FIELD VISIT REPORT

ON

BANGLE FACTORY, FIROZABAD, UTTAR PRADESH, INDIA

Submitted by: Group 3

2016 ProSPER.Net Young Researchers' School

'Sustainable Energy for Transforming Lives: Availability, Accessibility, Affordability'

INTRODUCTION

Bangle is one of the beautiful ornaments which are worn by Indian women mostly in different styles and Firozabad is known for making beautiful bangles. Firozabad is a city which is located in Uttar Pradesh. Initially the working environment of glass factory for workers was very harsh which include high temperature and high level of pollutants and it really used to get quite worse in summers. With respect to health safety also it was not good at all; if melted glass is put on any part of the body it could burn 100% skin of that part of the body. There were very less safety measures like workers work there without gloves, face mask, etc.

Initially Firozabad bangle industries used coal for the production of bangles which has not only affected the working environment in worst way but it also affected the environment of the cities. Latterly Firozabad bangle factory has used the latest innovations for the production of bangles with the help of TERI. They have switched to natural gas instead of coal which was conventionally used for a long. Use of natural gas is more eco-friendly and reduces pollution and with the use of furnace the working environment has drastically improved.

METHODOLOGY

The principal constituent of glass is silicon dioxide (SiO_2) and in order to improve the chemical resistance lime, alumina and magnesia are added in small quantities. Other chemicals are added as needed to impart different colors to the glass.

Process at Firozabad Glass Factory

The kind of furnace (operational unit) used in the factory is the Tank furnace having a large capacity around 15-30 tonnes of glass daily. The furnace was made up of cement completely which has a life span of 3 years. The furnace was fitted with regenerators (heat recovery devices) used to recover heat from flue gases and use it to preheat combustion air. Prior to 1996, there were two kinds of tank furnaces operating in Firozabad: coal-fired and oil-fired, which has been now converted to biogas powered making it a cleaner technology.

The raw materials taken in required proportions are fed into a glass melting Tank furnace and glass produced in molten state, which is then blown in desired shapes. These products are then heated and cooled in a controlled manner, in a process known as annealing, to impart hardness to the glass. Products then undergo the final finishing operations and packed. The steps are described in detail below:

1. First, a worker (known as the gulliwalla) uses a long iron pole to scoop out a glob of molten glass from the pot furnace at a temperature of around 1300 °C.

2. He gives the glob to a worker who gives it an appropriate shape. If necessary, he coats the glass with a small quantity of colored block glass that is melted separately in a small refractory container called tali.
3. The shaped glob is then taken to the Sekai Bhatti which gives it a roughly cylindrical shape by rotating the rod.
4. The still-soft cylindrical mass of glass, now cooled down to a temperature of around 500 °C, is then taken to a furnace, the Belan Bhatti where it is rotated, covered with thin filament of glass and cut at periodic intervals.
5. The spiral lengths of glass that get cut off at lengths are collected and sent for cutting.
6. The cut bangles are tied with strings into bunches. Each bunch contains approximately 320 bangles, and is called a tora.
7. The bangle bunches are then sent to household units for further processing into 'raw' bangles
8. Finally, the raw bangles are annealed in a furnace known as the Pakai Bhatti to yield the finished product.

ENERGY EFFICIENCY MEASURES

The pre-heating technology in Bangles industry

Beside to achieve fuel shifting in bangle industry from coal fuel to natural gas, a new technology takes place through glass production process. The new system minimized energy wastage by using pre-heated air for combustion, and utilizing the heat of the outgoing flue gases. This technology depends on recover the heat energy from exhaust gas of furnace, that it will be used to pre-heat the fresh air which is required to run the furnace continuously.

Waste heat Recovery in Pot Furnace

Traditional System**:** In this system, the air combustion is supplied by the fresh ambient air. This new air consumes extra fuel. On other hand, the flue gas will discharge without benefit its high temperature.

New system: The main goal of this technology is to recover the waste heat for preheating combustion air which is used for natural gas combustion.

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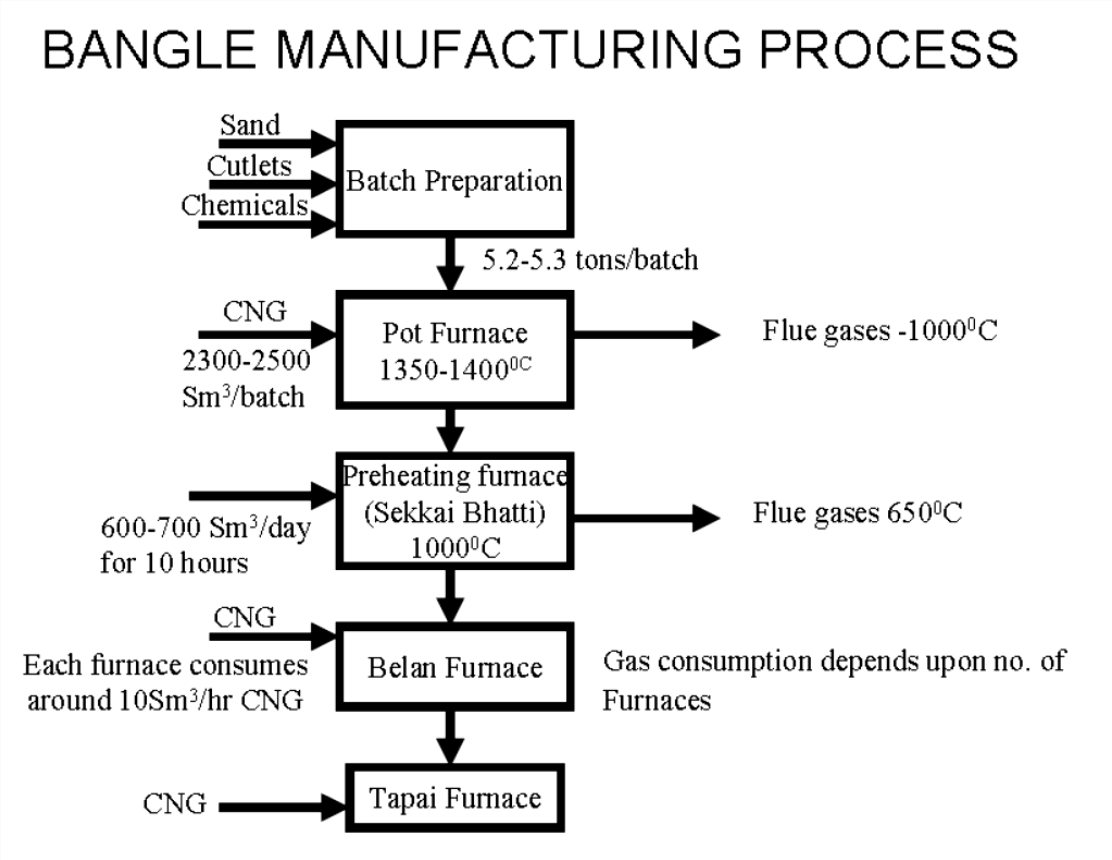
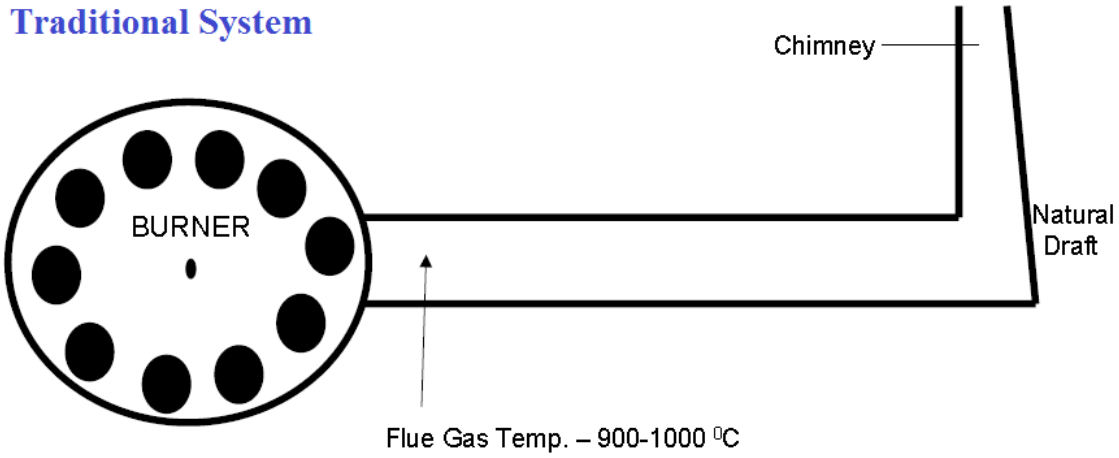
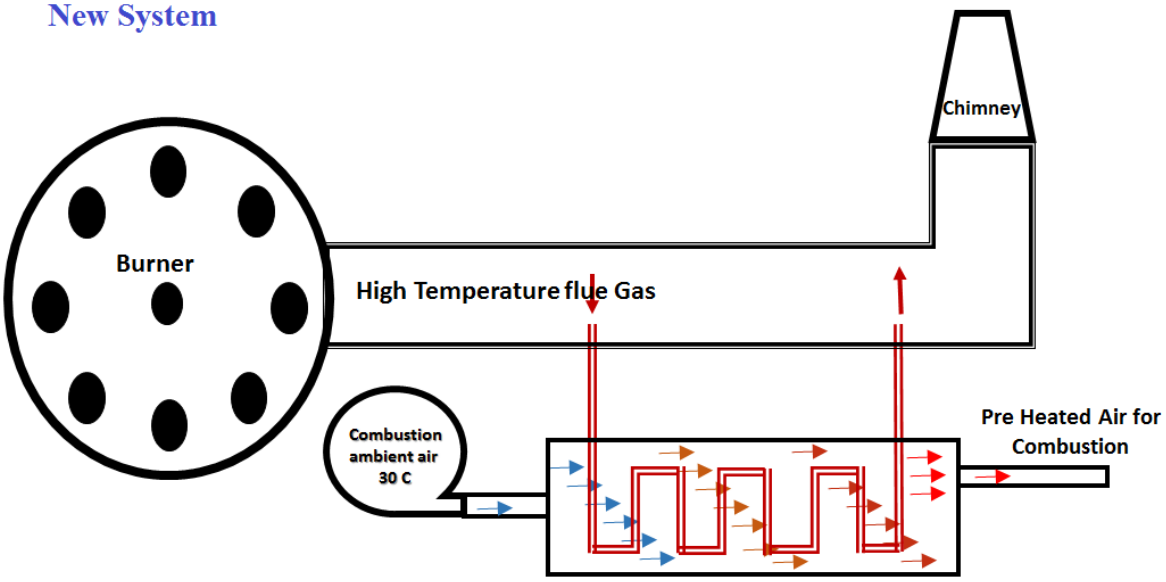


Source: Clean Technology Initiative in SMEs Cluster; A. K. ASTHANA



New System



New Technology's advantages:

- Energy savings: 25 – 30% lower than conventional technologies
- Simple payback: ~ 1 to 2 years
- Drastically reduced pollution
- Improvement in the working environment
- Reduced health risks to workers and the society at large
- Improved profitability and sustainability of the sectors

LIMITATIONS & SUGGESTIONS

After studying the scenario and visiting one of the Bangle Factories in Firozabad, following suggestions are being made:

- Although the workers in the bangle factory are coordinated enough to get their work through safely, but some occupational and health hazard measures should be implemented in the factory to avoid any kind of accident.
- Workers in the factory should wear face masks, gloves etc for their own safety and health benefits.
- If possible, more energy efficient techniques should be tried to bring in practice as it will reduce the energy consumption of the industry and will maintain better ambient and outside air temperature.
- As the energy efficient measures that have been taken up in the bangle industry have benefitted so many people, it is suggested that it should be replicated in other manufacturing cities across the country and also in other countries.
- Awareness about the basics of energy saving, safety and health concerns should be made among the local masses.