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Wood biomass use for energy in Europe under different assumptions of coal, gas and CO_2 emission prices and market conditions

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ABSTRACT

This study examines the effects of different coal, natural gas and carbon emission prices and market situations on the use of wood for electricity and heat production in the European Union. The analysis is carried out using the global forest sector model EFI-GTM expanded to cover electricity and heat production from wood, coal, natural gas, wind and solar energy. Analysis shows that with low coal and gas prices, use of wood for energy will be limited to low cost logging residues. With high coal, and especially natural gas prices, industrial wood also comes to be used for energy. At a carbon price of 100 €/tCO_2, some 32 Mm^3 of industrial wood, in addition to 224 Mm^3 of logging residues, are projected to be used for electricity and heat in the EU region (including Norway and Switzerland) in 2030. The relatively low quantity of industrial wood used by the energy sector despite the collapse of the use of coal is explained by the fact that under high CO_2 prices, other energy forms like natural gas, solar and wind energy become more and more competitive. However, the amount of industrial wood used for energy may substantially increase with subsidies for using wood for electricity and heat, even with relatively low carbon prices. With a high coal and gas price and a carbon price of 100 €/t, a subsidy of 30 €/MWh to the wood based and coal with wood co-firing electricity production will have a significant impact on the European wood based sector. Depending on the development of the market demand for

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forest industry products, such a subsidy may cause a 10–12.5% reduction in forest products production, a 6–9% increase in harvest level, about 30–60% increase in the pulpwood prices, and a 6–9 fold increase of wood imports in the EU, compared to the respective case without a subsidy in 2030.

Introduction

In 2009, the leaders of European Union (EU) and the G8 announced an objective to reduce greenhouse gas (GHG) emissions by at least 80% below 1990 levels by 2050 in order to halt the global climatic warming to 2 °C (ECF, 2010a). On 15th of March 2012, the European Parliament adopted a non-binding resolution that supports the European Commission's "Roadmap for moving to a competitive low carbon economy in 2050" (EC, 2011a). This resolution sets intermediate reduction targets of the order of 40% by 2030 and 60% by 2040 in addition to the long run 80% emission abatement target. Before that, the EU had put in place legislation to reduce its emissions to 20% below 1990 levels by 2020. The roadmap also suggests how the sectors contributing to most of the EU emissions, i.e. power generation, industry, transport, buildings and construction, and agriculture, can transit to a low-carbon economy in a cost-effective way. The power generation industry has a special target to reduce its GHG emissions by 54–68% by 2030 and by 93–99% by 2050 compared to 1990 levels.

Studies by the European Climate Foundation (ECF, 2010a) and the European Commission (EC, 2011b) address the feasibility, challenges and implications of the 80% emissions abatement objective. The EC concluded that one of the consequences of achieving the 80% emissions abatement objective would be high CO_2 prices after 2030; over 100 €/t in 2040 and 200 €/t in 2050. In late 2011, the European Commission also published the EU Energy Roadmap 2050 Impact Assessment Report (EC, 2011c) with more detailed projections for the EU Energy sector up to 2050.

According to the ECF report (2010a), renewable energy sources (RES) are going to play a key role in achieving EU energy sector decarbonisation targets in 2050 by supplying a major part of electric power and heat. Only a minor share of energy is expected to be provided by coal and gas with carbon capture and storage (CCS). By 2030, RES energy supplies are expected to provide 55–60% of electricity, while the remainder will be provided by nuclear power, coal and gas. The use of coal and gas is expected to gradually diminish as a result of reduced CO_2 emission allowances sold on the EU Emissions Trading System (ETS) and rising CO_2 prices. However, ECF (2010b) projects the use of natural gas to increase significantly by 2030, at the same time as the use of coal – the heaviest CO_2 emitter – shrinks.

Since coal and gas are the two most important fuels used in Europe in power production, their prices and the CO_2 emission prices will affect how the new RES, including wood biomass, will compete for the share of the power market. Gas is more expensive fuel than coal, but it burns with lower CO_2 emissions.

In the near term, materialisation of the long-term projections regarding the decreased use of coal and the increased use of gas does not seem so straightforward. There has been abundant supply of CO_2 emission permits in the market in 2012 as a result of the economic downturn, and also because the EU RES directive has already spurred the member states to use increasing amounts of renewable energy. Consequently, the CO_2 prices have fallen to a very low level of about 5 €/t in October 2013. Coal prices have also decreased, due to the global economic recession and the increased use of low priced shale gas in USA to replace coal. North American coal is increasingly exported to Europe and Asia causing decreased coal prices globally. The falling prices of coal and CO_2 emission allowances are stimulating many major European power utilities to shift from gas to coal. According to Bloomberg (2012), E.ON and RWE – the biggest utilities in Germany, Europe's largest power market – are considering shutting unprofitable gas-fired plants. RWE has increased electricity from lignite coal by 20% in Germany in the first quarter of 2012. Furthermore, after the Fukushima nuclear disaster Germany decided to phase