

# Market Power in Tradable Performance-Based CO<sub>2</sub> Emissions Standards in the Electricity Sector

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## Executive summary

Considerable flexibility is given by the U.S. Environmental Protection Agency to each state to achieve the state-specific performance standard under the federal Clean Power Plan (CPP). Conventional wisdom believes there are two sets of tools available on the table: a tradable performance-based and a mass-based permit program. While both approaches intend to harness economic efficiency through trading either mass-based or performance-based credits, fundamentally these two types of programs are different in a number of ways. First, the tradable performance-based standard is essentially revenue neutral as it involves a cross-subsidy from relatively high-emitting generators to relatively low-emitting generators. The standard effectively lowers the marginal cost of low-emitting generators through awarded tradable permits. On the other hand, the tradable mass-based standard increases the marginal cost of all generators in proportion to their emission rates. Depending on how the program is designed, the sizable economic rent associated with tradable permits under the mass-based standard (by auctions for example) can be re-distributed either to producers, consumers, or retained by the government for other purposes. The cross-subsidy under the performance-based standard would effectively subsidize low-emitting units, which are more likely at margin. This, in turn, will lower power prices, thereby encouraging more consumption as well as enhancing permit quantity demanded.

This paper studies the short-run impact of the mass- and performance-based standard under imperfect competition either in the product market only or in both the product and the permit markets. A stylized analytical model is developed to produce generalized conclusions, and a more realistic model implemented numerically is used to evaluate policy efficiency while subjecting each scenario to a same level of total CO<sub>2</sub> emissions. Our analysis shows that the market equilibrium is determined not only by the types of the standards, i.e., mass- or performance-based, but also by market structure as well as the asset endowment of the dominant firm. While a dominant firm might be more capable of manipulating the market under the performance-based standard, the impact on the power market is somehow attenuated by the cross-subsidy from high-emitting to low-emitting units through a lowering of the power prices. We document in this paper an interesting finding that when the endowment of the dominant firm is relatively dirty, the performance-based standard can outperform the mass-based standard as the cross-subsidy leads to higher consumption and scarcer permits. Consequently, the dominant firm's incentive to behave strategically in both product and permits markets is mitigated due to the higher permit price. On the other hand, when the endowment of the dominant firm is relatively clean, the leader will act more aggressively to extract economic rent under the performance-based standard, thereby worsening market outcomes when compared to the counterpart mass-based standards. This is partially due to the fact that the lower permit price when the leader is relatively clean cannot lower the power price adequately to benefit consumers.

Given that incumbent firms located in the PJM Interconnection with a sizable market share typically own coal-based facilities, the performance-based policies might less likely be subject to market power manipulation than what we described herein. On the other hand, given that leading utilities in California, e.g., PG&E, San Diego Gas & Electric,

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and Southern California Edison, own a significant amount of zero-emission renewables, the performance-based policies might be more likely out-performed by the traditional mass-based policy on the ground of market power.

**Keywords:** Climate policy; electricity industry; mathematical program with equilibrium constraints; performance-based standards.