FIVE YEARS OF SUCCESSFULL OPERATION WITH FOSTER WHEELER CFB BOILERS BURNING OIL SHALE AT NARVA POWER STATIONS

In Estonia AS Narva Elekrijaamad owns and operates Balti and Eesti power plants, and is the largest oil shale burning power plant in the world with the total production capacity of 2600 MWe electricity and 589 MW for district heat. The average annual oil shale combustion is 9.5-10 million tonnes per year. The pulverized fired (PF) boilers were commissioned in 1959-1973; hence there is forty-five years experience with combustion of oil shale with pulverized fired combustion technology. Due to the age of the oldest blocks and the poor environmental performance of the PC units, AS Elektrijaamad ordered renovation of unit no. 8 in Eesti plant and unit no. 11 in Balti plant with Foster Wheeler CFB boilers. The renovation included also the modernization of the steam turbines, which were upgraded to produce 215 MWe instead of the original 200 MWe. Foster Wheeler Energia Oy, Finland, provided the new CFB boilers and the turbine modernization as EPC basis.

The Estonian oil shale has very high ash content, up 50% in as received basis and low heating value. The ash composes of carbonate part and sandy clay part. Oil shale contains alkalis and chlorine, which reduce the melting point of ash and creates high temperature corrosion in superheaters. In the PF boilers, the high temperature of the flame results in the melting of ash and has considerable slagging problems in the superheater section of the PF boilers. In addition, the superheaters have suffered severe high temperature corrosion due to chlorine. Due to these problems the availability of the PF boilers has been poor and they have not been able to achieve their design capacity. Also the emissions of SO_2, NO_x and dust from the PF boilers exceeded considerably the current European standards.

A comprehensive investigation on the suitability of CFB technology for oil shale, including several pilot tests, was performed together with AS Narva Elektrijaamad, Tallinn Technical University and Foster Wheeler. The investigations confirmed, that CFB technology is well suited for the combustion of oil shale and finally Foster Wheeler was selected to supply he CFB boilers. The first boilers in Eesti plant had first solid fuel fire at the end of 2003 and the unit started commercial production in February 2004. The performance of the new CFB boilers has exceeded the expectations; the availability has been excellent, no slagging takes place in the superheaters and corrosion of superheaters has not been detected. The emissions are very low, e.g. SO_2 emission is practically zeroed due to the inherent sulphur capture by the calcium in the fuel ash.

This paper describes the technical concept of the CFB boiler and the operating experiences of the combustion of Estonian oil shale with the CFB technology during the five years of operation.