



Event Summary:

Market Designs for the Clean Energy Transition: The Role of New Generator Finance

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INTRODUCTION AND KICK-OFF

On November 28, 2018, World Resources Institute (WRI) partnered with Resources for the Future (RFF) to co-host a workshop aimed at broadening and deepening stakeholder understanding of how merchant generation is and will be financed, and the implications for wholesale market design and operations. This workshop built upon two previous workshops – WRI’s “*Market Designs for the Clean Energy Transition*” in July 2018, as well as RFF and the National Renewable Energy Lab’s (NREL) “*The Future of Power Markets in a Low Marginal Cost World*” in September 2017.

The workshop began with an educational review of financing over the past decade and then shifted toward consideration of the changing conditions for financing. After this context-setting session, participants discussed policy levers and market designs that drive and properly accommodate rapid decarbonization. Ultimately, the workshop concluded with a review of proposals for long-term market designs that will be detailed in forthcoming papers, developed from “*Long Term Visions for Wholesale Electricity Markets in a Future Dominated by Zero Marginal Cost Resources*,” a workshop convened by Energy Innovation on February 26-28, 2018. Participants discussed proposed frameworks and potential market designs, tying in lessons from the day regarding innovation in financing, investment requirements, governance issues, political will and technical limitations. The objective was to provide participants with education and discussion opportunities that would ultimately improve policy and market designs and inform research agendas.

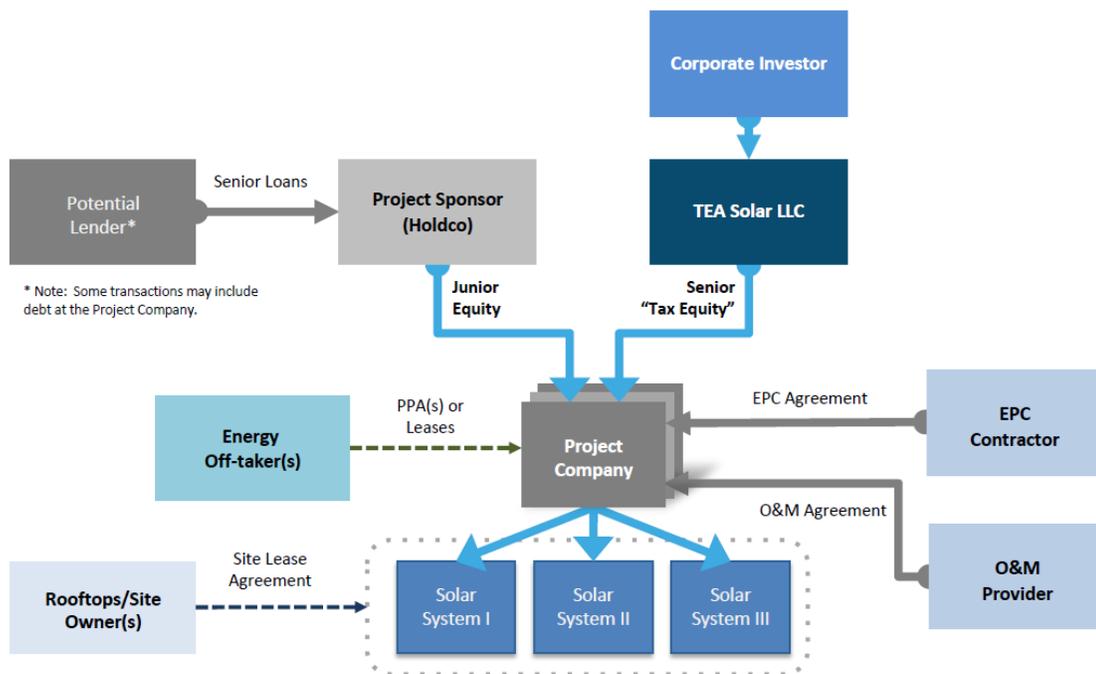
PANEL 1: Retrospective 2008 – 2018: Financing new generation under changing policies and markets

The first panel was intended to be educational and informative (particularly for policy participants unfamiliar with the finance world) on the mechanics of project finance and its key role in widespread investment in clean energy. Project finance holds the largest source of capital but comes with low-risk stipulations.

Project finance is a necessary tool for rapid decarbonization. However, it entails three major challenges in the area of clean energy: quantity, quality and location (see [Derisking Carbon: Making Green Energy Investments Blue Chip](#)). The “quantity” problem refers to the enormous amount of annual capital investment required – nearly three times current investment rates – in order to meet the IEA’s “450 Scenario.” The “quality” problem refers to many clean energy projects being too risky for the respective pool of capital, and the “location” problem references the divergence between areas where capital is available (the developed world) and areas where clean energy investment is most needed (the developing world). To illustrate the quality and location problems, panelists contrasted financing utility-scale solar and wind in the developed world (which is low-risk) against financing other projects, including projects in developing countries, new technologies like carbon capture and storage (CCS) and complex technologies like nuclear, all of which involve greater risk.

To better explain project finance, panelists described how electricity generation projects are structured as special-purpose vehicles so that claims to the project have no recourse to the project sponsor as shown in Figure 1 below.

Figure 1: Key Parties and Agreements of an Example Renewable Energy Project



Source: Tax Equity Advisors, LLC.

Energy project finance involves a suite of investors, contractors and customers that are needed to drive the transaction. Since renewable energy projects receive tax benefits that the project itself cannot fully use, projects have tax equity investors along with traditional equity and debt providers.



Investors evaluate projects in detailed risk assessments to determine whether the overall risk is sufficiently low given the expected investment return. Panelists categorized risks broadly as policy, market, project development or investment regime risks. Wind and solar projects that have contracted revenue offer very low-risk profiles, making them analogous to bonds. However, other technologies may be challenged by a high level of risk (such as nuclear) or have a structure unsuitable to project finance, such as energy storage that has no inherent cash flows.

Panelists also discussed how regional transmission organization (RTO) market designs have led to different financial arrangements for new generators and entail different financing costs. An analysis of how new capacity is procured in different RTOs, with an emphasis on the past two years, showed how projects – especially wind, solar and natural gas – have been financed and how these arrangements are changing (see [Financial Arrangements Behind New Generating Capacity](#)). ERCOT, for example, led both in new capacity installations and in the variety of ownership and contracting structures. The rise of merchant wind projects (mostly in Texas) has led to some new financing arrangements, such as financial hedges, in order to mitigate risk. Compared to RTOs with capacity markets, which provide more certainty in the recovery of fixed costs, energy-only markets present substantial revenue risk for project developers. As a result, project finance varies significantly between RTOs with different structures. Projects in PJM, which has the most visible capacity market, have relatively inexpensive debt and higher leverage ratios. In ERCOT, with its energy-only market, debt financing is more expensive and constrained.

The interaction between policy, finance and technology is critical for clean energy investment to reach its required scale. The panelists highlighted the new version of the 45Q tax credits for carbon capture and storage as an example where policymakers engaged with the financial community to create a suitable incentive. Whereas the previous version of 45Q failed to generate investor interest, the current policy, which was designed with input from financiers to increase the credit amount and remove the program cap, has the potential to spur deployment. As a general theme, panelists stressed the need for “investment grade” energy policy to facilitate low-risk institutional investment. With appropriate policies in place, financial products will develop as the market and technologies mature.

PANEL 2: Prospective 2019 and Beyond: The Effects of Shifting Policies & Market Conditions for New Generation

Following the previous panel’s retrospective discussion, this panel looked to 2019 and beyond to explore the anticipated impacts of shifting public policies and market conditions on investment in new generation. In particular, the discussion focused on the implications of the 2017 tax reform, phase-out of federal tax policies like the investment tax credit (ITC) and production tax credit (PTC), and de-risking investments.

The speakers kicked off the panel with a discussion on how changing market conditions have already impacted wind and solar financing. Commercial and industrial (C&I) solar projects were once popular in the solar market and are now the least financeable due to credit risk. Instead, residential and utility-scale solar have risen to the forefront of the market, and that is expected to continue. The cost of capital, especially for solar, has come down considerably in recent years with technological improvement, increased information and new investors and business models. Solar energy is now considered less risky than wind due to operational factors and greater predictability in comparison to wind.

Technological confidence has led to low project risk once financed, but risk during project development is still high. Projects face several challenges including regulatory hurdles, interconnection risks and well-funded opposition from oil and gas companies. Investors are careful about identifying these challenges, but panelists noted that not all risks can be



mitigated, and provided an example of a project that was cancelled in a matter of minutes after millions of dollars in pre-developments costs had already been spent.

Additionally, the market used to be flooded with corporate off-takers willing to buy power, but now it is more difficult to find willing large buyers that have not already entered into a power purchase agreement (PPA). PPAs have therefore become more difficult to procure, leading to higher levels of risk and uncertainty for project developers. Some speakers claimed that this issue represents one of the biggest risks for renewables projects in the years to come.

The panelists then discussed the implications of recent and near-term changes in tax and policy for project risk. Tax reform in 2017 had some negative implications for renewable energy investments. The reduction of the corporate tax rate from 35% to 21% resulted in lower demand for tax credits that have motivated capital for renewable energy projects. Furthermore, tax deductions for owning renewable projects, such as accelerated depreciation (MACRS), are now worth less with a lower corporate tax rate. As a result of both effects, the proportion of tax equity in renewable projects has decreased over the past year. These changes have increased the costs and uncertainty of project financing.

With federal policy, the production tax credit (PTC) for wind has already declined and is set to expire at the end of 2019, while the investment tax credit (ITC) for solar is set to phase-down at the end of 2019 and will remain at 10% after 2021. With these incentives phasing out, the panelists expect to see a rapid and massive build-out of wind power over the next year and solar energy before the end of 2021, in order to take full advantage of these policies. After those dates, investment in these projects is expected to decline, but the panelists agreed that solar developers will still be able to reap some value from the 10% ITC that is permanent in the tax code.

As for state policy, many renewable portfolio standards (RPS) are leveling-off in the next few years, and the loss of these incentives will lead to less demand for renewables in these states. However, other states are doubling down on their RPS requirements, which would encourage continued investment in clean energy.

The panelists stressed the need for long-term price signals in order to de-risk investments. Project finance depends on long-term revenue streams, and thus, visibility into how these revenues will look is necessary. Some panelists suggested that an economy-wide carbon tax could provide the proper long-term investment signals for renewable projects and lead to greater certainty for investors. In general, the panelists agreed that investors need to plan for anticipated changes in policy now.

PANEL 3: Policy Levers to Drive Decarbonization of the Power Sector (in RTOs), 2019 & Beyond

This panel explored how climate and clean energy policies should be designed with private and public financing in mind in order to promote investment in decarbonized resources. To do so, representatives from a diverse set of states discussed how their state has embraced decarbonization.

The states represented were Minnesota, Pennsylvania and New York, all of which are unique with respect to market structure. Minnesota has vertically integrated electric utilities that follow an integrated resource planning process, while Pennsylvania and New York both have restructured electricity sectors and participate in wholesale markets. Unlike Pennsylvania, which is part of the broader PJM interconnection, New York has its own independent system operator (NYISO). These different structures dictate how policy is formed in the states.

Minnesota, for example, can drive decarbonization directly at the resource planning level and has therefore significantly reduced dependence on coal-fired plants in recent years. However, the state faces challenges with respect to encouraging



distributed generation due to limitations from its vertically integrated structure. Pennsylvania has attempted to encourage decarbonization through state policies but has faced opposition from the state's fossil fuel industries. Issues related to impacts on low-income people have also been raised. For this reason, the speaker argued that Pennsylvania represents a microcosm of the United States in terms of the issues facing decarbonization efforts. Lastly, New York can take advantage of its single-state ISO and is attempting to price carbon at the wholesale market level, in addition to working on aggressive state decarbonization policies. This coordination between the ISO and the state has landed NYISO a seat at the table with state commissioners, with whom they work to find the best solutions for driving climate policies.

The panel rounded out with a discussion of clean energy legislation at the federal level and its relation to state level goals. Despite a recent bipartisan carbon pricing proposal, legislative action on climate is unlikely in this Congress, so current activities can be viewed as table-setting for future work. Future federal legislation should be designed to interact well with state policies. For example, a federal carbon tax would likely work well with existing state policies and would not impede state efforts to pursue more aggressive goals, while a cap-and-trade policy could act as a ceiling for state ambition since one state's ambitious target could allow another state to underperform. The panelists also discussed how a technology-neutral clean energy standard (CES) could be a viable option for either states or the federal government to consider. (See RFF research on this topic [here](#).)

PANEL 4: What Does This All Mean for Market Design?

Dynamic variable resources entering markets including wind, solar, demand flexibility, storage and other emerging technologies are significantly different than the existing set of resources around which market rules were originally created. These resources typically have no production costs - their costs are nearly entirely fixed. These resources also have different production characteristics than many existing technologies and are changing the ways that grid operators manage the grid (for example, introducing ramping products). The era of variable energy is at odds with the current paradigm, making resource adequacy and flexibility more difficult to achieve. In February 2018, the Hewlett Foundation funded a workshop hosted by Energy Innovation that examined a few possible paths forward for market design. These models seek to address two key challenges: 1) the need to provide large amounts of cheap, clean electricity and minimize the burden on the grid, and 2) the need for balance and resource adequacy.

This panel revisited these potential paths and began to examine their similarities, differences and abilities to address the financing issues identified earlier in the workshop. Future market design could continue to develop toward energy-only and ancillary service markets that rely on scarcity pricing to incentivize flexible resources, impose penalties to support resource adequacy and allow long-term cost recovery to come from decentralized secondary bilateral markets. Another path, however, would create a voluntary longer-term integrated forward market for procurement. Under this second path, new and existing resource owners would submit bids to provide services to a market administrator, and this forward market would guide investment toward the optimal mix of resources through long-term contracts.

There were some variations provided on how the second path could manage this long-term planning mechanism – as a formalized clearinghouse for bilateral markets similar to those in Europe today, by developing a central market optimizer that incorporates a wider range of bids (transmission, storage and demand side) into blocks of shaped power or by creating a configuration market that acts as a platform for an array of resources for balancing.

As the panel compared possible paths forward, one panelist noted that there are many ways to achieve long-term revenue assurance and highlighted the difference between market structure (the division of roles among different entities) versus market design (the operation of markets). The key market design features that address high renewable penetration could



be listed as: fast (up to five minutes), fair (technology-neutral), far (covering wide geographic regions) and free (allowing bilateral contracts and state policies). Finding credit-worthy counterparties, which surfaced as a top issue in the panel, is not a market design issue, and existing challenges may be tied to poorly-conceived retail access programs. State requirements for retail suppliers to demonstrate credit-worthiness through bonding or other mechanisms was suggested as a possible solution.

Another panelist argued that even if there were more creditworthy counterparties, they may not be able to contract for variable energy resources during times of scarcity if those resources are not available. For this reason, a multistate optimization process that works with locational marginal prices (LMPs) in the short run could help procure power needed over time in tranches. The recent optimization modeling study for MN (see "[Pathways Toward a Clean, Reliable and Affordable Transportation and Energy System](#)," prepared by Vibrant Energy for McKnight Foundation and GridLab) was highlighted as a vision of the future assuming efficient resource development. The panelist returned to the earlier theme of "investment-grade" energy policy in the context of increasing penetration of variable renewables. The key concern is that energy and ancillary services-only markets would not sufficiently incentivize variable renewable and storage resources given the very low average LMPs and negative correlation between the output of these resources and scarcity pricing.

DISCUSSION AND OUTCOMES

Discussion over the day focused broadly on the need for investment, what mechanisms are needed to support and de-risk investment and how market designs impact the investment decision. Within this discussion, there are two main dilemmas to address. First, given that we need rapid decarbonization of the electric sector, how do we design policy that facilitates massive investment from a low-risk pool of capital? Second, how do we design wholesale markets in order to incentivize investment in optimal resources and accommodate a high penetration of these resources at least cost while also maintaining reliability and adequacy?

In response to the first dilemma, finance experts stressed the role of risk in financing decisions and how these risks are reduced by maturing technology, predictable long-term cash flows and consistent policy. Panelists emphasized the need for communication and coordination between policymakers and the financial community in order to establish appropriate incentives. Financial experts also agreed that long-term price signals are necessary in order to encourage investment, and an effective price on carbon would accomplish this.

Representatives from a diverse set of states discussed their own approaches to promoting decarbonization through policy as well as the political challenges of these choices. States struggle with pushing a clean energy agenda against local economic concerns, and this is particularly challenging for those with in-state fossil fuel resources like Pennsylvania. In the absence of federal policymaking, states are taking the lead with respect to decarbonization efforts. Panelists encouraged states to pursue carbon pricing, clean energy standards, amendments to local laws to facilitate clean energy deployment or some combination of these.

Regarding the second dilemma, many workshop participants argued that capacity markets are not an optimal future design for several reasons. They argued that capacity markets do not adequately reward the flexibility that is needed, may keep uncompetitive generators online and are unlikely to be cost-effective in providing reliability and adequacy. The two options for future market designs that were discussed included both energy and ancillary services markets but differed with respect to a centralized market for long-term contract procurement. The panelists believed that their respective



models could provide resource adequacy and reliability to the grid while also encouraging long-term investment in clean technologies. Furthermore, the panelists offered principles to guide either market design to its most effective form.

The two concepts that were raised throughout the day were flexibility and risk. While the objectives of the workshop were not to discuss flexibility, it came up continually as a critical need for the market (both on hourly and day-to-week timescales), and thus proper incentives for investment in flexibility are key. Risk was also fundamental to the discussions throughout the day – who should bear which risks and why market prices are needed to quantify these risks.

When asked about potential research needs or questions for further study, participants thought that there were several areas that warranted attention. Foremost, the education and exchange of ideas between financial and policy experts during the workshop highlighted the need for more interdisciplinary research moving forward. In addition, thought leadership around the range of proposals presented and some commonsense guides explaining the conceptual frameworks are needed. Further modeling was emphasized, with the specific suggestion that long-term optimization models could be examined more fully by gamifying them into a simulation that market participants could test out. This type of interaction with the proposals could surface more challenges and outcomes than experts could recognize through continued discussion alone. Participants also felt more research was needed around demand side participation in wholesale markets, the issue of market power and how to manage it, and mechanisms for guiding retirement of existing resources that supports decarbonization. Finally, experts pointed out the urgency for a solution and the need to figure out an implementation path that major market reform could take, particularly analyzing how these solutions can grow out of efforts already underway. Rather than waiting for a national carbon price or state by state changes, participants felt that new models should be built around incremental progress so that change can begin now and evolve into solutions.

Staff from World Resources Institute and Resources for the Future thanked participants for not only sharing their experiences and insights but also offering up a research agenda for 2019 and beyond.