Incumbent's Bane or Gain? Renewable Support and Strategic Behavior in Electricity Markets

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Incumbent firms play a decisive role in the success of renewable support policies. Firstly, incumbents' investments into renewables may directly increase the installed capacity of green technologies. Secondly, the success of decarbonization in the energy system depends on how incumbents adapt the generation from their CO_2-emitting conventional technologies in response to support policies. On the other hand, incumbents might be able to manipulate markets due to their relatively high market share and experience in the electricity markets. Given this background, it is crucial to analyze incumbents' reactions to renewable support policies, accounting for the possibility of strategic behavior.

In this paper, we develop a game-theoretical investment and operation model to analyze the interactions between incumbent and newcomer firms as well as between conventional and renewable technologies under several renewable support policies, namely feed-in tariff (FIT), feed-in premium (FIP), and auction-based policies. Particularly, we focus on the effects of renewable support policies on market price (as a measure of market power and market manipulation) and CO_2 emitting conventional production (as a measure of success of climate and decarbonization policies).

We show that under a FIP scheme the regulator might want to specifically target either the incumbent firms or the newcomer firms, as the ownership of the renewables affects the market outcomes: while market price decreases as a function of only newcomer's investment, CO_2 emitting conventional production decreases more if incumbent owns more renewables. In contrast, in a FIT scheme, only the total installed renewable capacity affects market prices and CO_2 emissions, whereas the ownership structure is irrelevant. We show that depending on whether the regulator is more concerned about market power (price), or emission abatement, it should choose a different support scheme: in a FIP policy (and FIP based auctions), the strategic behavior of the incumbent leads to lower CO_2 emissions but higher market price compared to a FIT policy (and FIT based auctions). We also show that in comparable conditions, incumbents invest more in renewables under FIP than FIT. Moreover, while strategic behavior may justify why incumbents have been relatively less responsive to FIT and FIP, under auctions, the incumbents strategically decide to invest in renewables as much (in FIT-based auctions) or even more than the newcomer (in FIP-based auctions). Consequently, we can show that comparing different support policies at the same total renewable target, FIP-based auctions lead to more CO_2 reduction but allow for more exercise of market power (higher market price).

Our results provide important insights for policymakers in electricity markets. First, policymakers should design the renewable support policy based on the actual level of competitiveness. Planning the premium or feed-in rates based on a perfectly competitive benchmark may result in unwanted levels of investment if real-world conditions are less competitive. Second, policymakers should choose a support scheme based on concerns about either market power or emission abatement. Given the high divergence in the number and type of incumbents in different restructured markets in the US and Europe, as well as differences in conventional power plant fleets, policymakers

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might favor FIP-based policies if they prefer lower conventional output at higher prices (e.g., in systems characterized by carbon-intensive coal generation with a rather modest market concentration) or FIT-based policies if lower market power and higher conventional production are desired (e.g., in markets with high shares of existing carbon-free generation and high market concentration). Third, to have a comprehensive cost estimation of auction-based support policies, policymakers should take into account not only the direct costs (e.g., awarded payments to the winners) but also the possible indirect costs for the consumers (e.g., stemming from higher market prices under FIP-based auction compared to FIT-based auction).