UNIVERSITY OF CAMBRIDGE
Electricity Policy Research Group

Investment Equilibrium Models under Emission Regulation and Different Energy Price Regimes

EPRG Working Paper 1112

Giorgia Oggioni and Yves Smeers

We consider an electricity market where sales are subject to two different price regimes. Some consumers procure electricity through long-term contracts at average cost based price; the others are supplied at marginal cost price. Arbitrage between the two market segments is impossible. Generators invest to satisfy demand in both market segments. The problem is motivated by proposals of European Energy Intensive Industries (hereafter EIIs) in reaction to the Cap and Trade system on CO2 emission (the EU-ETS). EIIs argue that plants operating outside the EU are not today subject to similar legislations and face lighter emission constraints. This puts their European plants at a competitive disadvantage because they pay higher electricity prices and incur emission costs. EIIs find that electricity price is much higher compared to the production costs and attribute this phenomenon not only to the EU-ETS, but also to a malfunctioning of the European energy markets that originates in three main inefficiencies: limited access to cross-border connections, the absence of a real competition in the power markets and the difficulties to find a correct policy to address the impact of the EU-ETS on electricity prices. They then detail measures that, in their opinion, would counter this high price.

The recourse to nuclear energy is the first measure envisaged by EIIs, but nuclear investments are currently restricted in most of Europe and EIIs would like to remove these restrictions. EIIs also recurrently explain that cross border trade should be facilitated so that they can access different suppliers in competition. Finally, they ask for long term, nuclear based contracts, for base load supplies. Our paper considers the impact of nuclear policy, cross-border trade and long-term contracts within the EU-ETS and whether

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

they can heal EIIs difficulties. EIIs' proposals structure our models. We accordingly segment the consumer market in two parts: one is ruled by average cost type contracts; the other is subject to marginal cost pricing. Except for this price discrimination that is a true departure from perfect competition, we assume that agents are price takers and generation is perfectly competitive and represented by a simple dispatch embedded in an investment model. We model different zonal nuclear policies by allowing or disallowing investments in this technology. Uneven policies induce EIIs to procure electricity from nuclear zones, which point to EIIs' concern about limitations to cross border trade. We treat this issue through a spatial model where pricing zones are linked by an electrical grid. We model extreme impacts of transmission organization by three counterfactuals. The first case assumes no limitations to cross border trade: the region is represented by a single node. This offers a reference to assess cross border trade limitations. The second counterfactual is obtained when EIIs procure electricity at a single price in the region. This is referred to as the regional contract scenario. In contrast, European authorities (competition and energy) and EIIs consistently repeat that the European power market is geographically segmented by nation (or smaller) and hence that cross border contracts are impossible. This justifies zonal average cost contracts which are our third counterfactual.

We model average cost based contracts that compute the full cost of electricity, transmissions and CO2 and reallocate them to EIIs. We analyze the problem by modelling the impact of the inception of the EU-ETS under three different investment scenarios: fixed capacities in 2008, French nuclear investments in 2020 and German and French nuclear investments in 2020. As expected by EIIs, average cost pricing decreases the profits of the generators in a way that should reduce their electricity costs. Also expected, but from standard economic theory, average cost pricing decreases overall welfare compared to pure marginal cost pricing. Much less expected, EIIs remains far from being compensated for the impact of the EU-ETS. Last but not least, except when energy investment policies are harmonized (especially for nuclear), average cost pricing favours EIIs of one country, but hurts those of another with the result that it will always be impossible to agree upon any proposal in the European context. Harmonization of investment policies is the way forward, but it seems a long way off. The main conclusion is that average cost based contracts might underdeliver compared to EIIs expectations, at least as long as energy policies remain unharmonized as they are today in Europe. Harmonization could dramatically change the situation. Other features of long term contracts, such as the need for long-run volume and price risk hedging, are currently appearing in the

market that may add another rationale for these contracts in the future. This is missing in our current models.

Contact yves.smeers@uclouvain.be
Publication March 2011