple payback period	Years	2

Note:

*** The cost of SPM machines is an indicative value gathered from discussions with SPM machine suppliers. It may vary from operation to operation and product to product.*

Energy Saving Calculation for SPM facing machine

Parameter	Unit	Value
Power consumed by conventional facing machine	kW	2.2
Production on conventional facing machine	Pcs/hr	100
Specific power consumption on conventional machine	kWh/Pcs	0.022
Power consumed by SPM facing machine (motor capacity 3HP) @ 60% Loading	kW	1.34
Production on SPM facing machine (Projected)	Pcs/hr	300
Specific power consumption on SPM machine	kWh/Pcs	0.0044
Reduction in specific power consumption	kWh/Pcs	0.0175
Percentage savings	%	79.70
Operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	12,624
Annual cost savings	Rs.	182,588
Investment required	Rs.	550,000
Simple payback period	Years	3.0.

Note:

*** The cost of SPM machines is an indicative value gathered from discussions with SPM machine suppliers. It may vary from operation to operation and product to product.*