Research Results

Biomass: A Promising Energy Source

The ZEW, in cooperation with several domestic and foreign institutions, has assessed the performance of biomass for producing electricity and heat, and for transport services, using technical, economic and environmental criteria. The study, which was commissioned by the European Commission, complements their research on external costs of energy. The findings reveal that the energy use of biomass generally relieves environmental pressures and in some cases it is even competitive within the current economic framework.

■ Biomass is often regarded as the most important renewable energy source for meeting future energy demands within the EU. In fact in Finland, Austria, and Sweden, more than 15 percent of the total energy consumed is generated from biomass even today.

The use of biomass as a source of energy is characterised by a diversity of fuel types and conversion technologies. 'Biofuels'are not only derived from plant residues from agriculture, forestry and industrial sources, but also from the cultivation of energy crops (such as sugar beet and fast growing species). They also include gaseous energy sources, such as biogas from slurry, and liquid biofuels, such as rape seed oil, rape seed oil methyl ester and bioethanol, which are used as motor fuels.

By examining several existing facilities at various locations within the EU, the 'BioCosts' project covers a representative range of biomass applications. Each biomass case study was compared to a fossil fuel reference case:

- ▷ forestry residues vs. coal in a circulating fluidised bed combustion plant in Nässjö, Sweden (S1);
- ▷ industrial wood waste vs. fuel oil for industrial combined heat and power production in a boiler and steam turbine in Mangualde, Portugal (P1);
- ▷ gasification of woody biomass from fast growing tree species vs. coal for generating electricity in a gas and steam turbine process in Eggborough, Great Britain (UK);
- ▷ gasification of forestry residues vs. coal for combined heat and power production in a high-pressure combined gas and steam cycle plant in Värnamo, Sweden (S2);
- ▷ biogas from animal slurry vs. natural gas in a municipal cogeneration engine in Hashöj, Denmark (DK);
- ▷ cold-pressed rape seed oil vs. diesel fuel in a cogeneration plant in Weissenburg, Germany (D).

For the assessment of environmental effects, emission inventories were compiled for every stage of the fuel cycle. The impact pathways of selected priority impacts were analysed in detail. Where possible, the impact was quantified and valued in monetary terms. The derived external cost estimates range from about 0.001 to 0.18 ECU/kWh. With one exception, the biomass technologies achieve(d) better results than their fossil fuel reference technologies.

Biomass use already profitable

In summary, the analyses revealed that a well-organised exploitation of biomass energy sources can have significant environmental advantages over the use of fossil fuels. Above all, the use of both gaseous and solid biofuels can make a valuable contribution to the reduction of greenhouse gas emissions, such as CO_2. For conventional pollutants, the picture is more differentiated: In terms of SO_2 emissions, all biomass case studies showed better results, while for NO_X and CO emissions, some biomass case studies scored worse than their reference cases. Often the reason for high emissions has to be sought in the conversion technology and not in the fact that biomass is used as fuel.

Also in terms of energy production costs, the case studies showed large differences. Two case studies (S1 and P1) proved to be economical even under prevailing conditions. The other biomass fuel cycles are up to 100 percent more expensive than their reference fuel cycles, partly because the technologies are still at the stage of pilot projects. However, when taking into account external health costs and potential damage to the global climate in the market price, a number of biomass technologies (UK, S2, and DK) would be competitive as well. ◄

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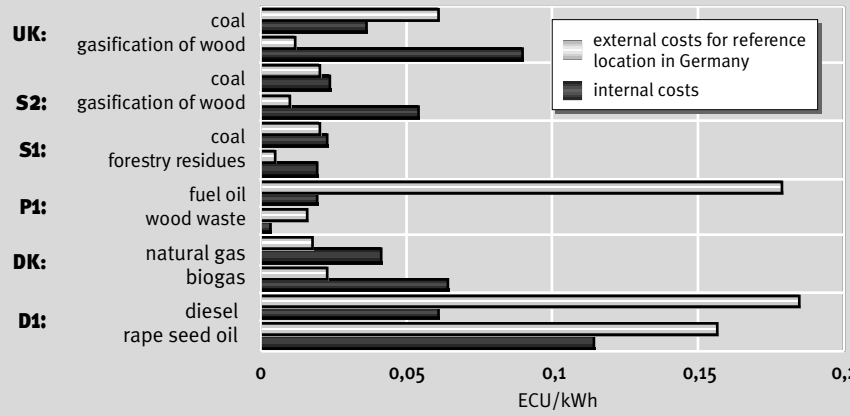
Biomass technologies compared to fossil fuel technologies



External costs were calculated as the impacts of air pollutants on human health. Internal costs were defined as fuel cost, investment cost, labour cost as well as operating and maintenance cost. Source: ZEW