State of Art Technology & India

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1.0 Preamble

Issue # 23 deals with State of Art Technology for energy efficiency, their availability within the Country, user technology transfer to India as well as to not so progressive firms in the Country, Pit falls, application area etc. The discussion will be concerning regenerative burner systems as offered by Japan Industrial Manufacturers Association (JIMA).

2.0 Relevance to Indian Industry:

Technology of high temperature Air combustion (HiTAC) finds application in reheat heat treatment annealing, in steel & metallurgical operation and gas treatment furnaces in wall paper industry & they may also find other application in glass furnaces.

- Indian steel market after depression of 2 years has shown competitiveness. Against a capacity of 8.5 million MT in year 2003-04, production of mild steel ingnots and of stainless steel is 5.3 & 3.5 million MT respectively. There are more than 600 induction melting furnaces for cast iron SS & alloys and 650 furnaces for mild steel. Reported power consumption is @ 525. Unit per ton.

- With improved availability of NG, LNG & LPG in the country and higher cost of electricity, lateral thinking on use of modern technology is required.

Considering above, there is a dire need to up-grade energy efficiency of various furnaces used in steel, glass, aluminum, industry by adopting various technologies tried out in Japan & Germany.

Advantages of high temperature Air combustion furnaces *HiTAC):

Report from Nippon Furnace Kogyo Kaisho Ltd., during year 2000 and CADDET (Center for the Analysis & Dissemination of Demonstrated Energy Technologies) UK in their result reports 445,447 and 448 at www.caddet.ee.org bring out following salient features of HiTAC technology in steel and paper industry.

(a) Significant reduction in energy consumption: Test results show reduction in primary energy by 35% to 65% with associated reduction in CO_2 and Nox emission.

(b) 167 heating furnaces were modified to HiTAC during year 1993-97. In a slab heating furnace of capacity 200 t/hr. at NKK energy consumption was reduced by 25%.

(c) It offers homogenous temperature distribution inside the furnace.

(d) Reduction in steel temperature heat-up time.

(e) Homogenous heating of steel.

(f) All reported demonstration / retrofit are with use of gaseous fuels.

(g) Control system requirements are more precise & faster

4.0 Major points to be considered while applying to Indian conditions

- For all furnaces operating with solid or liquid fuels for heating, heat treatment or annealing, flue gas composition w.r.t. SO_2 content, particulate matter, solid content, un-combustibles etc. will be present in prominent quantity as compared to flue gas generated by burning gas, LPG etc. This may affect performance of regenerative burners due to coking, solid deposition, high temperature corrosive & erosion. This needs to be established by demonstration test.

- For existing air-fuel burners, improving to flue gases recovery devise & pre-heating combustion air at higher temperature includes the installation of a recovery system, the modifications of the entire hot air circuit as well the installation of new preheated air extended stoppage.

  Installing regenerative burners would imply installing twice as many business and using them alternately various aspects like cost & maintenance rate of burners, alternating operation that can be damaging the quality of re-heating, flame stability during ignition and / or power transition phases need to be studied. As regenerative burners develop high temperature combustion in the presence of nitrogen, the NO_x constraint is still a concern, even if technology has been improved in the past few years.

- For steel plants, coal is the major fuel for power generation, cost of such power generation is cheaper as compared to use of LPG / LNG as a fuel in heating furnaces.

- For glass making at 1400^oC, electrical or gas or combination of both are used such furnaces are of regenerative type. However the major issue involved is higher volatization due to gas fired burners as compared to electric furnaces. This will deprive the benefits of gas usage.

5.0 **Any user of regenerative burner in India:**

Extensive survey of Indian Industry did not sight any actual user / demonstration plant on HiTAC technology. Considering substantial energy savings possible. They need to be tried out in Indian Environment duly considering above aspects.

Alternate Modern Technology: -

Review of state of the art flameless combustion technologies for heating application in direct fuel fired industrial furnaces bring out following 2 alternative technology:

1 HiTAC burner (using regeneration).

2 Flameless oxy-fuel burner.

Oxy fuel technology gives better heat transfer as well as a cleaner and more efficient process in warming or melting furnaces – e.g. for copper, aluminum, glass, iron and steel production. In conventional furnaces with air-fuel burning, the heating of large amount of the nitrogen in combustion air results in significant loss of energy. With oxy fuel technology air is replaced by oxygen. Thermal transfer by oxy combustion is characterized by considerable localized transfer due to high emissive (considerable concentrations of CO_2 & H_2O in the flames) and reduced flame volume leading to first an enhanced capability to transfer it's energy to the load and second an extra gain in energy efficiency.

AGA a member of Linde group has been pioneering the use of 100% oxy fuel applications in reheat furnaces. With an installed base of more than 80 furnaces, AGA revamped 16 MW walking beam furnace by providing 26 flameless oxy fuel burners. It resulted in 30% increase in over-all capacity, 40 – 50% increase in heating capacity in existing furnace, reduction of over 25% in fuel consumption. Bohler Udderholm, Sweden at their production facility at Hagforms, converted cold-air combustion to oxy fuel. Here 8 No. Of burners designed with conventional air fuel system and with a total power capacity of 2.8 MW and operating with low sulfur medium, heavy oil, were replaced by 6 water cooled metallic, supersonic re-circulation oxy fuel burners. Primary goal was to increase production capacity. They achieved 5-20 % increase in capacity and 45-50% reduction in specific energy with corresponding reduction in the fuel borne emissions SOX, CO_2 & particulates. Encouraged by positive results 5 furnaces were converted to oxy fuel progressively during the period year 1994 to 2001. Ovako Steel, a leading Swedish steel company has modified 75% of its furnaces to solely operates on oxy fuel system and totally 42 furnaces are modified. These find extensive application in reheats & annealing furnaces Linde has refitted oxy fuel technology to almost 90 reheat & annealing furnaces. In Sweden half of all the Country's reheat furnaces have been converted to this process.

PRAX AIR carried out extensive programme on use of oxy fuel burners for glass furnaces in USA. The programme was funded by DOE @ $ 1.4 million with co-funding by industrial participants. Success was measured as follows: NOX reduction by 80%, Natural gas consumption reduced by 11 to 15%, electric boosting energy was reduced by 17 to 26%. At the end of year 1995, 11% of total glass production in USA was by oxy fuel furnaces. Net energy gain was 0.2 Million Kcal / MT glass.

To summarize, alternative technology like HiTAC or oxy fuel have been commercially applied for increasing capacity and reducing specific energy consumption. They can be further examined for application in Indian Steel industry.

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