UTLIZATION OF SOLID WASTE FUELS
THROUGH FLUIDIZED BED COMBUSTION

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The fluidized bed described for burning anthracite culm seems well adapted to burning some fuels with up to 69% ash. The table showing practically no tube wastage in 10,000 hr deserves special attention because most operating units show more loss. On a conference field trip in China last August a group of us observed two small boilers using 70% ash coal that had been able to reduce tube erosion to acceptable levels by welding short steel bars to the tubes. The bars are transverse to the bed particle flow, hence tend to reduce the “scrubbing” velocity of the particles. But the bars, called “fins” do waste away.

Both examples in this paper refer to “Solid Waste Fuels”. The implication in the title is that other wastes can be burned. Have either of the authors tried municipal solid waste with its low melting point ash constituents?

Discussion by

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It is stated that the fabric filter air-to-cloth ratio is 6:1. Experience to date suggests a lower ratio gives better performance.

Discussion by

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This was an informative and well presented report of a technology which has been of great interest.

The motivations for developing the AFB Boiler for Shamokin can be fully appreciated in view of the need for a system capable of consuming the huge piles of anthracite culm (anthracite coal cleaning plant waste) which has low sulfur, low volatile matter, but very high ash inert (67-72%) and therefore relatively low calorific value.

There are very few burning systems which can consume this type of waste as a fuel without extensive beneficia tion. The technical success at Shamokin and the resolution of the operational problems described is a credit to the ingenuity and resiliency of all involved. It is hoped that the urgency and commercial conditions will ultimately prevail to take advantage of this development.

However, the technical and operational motivation is not as obvious for applying an AFB forced circulation furnace (hot water) boiler for consuming a high volatile, biomass fuel, very low in ash and sulfur albeit high in moisture and requiring significant energy to virtually pulverize the fuel to permit unfettered furnace feeding. Conventional boiler designs are available which are capable of effectively burning coarsely hogged wood waste.
and sawdust, separately or in combination with bituminous coal. The criteria for selection and the appeal of AFB over the alternative burning systems considered would be very informative.

AUTHORS’ REVISION

The two Clairvivre wood/coal burning boilers in France have been changed from hot water generation to steam generation. Instead of the heating water being directly heated in the boilers, it is indirectly heated by steam generated by the boilers. The two boilers are of the natural circulation type and incorporate vertical water-tube design. Figure 8 of the paper should be replaced by the attached revision to reflect the change.

Steam and water circuits of the 5.8 MW boiler is described as follows:

Saturated steam of 100 psig, equivalent to 20 million Btu/hr is generated in the boiler. The steam is then directed into an indirect heat exchanger where it gives up latent heat to heat the water. Condensates are returned to the steam drum. Heating water, which was circulating through the heating circuits, returns cooled. It first enters the economizer to recover sensible heat from off-gases. It is further heated by the steam and returns to the heating circuits.

Ashes are collected in the convection section and recycled back to the bed to enhance combustion efficiency. Ashes captured in the cyclone can be either recycled or drawn out for disposal. Bottom ash is drawn out of the bed by a FluoSeal device and cooled for disposal or for reusage at a later date.

Other information such as fuel characteristics, design parameters, and feed preparation remain the same as written in the paper.

AUTHORS’ REPLY

To R. B. Engdahl

We are aware of several fluidized bed installations where fin type deflectors were attached to horizontal in-bed tubes to reduce tube erosion. The deflectors, however, were eroded out and had to be frequently replaced. We feel that the deflector design needs more development before becoming acceptable to the boiler customers.

We have encountered the problem caused by chloride and sodium contained in the ash, when refinery waste or paper mill waste were burned in a fluidized bed. The problem, however, has been resolved. We feel that municipal solid waste, after removing metal objects, can also be burned in a fluidized bed. Unfortunately, we have not had a chance to try it.

To R. E. Sommerlad

Preheat burner was found to be undersized at start-up and bituminous coal had to be added to supplement heat. The amount of coal used for each start-up amounted to 1000 lb. Since coal feeding was not expected initially, no specific device for coal feeding had been installed. Instead, a limestone feed system was used.

Regarding the air-to-cloth ratio of the fabric filter, I have to agree with Mr. Sommerlad’s comment. The 6 to 1 ratio is too high and we feel that the ratio should be 4 to 1 or less.

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FIG. 8 FLUIDIZED BED BOILER (CLAIRVIVRE AFB BOILERS)