Principles to Guide PJM's Capacity Market/Resource Adequacy Reform Discussions

Advanced Energy Economy

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About Advanced Energy Economy

- AEE represents more than 100 companies and organizations that span the advanced energy industry and its value chains.
- Technologies represented include energy efficiency, demand response, solar photovoltaics, solar thermal electric, wind, energy storage, electric vehicles, advanced metering infrastructure, transmission and distribution efficiency, fuel cells, hydro power, advanced nuclear power, combined heat and power, and enabling software.
- AEE also supports the work of the Advanced Energy Buyers Group (”AEBG”), a coalition of large buyers of advanced energy technologies to meet sustainability goals.
- AEE pursues policy transformation in the states and in wholesale power markets that expand market opportunities for advanced energy technologies and lay the foundation for a 100 percent clean advanced energy future.

Agenda

1. Why is Reform Needed?
2. Goals/Objectives for Comprehensive Reform
3. Additional Issues to Consider

Why is Comprehensive Capacity Market Reform Needed?

- **PJM's current capacity market construct does not reflect state and consumer demand for clean energy:**
  - The market was designed to procure a single capacity product (megawatts of any type) to ensure that sufficient resources are available, at least cost, to meet a forecasted system peak load.
  - Today, more states and consumers are demanding clean energy products, but the existing capacity market construct was not designed to account for these choices.

- **The proliferation of clean energy resources to meet this demand means that the existing construct will not be sustainable:**
  - The development of clean energy resources will continue to accelerate.
    - Today, 92% of PJM's queue is solar, wind, batteries, or hybrid technologies
    - Further demand growth will be driven by expanding government policies (state and city/local), utility commitments, corporate commitments, and declining costs (see appendix)
  - A capacity market that is increasingly divorced from the clean energy attributes being demanded will not be sustainable.

Why is Comprehensive Capacity Market Reform Needed?

- **The existing capacity market and the capacity product it procures is not well suited to meet resource adequacy needs in a future with more renewables:**
  - More clean and flexible megawatts like storage, demand response, energy efficiency, distributed energy resources, and other advanced energy technologies will be needed to meet new and different reliability needs (fast response, ramping, etc.) *while also* meeting decarbonization objectives. Today's undifferentiated product won't meet these needs and objectives.
  - These resources are mostly not energy intensive, and they depend on stable non-energy revenue streams like those provided by the existing capacity market.
  - As system resource adequacy and reliability needs and the nature of system peaks evolve, the capacity market construct must send much stronger price signals than exist today for the exit of inefficient and inflexible resources and the entry of efficient and flexible resources.

Near-Term: Address Challenges of the Expanded Minimum Offer Price Rule (MOPR)

- **Advanced energy companies support immediate steps to address the expanded MOPR:**
  - It is appropriate to take any available near-term steps to resolve the serious challenges and tensions created by the expanded MOPR, provided doing so does not sidetrack stakeholders from pursuing comprehensive long-term reforms.
    - Eliminating/significantly scaling back the expanded MOPR relieves tensions around identifying and mitigating “State Subsidies” and crafting unit-specific MOPR floors; it returns MOPR to its original narrow purpose of mitigating buyer-side market power.
    - By ensuring that more clean resources supported by state policies can clear, it also helps reduce growing separation/silos between clean energy procurement and capacity market/resource adequacy procurement.
    - This step does not, however, fully address the growing problems created by procurement of the existing undifferentiated capacity product, and the growing disconnect between the capacity construct and the procurement of clean energy to meet policy and customer demands.

Principles for Comprehensive Capacity Market/Resource Adequacy Reform Discussions

- **A reformed capacity market/resource adequacy mechanism should:**
  1. Support the ability of states and customers to meet their clean energy targets while ensuring system reliability.
  2. Preserve regional competition through an open, transparent, and fair market structure that allows clean resources to provide capacity and other reliability attributes.
  3. Ensure that the resource adequacy value of clean energy resources is captured and compensated and reverse the increasing trend of divorcing clean energy procurement from capacity/resource adequacy procurement (i.e., seek to harmonize the two).
  4. Attract and support clean resources that will meet the differentiated resource adequacy, reliability, and flexibility needs of a high renewables/advanced energy system (including non-energy intensive resources), while facilitating the orderly retirement of high-emitting and inflexible resources.
  5. Ensure that the market is transparent, durable, transactable, well-understood, and provides actionable price signals.

Additional Key Issues That Require Further Consideration

- **Transition Issues**
  - How quickly can and should PJM move from the existing market to a new design, while accommodating FERC and state concerns about the MOPR?
- **Governance and Role of the States**
  - Are new or revised governance provisions necessary to ensure the durability of a future market design that more explicitly incorporates state policy objectives and customer clean energy demands?
- **Avoiding Preemption or Disruption of State Policies/Agreement**
  - Proactively address concerns that aligning wholesale markets with state policies will risk preemption of those policies by FERC.
- **Market Stability**
  - What tools do we have to make a new market design stable and sustainable as the resource mix changes over the next 20+ years?

Comments / Questions

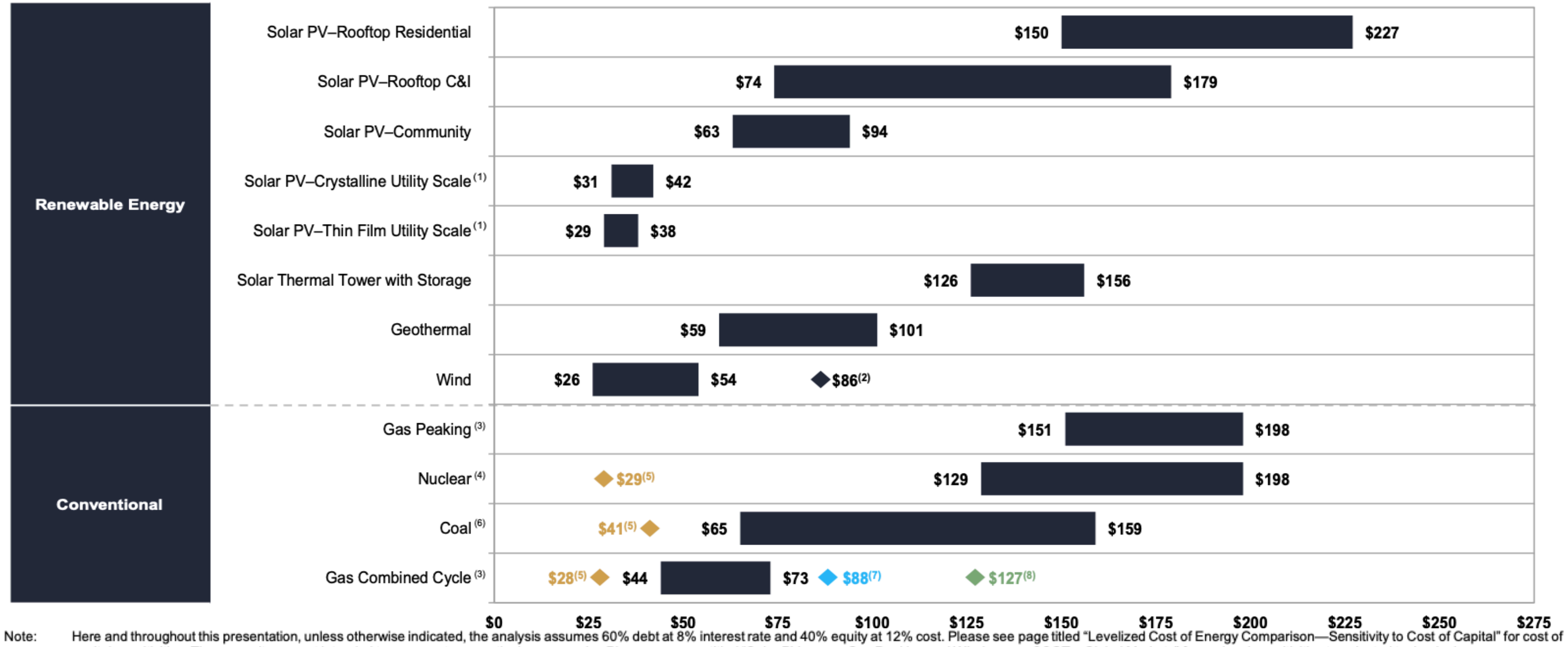
Jeff Dennis, General Counsel and Managing Director
e: jdennis@aee.net
t: @EnergyLawJeff

Appendix

Advanced Energy Technologies are Among the Most Cost Effective Options for Power Generation

Levelized Cost of Energy Comparison—Unsubsidized Analysis

Selected renewable energy generation technologies are cost-competitive with conventional generation technologies under certain circumstances



Note: Here and throughout this presentation, unless otherwise indicated, the analysis assumes 60% debt at 8% interest rate and 40% equity at 12% cost. Please see page titled "Levelized Cost of Energy Comparison—Sensitivity to Cost of Capital" for cost of capital sensitivities. These results are not intended to represent any particular geography. Please see page titled "Solar PV versus Gas Peaking and Wind versus CCGT—Global Markets" for regional sensitivities to selected technologies.

(1) Unless otherwise indicated herein, the low case represents a single-axis tracking system and the high case represents a fixed-tilt system.

(2) Represents the estimated implied midpoint of the LCOE of offshore wind, assuming a capital cost range of approximately $2,600 – $3,675/kW.

(3) The fuel cost assumption for Lazard's global, unsubsidized analysis for gas-fired generation resources is $3.45/MMBTU.

(4) Unless otherwise indicated, the analysis herein does not reflect decommissioning costs, ongoing maintenance-related capital expenditures or the potential economic impacts of federal loan guarantees or other subsidies.

(5) Represents the midpoint of the marginal cost of operating fully depreciated gas combined cycle, coal and nuclear facilities, inclusive of decommissioning costs for nuclear facilities. Analysis assumes that the salvage value for a decommissioned gas combined cycle or coal asset is equivalent to its decommissioning and site restoration costs. Inputs are derived from a benchmark of operating gas combined cycle, coal and nuclear assets across the U.S. Capacity factors, fuel, variable and fixed operating expenses are based on upper- and lower-quartile estimates derived from Lazard's research. Please see page titled "Levelized Cost of Energy Comparison—Renewable Energy versus Marginal Cost of Selected Existing Conventional Generation" for additional details.

(6) High end incorporates 90% carbon capture and storage. Does not include cost of transportation and storage.

(7) Represents the LCOE of the observed high case gas combined cycle inputs using a 20% blend of "Blue" hydrogen, (i.e., hydrogen produced from a steam-methane reformer, using natural gas as a feedstock, and sequestering the resulting CO_2 in a nearby saline aquifer). No plant modifications are assumed beyond a 2% adjustment to the plant's heat rate. The corresponding fuel cost is $5.20/MMBTU.

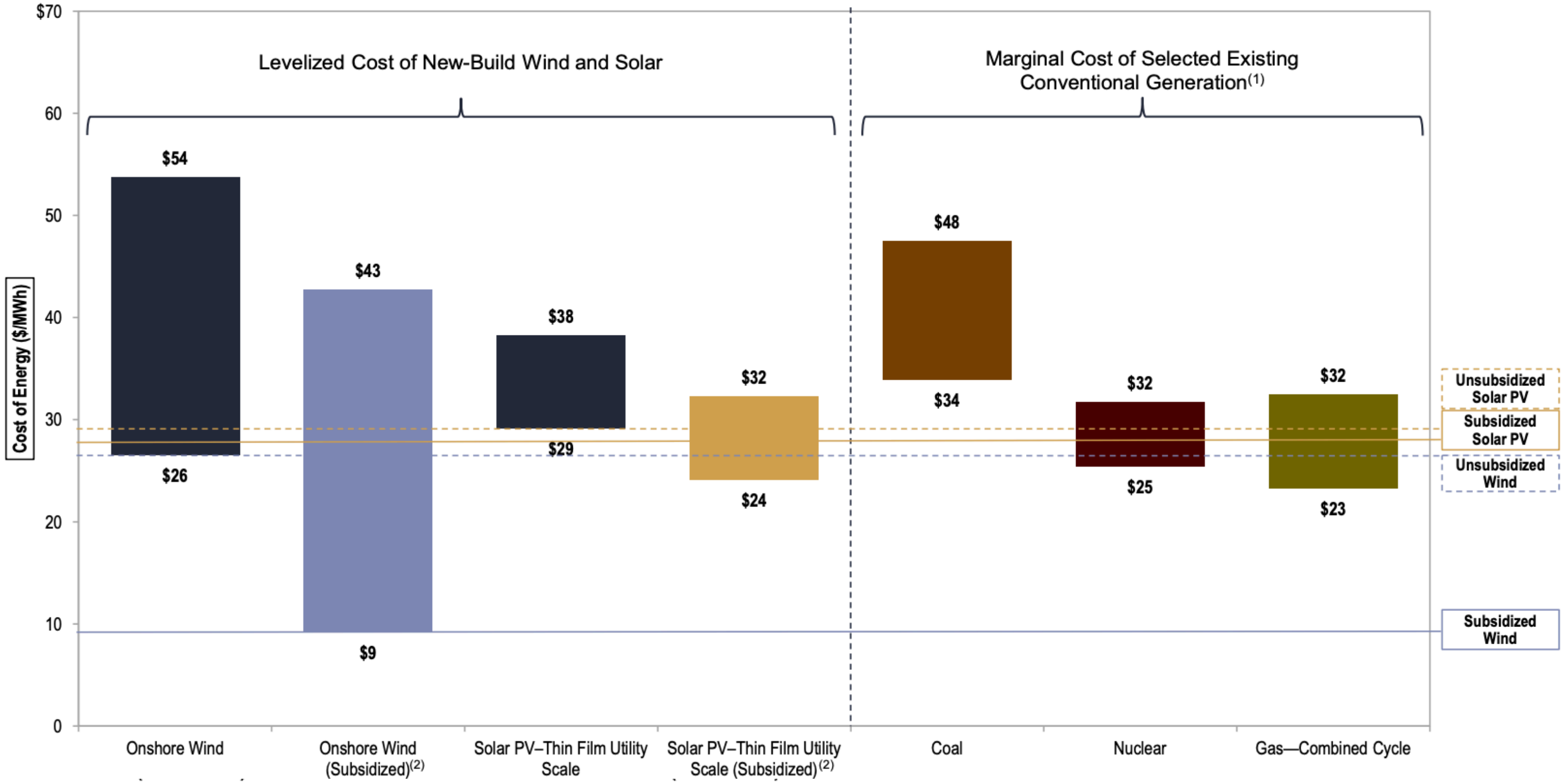
(8) Represents the LCOE of the observed high case gas combined cycle inputs using a 20% blend of "Green" hydrogen, (i.e., hydrogen produced from an electrolyzer powered by a mix of wind and solar generation and stored in a nearby salt cavern). No plant modifications are assumed beyond a 2% adjustment to the plant's heat rate. The corresponding fuel cost is $10.05/MMBTU.

Source: Lazard 2020

Advanced Energy Technologies are Among the Most Cost Effective Options for Power Generation

Levelized Cost of Energy Comparison—Renewable Energy versus Marginal Cost of Selected Existing Conventional Generation

Certain renewable energy generation technologies have an LCOE that is competitive with the marginal cost of existing conventional generation



Source: Lazard estimates.

Note: Unless otherwise noted, the assumptions used in this sensitivity correspond to those used in the global, unsubsidized analysis as presented on the page titled "Levelized Cost of Energy Comparison—Unsubsidized Analysis".

(1) Represents the marginal cost of operating fully depreciated gas combined cycle, coal and nuclear facilities, inclusive of decommissioning costs for nuclear facilities. Analysis assumes that the salvage value for a decommissioned gas combined cycle or coal asset is equivalent to its decommissioning and site restoration costs. Inputs are derived from a benchmark of operating gas combined cycle, coal and nuclear assets across the U.S. Capacity factors, fuel, variable and fixed operating expenses are based on upper and lower quartile estimates derived from Lazard's research.

(2) The subsidized analysis includes sensitivities related to the TCJA and U.S. federal tax subsidies. Please see page titled "Levelized Cost of Energy Comparison—Sensitivity to U.S. Federal Tax Subsidies" for additional details.

Source: Lazard 2020

Consumers, especially large energy users, are choosing renewables and other advanced energy technologies

- According to data collected by the Renewable Energy Buyers Alliance, over 30 gigawatts of voluntary purchases of renewable energy were made from 2015-2020
  - *See* "REBA Deal Tracker" (note that 82% of these deals were in RTO/ISO markets)
- Looking ahead, in 2019 Wood Mackenzie projected an additional 85 GW of demand for renewables from corporate purchasers through 2030.
  - *See* Wood Mackenzie, "Analysis of Commercial and Industrial Wind Energy Demand in the United States" (August 2019)
- Between 2015 and the first quarter of 2020, U.S. cities signed 335 renewable energy deals totaling 8.28 gigawatts (GW)
  - *See* World Resources Institute, "How US Cities and Counties Are Getting Renewable Energy" (June 2020)