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Pricing carbon in the U.S.: A model-based analysis of power-sector-only approaches[☆]

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ABSTRACT

One proposed climate policy is a “power-sector-only” approach that would focus exclusively on controlling carbon dioxide emissions from electricity generation. This paper uses an intertemporal computable general equilibrium model of the world economy called G-Cubed to compare a power-sector-only climate policy with two alternative economy-wide measures that either: (1) place the same price on carbon or (2) achieve the same cumulative emissions reduction as the program limited to the power sector. We find that the power-sector-only approach requires a carbon price to electric utilities that is almost twice the economy-wide carbon price that would achieve the same cumulative emissions. In addition, we find that the power-sector-only policy does not produce offsetting increases in emissions in other sectors or other countries. Rather, we find that domestic carbon emissions outside the power sector fall slightly relative to baseline as higher electricity prices slow overall economic activity. Global emissions leakage is negligible

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as the price of oil in other currencies changes little. All three policies reduce investment in the capital-intensive energy sector, which lowers imports of durable goods and strengthens the U.S. terms of trade.

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1. Introduction

In June 2010, as the prospects in the U.S. Senate for an economy-wide cap-and-trade bill dimmed, some proponents of climate policy began to push for a more limited-scope approach. One proposed way to limit the scope of the bill was to apply the cap-and-trade program only to the carbon dioxide (CO₂) emissions from electricity generation. For example, Senator Bingaman proposed to cut electric utilities' CO₂ emissions by 17 percent by 2020 from 2005 levels and 42 percent by 2030. Starting in 2012, his proposal would have covered utilities that emit more than 25,000 metric tons of carbon dioxide-equivalent per year starting in 2012. Large manufacturers could opt in to the program. Although the Senate did not take up the measure, the proposal established a new line of climate policy discussion.

A power-sector only approach offers several advantages that some believe might make it easier to pass than an economy-wide cap-and-trade system.¹ It would be simpler and regulate fewer entities. It would apply to a sector that does not oppose the bill (at least under certain conditions) and that already has cap-and-trade experience from the Acid Rain program. It could also potentially provide the bulk of emissions reductions that an economy-wide program would have produced in its early years, owing to the relatively lower cost of abating emissions from electricity generation than from other sources. Along with controlling carbon, a bill focused on the power sector could also rationalize regulation of conventional pollutants from the same sources such as particulate matter, mercury, and coal ash.

However, a power sector only approach would differ importantly from an economy-wide approach. First, it would cover far fewer emissions. Fig. 1 shows that in 2009, the power sector contributed only about 33 percent of total U.S. greenhouse gas emissions.² Most importantly a power-sector only approach would exclude nearly all U.S. petroleum consumption and coal and gas in industrial and residential uses.

This limited coverage is intrinsically less economically efficient than an economy-wide approach because it would fail to equalize the marginal abatement costs across sectors and greenhouse gases. That said, the GDP and welfare effects of climate policy depend on more than abatement costs, including adjustment costs and effects on prices of traded goods. This study examines just such general equilibrium outcomes.

Emissions constraints in the power sector, like any non-comprehensive approach, could affect emissions and output in other sectors in complex ways. Higher electricity prices could reduce output in electricity-intensive sectors in particular. More generally, higher electricity prices pass through to all goods and services, and those higher real price levels can lower aggregate output and thus emissions in non-electricity sectors. On the other hand, in theory emissions constraints in the electricity sector could induce substitution into other energy sources within the U.S. economy and thereby raise emissions outside the power sector. We find here that a price on carbon in the power-sector only does not produce offsetting increases in emissions in other sectors. Rather, emissions outside the power sector fall slightly relative to baseline.

We expect the overall economic footprint of an economy-wide tax on carbon will be much larger than the same per-ton tax levied only on carbon in the power sector. First, a broader tax will produce much greater revenue because it would tax far more emissions. Second, emissions outside the power

¹ Kyle Danish, "Is a Power Sector Cap a Workable Plan B?" *National Journal* online edition, June 22, 2010, downloaded August 17, 2010, from <http://energy.nationaljournal.com/2010/06/what-fits-the-bill.php>.

² U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2010*, April 2012. <http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-ES.pdf>

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