Co-firing with biomass at Edenderry Power Station

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This case study is provided as an example of the use of biomass resource along with conventional fuels in combustion based power plants in order to significantly reduce the carbon emissions by replacing significant quantities of fossil fuels with net carbon neutral renewable biomass fuel.

The Edenderry power station, located just north of Clonbullogue in Co. Offaly in Ireland, was built and commissioned long back in 2000. The station was subsequently owned by E.ON, a German power company, and was purchased by Bord na Móna in December 2006. The power plant is based on the bubbling fluidised bed boiler consuming one million tonnes of milled peat per annum, and has an annual energy input requirement of 7.7 peta joule (PJ).

In order to reduce the inherent high carbon emissions from use of milled peat die to its chemical properties, the company tried the operations using cofiring of biomass (wood chips and saw dust) in 2002. The Biomass/peat co-firing tests carried out in a bubbling fluidised bed test facility at VTT, Jyvaskyla, Finland, to examine flue gas constituents, particle deposition and corrosion risks associated with peat/biomass mixes. The trials were conducted to determine the chemical suitability of biomass materials for co-firing of biomass materials and to find out their ability to flow through existing peat handling and screening facilities. Carbon neutral materials suitable for co-firing in the peat power stations fall into three broad categories:

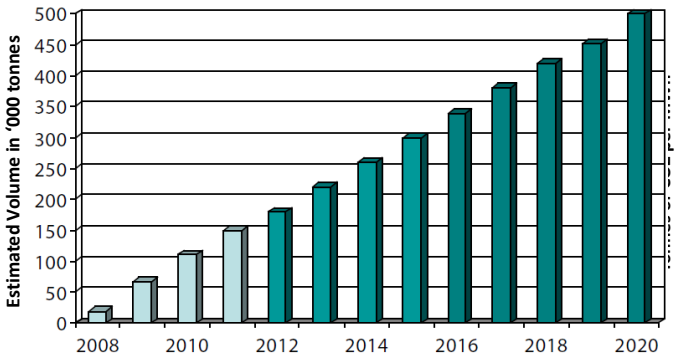
- Forest derived materials: either direct from forest or residues from wood processing
- Land based materials: short rotation coppice (SRC) or energy crops grown specifically for non-food purposes
- Recovered materials: clean uncontaminated wood, separated out from waste streams

The successful trials showed that the plant was capable of running on a mixture of peat and other biomass materials without any major problem and with significantly reduced carbon emissions depending on quantum of biomass used in co-firing. The Government immediately brought out the White Paper on energy 'Delivering a Sustainable Energy Future for Ireland', which was published in March 2007, and set a target of 30% co-firing at the three State owned peat power generation stations to be achieved progressively by 2015 beginning with immediate development by Bord na Móna of its pilot project at Edenderry Power Station.

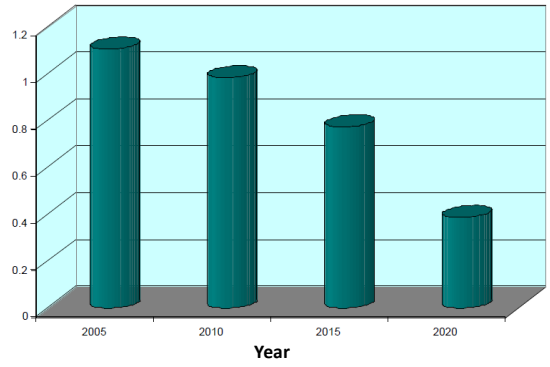
The bubbling fluidised bed at Edenderry has a fairly wide tolerance for both moisture content and particle size of biomass materials. However, some chemical parameters require close scrutiny, particularly in relation to alkaline halide concentrations and risk of corrosion; and the ash melting characteristics and potential boiler fouling (See Table).

Moisture content (%)	**10–60 (individual biomass materials) 45-55 (peat & biomass fuel blend)**
Ash Content (%)	< 5
Particle size (mm)	<40
Gross CVd (GJ/t)	>18
Chlorine content (%)	<0.1
Ash Deformation (°C)	>1000

Initially, the plant was not licensed for co-firing but later in 2007, the Government of Ireland released White Paper on energy 'Delivering a Sustainable Energy Future for Ireland', which set a target for co-firing in the peat stations. The Edenderry power station started the co-firing of peat and biomass products in 2008. The power plant consumed 17,700 tonnes of biomass in the year 2008, displacing about 19,100 tonnes of peat, and preventing the emission of some 16,800 tonnes of CO2. The biomass materials consumed were sawdust, arising as a co-product at sawmills, and wood chips, supplied either as a co-product or direct from the forest. Other materials trialled included SRC (willow) chips, birch chips from cutaway peatlands, wood pellets, recovered wood chips, miscanthus and imported materials such as olive pellets and palm kernel shells.



Biomass usage at Edenderry



Carbon intensity of Co-firing at Edenderry

The year wise displacement of Peat with biomass in the Edenderry plant is shown graphically. The figures are shown in Energy Tonne (ET), where one Energy Tonne (ET) is equal to 7.7 Giga Joule (GJ). It is envisaged that the plant will be able to utilise up to 30% of a plant's maximum rated capacity until 2017; up to 40% between 2017 and 2019; and up to 50% thereafter. With a projected increase in the proportion of biomass utilised, the carbon emissions will continue to fall from 1.2 tonnes of CO_2 emission per MWh to 0.2 tonnes CO_2/ MWh.