The Future Role of Regional Transmission Organizations

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Advanced Energy Economy
April 20, 2021

About Advanced Energy Economy (AEE)

- AEE is a national association of businesses that are making the energy we use secure, clean, and affordable.
- AEE is the only industry association in the United States that represents the full range of advanced energy technologies and services, both grid-scale and distributed. Advanced energy includes energy efficiency, demand response, energy storage, wind, solar, hydro, nuclear, electric vehicles, and more.
- 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.

Three key industry trends shaping the future role of, and demands on, RTOs/ISOs

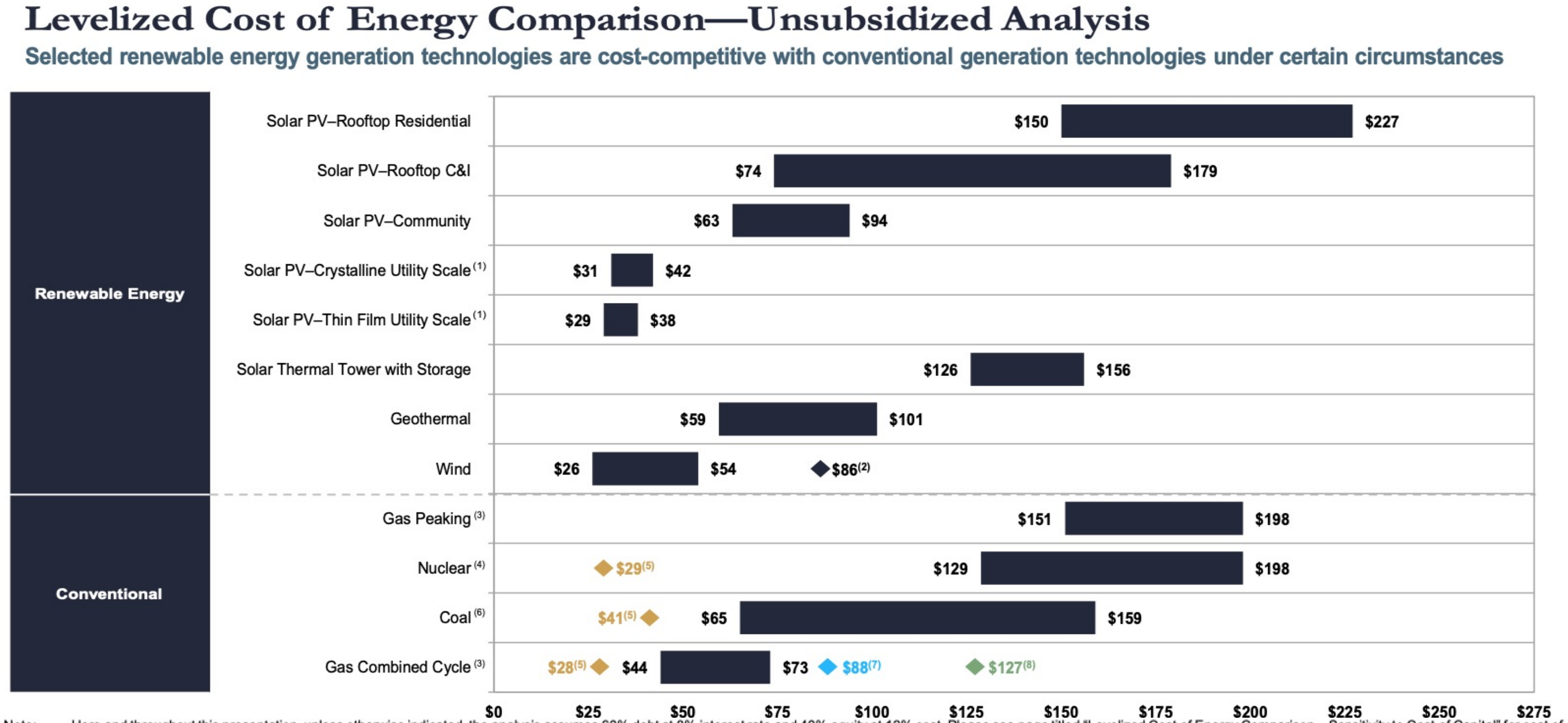
1. Massive technology shift to wind, solar, and energy storage, along with ever-increasing adoption of distributed energy resources, all driven by cost declines, state and federal policy, and consumer preferences

2. States are taking a much more direct role in shaping the resource mix today as compared to when RTOs/ISOs were formed

3. Large customer expectations and demands now extend beyond just lower cost and choice to reduced carbon emissions and other new factors

These trends are putting new pressures on existing RTOs/ISOs, while also driving interest in expanding regional competitive markets

Advanced Energy Technologies are Among the Most Cost Effective Options for Energy Production



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.

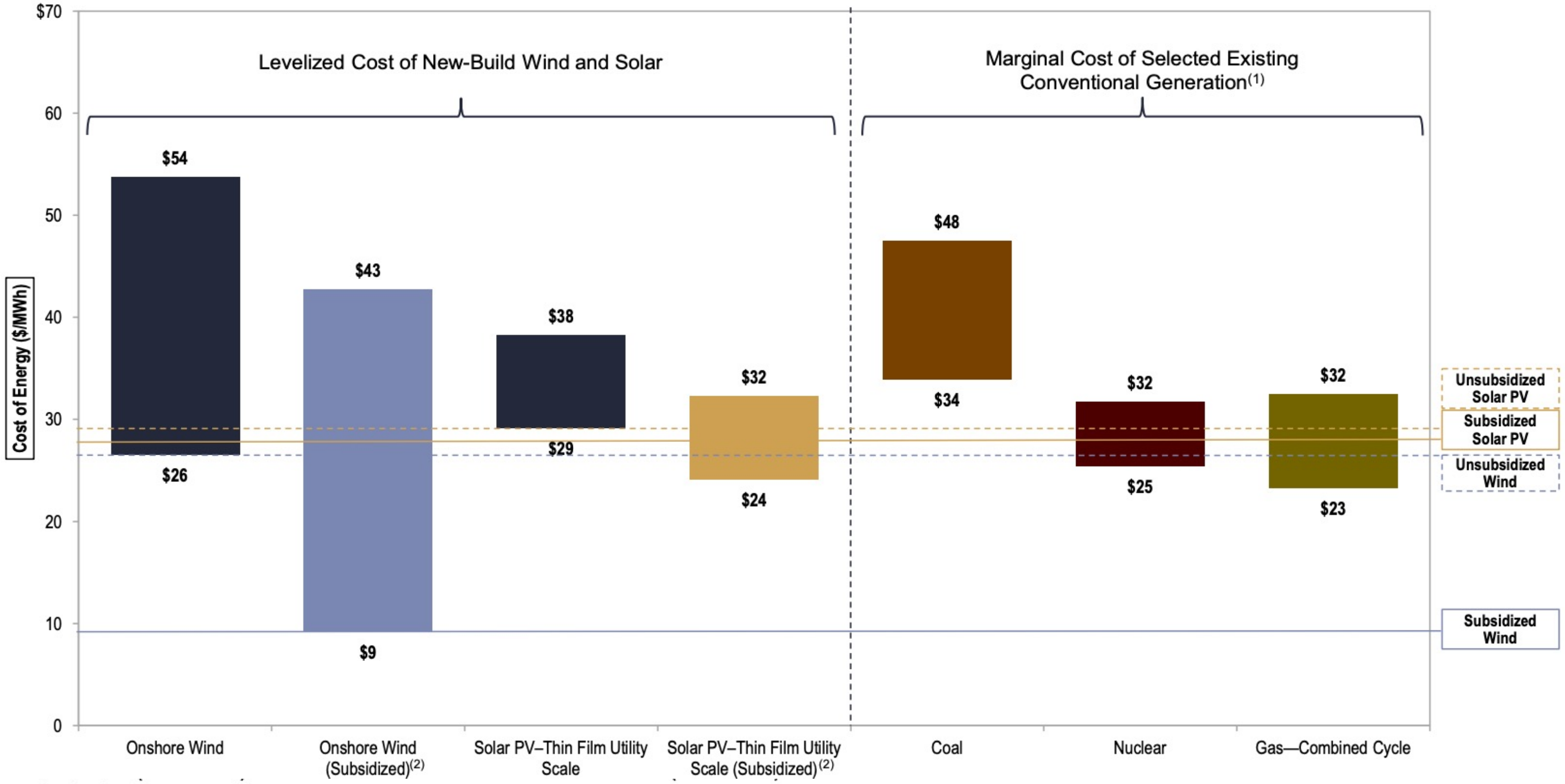
(8) Represents the LCOE of the observed high case gas combined cycle inputs using a 20% blend of "Green" hydrogen, (i.e., hydrogen produced from an electrolyzer powered by a mix of wind and solar generation and stored in a nearby salt cavern). No plant modifications are assumed beyond a 2% adjustment 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 Energy Production

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.

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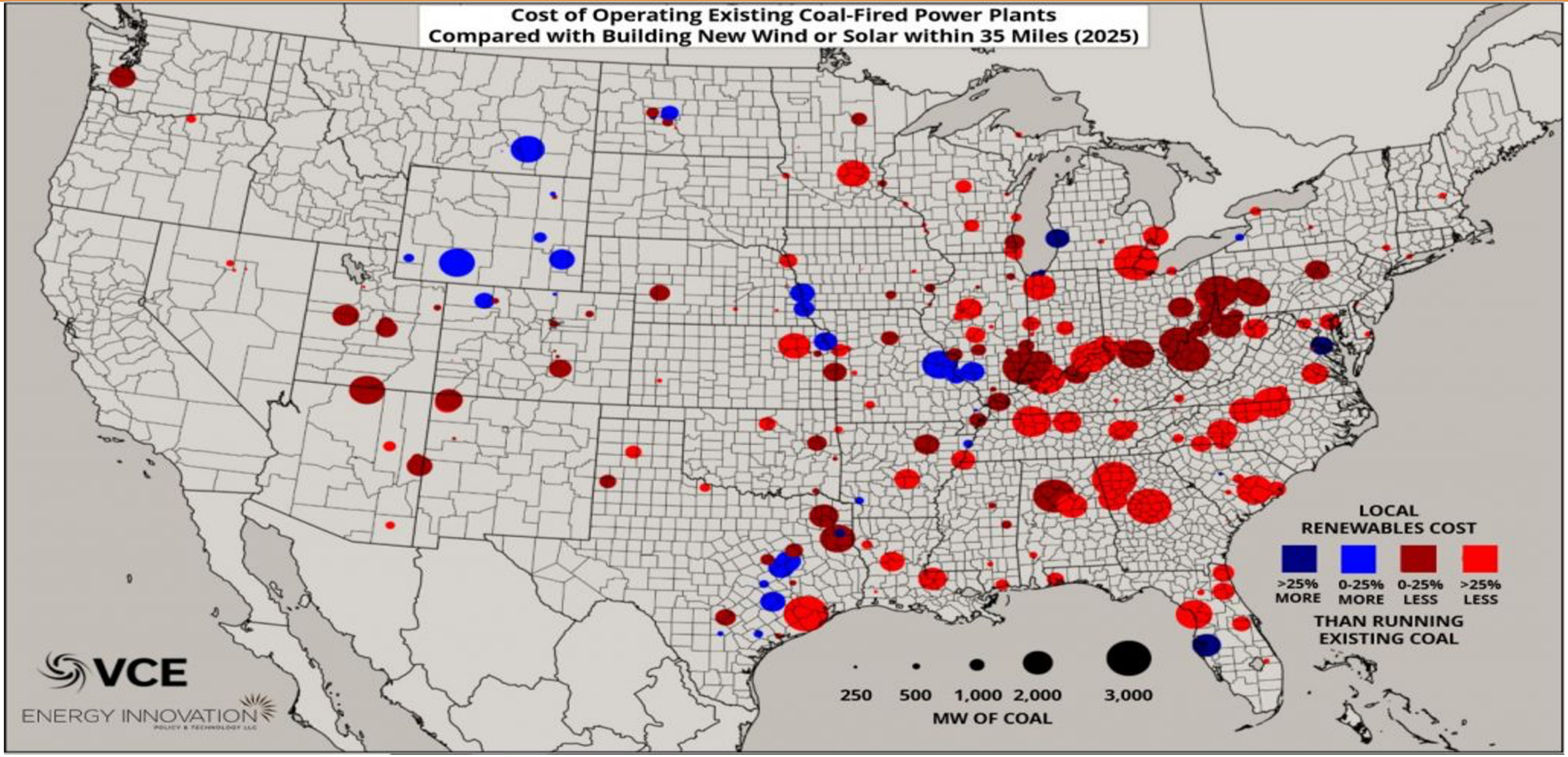
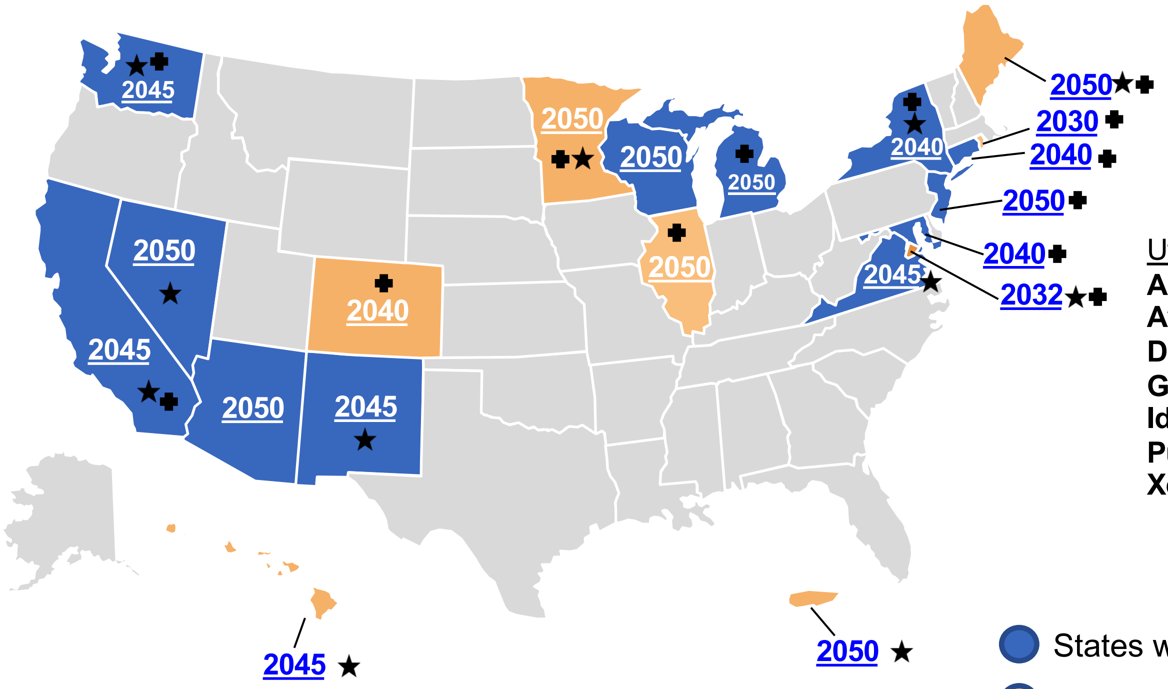
Source: Lazard 2020

The “coal cost crossover”



Source: Vibrant Clean Energy and Energy Innovation Analysis (March 2019) https://energyinnovation.org/wp-content/uploads/2019/04/Coal-Cost-Crossover_Energy-Innovation_VCE_FINAL2.pdf

Policy Drivers – States and utilities are committing to 100% clean advanced energy



Utilities Committed to 100% Clean Energy
APS (AZ)
Avista (WA, ID, OR)
Duke Energy (OH, KY, TN, NC, SC)
Green Mountain Power (VT)
Idaho Power (ID, OR)
Public Service Co. of New Mexico (PNM)
Xcel Energy (MN, MI, WI, ND, SD, CO, TX, NM)

States with 100% clean energy target
States with 100% renewable energy target
★ States where the goal is codified in law
✚ States with economy-wide decarbonization targets

Source: Advanced Energy Economy, December 2020

Customers are choosing renewables, DERs, and other advanced energy technologies in increasing numbers

- 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)
- DER investments expected to eclipse $110.4 billion between 2020 and 2026
  - *See* Wood Mackenzie analysis; solar, EV infrastructure, and storage are bulk of investment

These trends are creating new challenges for existing RTOs, including:

- Market rules and designs were developed around on the characteristics of the predominately thermal fleet we had at the time
  - Results in barriers to entry and failure to capture value and capabilities of new technologies
  - Order Nos. 841 and 2222 were one approach to that problem (adding new participation models)
- Markets and traditional system operations will be disrupted by much more dynamic supply and demand conditions
  - Creates strains on existing planning processes (and markets that use them as an input)
  - Distributed energy resources require new coordination and operational practices
- Governance and stakeholder processes are becoming increasingly strained
  - There are lots of new players who have an interest in what is happening inside RTO stakeholder processes
  - Stakeholder process is increasingly a “zero sum game”
  - With states more active in shaping the resource mix, what role do they want/need in governance?

These trends also show why we need more RTOs and broader wholesale markets, not less

- AEE's multi-technology and corporate buyer members uniformly support the creation of broader wholesale markets everywhere
- Key benefits they see in these markets:
  - Improved operational efficiencies and grid reliability as a result of sharing of resources over a wider geographic area
  - The ability to integrate larger amounts of renewables through geographic scope and optimized transmission service and access
  - Reduced barriers to entry, and reduced incumbent market power, for all technologies and market participants through independent operation of markets for energy, capacity, and ancillary services
  - Price and operational transparency; more tools that facilitate transactions for voluntary buyers
- An energy imbalance market ("EIM") can produce some, but not all, of these benefits

Key questions going forward

- Are the benefits of RTOs being overshadowed by recent controversy and noise over specific issues (e.g., PJM MOPR, competitive transmission, etc.)?
- Have the original benefits utilities expected from joining an RTO been diminished (outside of ROE, *e.g.*, regulatory flexibility)?
- Should RTO participation be mandatory?
  - House CLEAN Future Act would require RTO membership
  - What evidence would FERC need to conclude that a utility must join an RTO?
    - Historically ISOs were considered a remedy for competition issues created by mergers
- In the West and Southeast, it is *states* that are leading the conversation about the need for more competitive regional wholesale power markets. How should states collectively move forward, and what role should they have (or do they have to have) in RTOs in the future?

Thank you for inviting me!

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