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

Ludhiana Forging Cluster

Baseline Energy Audit Report
Tajaka Incorporation

Submitted to

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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	:	**Tajaka Incorporation**
Address	:	Plot No. 2, C-1, Jaspal Banger Road, Kanganwal, Industrial Area 'C' Ludhiana
Contact Person	:	Mr. Gurpreet Singh Narula - 0161-2511222
Products	:	Cycle Parts
Production	:	1 ton per day
Bank Details	:	01030500000064
TAN / PAN No.	:	
Contract demand	:	283 kVA

2. Existing Major Energy Consuming Technology

Lathes Machine

- Manually operated lathe machines for machining job work including facing, turning, grinding etc.
- Electrical rating of 2 hp- 7 hp with production/ machining of 50-100 pieces per hour.

3. Proposed Energy Saving Technologies with Cost Economics

Proposed Energy Measures

- Replacement of manual machines into automatic special purpose machine (SPMs)

Table 1: *Cost Economic Analysis*

Technology	Estimated Energy Savings (%)	Savings	Investment	Simple Payback period (Years)
SPM machine- Grinding	69	103,020	350,000	3.5
SPM machine - Turning	70	96,732	350,000	3.6
SPM machine- Facing	80	96,682	350,000	3.6
Total		**296,434**	**1,050,000**	

Introduction

1.1 ABOUT THE UNIT

M/s Tajaka Incorporation 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. 2, C-1, Jaspal Banger Road, Kanganwal, Industrial Area 'C' Ludhiana

The raw material procured by the unit for making cycle parts.

According to the assessment of the energy consumption data collected, the specific thermal energy consumption and specific electrical energy consumption is 0.37 L/kg (314.7 kcal/kg) of product and 0.15 kWh/kg (129.67) of product respectively. The total specific energy consumption (in kCal) is 314.7 kCal/ kg of product. Details of annual electrical and thermal energy consumption and specific energy consumption details in Tajaka Incorporation are presented in table below:

Table 1.1: ***Details of Tajaka Incorporation***

SN	Parameter	Value	Unit
1	Name and address of unit	M/s. Tajaka Incorporation	
2	Contact person	Mr. Gurpreet Singh Narula - 0161-2511222	
3	Manufacturing product	Cycle Parts	
4	Daily Production	1 ton per day	
	Energy utilization		
5	Average monthly electrical energy consumption	29519	kWh per month
6	Average monthly thermal (FO) energy consumption		Liters per month
7	Average specific thermal energy consumption^1	0.000	Liter /kg of product
		0.0	kCal/kg of product
8	Specific electrical energy consumption^2	2.67	kWh/Kg of product
		2299.14	kCal/kg of product
9	Specific energy consumption	2299.1	kCal/kg of product
10	Electrical energy cost	122.52	Rs/Kg of product
11	Thermal energy cost	0.0	Rs/kg of product
12	Total energy cost	122.52	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 Tajaka Incorporation are presented below:

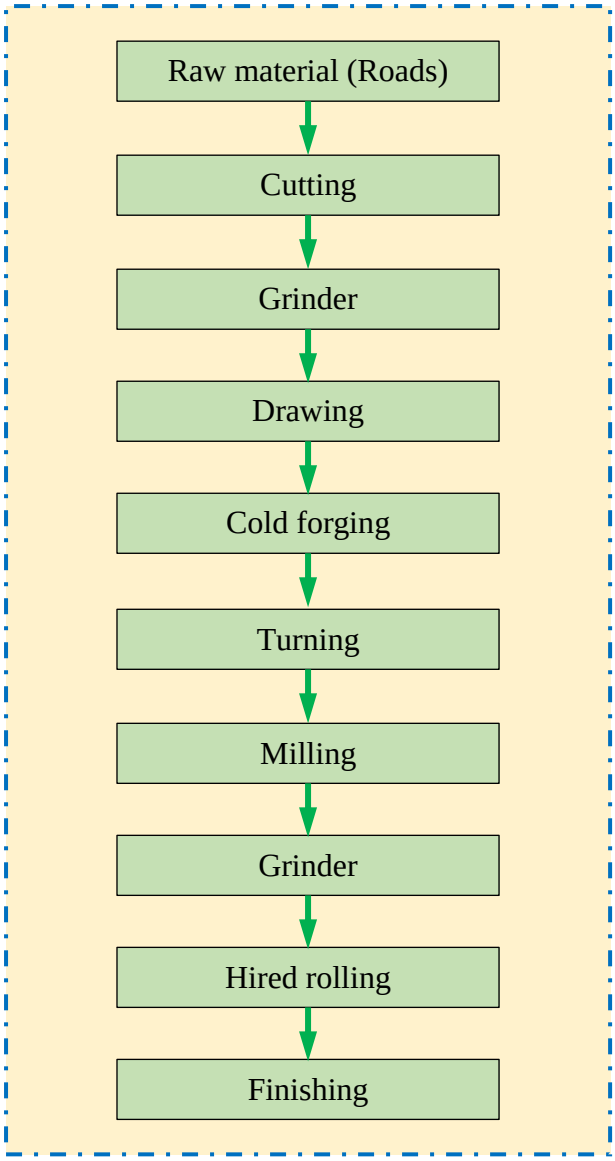

Figure 1.1: ***Flow chart of the production process***

1.3 ENERGY AUDIT METHODOLOGY

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

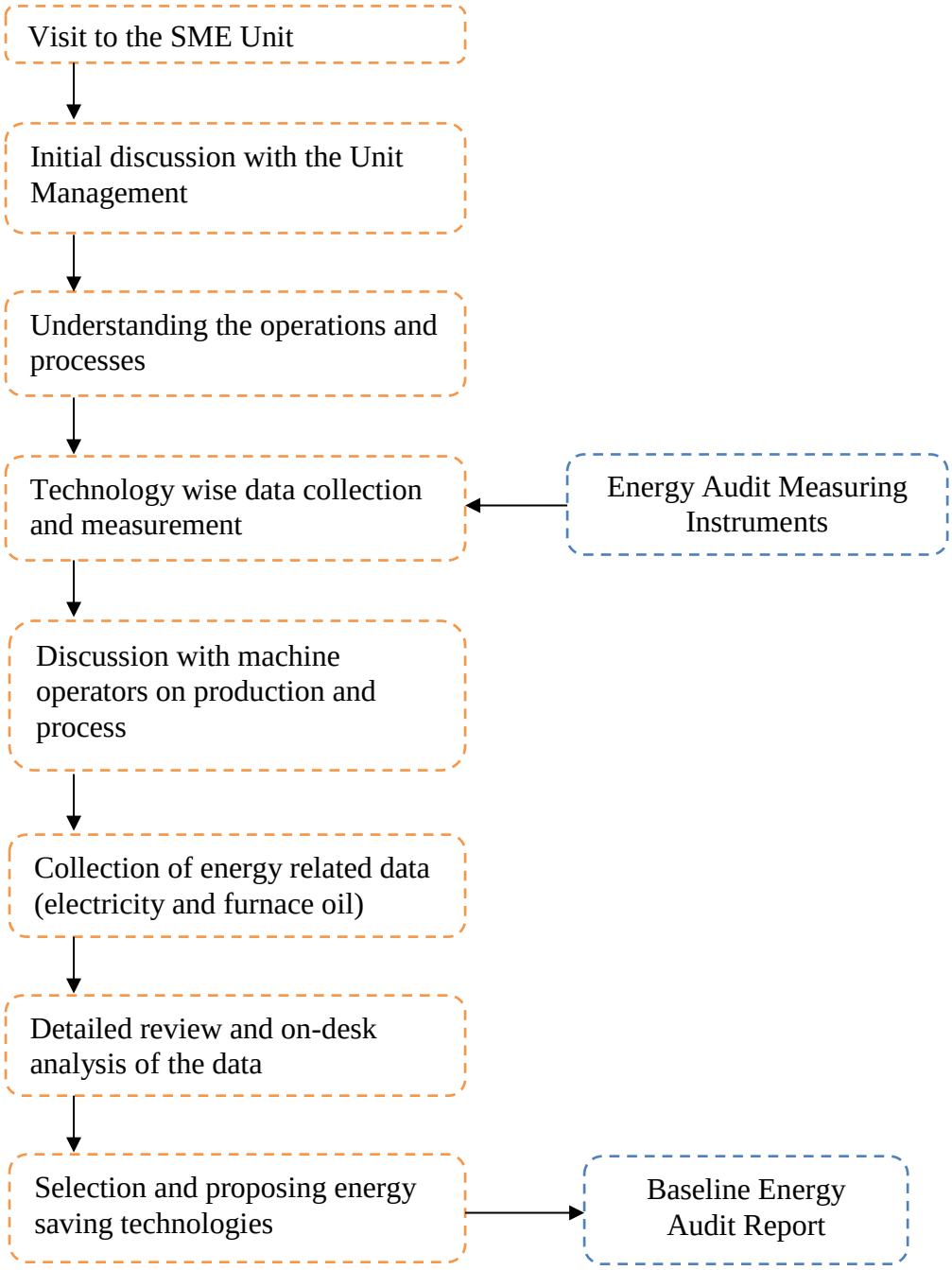

Figure 1.2: ***Energy audit process***

Present Process, Observations and Proposed Technology

2.2 SPECIAL PURPOSE MACHINES (SPM)

2.2.1 Present Process:

M/s Tajaka Incorporation has installed manually operated 3 lathe machines for various components machining job work like facing, turning, grinding, drilling etc. These machine runs on electrical motors having the capacity varying from 2 HP to 7 HP with production/ machining of 1000- 1200 pcs/day.

Machine	Numbers	Motor rating
Grinding Lathe	1	7 hp
Turning	1	2 hp
Facing	2	3 hp

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 covert the existing manual machines into automatic special purpose machine (SPMs) by implementing PLC control mechanism. 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 for grinding, turning and facing are given in Table 2.1, Table 2.2 and Table 2.3.

Table 2.1: *Energy saving calculation for grinding operation*

Parameter	Unit	Value
Power consumed by conventional grinding machine	kW	5.22
Production on conventional turning machine	Pcs/hr	75
Specific power consumption on conventional machine	kWh/Pcs	0.07
Power consumed by SPM turning machine (motor capacity 5 hp) @ 80% Loading	kW	2.98
Production on SPM turning machine (Projected)	Pcs/hr	668
Specific power consumption on SPM machine	kWh/Pcs	0.27
Reduction in specific power consumption	kWh/Pcs	0.016
Percentage savings	%	69
Daily operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	13,736
Annual cost savings	Rs.	103,020
Investment required	Rs.	350,000
Simple payback period	Years	3.4

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 0.0045 kWh/ pcs whereas the specific power consumption in modified SPM machine would be around 0.065 kWh/pcs resulting in 82% savings in electrical energy. The investment required for making an SPM machine would be around Rs 3.5 Lakhs with annual saving of Rs 1.03 Lakhs. The simple payback period of the technology is 3.4 years.

Table 2.2: *Energy saving calculation for turning operation*

Parameter	Unit	Value
Power consumed by conventional turning machine	kW	1.492
Production on conventional turning machine	Pcs/hr	80
Specific power consumption on conventional machine	kWh/Pcs	0.01865
Power consumed by SPM reducing machine (motor capacity 2HP) @ 60% Loading	kW	0.88028
Production on SPM reducing machine (Projected)	Pcs/hr	413
Specific power consumption on SPM reducing machine	kWh/Pcs	0.002
Reduction in specific power consumption	kWh/Pcs	0.017
Percentage savings	%	70
Daily operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	12987
Total annual cost savings	Rs.	96,732
Investment required	Rs.	350,000
Simple payback period	Years	3.62

As per the detailed calculations done, it is proposed to convert existing conventional turning machine into automatic Special Purpose Machines (SPMs). The specific power consumption on a conventional grinding machine is 0.002 kWh/ pcs whereas the specific power consumption in modified SPM machine would be around 0.017 kWh/pcs resulting in 70 % savings in electrical energy. The investment required for making an SPM machine would be around Rs 3.5 Lakhs with annual saving of Rs 0.97 Lakhs. The simple payback period of the technology is 3.62 years.

Table 2.3: *Energy saving calculation for facing operation*

Parameter	Unit	Value
Power consumed by conventional facing machine	kW	2.238
Production on conventional turning machine	Pcs/hr	80
Specific power consumption on conventional machine	kWh/Pcs	0.027975
Power consumed by SPM reducing machine (motor capacity 3HP) @ 60% Loading	kW	0.88028
Production on SPM reducing machine (Projected)	Pcs/hr	415
Specific power consumption on SPM reducing machine	kWh/Pcs	0.002
Reduction in specific power consumption	kWh/Pcs	0.026
Percentage savings	%	80
Daily operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	12,890
Total annual cost savings	Rs.	96,682
Investment required	Rs.	350,000
Simple payback period	Years	3.62

As per the detailed calculations done, it is proposed to convert existing conventional facing machine into automatic Special Purpose Machines (SPMs). The specific power consumption on a conventional grinding machine is 0.002 kWh/ pcs whereas the specific power consumption in modified SPM machine would be around 0.026kWh/pcs resulting in 80 % savings in electrical energy. The investment required for making an SPM machine would be around Rs 3.5 Lakhs with annual saving of Rs 0.96 Lakhs. The simple payback period of the technology is 3.62 years.

Annexure 1

Basic details and energy utilization pattern of M/s Tajaka Incorporation

Parameter	Value	Unit
Name and address of unit	M/s. Tajaka Incorporation	
Contact person	Mr. Gurpreet Singh Narula - 0161-2511222	
Manufacturing product	Cycle Parts	
Daily Production	1 ton per day	
Energy utilization		
Average monthly electrical energy consumption	29519	kWh per month
Average monthly thermal (FO) energy consumption	0	Liters per month
Average specific thermal energy consumption^1	0	Liter /kg of product
	0	kCal/kg of product
Specific electrical energy consumption^2	0.37	kWh/Kg of product
	314.78	kCal/kg of product
Specific energy consumption	314.78	kCal/kg of product
Electrical energy cost	2.75	Rs/Kg of product
Thermal energy cost	0	Rs/kg of product
Total energy cost	2.75	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.

Annexure 2

Energy saving calculation for SPM machines – Grinding Operation

Parameter	Unit	Value
Power consumed by conventional grinding machine	kW	5.22
Production on conventional turning machine	Pcs/hr	75
Specific power consumption on conventional machine	kWh/Pcs	0.07
Power consumed by SPM turning machine (motor capacity 5 hp) @ 80% Loading	kW	2.98
Production on SPM turning machine (Projected)	Pcs/hr	668
Specific power consumption on SPM machine	kWh/Pcs	0.27
Reduction in specific power consumption	kWh/Pcs	0.016
Percentage savings	%	69
Daily operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	13,736
Annual cost savings	Rs.	103,020
Investment required	Rs.	350,000
Simple payback period	Years	3.4

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.*

Annexure 3

Energy saving calculation for SPM machines – Turning Operation

Parameter	Unit	Value
Power consumed by conventional grinding machine	kW	1.492
Production on conventional turning machine	Pcs/hr	80
Specific power consumption on conventional machine	kWh/Pcs	0.01865
Power consumed by SPM turning machine (motor capacity 5 hp) @ 80% Loading	kW	0.88028
Production on SPM turning machine (Projected)	Pcs/hr	413
Specific power consumption on SPM machine	kWh/Pcs	0.002
Reduction in specific power consumption	kWh/Pcs	0.017
Percentage savings	%	70
Daily operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	12987
Annual cost savings	Rs.	96,732
Investment required	Rs.	350,000
Simple payback period	Years	3.62

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.*

Annexure 4

Energy saving calculation for SPM machines – Facing Operation

Parameter	Unit	Value
Power consumed by conventional facing machine	kW	2.238
Production on conventional turning machine	Pcs/hr	80
Specific power consumption on conventional machine	kWh/Pcs	0.027975
Power consumed by SPM reducing machine (motor capacity 3HP) @ 60% Loading	kW	0.88028
Production on SPM reducing machine (Projected)	Pcs/hr	415
Specific power consumption on SPM reducing machine	kWh/Pcs	0.002
Reduction in specific power consumption	kWh/Pcs	0.026
Percentage savings	%	80
Daily operating hours	Hrs	8
Annual operating days	Days	300
Annual electricity savings	kWh	12,890
Total annual cost savings	Rs.	96,682
Investment required	Rs.	350,000
Simple payback period	Years	3.62