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Sinter Coolers

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Abstract— At present, distributed generation (DG) has been a research focus all over the world. As a kind of DG system, cogeneration system utilizing waste heat from sintering-cooling process plays an important role in modern iron and steel enterprises

I. INTRODUCTION



The frequently used and most worrying thing now a days is global warming which actually we know as it is the increase of earth's average temperature due to green house gases which trap heat that would otherwise escape from earth but recent studies specifying that waste heat produced from industries (large scale industries like steel making plants, oil refinery industries etc..) is more speedily deteriorating the environment now a days than above said green house gases so we are converting that waste heat produced from steel making industries into electricity in order to reduce the heat even in a small quantity. Most of our steel plants are now using sinter plants or sinter coolers to convert iron into steel and these are producing the exhaust steam in a larger quantity.

II. SINTER PLANT

Sintering is an agglomeration process of fine mineral particles into a porous mass by incipient fusion caused by heat produced by combustion within the mass itself. Iron ore fines, coke breeze, limestone and dolomite along with recycled metallurgical wastes are converted into agglomerated mass at the Sinter Plant, which forms 70-80% of iron bearing charge in the Blast Furnace. The vertical speed of sintering depends on the suction that is created under the grate. At VSP, two exhausters are provided for each machine to create a suction of 1500 mm water column under the grate.

There are several types of sintering machines based on their construction and working, they are

- Belt type
- Stepping type
- Air Draft type
- Box type and so on.

Smelting is the term related to metallurgy and we use blast furnaces for smelting. We can call blast furnaces differently in different relations like bloomeries for iron, blowing houses for tin, smelt mills for lead, sinter plants for base metals like steel, copper, iron ultimately.

Iron ore cannot be directly charged in a blast furnace. In the early 20th century sinter technology was developed for converting ore fines into lumpy material chargeable in blast furnaces, though it took time to gain acceptance in the iron ore making domain but now places an important role in generating steel, metallurgical waste generated in steel plants to enhance blast furnace operation.

III. WASTE HEAT RECOVERY IN SINTER PLANT

In sinter plant sensible heat can be recovered both from the exhaust gases of the sinter machine and off-air of the sinter cooler. Heat recovery can be in different forms.

- Hot air steams from both sinter machine and sinter cooler can be used for the generation of steam with the installation of recovery boilers. This steam can be used to generate power or can be used as process steam. For increased heat recovery efficiency, a high temperature exhaust section should be separated from a low temperature exhaust section and heat should be recovered only from high temperature exhaust section.
- Sinter machine exhaust section can be recirculated to the sinter machine, either after going through a heat recovery boiler or without it.
- Heat recovered from the sinter cooler can be re-circulated to the sinter machine or can be used for pre heating the combustion air in the ignition hood, for pre heating of the raw mix to sinter machine. It can be used to produce hot water for district heating.

A. Features

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- Waste gas heat of a sintering plant is recovered as steam or electric energy. The heat recovery efficiency is 60% for waste gas from cooler and 34% for waste gas from sintering machine proper.
- Waste gas heat recovery from sintering machine proper also leads to the reduction of coke consumption.
- Applicable whether the cooler is of a circular type or linear type.
- CO₂ emissions can be reduced, leading to a possibility of employing this system in a CDM project.

IV. SINTER PLANT COOLER WASTE HEAT RECOVERY SYSTEM

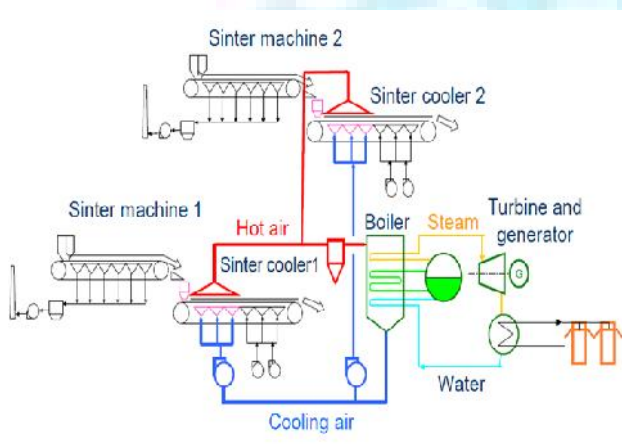


Fig. 1 Block diagram of sinter cooler plant

This is a system for recovering the sinter cooler's high-temperature exhaust gas as steam which can be used for power generation. Furthermore reuse of the exhaust heat as the thermal source of sintered ore production will improve the productivity of sinter machines.

The main principle involved in this system is converting heat into steam then we use the normal generation process where the turbine rotates giving mechanical energy as input to the generator in order to get electricity as output. The system recovers sensible heat from hot air emitted by the cooling process of two sinter coolers located downstream of two sinter machines. The heat is captured by heat recovery hoods and then routed to a heat recovery boiler to generate super-heated steam, which is converted to electricity by a turbine connected to a generator.

V. RECOVERY OF WASTE HEAT EMITTED BY THE COOLING PROCESS INTO STEAM

As like heat recover ventilators this system will work i.e. whenever the heat recovery hoods take heat from sinter cooler this will be directly given to the boiler which on high

temperature and water convert this into steam. The water tube boiler which has water in its tubes heated by this hot recovered air and this water will be converted into steam. This steam drives the turbine and give mechanical energy which is input to the generator and this generator will give electricity.

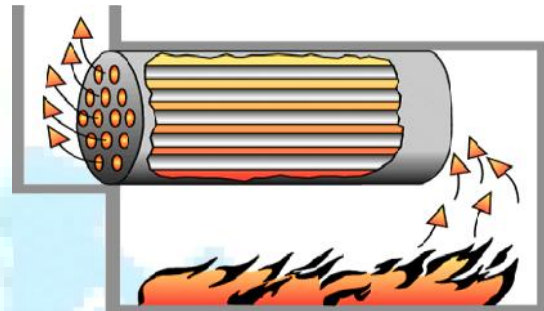


Fig. 2 Recovery of waste heat emitted

VI. ADVANTAGES AND DISADVANTAGES

A. Advantages

1) *Reduction in pollution:* A number of toxic combustible wastes such as carbon monoxide gas, sour gas, carbon black off gases, oil sludge, Acrylo nitrile and other plastic chemicals etc. releasing to atmosphere if/when burnt in the incinerators serves dual purpose i.e. recovers heat and reduces the environmental pollution levels.

2) *Reduction in equipment sizes:* Waste heat recovery reduces the fuel consumption, which leads to reduction in the flue gas produced. This results in reduction in equipment sizes of all flue gas handling equipment such as fans, stacks, ducts, burners, etc.

3) *Reduction in auxiliary energy consumption:* Reduction in equipment sizes gives additional benefits in the form of reduction in auxiliary energy consumption like electricity for fans, pumps etc.

Recovery of waste heat has a direct effect on the efficiency of the process. This is reflected by reduction in the utility consumption & costs, and process cost.

B. Disadvantages

1) *Capital cost:* The capital cost to implement a waste heat recovery system may outweigh the benefit gained in heat recovered. It is necessary to put a cost to the heat being offset.

2) *Quality of heat:* Often waste heat is of low quality (temperature). It can be difficult to efficiently utilize the quantity of low quality heat contained in a waste heat medium. Heat exchangers tend to be larger to recover significant quantities which increases capital cost.

3) *Maintenance of Equipment:* Additional equipment requires additional maintenance cost.

CONCLUSION

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To meet the increasing world demand for energy, the rate of depletion of non-renewable energy sources must be reduced while developing alternative renewable sources. This can be achieved by increasing the overall thermal efficiency of conventional power plants. One way to do this is by waste heat recovery. Most of the techniques currently available recover waste heat in the form of thermal energy which is then converted to electricity in a conventional steam power plant. Another approach which has received little attention so far is direct conversion of thermal waste energy into electricity.

In this article, a configuration of waste heat recovery system is described

we studied the composition and characteristics of waste heat resources and found out a typical process of energy recovery, conversion and utilization. Waste heat constitute almost 20% in global warming where as in this maximum amount of heat

is from large scale industries and power plants. As 70% of our steel plants containing sinter plants and the circulation system is for waste heat, which has been emitted only to the atmosphere. The system is expected to promote energy efficiency by utilizing waste heat, thereby reducing CO₂ emissions. It will enhance environmental effects because cooling air is used in a closed cycle without emitting a high concentration of dust into the atmosphere and power shortages can also be overcome.

ACKNOWLEDGMENT

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression, “One of us (R. B. G.) thanks . . .” Instead, try “R. B. G. thanks”. Put applicable sponsor acknowledgments here; DO NOT place them on the first page of your paper or as a footnote.





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