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Options for Issuing Emissions Allowances in a Pennsylvania Carbon Pricing Policy

Issue Brief 19-08 by **Dallas Burtraw**, **Maya Domeshek**, **Anthony Paul**, **and Paul Picciano** — October 2019

We explore policy design elements for a potential electricity sector carbon cap in Pennsylvania.

A carbon cap is a method of carbon pricing that sets a limit on total carbon emissions and requires emitters to turn in a permit, called an allowance, for each ton of carbon dioxide they emit. Emissions allowances under a cap can be sold through an auction or distributed directly to emitters or other entities and can be traded in a secondary market, which leads to the identification of a carbon price based on the scarcity of allowances. This ensures that those entities that can reduce emissions in the least expensive manner will do so, saving the cost of an allowance.

An electricity sector carbon cap in Pennsylvania would require generators to turn in allowances for the carbon emitted in the process of electricity generation. Such a program brings with it several policy options—whether to allow trading of allowances ("linking") with the Regional Greenhouse Gas Initiative (RGGI) carbon market, what to do with the revenue from the sale of allowances (allowance value), and what companion policies to implement.

In a previous **report** (Report 19-04) and **issue brief** (Issue Brief 19-07) we concluded that with a Pennsylvania electricity sector carbon cap:

- Emissions reductions would be achieved at low cost.
- Low allowance prices would accelerate emissions reductions if Pennsylvania adopted features of the RGGI design.
- Renewable energy policy would achieve emissions reductions at greater cost but would also create clean energy infrastructure that would contribute to emissions reductions in the long run.
- A trade-ready program design in Pennsylvania would link seamlessly with the Regional Greenhouse Gas Initiative.
- Emissions leakage would be moderate.

Here, using RFF's Haiku electricity sector model, we expand on our previous work by focusing in more detail on a Pennsylvania carbon cap that is linked with RGGI. Linking the state program with RGGI can lower total costs, insulate the allowance markets from shocks due to local events, and amplify the climate policy signal of Pennsylvania's decision to cap emissions on the national stage.

In this analysis, we study the distribution of allowance value between the general fund (No AA), electricity consumers (Cons), and electricity producers (Prod) as well as the interaction of carbon pricing with Pennsylvania's Alternative Energy Portfolio Standard (AEPS) which is designed to support the development of clean energy. All results are for 2026.

We present six main findings.

Policy Representations:

Allocation to consumers (Cons) is represented as allowance value split between support for energy efficiency and consumer electricity rate relief.

Allocation to producers (Prod) is represented as updating output-based allocation (OBA), in which electricity producers receive free allowances in proportion to their share of generation. This use of value acts as a production incentive that mitigates "leakage" and is distinct from grandfathering.

We include policy scenarios that allocate to various subsets of producers: allocation to all producers (OBA All), allocation to all producers except coal and existing renewables (OBA All Except), and allocation to non-emitting producers (OBA Non-Emitting).

The AEPS is represented as a requirement that 8% of Pennsylvania's electricity demand be covered by wind and solar by 2021. We consider scenarios where the AEPS is eliminated and where it is expanded to require 15% from wind and solar by 2026. We assume Renewable Energy Credits are tradeable within the PJM region.

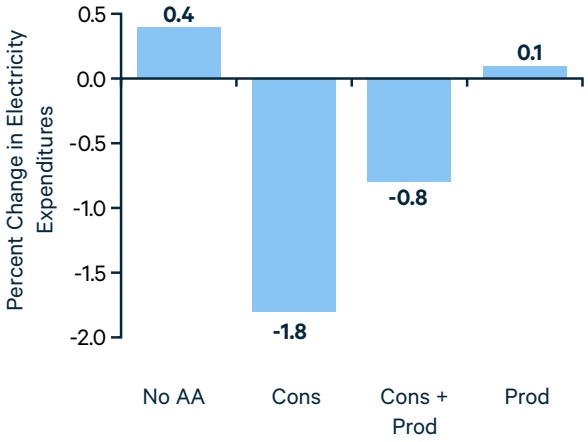
1. All cap policy scenarios lead to significant emissions reductions in Pennsylvania and the US.

Emissions in Pennsylvania fall from 118 million tons of carbon dioxide in the 2026 baseline to 83–90 million tons in the scenarios examined. National electricity sector emissions fall from 1710 million tons in the 2026 baseline to 1677–1684 million tons, a reduction of 1.5–1.9%.

2. The change in electricity prices would be unobservable.

Across all capped scenarios, electricity prices never change more than +/- 0.5% relative to BAU. Total electricity expenditures in Pennsylvania increase the most when allowance value is allocated to general funds (0.4%) and decrease the most when allowance value is allocated to consumers through energy efficiency investments and rate relief (-1.8%) (figure 1).

Figure 1. None of the carbon cap scenarios have a strong effect on expenditures. Allocating allowance value to consumers causes expenditures to fall below business as usual.



3. A carbon price leads to increased nuclear generation and decreased gas generation in Pennsylvania.

Regardless of allowance allocation, the most immediate effect of the carbon cap in 2026 relative to the business as usual (BAU) baseline is to forestall expected retirements of nuclear and increase in-state generation from nuclear (by 225%–280%) and decrease in-state generation from gas (by 33%–40%) (figure 2). The model contains gas prices that are higher than are observed currently, allowing nuclear capacity to remain profitable with greater ease than may be possible under current or future gas prices, but the preservation of existing nuclear capacity in all carbon cap scenarios is a robust result.

4. Shifting allowance value to producers with updating output-based allocation increases gas and nuclear generation and energy exports in Pennsylvania.

We test the impact of allocating allowances to producers (via OBA), with all generators—regardless of vintage or fuel—eligible to receive free allowances in proportion to their share of generation. As the share of allowance value offered to producers (as opposed to consumers) increases, all generators within Pennsylvania increase their generation, but gas and nuclear most of all (figure 2).

Figure 2. A carbon cap increases nuclear generation and decreases gas generation. As the share of allowance allocation assigned to producers increases, gas, nuclear, and total generation increase.

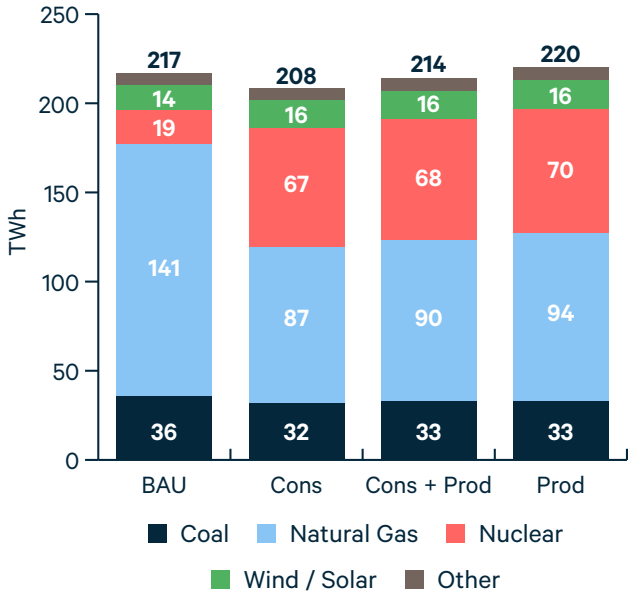
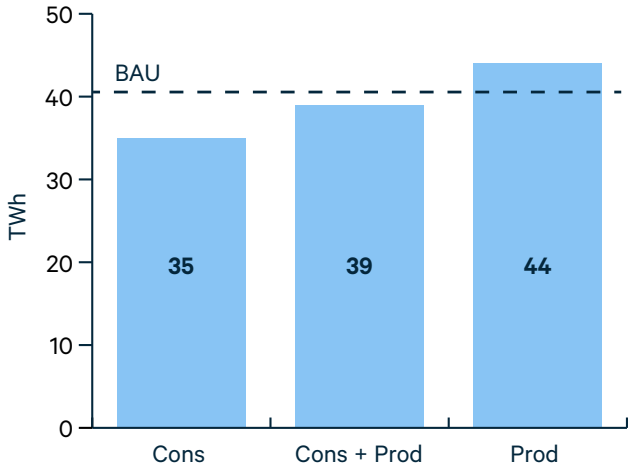


Figure 3. Pennsylvania electricity exports increase as the allowance value assigned to producers increases.



As the share of allowances that are distributed using OBA increases, so do Pennsylvania's electricity exports (figure 3). In fact, the production incentive embodied in OBA causes exports to increase above BAU levels. Most of these exports are to other RGGI states, so the shift in the location of generation does not change emissions under the cap, and has little effect on the total level of US emissions. In all scenarios discussed in this section, US emissions fall to 1,683 M tons compared to a BAU of 1710 M tons.

5. Targeting allowance value to non-emitting producers decreases emissions in Pennsylvania and the US.

Targeting allowance allocation (via OBA) to all generators except coal and existing renewables (OBA All Except) decreases coal and increases gas and nuclear generation within Pennsylvania compared to allowance allocation to all producers (OBA All). Targeting allowance allocation to only non-emitting generators (OBA non-emitting) decreases coal and gas and increases nuclear. Both selective OBA scenarios increase Pennsylvania renewables, but the OBA All Except scenario incentivizes greater in-state electricity production than the OBA non-emitting scenario (figure 4).

Changes in the Pennsylvania generation mix from targeted OBA are accompanied by small changes in the national electricity mix: a slight decrease in national coal generation and a slight increase in national renewable generation.

As we shift from allowance allocation to all producers (OBA All) to allowance allocation to some producers (OBA All Except) and to non-emitting producers (OBA non-Emitting), Pennsylvania emissions fall from 90 M tons of carbon dioxide to 87 and 83 M tons, respectively. More importantly, national emissions also decrease between OBA All and the targeted OBA scenarios. OBA All Except lowers national emissions slightly more than OBA to non-emitting generators because of its higher generation and exports (figure 5). It is noteworthy, however, that RGGI only covers CO2 and not other greenhouse gases, such as methane, which might increase as a result of higher gas generation in the OBA All Except scenario.

Figure 4. Pennsylvania generation responds to targeted OBA.

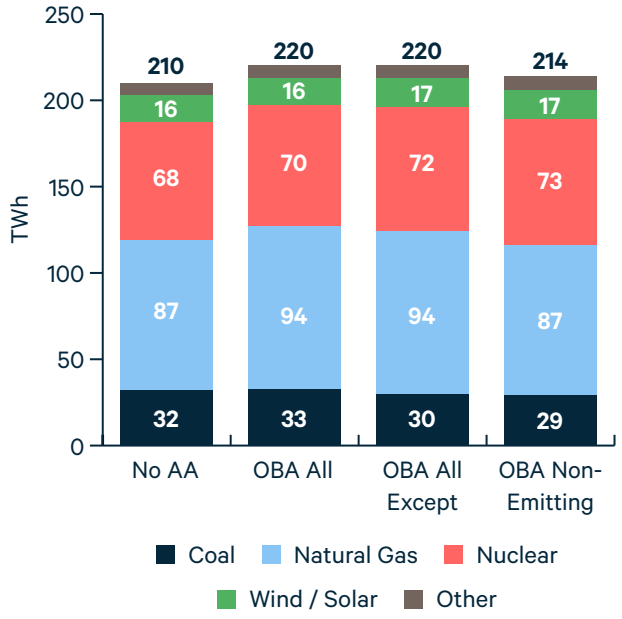
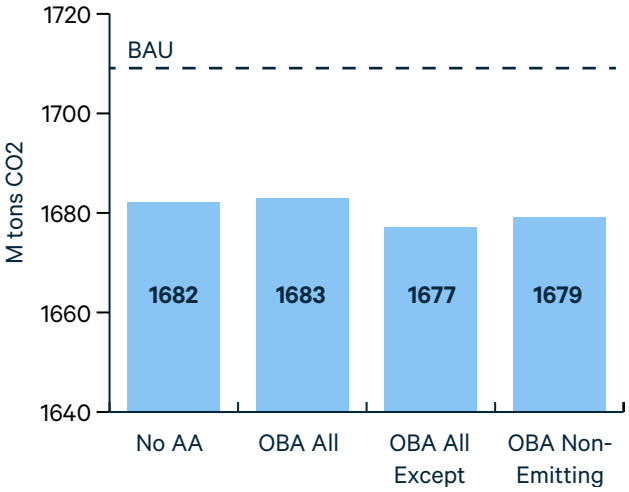


Figure 5. US CO2 emissions decrease, as allowance value moves towards lower-emitting sources.

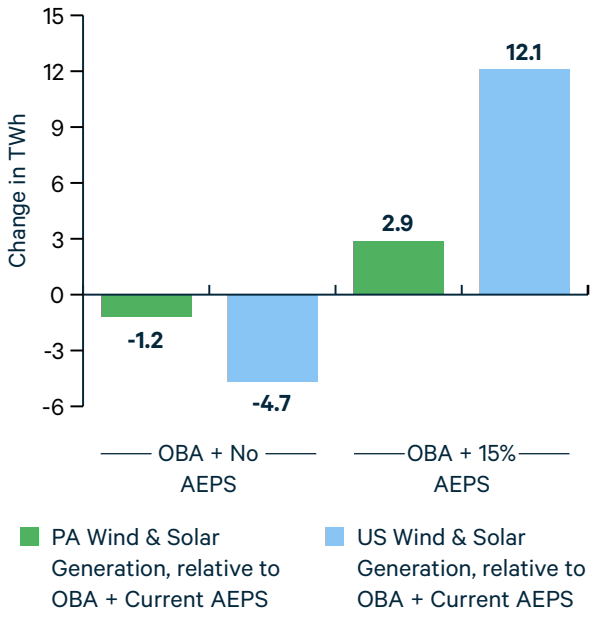


6. The Carbon Cap increases the effect of the AEPS but cannot replace it.

If deployed alongside the current AEPS, by 2026 the carbon cap would generate 13-25% (1.7-3.5 TWh) more wind and solar generation within Pennsylvania than would the AEPS alone (BAU).

The carbon cap cannot replace the AEPS because changing the AEPS will have repercussions for the stringency of neighboring states' renewable technology standards. Alternative Energy Credits and Renewable Energy Credits (RECs) generated in one state can often be used for compliance with a renewable technology standard in another state. Eliminating the AEPS would increase the supply of RECs that utilities in neighboring states could use to meet their compliance obligations instead of funding new renewable projects. National renewable generation would thus fall even more than renewable generation in Pennsylvania. Conversely, if Pennsylvania strengthened its AEPS, it would increase renewables both inside and outside of Pennsylvania (figure 6).

Figure 6. Changes in the AEPS create ripple effects for all US wind and solar.



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