The Other Renewable: Hydropower Upgrades and Renewable Portfolio Standards

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Executive summary

Renewable Portfolio Standards (RPS), that require that a minimum amount of energy come from renewable resources, have been one of the main policy instruments for encouraging renewable energy investment in the United States. By several accounts, these policies have been found to be effective in promoting wind and solar power generation. However, an analysis of the effect that these policies have had on hydropower investment is missing from the literature.

Hydropower is both renewable and, in some cases, dispatchable. Hence hydropower has the potential to help states meet their RPS goals while overcoming the intermittency problem associated with solar and wind power. Because of environmental restrictions and the exhaustion of potential sites, investments in new capacity are limited. However, as the Department of Energy points out[4], significant gains in capacity and efficiency can be made by refurbishing existing hydropower plants.

We study the decision of hydropower plant owners to invest in existing plants. We estimate that RPS rules have a significant positive effect on the probability of a planned upgrade.

Given that hydropower can be both a substitute for solar and wind power as well as a complimentary source of balancing generation, it is not ex-ante clear what the relationship is between planned investments in hydropower and existing capacity in wind and solar capacity. Our results indicate that planned hydropower upgrades serve as a substitute for wind and solar power under RPS. Hydropower investments tend to be a way of fulfilling RPS requirements instead of solar and wind power, rather than as a complimentary form of balancing power.

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A major methodological problem in working with data from the entire continental United States is accounting for the unobserved geographic variables that may bias the estimation. Geographic fixed effects could be used to control for this variation, and a variable indicating a plant's transmission system owner is available. However, the inclusion of these 230 fixed effects may lead to an overfitting of the data as well as absorbing of all the variation needed to estimate the policy effect of RPS. Instead, we have used a Bayesian multilevel model that allows us to model both the geographic diversity of our data as well as the policy effect of RPS, while avoiding overfitting.

Keywords Renewable portfolio standards, Hydropower, Bayesian methods, Multilevel models, Planned investment.