
Not resource shuffling.

The Energy Institute at Haas, part of UC Berkeley, has a new study that looks at California's rules for regulating electricity importers in the cap-and-trade program. These rules attempt to keep importers from gaming the cap-and-trade system via resource shuffling. The Energy Institute has simulated different counterfactual cap-and-trade rules using 2007 electricity market data.

The report makes a good case for setting the default emissions rate rather high, at the rate of the average emissions from a coal plant. In my opinion, the report also has some conceptual problems that make it difficult to extrapolate from the report to predictions in an actual cap-and-trade regime.

After the jump, I explain what resource shuffling is and look at the report in more detail.

Ahh, resource shuffling. Such a simple concept, such an impossible problem to prevent in the cap-and-trade world. For those who don't know what resource shuffling is but, incredibly, are still reading this post, here is a brief explanation:

California is using cap-and-trade to put a price on all greenhouse gas (GHG) emissions in the state. Electricity generation (think coal and natural gas power plants) produces significant GHG emissions and thus will be more costly under cap-and-trade. Left to their own devices, utilities would purchase power from out-of-state and thus avoid the cap-and-trade 'tax.' To avoid this "leakage", California importers of electricity need to purchase allowances (again, think 'tax') for the emissions generated from production of out-of-state electricity when it is imported into California. But a clever utility with both a solar and a coal plant out-of-state will claim that the electricity it imports into California is all renewable (zero GHG emissions); it sent all the dirty electricity out-of-state (Utah, probably). Despite the fact that electricity from the solar and coal plants are indistinguishable electrons and the utility does not have complete control over the path of those electrons once they leave the plant. This accounting trick is “resource shuffling.”

The Energy Institute examined the impact of different rules on emissions in the Western Regional electrical network (CA, AZ, NM, NV, WA, OR, MT, WY, UT, CO). They took data from the 2007 electricity market as the baseline, and then used that data to infer what would happen to regional electricity generation and emission rates given different sets of rules concerning resource shuffling. When importers can take advantage of shuffling, we would expect to see more emissions in the states other than California, up to the amount reduced in California, thanks to cap-and-trade.

Take our coal and solar plants in Utah. If 50% of their output was sent to California and the coal plant produced 1 ton / MWh, then California’s emissions would be 0.5 ton / MWh and we would see the other 0.5 ton / MWh in Utah’s emissions. But with resource shuffling, we could pretend that solar-generated electricity went only to California, lowering its emissions to 0, while Utah’s emissions increased to 1 ton / MWh (all coal). The net emissions remain the same for the Western Region.

One difficulty with preventing resource shuffling is knowing what emissions rate to attribute to any given imported electron. If you know that a coal plant generated the electricity, then you can assign the appropriate emissions rate; but without such identification, you have to guess. Over 50% of electricity imports into California lack the necessary identification and thus fall under a “default” emissions rate.

To model these effects, the Energy Institute first modeled the regions without a California cap-and-trade program. Then it modeled different counterfactuals: cap on only California sources, cap with a default rate set to an average natural gas plant, cap with a default rate set to an average coal plant (higher emissions rate) and a cap on all Western Region states.

The Energy Institute’s modeling showed that it is difficult to reduce emissions in the region without using a region-wide cap. It also showed that a default emissions rate was preferable to just ignoring import emissions, in that it prevented some of the “leakage” whereby California’s emissions appear lower than they should be thanks to resource shuffling. (The study did not provide error estimates, and so it is unclear if the difference in modeled emissions are within the predictive margin of error). Intuitively, it makes sense that higher default rates would discourage some types of resource shuffling. If all unidentified emissions are set to the rate of an average coal plant, then it makes little economic sense to allow imported electricity to remain unidentified. Thus the economic incentive for what the report calls “laundering” imports.

I would hesitate, however, to use this model to predict how California’s cap-and-trade market will perform overall. I think the model has a few conceptual flaws that limit its usefulness for broader extrapolation.

First, the authors write that

> To a first-order, short-run emissions reductions will have to come either from shifting production among conventional sources, a reduction in end-use electricity demand, or through substitution with unregulated imports, i.e., leakage or reshuffling.

This is probably a fair assumption for purposes of this paper, but it biases the model towards an inability to achieve emission reductions. That is, there is no real driver of emission reductions in this model because the model rules allow only for emission shuffling. Take each source of emission reduction in turn:

1. Shifting production among conventional sources. This could mean either “laundering,” whereby dirty power is moved to the better default emissions rate, or real shifting from dirty power to using more renewables. But if I understand the report correctly, the model assumed that total production from “clean sources” (wind, solar, hydro) would not change in the short term. Without such an increase, there can be no decrease in emissions attributable to these sources.
2. Reduction in end-use electricity demand. Lowered demand could certainly result in lowered emissions. But the report is quite clear that “[a]s electricity is an extremely inelastic product, we utilize an extremely low value for the slopes of this demand curve.” In other words, the model assumes that demand is relatively unresponsive to changes in electricity price, so I would not expect to see much decrease in emissions from lowered demand.
3. Substitution with unregulated imports. This is what the paper sets out to prove: that leakage or shuffling is the driver for emission “reduction” in California’s program. If (1) and (2) are not important factors, (3) is all that is left.

Without incorporating longer-term responses to cap-and-trade, I don’t think this model achieves the necessary realism to make it useful for analyzing the program as a whole. Think of it this way: the model considers either a 15% or 25% emission reduction as if it happened overnight, while California’s program takes 7 years plus 5+ years of lead time to achieve the same goal.

Second, as far as I can tell the authors do not model the cap-and-trade auction or allowance trading. Allowance trading may drive decisions in the electricity market, just as the electricity market may drive prices of allowances. The models treatment of the cap is perhaps a bit too simplistic for extrapolation to cap-and-trade as a whole.

I would have also liked to see estimates of the model’s accuracy and bias. Figure 2 compares actual emissions (2007) with simulation results without a cap, but no attempt is made to translate that into standard errors throughout the report. It would also be nice to see the model used to predict years other than 2007, to get a sense for how accurate it is in extrapolating to new data sets.