Biomass Co-firing in Coal Power Plants

INSIGHTS FOR POLICY MAKERS

Biomass co-firing consists of combusting biomass and fossil fuels, mostly coal but also natural gas, in the same power plant. In most cases, biomass co-firing in coal power plants takes place by mixing biomass with coal before the burners, but biomass can also be gasified and burned in separate burners, after which the gaseous fuel or steam is mixed with the boiler streams of the coal-fired power plant. The advantage of biomass co-firing is that it reduces greenhouse gas emissions from coal-fired power and enables power generation from biomass with the high efficiency achieved in modern, large-size coal-fired power plants, which is much higher than the efficiency of dedicated, 100% biomass power plants. The total energy efficiency can be increased even further if biomass co-firing takes place in combined heat and power (CHP) plants. The other advantage of biomass co-firing is that the incremental investment for burning biomass in coal-fired plant is significantly lower than the cost of dedicated biomass power. At present, co-firing projects in coal-fired power plants exceed the biomass capacity of dedicated biomass plants.

The costs of biomass acquisition and transportation determine to a large extent the economic feasibility of co-firing. The acquisition costs depend on possible competition with other biomass energy uses (biofuels) or non-energy applications. A stable and cheap flow of biomass is needed to sustain a biomass co-firing project. The biomass feedstock can be sourced from residues or waste streams from forestry, agriculture, pulp and paper, and sugar industries, or from dedicated energy crops (e.g. short-rotation coppices). Local availability of large quantities of cheap biomass makes biomass co-firing more economically attractive. If local sources are not sufficient, high energy-density, pre-treated biomass (e.g. wood pellets) can be used. In these cases, long-distance transportation and logistics (e.g. an inland harbour) play an important role on the economic viability. In developing countries, the use of waste streams from agriculture and forestry may also create additional value and job opportunities, and contribute to the rural development.

Coal-fired power stations that provide both power and heat to district heating networks (such as in Northern Europe) or even industrial facilities may significantly increase the efficiency and the economics of biomass co-firing. Appropriate policies are needed to seek an efficient use of the available biomass resource by encouraging the use of co-firing in connection with CHP wherever suitable. Policies should also take into account the co-benefits from the use of agricultural residues or demolition waste, which would otherwise constitute a disposal challenge.

Biomass co-firing has an enormous potential for reducing the CO2 emissions as biomass can replace between 20% and 50% of coal. However, the net reduction of CO2 emissions and other pollutants depend to a high degree on biomass feedstock's origin and supply chain. In addition, a high percentages of biomass co-firing may reduce efficiency and power output. Nevertheless, the substituting of only 10% of coal in the current installed coal-fired electrical capacity would result in about 150 GW biomass power capacity, which is 2.5 times the current globally installed biomass power capacity.

Biomass co-firing can be considered as a transition option towards a completely carbon free power sector. Several European countries and American States already offer policy incentives or have mandatory regulations to increase the renewable share in the electricity sector, which support the use of biomass co-firing, and most biomass co-firing projects takes place in these countries. The Clean Development Mechanism (CDM) recognises biomass co-firing as a way to reduce CO2 emissions in developing countries. However, to exploit the co-firing potential with no environmental impact urgent measures and technology preparation are needed in emerging economies such as India and China, where coal-fired power capacity is rapidly growing and large sources of biomass are available. The indicators developed by international organisations to measure the sustainability of bio-energy (including protection of soil and water resources, bio-diversity, land allocation and tenure, and food prices) need to be integrated into the policy measures.

Please send comments to Philippe Lempp (plempp@irena.org), Author, and to
Giorgio.Simbolotti@enea.it, Giancarlo Tosato (gct@etsap.org) and Dolf Gielen (dgielen@irena.org), Project Co-ordinators