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THE EUROPEAN ENERGY SYSTEM AND THE CO2 EMISSIONS MITIGATION POLICIES UP TO 2050

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Overview

The future of energy for Europe will be strongly dependent on the future world energy context which will be dominated by two key issues. The first one will be meeting the growing energy needs of a large part of the world population, mostly in Asia, Africa and South America. The second question is the need for the world energy system to address the major environmental issues raised by the future energy consumption growth, and most especially its impact on anthropogenic climate change.

Both issues are key for Europe as on the one hand it will have to face the growing competition for supply by other regions, and on the other hand because it intends to take the lead on climate change mitigation policies.

More and more people agree that avoiding climate change will be cheaper than dealing with its effects. "Dealing with climate change is an imperative for today, not an option for tomorrow" (Beckett, 20061). To meet the goals of the Framework Convention on Climate Change that aims at "stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (article 2, UNFCCC, 1992), several European countries, recently echoed by the European Commission, are currently proposing that the emissions of industrialized countries be cut to a third or a fourth of their current levels, and that the growth of emissions in the developing countries should be sharply curtailed. The resulting global emissions profiles would then enable GHG concentrations to be stabilized at between 450 and 550 ppmv, which is less than twice the pre-industrial level of 270 ppmv in 1800.

In this paper we focus on what GHG emissions mitigation policies mean for the European energy system within a global framework.

Methods

We carry out a comparative study on the European energy system through 3 scenarios of CO2 emissions mitigations policies up to 2050 with the POLES model. These scenarios are produced by the world energy model POLES that has been used on various national, European and international prospective studies on the energy system. The model allows us carrying out a comprehensive analytical study with a particular focus on Europe within the world energy context.

These scenarios are the POLES Reference scenario (see WETO-H2 report (1)), the Stabilisation 450 - Factor 4 scenario, which is in fact a scenario that aims at stabilising world CO2 concentration at 450 ppmv while imposing a "factor 4" reductions for industrialised countries compared to today's levels, and finally an intermediary Carbon Constraint scenario, which is derived from the WETO-H2 study. We analyse the way the

[1] Margaret Beckett « Gleneagles dialogue meeting-Becket opening remarks » 3/10/2006

world energy system adapts to these different levels of CO2 emissions constraints, and go into further details for the European energy system.

Results

We compare world primary consumptions, energy sector CO2 emissions and international prices in all 3 scenarios and explicit the contribution of the various technological options to emissions reduction in the Carbon Constraint scenario and the Stabilisation 450 scenario in comparison to the Reference scenario.

We then analyse more thoroughly the energy system and the related emissions at European level, focusing on sectoral consumptions (transport, industry, residential – tertiary) and the power sector. Finally, the issue of energy security for Europe is addressed in all 3 scenarios, where it appears that strong CO2 emissions limitations reinforce its energy independence.

Conclusions

This analytical work shows that a drastic reduction in GHG emissions by 2050 is only possible if active policy measures are implemented to establish a carbon value that increases rapidly. Even though these scenarios are exploratory, it shows that no major option may be neglected if we have to reduce significantly total GHGs. These options are: "Low Emissions" consumption technologies in the construction, transportation and manufacturing sectors, large deployment of renewable energies, nuclear power and carbon capture and storage for thermal plants. It must be noted that these measures are only likely to be acceptable if additional measures are implemented to make the burden tolerable for both consumers and the business community and if the constraining scheme allows for long-term anticipation and adaptation.

The climate change policies have a direct impact not only on GHG emissions but also on the price of primary energies, and in particular on that of crude oil. The Stabilization 450 scenario results in a crude oil price that is half that of the Reference scenario and stabilizes at today's levels as higher carbon taxes reduce the demand for fossil fuels. The pressure on conventional oil resources is reduced, both alleviating the problem of global hydrocarbon resource depletion and decreasing global energy dependency on limited producing regions.

Our work has thus shown that sustainable energy development depends largely on the ambitiousness and effectiveness of these policy measures. There are of course limits to what can be done mostly because the POLES model does not allow assessing the carbon constraint's reciprocal impact on the economy, since it is a partial equilibrium model. Efforts are currently under way to better understand the structural changes resulting from the adoption of a low-emission profile on the overall economy, technologies and behaviours, by establishing closer links between sector-based models and macroeconomic models and trying to represent the potential characteristics of a "low CO2 society" in greater detail.

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