A FORGING UNIT IN PUNE SWITCHES FROM OIL FIRING TO ELECTRICAL HEATING OF FORGING FURNACE TO REDUCE ENERGY COSTS

Tags:		
Sub-sector	:	Forging
Location	:	Pune (Maharashtra)
Partners	:	SIDBI, TERI
Year	:	2012-15

Background

Pune is one of the important manufacturing centres for many type of industries like automobiles, chemicals, and auto allied industries, such as forging. Pune houses all sectors of the automotive industry - two-wheelers, auto rickshaws, cars, tractors, tempos, excavators, and trucks. Large automotive companies like Tata Motors, Mahindra & Mahindra, Mercedes Benz, Force Motors (Firodia-Group), and Kinetic Motors have manufacturing set ups in Pune. Automotive companies, including General Motors, Volkswagen, and Fiat have set up green-field facilities near Pune. Several automotive component manufacturers like Saint-Gobain Sekurit, TATA Autocomp Systems Limited, Robert Bosch GmbH, ZF Friedrichshafen AG, Visteon, and Continental Corporation are located around Pune. Forging and its allied industries are generally dedicated to the automobile industries.

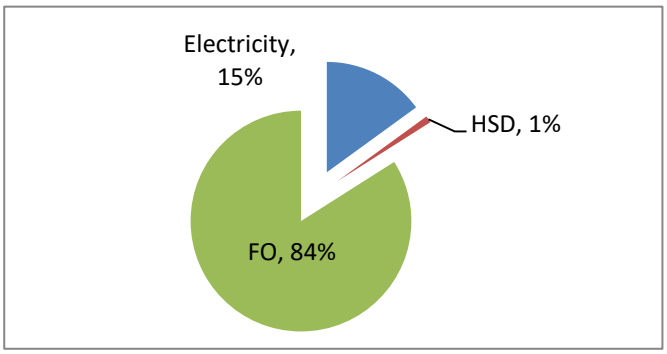
There are about 70 MSME forging units operating in the cluster. Of these, 50 units are forging industries and the remaining 20 units are involved in heat treatment process. These units are spread across different industrial estates developed by Maharashtra Industrial Development Corporation (MIDC), such as Pimpri-Chinchwad MIDC, Chakan MIDC, Bhosari MIDC, and other areas like Kharadi, Alandi, Haveli, Shikrapur, and Sanaswadi. These units involved in heat treatment of forged products are also located in the cluster catering to the needs of the forging units.

About the forging unit

The forging unit, wherein the implementation of energy efficiency measures was carried out, was set up in 2008. The unit is involved in the manufacturing of gears, splitnut and spacers for automobile industries and operates for about 310 days in a year. The major steps involved in the forging process of the unit includes (i) cutting of steel rods into billets, (ii) heating billets in furnace and (iii) forging of heated billets with hammers and presses. The forged component is trimmed and sent for heat treatment. The annual production of the unit was about 2400 tonnes during 2014–15.

Energy consumption

The forging unit was using furnace oil in the forging furnaces. The thermal energy forms a major share of energy consumption (~84%) in the unit. Electricity, sourced from grid is used in presses and other utilities. DG set is installed and used only during power failure, which is generally insignificant in the cluster. The annual energy consumption of the unit is estimated to be 222 tonne of oil equivalent (toe). This is equivalent to an energy cost of Rs 125 lakh and GHG emissions of 894 tonne of CO_2 annually.



Share of various fuels

About forging furnaces

There were three number of box type forging furnaces employed in the unit. The furnace has been constructed with a 15 inch refractory lining and class-B insulating bricks along with metal cladding. The furnaces were locally fabricated and used for heating of billets. All the furnaces were using furnace oil (FO) as fuel. The furnaces have an average heating capacity of 400 kg per hour. About 10 batches of material is heated in the furnaces, with an average batch time of 2-2½ hours per batch. The average temperature of the furnaces maintained is about 1150–1200 ^{o}C. The connected electrical load of each furnace is 5 hp (3.7 kW). The forging furnaces account for more than 80% of overall energy consumption of the forging unit.


FO fired forging furnace

Energy audit of forging furnace

A detailed energy audit of the forging unit was conducted by TERI during 2012 covering all major energy intensive equipment/ systems in operation. One of the major energy consuming equipment identified was the forging furnace associated with the 1.25 tonne hammer. The average production of this furnace was 932 tonnes per year.

The performance monitoring of the 1.25 tonne forging furnace was undertaken. The thermal efficiency of the furnace i.e. heat absorbed by the feed material to the heat input by the fuel, was observed to be about 9.5%, which is substantially low and would require alternate options for improvements. The specific energy cost for the forging furnace was

estimated at Rs 7,681 per tonne of job of heating. Some of the factors attributing towards low thermal efficiency of the furnace included (i) high flue gas loss, (ii) high skin temperatures (150-250 ^{o}C), (iii) heat loss through loading- unloading doors, and (iv) frequent stoppage of hammer for die setting, maintenance, etc.

Energy efficiency option

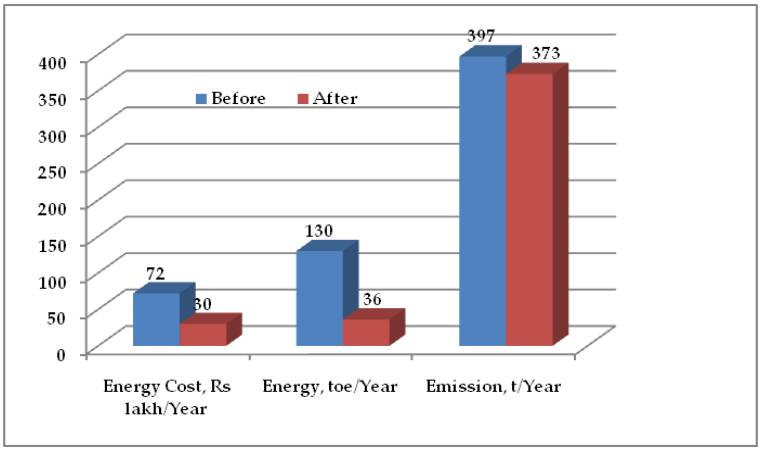
The low efficient FO fired furnace was replaced with an energy efficient induction billet heater. The capacity of the electric billet heater was 500 kg per hour with an electrical rating of 200 kW. The 'specific energy consumption' (SEC) of the electric billet heater was about 450 kWh per tonne. The estimated specific energy cost of heating with electrical billet heater is about Rs 3,152 per tonne, which is about 41% of specific energy cost of the FO fired furnace.

Electrical billet heater

The annual energy savings include 138 kL of FO; the additional energy consumption with electrical billet heater is 419,400 kWh of electricity per year. The net energy cost savings is Rs 42.21 lakh per year and the investment on electric billet heater is about Rs 67 lakh with a simple payback period of 1.6 years.

Overall impacts

The forging unit had replaced the inefficient oil fired furnace with an efficient electric billet heater. This has led to an annual energy saving of 100 tonne of oil equivalent (toe) with a corresponding greenhouse gases (GHG) reduction of 23.7 tonne CO_2 per year. Further, the switch over to electrical heating has led to pollution free work environment, improved comfort level and safety.



Overall impacts

Acknowledgements

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