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EDITOR'S PAGE

NEW EPOCH IN ESTONIAN OIL SHALE COMBUSTION TECHNOLOGY

Sustainable development of the oil shale-based electricity production depends on the efficiency of the energy system and on the environmental impact. The present year is notable for Estonian power engineering based on domestic oil shale. Using the circulating fluidized bed combustion (CFBC) technology, approved in the world, two 215 MW_{el} energy blocks are starting to operate. CFBC technology means not only more efficient oil shale utilization and higher thermal efficiencies but also much less atmospheric emissions.

During the last forty years Estonian power production has been almost 99% based on domestic oil shale, and wider utilization of alternative energy sources (biomass, peat, wastes, wind) is just starting to move ahead. According to the Estonian State Energy Program, renewable power share should achieve 5.1% to the year 2010.

Total thermal capacity of installed oil shale burning boilers is 10.7 GW_{th}, and every year about 11 million tonnes of oil shale are fired. The conventional pulverized combustion technique for burning oil shale is characterised by very intensive fouling of the heat transfer surfaces of the boilers with bound sulphate ash deposits and high-temperature corrosion. Basic environmental problem in oil shale pulverized firing (PF) are high acidic compound emissions, especially SO_2 ones (SO_2 820–1360 and NO_x 90–110 mg/MJ), and huge amount of ash (~5 million tonnes per year) landfilled through the hydraulic ash removal system.

Necessity to renovate Estonian power plants and in connection of that the question about changing of burning technology was arisen in the end of the 1980s. Using the fluidized bed combustion technology seemed a most prospective one.

Before the final selection of technology, the tests with oil shale were carried out in 1 MW_{th} CFBC test facilities of Hans Ahlstrom laboratory in Karhula (Finland), LLB Lurgi in Frankfurt am Main (Germany), and also in 0.15 MW_{th} test facility in the University of British Columbia in Vancouver (Canada). The results showed that Estonian oil shale is a well acceptable fuel for fluidized bed boilers.

Based on the above-mentioned tests, *Eesti Energia AS* (*Estonian Energy* Ltd.) decided at renovation of power plants to use circulating fluidized bed technology. *Eesti Energia AS* and the winner of the boiler contest Foster

Wheeler signed a contract to build two 215 MW_{th} energy blocks starting operation in 2004. The operational testing-adjusting-analyzing process of the first block is presently going on, and it is too early to speak about the final result, but some conclusions may be drawn today.

Measurements of emissions showed that SO_2 content in the flue gas in the case of CFB combustion is close to zero (<5 ppm) without adding special adsorbents, as the Ca/S ratio (8–10) in oil shale is high. Comparing with pulverized firing boilers, 100-fold drop in SO_2 content (below 15 mg/m^3) took place, and almost twice-lower NO_x concentrations were measured.

Decomposition extent of carbonates is also noticeably lower, comparing with pulverized firing boiler (~75% versus PF ~98%). It is caused by lower temperatures in the CFB boiler furnace, which remained at about 800 ºC during the first operations at nominal load.

Partial decalcination (~70%) of oil shale carbonates and almost full sulphation of SO_2 at CFB firing results in oil shale effective heating value raise by ~4% and corresponding CO_2 emission factor reduction by ~10% comparing with pulverized firing.

Because of lower specific fuel consumption, the effect of CFB firing is even more significant to diminish the emissions per produced net power, enabling ~18% decrease of CO_2 per MWh.

As mentioned before, the other problem related to reducing the environmental impact of the oil shale power plants are ash fields. Every year millions of tonnes of oil shale ash are land filled. Oil shale ash itself is not toxic. The danger lies in hydraulic transport of ash to the ash fields. At the moment hydraulic ash removal system is used, and the basic environmental problem is the possible release of highly alkaline (pH 12–13) ash field water into the surroundings.

To sum up, it can be mentioned that Estonian oil shale power engineering is starting a new epoch: replacement of the existing energy blocks with new environmentally friendly equipment of higher thermal efficiency. Air emissions of oil shale power plants could be handled through the CFB combustion technology.

However, the other basic environmental problem connected with ash fields is still in need of a good solution. Possible solutions including water neutralization and renovation of the whole ash removal system are at the research stage at the moment. The plans include flue gas CO_2 capture, fly ash dry removal and ash utilization prospects.

I hope that in following OIL SHALE issues the reader can already find a thorough information about burning Estonian oil shale in circulating fluidized bed and about wider utilisation of oil shale ash.

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