

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

Ludhiana Forging Cluster

Baseline Energy Audit Report
Akal Enterprises

Submitted to



Submitted by



InsPIRE Network for Environment

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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	:	Akal Enterprises
Address	:	Near G.N.A 1 MT – Mahata, , G. T. Road, Phagwara-144401, Punjab
Contact Person	:	Mr. Parminder Singh Kundi (Cell No: 9876000013)
Products	:	Various types of Auto Parts
Production		2-3 tons per day
DIC Number		030031100081
Bank Details		Oriental Bank of Commerce; Branch : G T Road, Phugwada, Account Number: 00574011000286
TIN / PAN No.	:	AFRPS3539T
Contract demand		83.6 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 5 HP with production of 10-12 pieces per hour per set of lathe machine.

3. Proposed Energy Saving Technologies with Cost Economics

Proposed Energy Savings Measures

- ▶ Replacement of manual lathe machines by two numbers of CNC based Special Purpose Machine (SPM) for turning operations.

Table 1: *Cost Economic Analysis*

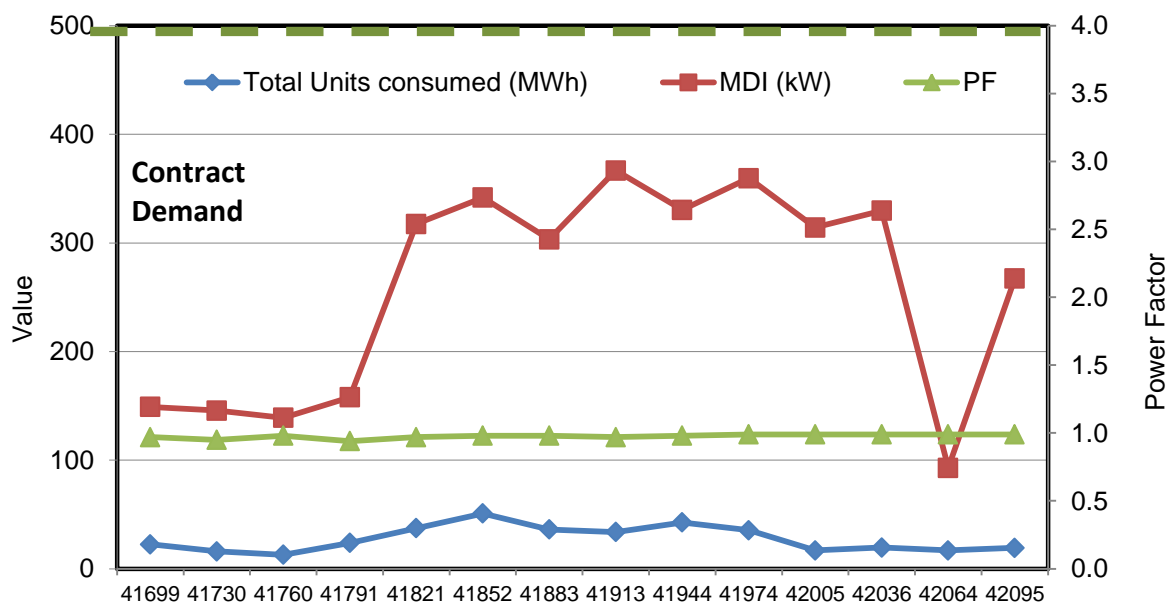
Technology	Estimated Energy Savings (%)	Savings (in Rs.)	Investment (in Rs.)	Simple Payback period (Years)
SPM - Turning Machine (2 No.)	70	251,698	1,100,000	4.4
Total		251,698	1,100,000	

Introduction

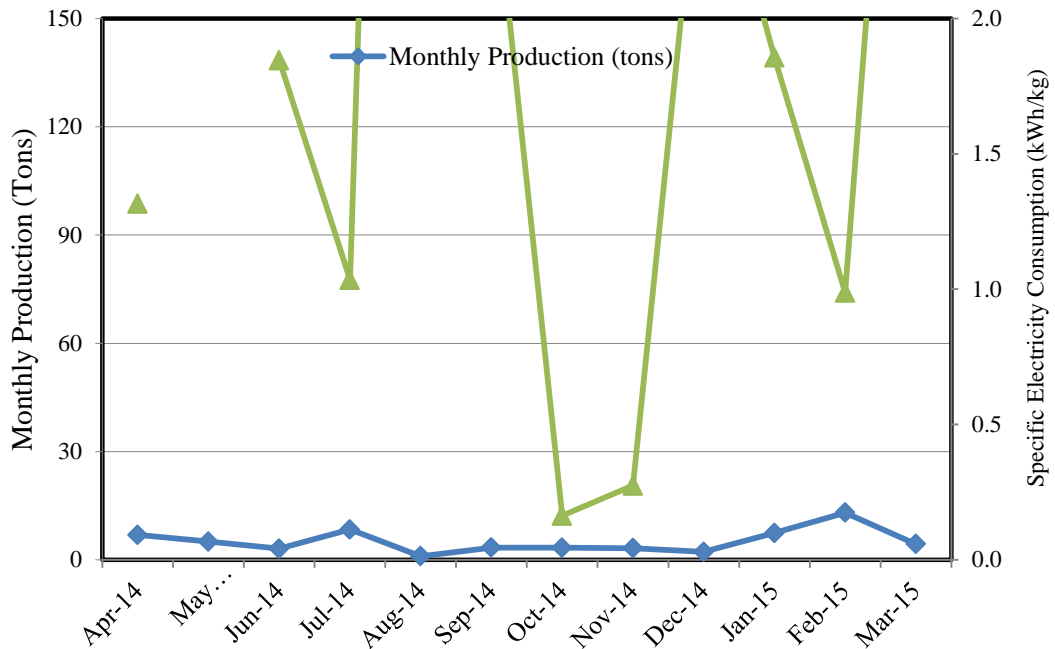
1.1 ABOUT THE UNIT

M/s Akal Enterprises is engaged in manufacturing of different types of car parts as per the customer requirement. The manufacturing unit is located at Near G.N.A 1 MT – Mahata,, G. T. Road, Phagwara-144401, Punjab

The daily production lies in the range of 2000– 3000 kgs per day (or 56 tons per month with 25 working days). Akal Enterprises is using Electricity supply from SEBs for various process and utility applications in premises. It was observed that the average monthly electricity consumption is 8634 kWh. Figure 1.1 depicts monthly electricity consumption vis-à-vis total monthly production of the unit for last one year.



(a) - Monthly variation of production and electricity consumption



(b) – Monthly variation of production and specific electricity consumption

Figure 1.1: Electricity consumption and production details

According to the assessment of the energy consumption data collected, the specific electrical energy consumption of product is 1.68 kWh/kg of product respectively. The total specific energy consumption (in kCal) is 1448.65 kCal/ kg of product. Details of annual electrical and thermal energy consumption and specific energy consumption details in Akal Enterprises is presented in table below:

Table 1.1: Details of Akal Enterprises

SN	Parameter	Value	Unit
1	Name and address of unit	M/s Akal Enterprises	
2	Contact person	Mr. Parminder Singh Kundi	
3	Manufacturing product	Various types of auto parts	
4	Daily Production	2-3 Ton	
Energy utilization			
5	Average monthly electrical energy consumption	8634	kWh per month
6	Average monthly thermal (FO) energy consumption	0	Liters per month
7	Average thermal specific energy consumption	0.000	Liter /kg of product
		0.0	kCal/kg of product
8	Electrical specific energy consumption	1.68	kWh/Kg of product
		1448.65	kCal/kg of product
9	Specific energy consumption	1448.6	kCal/kg of product
10	Electrical energy cost	12.69	Rs/Kg of product
11	Thermal energy cost	0.0	Rs/kg of product
12	Total energy cost	12.69	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 shift of 8 effective hours per day).

1.2 PRODUCTION PROCESS OF PLANT

The following figure shows the typical process employed at manufacturing of forged products at Akal Enterprises are presented below:

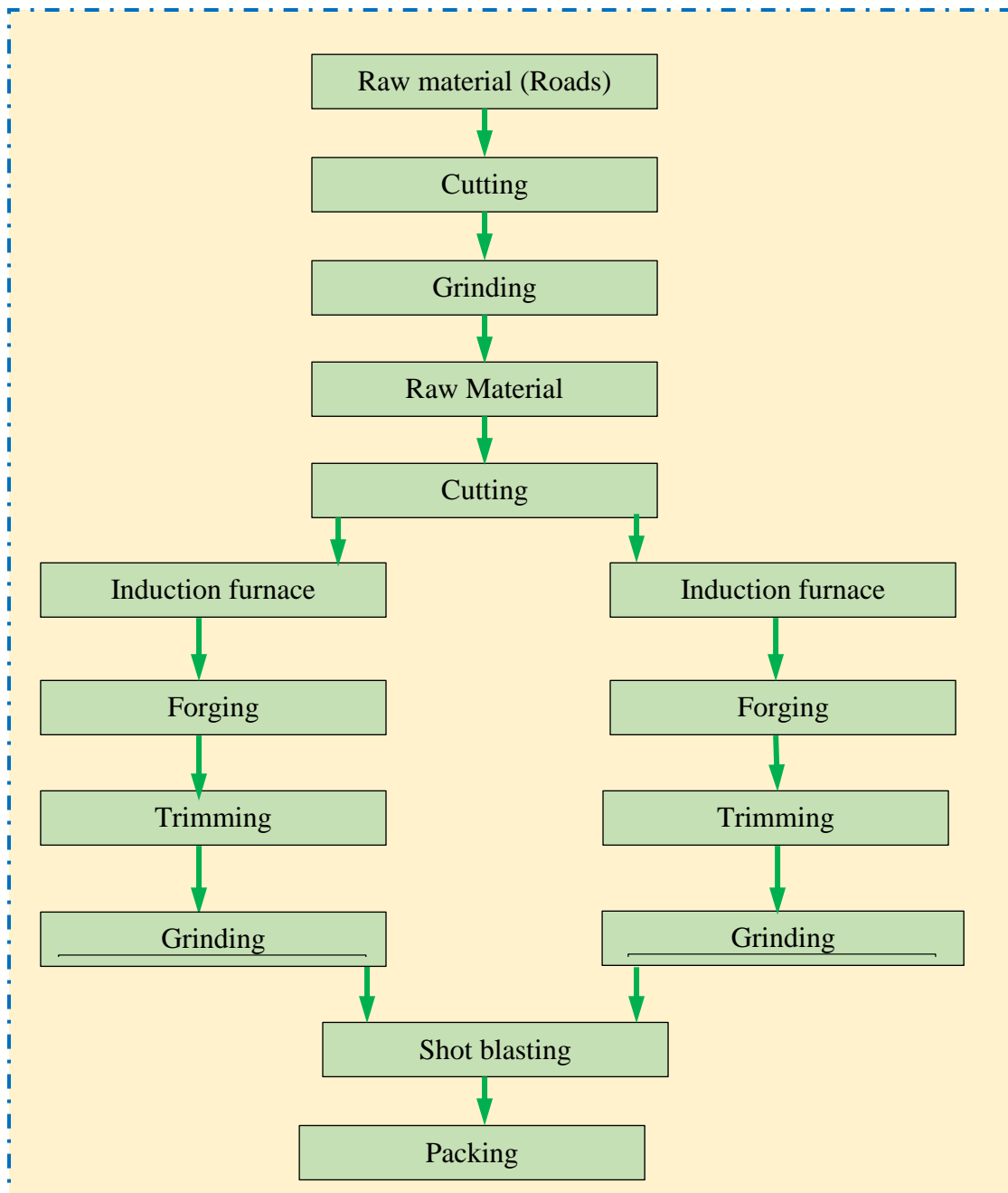


Figure 1.2: Flow chart of production process

1.3 ENERGY AUDIT METHODOLOGY

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

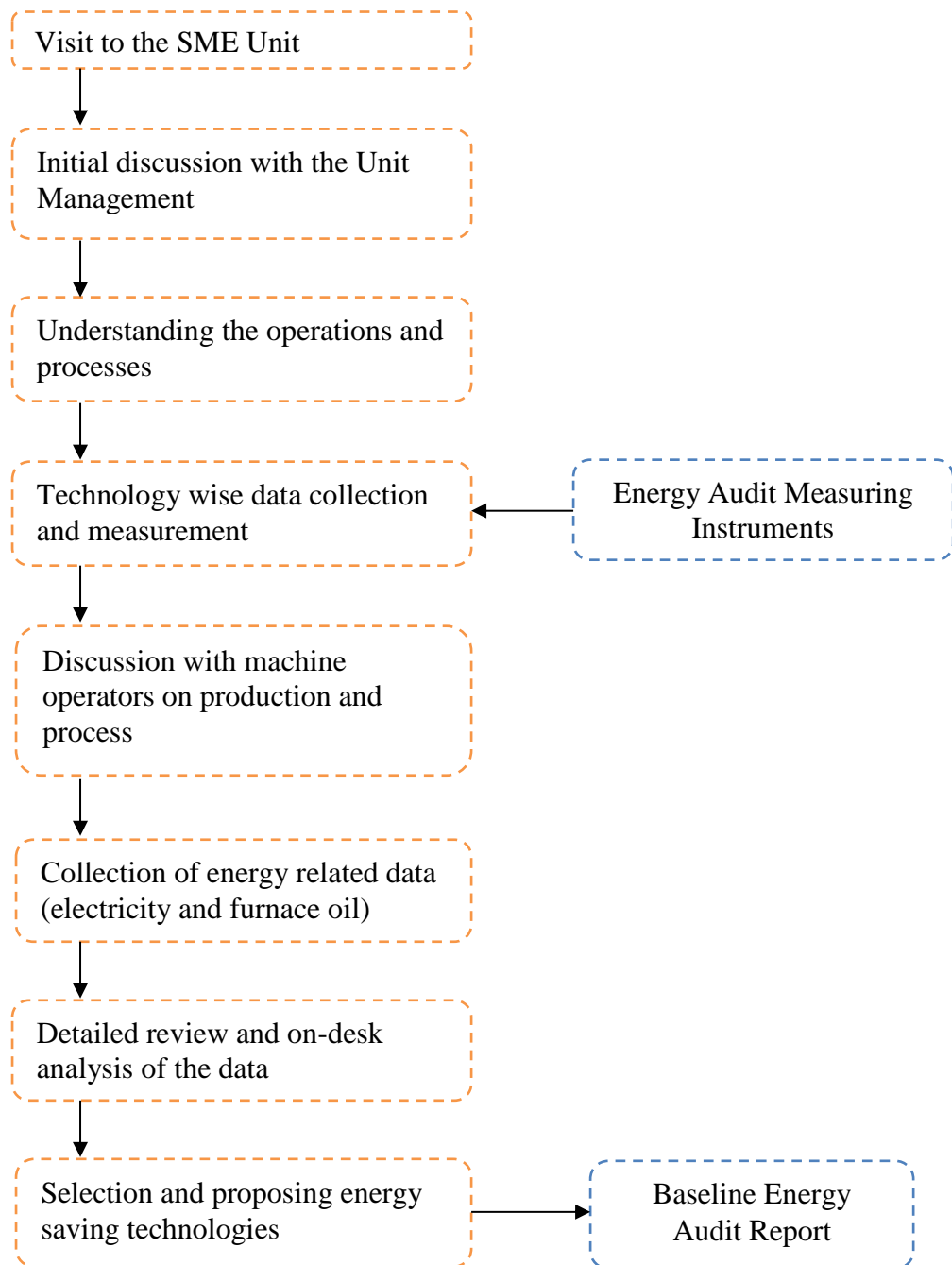


Figure 1.3: *Energy audit process*

Present Process, Observations and Proposed Technology

2.1 INDUCTION FURNACE

2.1.1 Present Process

Akal Enterprises has installed Induction 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.



2.2 SPECIAL PURPOSE MACHINES (SPM)

2.2.1 Present Process:

Akal Enterprises 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 5 HP with production/ machining of 10-12 pcs/hr.



2.2.2 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, 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.



2.2.3 Conclusion

In order to promote the energy efficiency and reduction in the overall energy cost in the factory, it is recommended to replace the existing manual machines by automatic special purpose machine (SPMs). 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 30-50% 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

2.2.4 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 2.1 and Table 2.2.

Table 2.1: *Cost Economic Analysis of proposed SPM 1 for turning operation*

Parameter	Unit	Value
Power consumed by conventional lathe machine	kW	3.73
Production on conventional turning machine	Pcs/hr	12
Specific power consumption on conventional machine	kWh/Pcs	0.311
Power consumed by SPM turning machine (motor capacity 5HP) @ 80% Loading	kW	2.984
Production on SPM turning machine (Projected)	Pcs/hr	32
Specific power consumption on SPM machine	kWh/Pcs	0.093
Reduction in specific power consumption	kWh/Pcs	0.218
Percentage savings	%	70.0
Daily operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	16,710
Annual cost savings	Rs.	125,849
Investment required	Rs.	550,000
Simple payback period	Years	4

As per the detailed calculations done, it is proposed to convert existing manual lathes into automatic Special Purpose Machines (SPMs). The specific power consumption on a manual machine is 0.311 kWh/ pcs whereas the specific power consumption in modified SPM machine would be around 0.093 kWh/pcs resulting in 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 1.25 Lakhs. The simple payback period of the technology is 4years.

Table 2.2: *Cost Economic Analysis of proposed SPM 2 for turning operation*Error! Bookmark not defined.

Parameter	Unit	Value
Power consumed by conventional lathe machine	kW	3.73
Production on conventional turning machine	Pcs/hr	12
Specific power consumption on conventional machine	kWh/Pcs	0.311
Power consumed by SPM turning machine (motor capacity 5HP) @ 80% Loading	kW	2.984
Production on SPM turning machine (Projected)	Pcs/hr	32
Specific power consumption on SPM machine	kWh/Pcs	0.093
Reduction in specific power consumption	kWh/Pcs	0.218
Percentage savings	%	70.0
Daily operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	16,710
Annual cost savings	Rs.	125,849
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Basic details and energy utilization pattern of M/s Akal Enterprises

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12	Total energy cost	12.69	Rs/kg of product

Note:

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

Energy saving calculation for each of the SPM machines – Turning Operation

Parameter	Unit	Value
Power consumed by conventional lathe machine	kW	3.73
Production on conventional turning machine	Pcs/hr	12
Specific power consumption on conventional machine	kWh/Pcs	0.311
Power consumed by SPM turning machine (motor capacity 5HP) @ 80% Loading	kW	2.984
Production on SPM turning machine (Projected)	Pcs/hr	32
Specific power consumption on SPM machine	kWh/Pcs	0.093
Reduction in specific power consumption	kWh/Pcs	0.218
Percentage savings	%	70.0
Daily operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	16,710
Annual cost savings	Rs.	125,849
Investment required	Rs.	550,000
Simple payback period	Years	4

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.*