Future Grid Proposal

A Carbon Free Power System by 2035

Luis Ortiz, Sc.D
Theodore J. Paradise

NEPOOL Markets & Reliability Committees
August 4, 2020

ANBARIC®

Future Grid Study Drivers

- State targets and renewable procurement goals are advancing rapidly, with additional procurements added every few months across the mid-Atlantic and Northeast. For example, the MA senate just passed an authorization for an additional 2,800 MW – for a total MA mandate of 6 GW; a New England total of 9,300 MW. This is in addition to current, significant PV goals.

- New England state 100% renewable or 0 carbon energy goals over the 2030 to 2050 timeframe

Atlantic states setting pace with offshore wind goals, projects

State	OSW target	Awarded to date
Massachusetts	3,200 (6,000 - pending)	1,604
Rhode Island	1,000	430
Connecticut	2,300	1,108
New York	9,000	1,826
New Jersey	7,500	1,100
Maryland	1,568	368
Virginia	5,200	12
Total	**29,768 MW (32,568 MW)**	**6,448 MW**

Biden Energy Plan – Zero Carbon by 2035

In July of 2020, the Biden campaign endorsed its energy policy working group recommendation of a zero-carbon electricity sector by 2035

Whether this federal policy is adopted in the coming months or not, it simply advances the energy and climate laws and policies already set by the New England States. In short: we know where we're headed

Anbaric Future Grid Study Proposal

The Anbaric study proposal seeks to identify for policymakers, stakeholders and grid planners the sort of bulk electric system we would need to plan and build to enable a carbon-free electric energy sector

This is important because the current state and possible federal laws require a different and more capable grid. And a 2035 target year is less than 15 years away. Given that transmission and supply planning, procurement and siting takes years (e.g. a single transmission project can take 5 to 9 years to site and construct), this work needs to begin now and a high-level guiding Future Grid roadmap study is needed

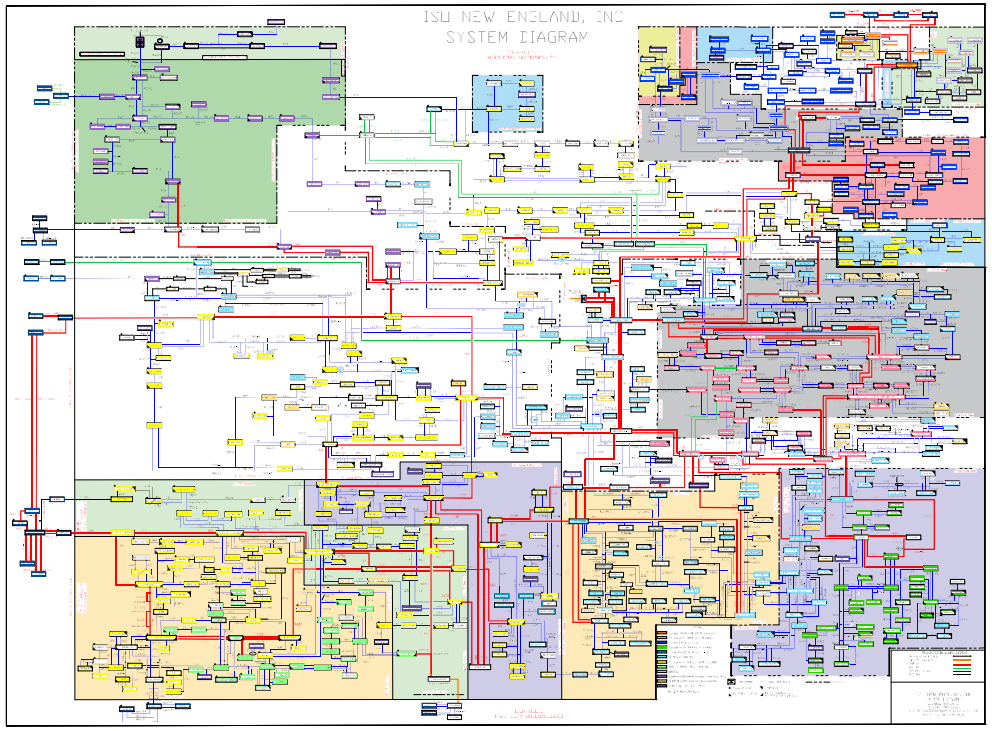
Key Study Points

Objective: Identify an onshore and offshore Future Grid blueprint for a power system that is carbon free by 2035, inline with the Joe Biden July 2020 energy plan and build upon other studies

Base Case: Current grid within the planning horizon

Additional Scenarios: Scenarios will be levels of storage, PV, and on-shore and off-shore wind needed to enable a carbon-free New England grid by 2035; sensitivities would also include varying levels of nuclear and electrification in-line with the Brattle Sept. 2019 study, adjusted to meet a 2035 target

Metrics to Develop: Informed by the other studies and should develop a picture of what is needed in terms of design and supply on that grid to meet the 2035 Biden zero carbon energy plan



Key Study Points - Continued

Transmission Network: Current grid as starting point that changes (retirements of fossil, additions of significant PV, storage, offshore wind, etc.) to meet 2035 zero carbon target

Supply Resource Mix:
Retire current fossil fuel generation fleet for 2035; replace and adjust for electrification with PV, storage, onshore and offshore wind resources, and other non-carbon resources.
Scenario analysis is with and without Millstone

Wholesale Net Load Gross and Electrification Forecasts: Brattle projections and other sources of policy target input to adjust 2035 load to account for electrification

Battery & Other Storage: Significant grid scale and distributed battery storage should be assumed to help provide for ramping and system contingencies

Key Storage Points

This is an opportunity to re-think grid-scale storage and the roles it can play / how it's utilized / how it's modeled

Storage should not be thought of a just a supply resource, but can and should be utilized in Future Grid studies to show the full value of storage to the grid – including ability to provide/avoid transmission facilities/upgrades upon interconnection of renewables (or growth of sub-transmission level renewables), in addition to firm energy supply, blackstart, ramping, regulation and contingency reserve

Advanced modeling can show where storage may be more cost-effective vs. a transmission circuit

Study Deliverable: A Future Grid Guiding Blueprint

An overview of the best ways (cost effective, fewer cables/lower environmental impact, maximize existing grid, provide resiliency, reliability, and controllability for system operators) to develop the transmission system to interconnect offshore wind, PV, significant battery storage, onshore wind and other distributed zero carbon resources; resulting document would be a blueprint for a Future Grid (onshore and offshore) reflecting what transmission and resources needed to be constructed to meet the Biden 2035 zero carbon energy system target while providing reliable electrical service. The output will build upon Brattle and other work to realistically identify the level and location of storage needed for a zero-carbon power system that is in-line with the Biden energy plan target and provides the capabilities to meet electric system needs for ramping, intermittent power changes, and contingencies.

Studies To Build On, A Non-Exclusive List

- Anbaric 2019 Economic Study Regarding 8,000 to 12,000 MW of Offshore Wind (Note: these levels are below the ~25 to 40 GW needed)
- ISO New England Grid Upgrades for Offshore Wind – June 2020 PAC
- Brattle September 2019 Study Looking at Grid Needed to Meet New England 2050 Goals
- Brattle / GE / CHA May 2020 Study Regarding Transmission for Offshore Wind
- MASSCEC Request and ISO-NE Response Re: Impact of OSW on 2017-2018 Cold Snap
- California ISO / Avangrid Study on Essential Grid Services That Can Be Provided by Wind Farms: http://www.caiso.com/Documents/WindPowerPlantTestResults.pdf

Thank you