Federal Energy Regulatory Commission
Technical Conference
Carbon Pricing in Organized Wholesale Electricity Markets
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Introduction

Thank you for the opportunity to participate in this technical conference. My comments here and during the conference are my own and do not represent the opinions of anyone else. The focus of my remarks will be on carbon pricing and the interactions with short-term electricity markets as found in the organized wholesale markets in the United States. I do not address the design and implementation questions focused on investments and resource adequacy that underpin capacity markets.

Carbon Pricing

Greenhouse gas emissions, principally "carbon" dioxide, create a climate externality that absent some policy action would have costs and benefits that would not be recognized in private market decisions of production and consumption. Unlike most externalities, the climate impacts of carbon emissions affect the whole world, because of atmospheric mixing, and extend over very long time-scales, due to the slow removal rate of natural processes.

Among the long list of difficulties in orchestrating a global response, for the Commission's purposes today I would emphasize the challenges of uncertainty and ubiquity. The climate impacts and their consequences could be very large or relatively modest, and would unfold over such a long-time frame that we don't know what solutions will be available or adopted. But we do know that material changes in carbon emissions will involve a vast array of individual choices affecting nearly every aspect of modern life. We should not think we can make all these choices today. Rather we should be focused on providing the structure and information to provide the right incentives to guide choices over a long horizon that allows for learning, surprises, and adaptation.

In addition to affecting every element of the economy, the global nature of the climate problem means that it affects every region. But continents, countries, states, cities, and so on are all different. There is no reason to assume that the best approach is to apply the same level or type of response everywhere. However, there is a good reason for recognizing that at the margin an

efficient approach for the world would have the same marginal cost of mitigation everywhere. There is no target level of emission reduction, and certainly no uniform target level, that should apply everywhere. However, the efficient marginal condition balancing marginal mitigation cost against the price of carbon should apply everywhere.

These conditions call out for common carbon pricing. For all the usual reasons, pricing can influence many and varied individual decisions in ways that mandates and standards cannot. Although it is difficult to determine the target price of carbon, this task is far easier than prescribing all the individual mitigation responses. On an optimal mitigation path, this common price is the social cost of carbon. (National Academy of Sciences, 2017) Actions which cost less than this price would be supported. Actions which cost more than the carbon price, would not be supported or would need some additional justification.

By itself, carbon pricing would not be sufficient. For example, the usual arguments apply with great force that there is a Research, Development & Demonstration (RD&D), but not Deployment, externality that calls for a greatly expanded role for government funding for organizations such as ARPA-E seeking major technology breakthroughs that could transform the world. (National Academy of Sciences, 2016)

In this sense, pricing carbon is necessary. And carbon pricing focuses on the right problem.

Efficient Carbon Pricing and Electricity Market Design

The Commission has the sometimes lonely responsibility to support and advance efficient electricity markets. Under the principles of open access and non-discrimination, efficient markets facilitate competition to provide better operations and investment.

The special features of the electricity system require more central coordination than other markets. (Hogan, 1995) Thus we have the system operators and Regional Transmission Organizations (RTOs) of organized markets. For the real-time market, the basic requirements stand on the framework of bid-based-security-constrained-economic-dispatch with locational prices. (Hogan, 2019) After sometimes painful experience, these basic elements appear in all the organized electricity markets in the United States, and they are continuously adapting and expanding to meet new challenges.

In principle, this market design can accommodate many changes in the technologies and operating practices in the market. For example, the underlying theory still applies even with increasing levels of intermittent resources. With a focus on first principles, the electricity market design is robust in theory and has worked well in practice.

Actual implementations of the market design have included certain simplifications that have become more problematic over time. Independent of its interest in carbon pricing, the Commission

should increase its efforts to develop and expand efficient market improvements. I would emphasize three areas that need further action by the Commission.

First, it is widely recognized that a major missing piece has been the demand participation assumed in the underlying theory but largely missing in practice. Here I am referring to demand that voluntarily bids into the market and pays for the power consumed. This is not the same as the myriad approaches to demand response where the idea is to be paid for the difference between actual consumption and some counterfactual.

Second, one of the flaws in the early market design was inadequate scarcity pricing, such as for operating reserves. This is closely connected to the lack of demand participation, in part because of a chicken-and-egg problem: without adequate scarcity pricing there is not enough incentive for demand participation.

Third, the changing dynamics of dispatch interacting with increased intermittent load invalidate the simplifying assumption that individual dispatch intervals can be evaluated and priced separately. Although full separability was never true in practice, increased attention to multiperiod pricing is becoming more important as part of supporting flexibility and short interval responses.

The Commission is aware of these issues. (Federal Energy Regulatory Commission, 2020) However, steady improvements in the implementation of real-time market design, dispatch and pricing, are increasing in importance, and these improvements would complement efforts to expand carbon pricing.

Given an efficient electricity market design, which design elements would need to be modified to accommodate efficient carbon pricing?

None.

Paying for carbon emissions at the common carbon price would become part of the variable costs of generation that are part of the generation offers, are included in the dispatch optimization, and determine the locational power prices. This is already done under the cap-and-trade program of the Regional Greenhous Gas Initiative (RGGI). The market works and the system operator takes on no responsibilities for managing carbon pricing or revenues.

Supporting and improving efficient electricity market design under the principles of open access and non-discrimination is a primary Commission responsibility. The changing mix of energy technologies enhances the importance of the task, but does not change the fundamentals. So too with efficient carbon pricing. The Commission should not lose sight of these fundamentals.

Second Best or Conflicting Policies

The perfect is the enemy of the good. Implementation of efficient carbon pricing, with a common price everywhere, will not be here soon. Some carbon pricing is probably better than no carbon pricing, although even this is not always true in such second-best situations. And as states and regions proceed, the Commission faces the reality of inconsistent, even conflicting carbon pricing and related policies. The questions asked of this technical conference reflect the challenges of conflicting polices rather than the problem of carbon pricing per se. Efficient carbon pricing should require no changes in the electricity market design. But conflicting carbon policies may be a different matter.

It is clear that the appropriate response by the Commission will depend on the particulars of the case at hand. The appropriate policy may well require border adjustments that would have to involve the RTO. (Butner *et al.*, 2020) These border adjustments could address prices for net imports, as in (Newell *et al.*, 2017), or quantity constraints, as in (PJM Carbon Pricing Senior Task Force, 2020).

An important general guideline would be to articulate as best we can the relevant objectives and how to mitigate any harms of the conflicting polices. This will depend in part on the selection of a counterfactual for reference and the definition of the harms to be addressed.

For example, consider the Commission's questions on "leakage--wherein carbon pricing causes internal resources to become less competitive compared to external resources, thus shifting production to emitting resources that are outside the carbon pricing region." The comparison is with the case of no carbon pricing. Whether this is good or bad would depend on the resource mix of the two regions. For example, if the internal resources were coal and the external resources were natural gas, the leakage could be seen is part of the solution, not part of the problem. If the comparison were with the case of efficient carbon pricing everywhere, then the problem might be seen as too little leakage. From this perspective, the approach of RGGI of not trying to mitigate leakage may be the best response.

For its own benefit, the Commission should be clear about the counterfactuals and different objectives. The issues are often confusing. Consider the case of the Western Energy Imbalance Market (EIM). (Hogan, 2014) Here the situation is different than RGGI, where generators outside the RGGI region are not part of the cap-and-trade program. By contrast, the cap and trade program administered by the California Air Resources Board (CARB) includes external resources. A central difficulty for this design is that it requires identifying the real-time generation sources providing power to import into California. On an integrated electrical network, this is impossible other than as a fictional accounting exercise that selects deemed resources as the providers. The resulting concern is with so-called "resource shuffling" where deemed contract accounting changes but the physical dispatch is the same.

Resource shuffling, changing the deemed mix of net imports, is not the same thing as leakage, changing the level of net imports. Which is a problem, and which is a solution, depends both on the facts at hand and the counterfactual used to evaluate the policy. For example, setting the counterfactual as efficient carbon pricing, for the CARB cap-and-trade system, leakage could be a problem but resources shuffling is part if the solution of mitigating the harm of conflicting carbon policies. Mitigating the harm requires explicit treatment of carbon under the dispatch and pricing of the EIM design. (Hogan, 2017)

The resource shuffling concern illustrates a related problem for the Commission. Quite separate from market efficiency and mitigating the problems of conflicting carbon polices, the concern with resource shuffling may point to another underlying objective. Although the discussion is confusing, it is clear the California parties would rather not credit emission-free renewables that have been built outside California under other programs or for other purposes. This is an attempt to discriminate among sources so as to capture the operating profits of generating units whose variable costs are lower than the market price. Viewed in this light, the Commission would surely object that a pricing rule that prevents resource shuffling would violate its non-discrimination policies. From this alternative perspective, again we see resource shuffling as part of the solution given the design of the CARB cap-and-trade system.

More broadly, as usual, the Commission will have to address and articulate the problems from multiple objectives that might be pursued under the inevitable market power states could exercise in manipulating market conditions. As is clear from the debates over capacity markets, the unintended (and sometimes intended) collateral damage can be material.

This would argue for care in making any deviations from the efficient market design principles. Furthermore, the added burden on system operators is a non-trivial concern. The many essential tasks that arise under the efficient market design, unique to electricity markets, already place heavy requirements on the system operators that are well known to the Commission. The bias should be against adding non-essential responsibilities simply because the system operator is conveniently there, when well-enough should left alone. There is much to be said for the RGGI approach. But the CARB cap-and-trade design illustrates a case where some adaptation of the market design might be required.

Conclusion

The fundamentals of efficient real-time electricity markets are fully compatible with efficient carbon pricing. The most important task for the Commission is to continue its work to improve actual short-term electricity markets to incorporate these fundamentals. The problems for electricity markets, and the environment, arise with inefficient and conflicting carbon pricing policies. Here there may need be some involvement of the system operator in modifying the

dispatch and pricing to address harms and unintended consequences. The details matter, both as to the facts at hand and the objectives of the policy.

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