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Upstream vs. Downstream CO_2 Trading: A Comparison for the Electricity Context

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As climate policy continues to evolve around the world, there are continuing debates over where in the supply chain to impose Greenhouse Gas (GHG) limits. Proposals range from far upstream at the sale of fossil fuels to far downstream at the purchase of manufactured products and energy by ultimate consumers. In the power industry, the upstream vs. downstream discussion has focused on whether to place the burden of compliance on plants that produce electricity, on the companies that distribute power, or even individual retail consumers.

A recently proposed approach is to regulate emissions at least partially "downstream" by placing a reporting and compliance obligation on retail providers of energy (here called "Load Serving Entities", or LSEs). Under this basic "load-based" approach, LSEs would have to demonstrate that the power they have purchased represents a mix of sources that achieves a specified target in terms of carbon intensity. The load-based approach is similar in philosophy to other downstream mechanisms, such as the idea of tradable personal carbon allowances that have been extensively discussed in the UK. In contrast, what is most commonly implemented is the second, more upstream alternative: source-based cap-and-trade system for power generators, such as the EU Emissions Trading System. A source-based approach places compliance responsibility on the facility that is emitting the pollution (the source). Each facility needs to acquire emissions permits to offset their total emissions.

It has been argued that "load-based" regulation would solve emissions leakage, cost consumers less, and provide more incentive for energy efficiency than traditional source-based cap-and-trade programs. But because pure load-based trading complicates spot

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power markets by requiring power sales to be differentiated by emissions rates, variants of load-based trading (GEAC and CO_2RC) that separate emissions attributes from energy have also been proposed.

We compare the market outcomes – prices, power sales, emissions, and income distribution – from these four proposals using simple complementarity-based equilibrium models. Under general conditions, we obtain the following conclusions. When all energy producers and consumers come under such a system, these load-based programs are equivalent to source-based trading in which emissions allowances are allocated by various rules, and have no necessary cost advantage. The GEAC and CO_2RC systems are equivalent to giving allowances free to generators, and requiring consumers either to subsidize generation or buy back excess allowances, respectively. As avoided energy costs under source-based and pure load-based trading are equal, the latter provides no additional incentive for energy efficiency, at least under decision rules used by utilities in the US. The speculative benefits of load-based systems are unjustified in light of their additional administrative complexity and cost, the threat that they pose to the competitiveness and efficiency of electricity spot markets, and the complications that would arise when transition to a federal cap-and-trade system occurs. In the case of personal carbon trading, the only exception would be if by making carbon impacts salient to consumers, inefficiencies in energy use by consumers are reduced sufficiently such that the resulting benefits exceed the likely considerable transaction costs associated with such a system.

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