National Clean Energy Standard Proposals: Considerations for PJM, Stakeholders, and Congress

Jeff Dennis

Managing Director and General Counsel

Advanced Energy Economy

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”)
- 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.

Overview of CES Proposals in 116th Congress

- **The CLEAN Future Act -** establishes a nationwide clean energy standard (CES) requiring all electricity suppliers to obtain 100% clean energy by 2050. Credits will be calculated based on carbon intensity; zero-carbon resources generate a full credit, while resources with carbon intensity lower than 0.82 metric tons of CO_2 equivalent per MWh generate partial credits
- **The Clean Energy Standard Act of 2019 –** requires electricity suppliers to reach 90% clean energy by 2040 and 100% by 2050. Zero-carbon resources generate a full federal energy credit (FEC) and low-carbon resources generate partial FECs
- **Clean Innovation and Deployment Act** - requires electricity providers to fully eliminate their net carbon emissions by 2050. The CES provides credit to renewable energy, nuclear power, natural gas, fossil/CCS sources, and any power generating source to the extent that it emits less CO_2 than an efficient coal-burning power plant
- **McKinley-Schrader Discussion Draft Proposal -** establishes a federal CES that requires utilities to purchase clean energy in increasing amounts over time to achieve emissions targets (80% CO_2 reduction by 2050). Credits will be issued to each generator that has an annual carbon intensity of less than 0.825 metric tons per MWh

Key Aspects of CES Proposals

- How is clean energy defined (i.e., what technologies are eligible)?
  - Proposals generally base calculation of clean energy credits on carbon intensity per MWh of generation
- Who holds the compliance obligation?
  - All the current proposals focus the compliance obligation on individual LSEs
- What is the timeframe for compliance?
  - Proposals require yearly increases in clean energy credit procurement against a baseline
  - CLEAN Future Act allows compliance based on submitting credits equal to a three year average of required credits
- Are there alternative compliance payments or credit trading available?
  - All proposals have an alternative compliance payment scheme
  - Most proposals allow for credit trading
  - One (McKinley-Schrader) explicitly allows credits to be banked for future use

Considerations for Congress

- Ensure that compliance tools accommodate restructured and competitive markets and provide flexibility
  - Relying solely on LSE-based compliance could have competitive implications
  - Trading and banking, and potential regional compliance options, could address this concern while providing flexibility to address reliability needs, delays in infrastructure development, etc.
- Transmission and interconnection are potential barriers to meeting a CES that must be accounted for and addressed
  - As noted, trading, banking, and multi-year compliance reporting can address these challenges
  - Siting and permitting must be addressed in any comprehensive CES strategy
- Role of energy efficiency, demand-side, and behind-the-meter options
  - Largely absent from proposals to date
- New operational and planning tools will be needed to ensure a reliable transition
  - Recognize that a CES-compliant system will require changes in the traditional operating paradigm
  - Focus federal R&D and programmatic support on developing software, modeling, and analytical tools to address these changes

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Considerations for PJM and Stakeholders

- What potential clean resource mixes could result from a national CES?
  - Lots of existing work out there on potential resource mixes that satisfy clean energy requirements while maintaining reliable service (see Appendix)
  - Focus on the range of potential mixes rather than trying to make a precise prediction; technology always outpaces our predictions in terms of both cost and reliable performance (see Appendix)
- What grid services and transmission infrastructure will be needed?
  - Flexibility/ramping needs
  - Implications for transmission planning
- How will markets and dispatch need to evolve or change?
  - Will existing markets and products obtain needed grid services, or must they be reformed? How do revenues shift among markets/services?
  - How might dispatch shift as generators and compliance entities seek to create/obtain clean energy credits?
- Other RTOs/ISOs are looking at these issues comprehensively; PJM should too (see Appendix)
  - Important to consider what the future grid looks like and needed market changes in tandem

Thank you!

Jeff Dennis
jdennis@aee.net

Twitter: @EnergyLawJeff

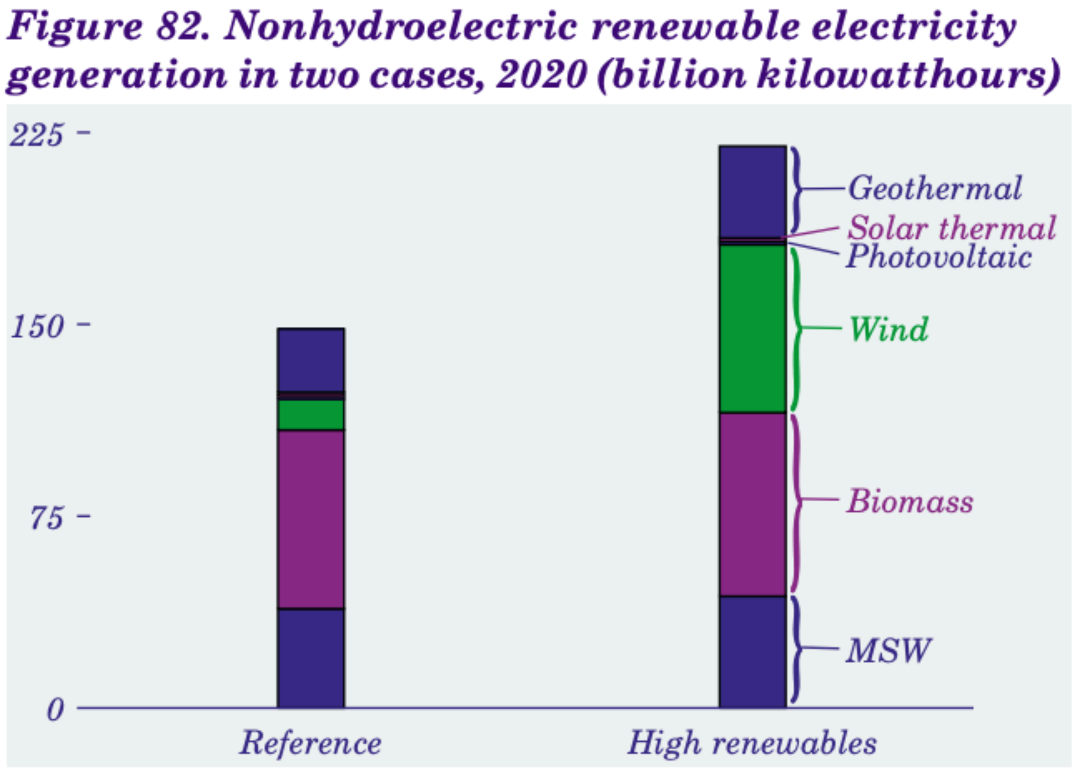
Appendix

A Small Sample of Resource Mix Simulations (not exhaustive!)

- University of California-Berkeley and GridLab, “2035 Report”, https://www.2035report.com/
  - Showing simulations of resource mixes that reliably serve load under a 90 percent clean energy standard (click on “Data Explorer”), both nationally and region-specific
- Rocky Mountain Institute’s “Clean Energy Portfolios” report, https://rmi.org/insight/the-economics-of-clean-energy-portfolios/
  - Showing that a mix of regionally-specific flexible, clean resources can reliably and cost-effectively be selected in place of new planned gas units
- Sepulveda, Jenkins, de Sisternes, Lester, “The Role of Firm Low-Carbon Electricity Resources in Deep Decarbonization of Power Generation”, available at https://powermarkets.org/research/
  - Evaluating economics of resource mix pathways that achieve deep decarbonization/clean energy objectives
- NREL’s Renewable Electricity Futures Study (2012), https://www.nrel.gov/analysis/re-futures.html
  - Analyzed 80% renewable scenarios (cost data extremely outdated, but still useful to see progression)

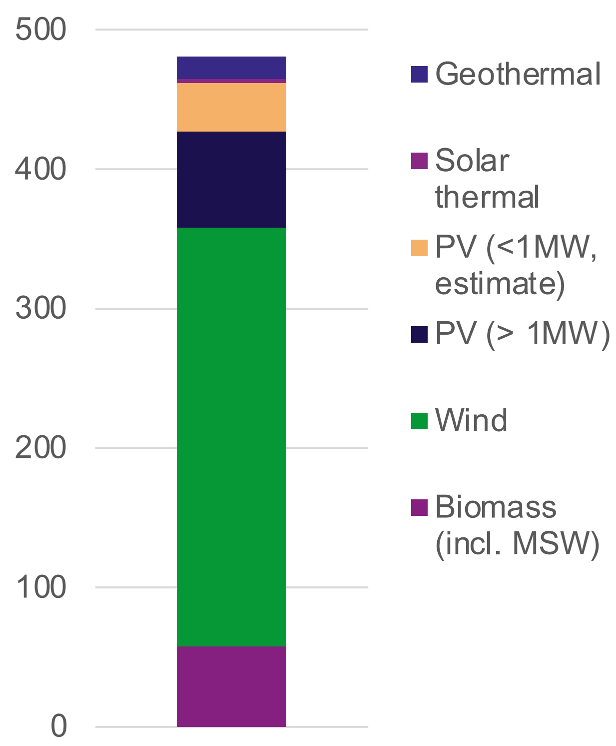
**AEE does not necessarily endorse any of the specific results of these studies; they are simply starting points for discussion*

Technology change has consistently outpaced projections



Source: EIA AEO 2000

Actual 2019 renewable electricity generation (billion kilowatthours)



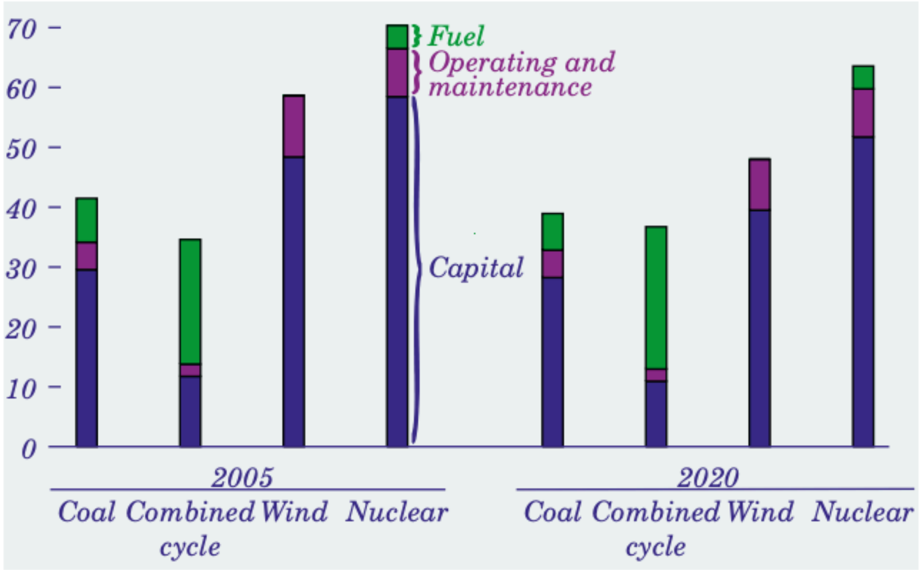
Source: EIA 2020
https://www.eia.gov/tools/faqs/faq.php?id=427&t=3

In 2000, EIA projected **12 billion kWh wind** and **1.3 billion kWh solar PV** in 2020.

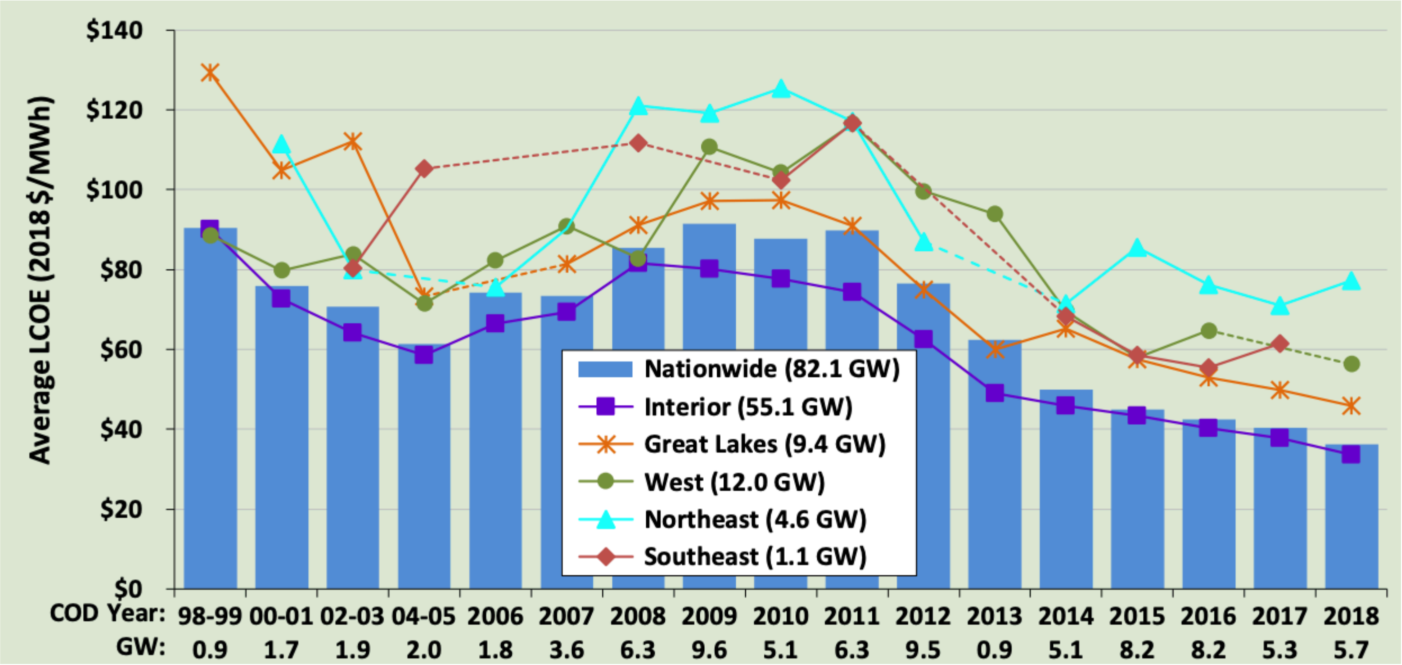
Actual data from 2019 shows **300 billion kWh wind** and **104 billion kWh solar PV.**

Generation costs have also fallen faster than expected

Figure 72. Electricity generation costs, 2005 and 2020 (1998 mills per kilowatthour)



Generation-weighted average wind LCOE values (excludes PTC)



Projected 2020 Wind Cost:
~$77/MWh (adjusted for inflation)

Source: EIA AEO 2000

Actual 2018 Wind Cost: ~$36/MWh

Source: DOE 2018 Wind Technologies Market Report

Meanwhile, technical capabilities have evolved

Service	Market Procured and Compensated Service?	Wind Can Technically Provide?[a]	Wind Currently Provides in U.S.?	Requires Pre-Curtailment for Wind to Provide?
Capacity	Y	Y	Y	N
Energy	Y	Y	Y	N
Inertial Response	N	Y	N/A	No[b]
Primary Frequency Response	Required but not compensated – proposals only	Y	Limited	Y
Fast Frequency Response	N – proposals only	Y	Limited	Y
Regulating Reserves	Y	Y	Limited	Y
Contingency – Spinning	Y	Y	Limited	Y
Contingency – Non-spinning	Y	Y	No	Y
Contingency – Replacement	Y	Maybe	No	Y
Ramping Reserves	Y (some locations)	Y	Limited	Y
Voltage Support	Y – cost of Service	Y[c] – location dependent	Limited	N
Black-Start	Y – cost of Service	Unclear, location dependent	No	N

Grid Services and Provision from Wind

Source: NREL 2019

- Studies show that inverter-based resources like wind, solar, and batteries *can* supply a range of grid services, although they are not currently providing all of these services

https://www.nrel.gov/docs/fy19osti/72578.pdf

Ongoing RTO/ISO Clean Energy/Future Grid Studies

- Several RTOs/ISOs are studying the grid services and resources that will be needed to support the reliability of a future system shaped by clean energy policies
  - NYISO “Grid in Transition” Report
    - Stakeholders are discussing aligning markets and state policy goals, valuing flexibility, and improving capacity and resource adequacy valuation
  - MISO Renewable Integration Impact Assessment (RIIA)
    - Study process to identify grid services and new infrastructure needed at increasing penetrations of wind and solar
  - ISO-NE/NEPOOL and New England States Committee on Electricity (NESCOE)
    - In response to requests from the New England state governors, ISO-NE will study “the future state of the regional power system” under decarbonization scenarios and identify reliability gaps
    - In response to requests of NEPOOL stakeholders, a parallel process will look at needed market reforms