California's CO_2 Cap-and-Trade System in Power Sector – Effects of Point-of-Regulation and Allowances Allocation on Emissions Leakage and Contract Shuffling

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Abstract

In response to Assembly Bill 32, the State of California is considering three types of carbon emissions trading programs for the electric power sector: load-based, source-based, and first-seller. They differ in terms of their point-of-regulation. In this talk, we formulate a market equilibrium model for each of the three approaches, considering power markets, transmission networks, and emissions trading. We analyze the properties of their solutions and show the equivalence of load-based, first-seller and source-based approaches. A numeric example illustrates the emissions and economic implications of the models. In the simulated cases, "leakage" eliminates most of the emissions reductions that the regulations attempt to impose. Further, "contract reshuffling" occurs to such an extent that all the apparent emissions reductions resulting from changes in sources of imported power are illusory.

In reality, the three systems would not be equivalent, because there will also be pool-type markets under the California Market Redesign and Technology Upgrade (MRTU), and the three systems provide different incentives for participating in those markets. However, the equivalence results under our simplifying assumptions show that load-based trading has no inherent advantage compared to other systems in terms of costs to consumers, contrary to claims elsewhere.

The second part of the talk will examine the effects of emissions allowances allocation schemes on the extent of the GHG (greenhouse gas) leakage and the contract shuffling. Two allocation methods are considered – grandfathering and output-update. Whereas grandfathering separates future allowances allocation from today's decisions, the output-based approach links the future awarded allowances to today's output level. The latter effectively subsidizes generators' production costs, encourages more output and consequently elevates GHG allowances prices in current period. We first analyze the effect of output-update allocation on the leakage and shuffling using a stylized duopoly model, which abstracts from details of point-of-regulation. A single-stage computable model, which allows representing source-, load and first-seller programs, is then applied to examine the implications. The latter model is equivalent to a two-stage formulation with perfect foresight. Our results suggest that the magnitude of GHG leakage is inversely associated with per MWh of the future allowances awarded for today's output. The power prices under output-update approach could be either higher or lower compared to the grandfathering. Yet, the equivalence among source-, load-based and first-deliverer approaches remains valid only under certain conditions.