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CARBON PRICING IMPACTS ON THE NORDIC POWER MARKET: COST INCREMENTS, MERIT ORDER DISTORTIONS AND MARKET POWER

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Overview

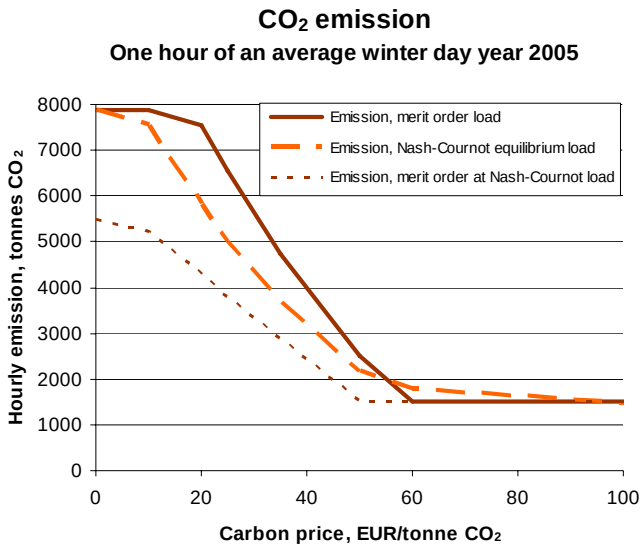
The introduction of CO2 emission permit systems such as the European ETS system may entail several consequences for the electricity sector. In general, such systems may have impacts on cost structure of generation technologies, wholesale prices and end-user prices of electricity, but they may also introduce distortions of merit order dispatch if companies are in a position to exercise market power. The introduction of a CO2 emission permit system may thus give rise to deadweight losses and trigger adjustments of technology portfolios at the company level as the structure of market power changes. In this paper we address the impacts as mentioned above with a particular focus on merit order dispatch and market power.

Methods

In order to analyze the problems at hand we apply a numerical partial equilibrium model, EMILIE (Wietze et al., 2006), that optimizes technology choice at the company level and calculates hourly equilibrium quantities and prices under perfect competition and under Nash-Cournot assumptions.

Results

In a perfectly competitive electricity market the power plants will be activated in ascending order according to their marginal generation cost. In the Nordic system the marginal cost of hydro power generation is significantly below the marginal cost of power generation from technologies that emit CO2. This assigns the higher merit to hydro power. As a CO2 emission permit system implies a cost increment to the CO2 emitting technologies only, hydro power will remain the technology with the highest merit after the introduction of such a system. However, companies exercising market power are likely to violate the merit order dispatch i.e. holding back on the low cost technology so as to ensure that the marginal technology is a technology with a high marginal cost e.g. coal condensing power. This will continue to be the case even after the introduction of a CO2 emission permit system. The implication of this is that the CO2 emission permit system may not be very potent in activating hydro power generation as long as market power is being exercised. Indeed, simulations show that carbon prices must exceed 30 EUR/tonne in order to induce a dispatch that is consistent with merit order dispatch. On the other hand, market power exertion typically leads to less emission of CO2 at any given CO2 price as compared with perfect competition. This is due to the lower volume sold under market power exertion. However, it turns out that this reduction is taking place at great cost to society. Indeed, as the attached figure shows, a much more sizable reduction of CO2 could have been obtained if technologies were loaded in accordance with merit order under market power exertion (Nash-Cournot equilibrium)



Otherwise, simulations also indicate that the introduction of a CO_2 emission permit system may change the degree of market power being exercised and the relative importance of companies involved.

Conclusions

The main conclusion to be drawn from this analysis is that the exercise of market power in the Nordic power market not only implies the usual deadweight loss in terms of introducing a wedge between the marginal willingness to pay and marginal cost of electricity generation, but also hinders the efficient use of the CO_2 emission permit system, since market power adds considerably to the abatement cost due to merit order distortions.

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