

Profiles

Experience of indirect cofiring of biomass and coal

'Indirect cofiring involves separate boilers for the coal and biofuel'

There has been increasing interest in the use of biomass for power generation in recent years. The principal reason is that the use of biomass can significantly reduce net CO₂ emissions. Cofiring biomass with coal has the potential to overcome some of the drawbacks of firing pure biomass. Cofiring can be direct, where the biomass and coal are fired in the same boiler, or indirect, where the combustion or gasification of biomass occurs in a separate facility. This report concentrates on indirect cofiring which is taken to mean technologies in which the ash from the coal and biomass are kept separate. Indirect cofiring involves either pre-gasifying the biofuel in a separate plant or firing the biofuel in a separate combustor and routing the steam to the main turbine. This technology is less common than direct cofiring. It has the major advantages that the coal ash is not contaminated by any constituent of the biofuel and that these constituents cannot cause corrosion or slagging in the main plant. Furthermore the total biofuel capacity is not limited by existing constraints imposed by installed hardware and any problems with the biomass plant will not result in the whole power plant being shut down. However, the major disadvantage of indirect firing is that installation costs are very much higher than for direct firing.

At Aabenraa in Denmark, a biomass boiler has been installed in parallel with an existing unit of the Enstedværket coal-fired plant. The two boilers are only connected via a common feedwater pipe from the condenser and a common steam pipe leading to a high-

'The use of biomass can significantly reduce net CO₂ emissions'

pressure steam turbine. The biomass boiler supplies steam corresponding to 40 MWe and the coal-fired unit has an output of 660 MWe. The biomass plant was fully operational in August 1998 but has incurred problems with corrosion which necessitated overlay welding the entire furnace in 2000.

The Amergas biomass gasifier which is located in Geertruidenberg, The Netherlands, will gasify demolition wood and fire it in the EPZ Amer power station, Unit 9, which has a net capacity of 600 MWe and 350 MWth. Demolition wood is waste wood and the product gas is cleaned before being fired in the existing boiler. The biomass gasifier's output is equivalent to 29 MWe or 26 MWe and 15 MWth. Dry testing of the plant was completed in January 2000. During subsequent hot commissioning several problems have arisen and major modifications are being undertaken which should be complete by summer 2002.

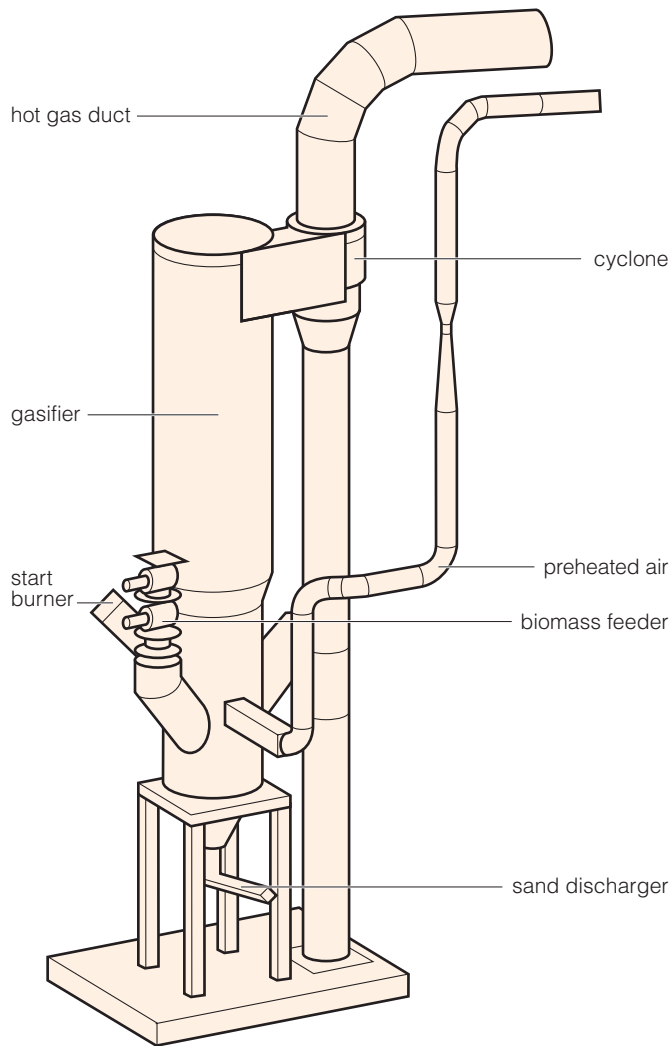
Avedøre 2 consists of a parallel powered combined cycle arrangement with a coal/natural gas/oil USC boiler, a biomass combustion unit able to burn wood chips or straw and an aeroderivative gas turbine running in an integrated cycle. The plant has the capacity at full load of 570 MWe or 485 MWe plus 570 MJ/s of district heating. The main unit is a 380 MWe ultra-supercritical boiler. The primary fuel was intended to be natural gas constituting about 85% of total fuel consumption with biomass accounting for 10% but since then the spot price of electricity has fallen and the price of natural gas has risen hence in 2002 the main boiler will be converted to use

'Generation costs were competitive for electricity production from biomass'

wood pellets. The biomass boiler is a once-through Benson type boiler consuming 26.5 tonnes of straw per hour and producing 40 MW electricity and 60 MJ/s heat. It has been designed for 100% straw firing or mixed firing with straw and wood chips. The USC boiler started operating in late 2001 and the biomass boiler was fired in January 2002.

A gasification project has been undertaken at the Kymijärvi power plant in Finland to demonstrate commercial scale gasification of a wet biofuel and the use of hot, raw, low calorific gas directly into an existing coal-fired boiler which currently produces 167 MWe and 240 MWth of district heating. The gasifier is of the atmospheric circulating fluidised bed type and the gasifier fuels consist of biofuels such as bark, wood chips, saw dust and recycled fuel from households, offices etc. The gasifier was connected to the main boiler in December 1997 and the gasifier output varies between 35 and 55 MWth.

The Austrian utility Verbund has installed a biomass gasifier at its 137 MWe coal-fired plant in Zeltweg. The project, which is known as BioCoComb, involves gasifying bark and wood chips in a CFB gasifier and feeding the product gas into the existing boiler to generate 10 MWth. The first gasification took place in December 1997 and by October 2000, 5000 tonnes of biomass and supplementary fuels had been gasified. For economic and strategic reasons the main power station was shut down in April 2001 but by then the project had demonstrated that the BioCoComb



The BioComb gasifier

process was technically sound and that the generation costs were competitive for electricity production from biomass.

A new boiler has been constructed at the Västerås CHP plant in Sweden to fire biomass. The biomass boiler is a CFB boiler with natural circulation. It connects to the turbine, condensate and feed water systems of the existing coal-fired Unit 4 which is a once-through boiler generating 180 MWe or 155 MWe and 250 MWdh. The biomass boiler will increase the production to 250 MWe or 220 MWe and 350 MWdh. The biomass boiler was started up in October 2000 and is in commercial operation.

Indirect cofiring of biomass and coal has thus been demonstrated successfully at a small number of power plants. The technology is more expensive than direct cofiring and some of the projects have involved a level of subsidy. The technique is

particularly suitable for biomass containing troublesome components or when the quality of the ash is of importance for subsequent sale or disposal.

Each issue of *Profiles* is based on a detailed study undertaken by IEA Coal Research, the full report of which is available separately. This particular issue of *Profiles* is based on the report:

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