Market Design for the Clean Energy Transition
Project Overview

World Resources Institute (WRI) and Resources for the Future (RFF) are collaborating on a project aimed at further developing improved electricity market designs that facilitate deep decarbonization, working effectively with other policy mechanisms aimed at decarbonization. Project leads are Karl Hausker (WRI, khausker@wri.org) and Karen Palmer (RFF, palmer@rff.org).

BACKGROUND AND GOALS

Rapid decarbonization of electricity generation is essential to fighting climate change. The transition to low- and zero-carbon technologies is underway, driven both by policy and by market forces. However, stronger federal and state policies are likely needed to achieve the required speed and scale of the transition in the years ahead. This task is particularly challenging due to the uncertainty regarding which investments and technologies will best support reliability and low costs while rapidly reducing carbon emissions. Electricity generation in the U.S. is subject to a wide range of policy and investment regimes, from traditional regulation of vertically integrated utilities to the varying rules, governance, and market designs of seven RTO/ISOs. Individual states show a similarly wide range of mandates, incentives, and other policies that shape power generation inside and even outside their borders.

This project focuses on RTO/ISOs and whether their current market designs are well-suited to enable and guide rapid decarbonization. Organized wholesale markets account for roughly two-thirds of US generation. Most experts agree that current market designs do well at managing daily dispatch and system operations. A growing body of opinion suggests that these designs face challenges in terms of supporting and rationalizing the new technologies and mix of investments needed, as stronger federal and state policies help drive deep decarbonization.

In addition to meeting traditional goals of reliability, safety and affordability, market designs should work in tandem with carbon reduction policies to:

- Enable the continued **deployment** of wind, solar, storage, and demand-side flexibility resources, and continued operation of zero-carbon nuclear plants where policymakers consider them safe and economical.
- Enable continued **innovation** and market entry by emerging low- and zero-carbon technologies (e.g., advanced geothermal, hydrogen gas turbines, advanced nuclear, Allam cycle power plants, bioenergy with carbon capture, etc.).
- Promote the best **combinations** of these new and existing resources over sufficiently broad geographic areas in ways that ensure reliability, lower the cost of decarbonization, and provide investors sufficient certainty to attract the needed finance.

To date, RTO/ISOs in the US have tried three basic designs, and policymakers continue to iterate on these

designs:[1]

1. **A stand-alone "energy-only" market design, without mandatory planning reserve levels to ensure resource adequacy.** These are short-term by design, consisting of day-ahead and real-time markets for MWh. This approach has its roots in mid-20th century power pools, and has gradually evolved into today's widely used Security Constrained Economic Dispatch market design. The "energy-only" approach depends on the cyclical appearance of scarcity conditions (reserve shortages) to produce "scarcity prices" that are high enough and frequent enough to provide, over time, a return on investment in existing and new plants. While there is evidence that this approach can work to maintain an acceptable level of resource adequacy with traditional technologies, concerns arise as to whether it will be able to work with the complex mix of renewable and complementary technologies needed for continuous reliability.
2. **An energy market (as in #1) plus a capacity market.** This approach developed in late 1990's and 2000's in several RTOs to address the so-called "missing money" problem that results when energy-only markets are not allowed to produce scarcity prices, due to policies such as ample mandatory reserve requirements and strict price caps.[2] Capacity market designs have multiplied and evolved in a number of different ways, but all of them procure standardized measures of capacity (MW) at the levels needed to ensure resource adequacy. Some have been widely criticized as favoring incumbent generators, and not efficiently supporting new clean energy technologies, especially those that can approximate fossil capacity's performance in well-coordinated combinations (such as renewables plus distributed resources such as storage and flexible load).
3. **An energy market (as in #1) plus state-level planning reserve (resource adequacy) requirements** for regulated utilities. These requirements, outside of the energy market, ensure a sufficient quantity of standardized MW of resources, either owned by or contracted by the regulated utility, to meet the state's required level of planning reserves. For such markets to function on the geographic scale that is likely needed to achieve the second of the three goals above, collaborative multi-state resource planning using sophisticated new tools would likely be needed.

A vibrant debate has emerged regarding how well these three existing market designs can enable a least-cost, deeply decarbonized electric grid that relies heavily on generation resources with variable output and zero or very low operating costs. Several experts have proposed alternative designs. These include approaches that would involve a conventional short-term energy market paired with an organized long-term market aimed at guiding deployment and financing of zero-carbon sources, as articulated in Long Term Markets Working with Short Term Markets, one of the papers generated by Energy Innovation's market design project.[3] Typically these approaches envision a periodic, centralized procurement of energy and/or capacity and awarding of long-term contracts that shape the capacity mix of a grid (recognizing that voluntary long-term bilateral contracting is common, along with other hedging mechanisms).

The idea of some form of long-term market is compatible with the recent reflections of Paul Joskow and Richard Schmalensee, longtime leading academics in this field.[4] Schmalensee concluded:

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[1] In addition, all three designs include ancillary services markets in various forms.

[2] Low natural gas prices and zero-marginal-cost renewables are exacerbating this problem by driving wholesale energy prices lower and lower.

[3] Energy Innovation's project also produced a paper titled A Decentralized Markets Approach, that advocated improvements in energy-only markets, more robust bilateral contracting, and greater scarcity pricing.

[4] See podcast in link above, and also: Paul Joskow, Challenges for wholesale electricity markets with intermittent renewable generation at scale: the US experience, *Oxford Review of Economic Policy*, Volume 35, Number 2, 2019, pp. 291–331. Working paper version: https://economics.mit.edu/files/16650.

> [RTO/ISOs] really need to do integrated resource planning at a regional level and think about the most efficient way to have the capital stock they need regionally, have debates about what that capital stock is, and procure it efficiently. Instead of trying to tweak a market design that is plainly not working, that's a big leap politically…. I think we're back to the future, in a way…. [W]e need intelligent decisions about the capacity mix and long-term contracts to enable financing.

WRI and RFF propose to further develop, analyze, and socialize design concepts for long-term markets among experts and stakeholders. In undertaking this work, WRI and RFF are *not* concluding that long-term markets are the *only* path forward or the best solution for each and every RTO/ISO. Rather, we are taking one promising new line of thinking that has received relatively little attention and resources and examining its potential in more depth. Ultimately, these ideas and others merit thorough examination and comparison.

WORKPLAN IN BRIEF

For this project, WRI and RFF will:

- **Conduct a literature review and expert interviews related to concepts for long-term market designs.** Prepare a background paper that summarizes the review and interviews. Topics will include:
    - long-term contracting experience in Europe and Latin American wholesale markets;
    - competitive procurements by states, public utilities (e.g., LADWP), utilities (Xcel Energy);
    - experience with Integrated Resource Plans and Resource Adequacy proceedings
    - experience outside of electricity in competitive procurements by public and private entities.
- **Commission four authors to prepare a set of papers that further develop concepts for long-term market designs.** Provide the background paper to these authors, and conduct a peer review process for their draft papers.
- **Conduct a virtual workshop** in Washington DC in December 2020 with a select group of experts and stakeholders to examine and evaluate the ideas in the papers.[5]

[5] In 2017, RFF and NREL held a workshop on the future of power markets. In 2018, WRI convened two workshops on market design, the second one held in collaboration with RFF, with a particular emphasis on the finance issues related to decarbonization. These workshops engaged many of the same issues and experts as the Energy Innovation project. In this project, WRI and RFF will look for additional synergies with Energy Innovation and other organizations active in this policy arena. WRI and RFF will engage a range of experts and thought leaders in this project, drawing on the workshops, and on the organizations' broad range of US energy and climate work.