ACHIEVING MAINE'S CLIMATE GOALS: ENVISIONING A ZERO CARBON ECONOMY

PRESENTED BY
Jurgen Weiss

PRESENTED TO
Environmental & Energy
Technology Council of Maine

JUNE 10, 2020

THE Brattle GROUP

Disclaimer

This presentation was prepared by The Brattle Group does not represent investment advice, and there are no third party beneficiaries. The Brattle Group does not accept any liability for any losses suffered, whether direct or consequential, in respect of the contents of this report or any actions taken or decisions made as a consequence thereof.

The analyses presented herein are necessarily based on assumptions with respect to conditions which may exist or events which may occur in the future. Please appreciate that actual future results may differ, perhaps materially, from those indicated. It is also important to acknowledge that the methodologies used to devise The Brattle Group's analyses and market overview simplify and may not accurately reflect the relationship between assumptions and outcomes. The Brattle Group does not make, nor intends to make, nor should any other party in receipt of this report infer, any representation with respect to the likelihood of any future outcome. The analyses and market overview are valid only for the explicit purpose for which they were prepared and as of the date of this report. Any decisions made in connection with this report or the subject matter hereof, or use of any information contained in this report, are the sole responsibility of the reader.

See Slide 2 Disclaimer

The presenter

Dr. Jurgen Weiss is a Principal at The Brattle Group, an international economic consulting firm. He is an energy economist with 25 years of consulting experiences. He specializes in issues broadly motivated by climate change concerns, such as renewable energy, energy efficiency, energy storage, the interaction between electricity, gas, and transportation. He works for electric utilities, NGOs, and government entities in North America, Europe, and the Middle East. *He also just accepted a Senior Faculty position at Harvard Business School.*

Dr. Weiss holds a Ph.D. in Business Economics from Harvard University, an M.B.A. from Columbia University and a B.A. from the European Partnership of Business Schools. Before Brattle, he co-founded Watermark Economics, was the head of global consulting for Point Carbon, a director at LECG and an associate at Booz Allen & Hamilton.

Contact Info
617.234.5739
617.792.9055 (m)
Jurgen.weiss@brattle.com

See Slide 2 Disclaimer

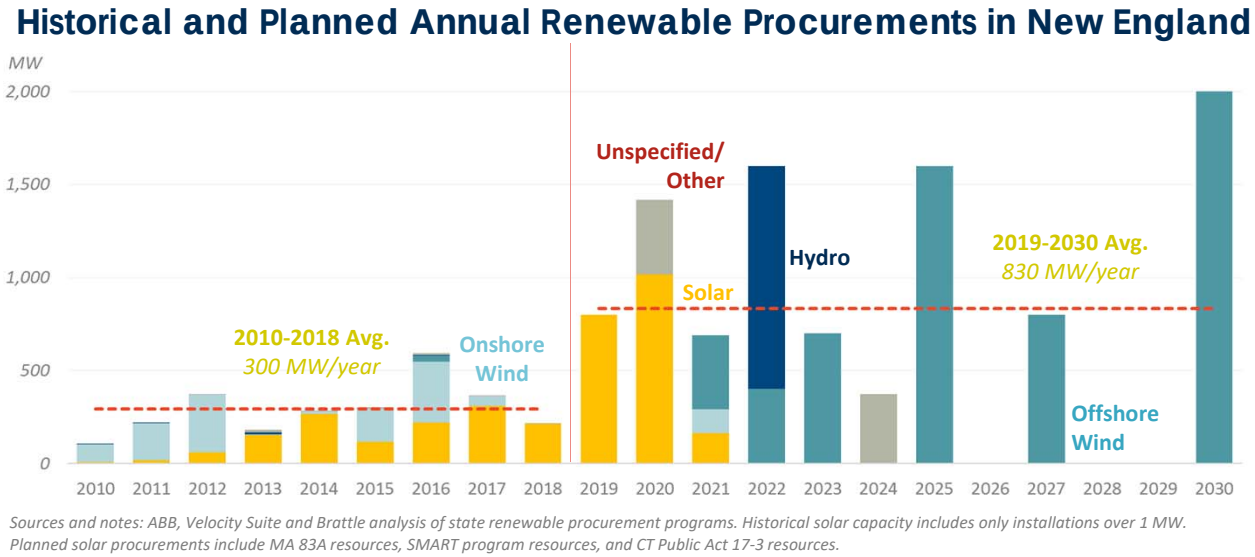
Overview

This presentation is based on three projects

- Coalition or Community Solar Access: Reaching New England's 2050 decarbonization targets
- RI Division of Public Utilities and Carriers: Heating Sector Transformation for RI
- NYISO: New York's Evolution to a Zero Emission Power System

See Slide 2 Disclaimer

Our 2019 report about New England asked whether NE is adding enough clean energy to achieve 80% by 2050 GHG reductions targets



Sources and notes: ABB, Velocity Suite and Brattle analysis of state renewable procurement programs. Historical solar capacity includes only installations over 1 MW. Planned solar procurements include MA 83A resources, SMART program resources, and CT Public Act 17-3 resources.

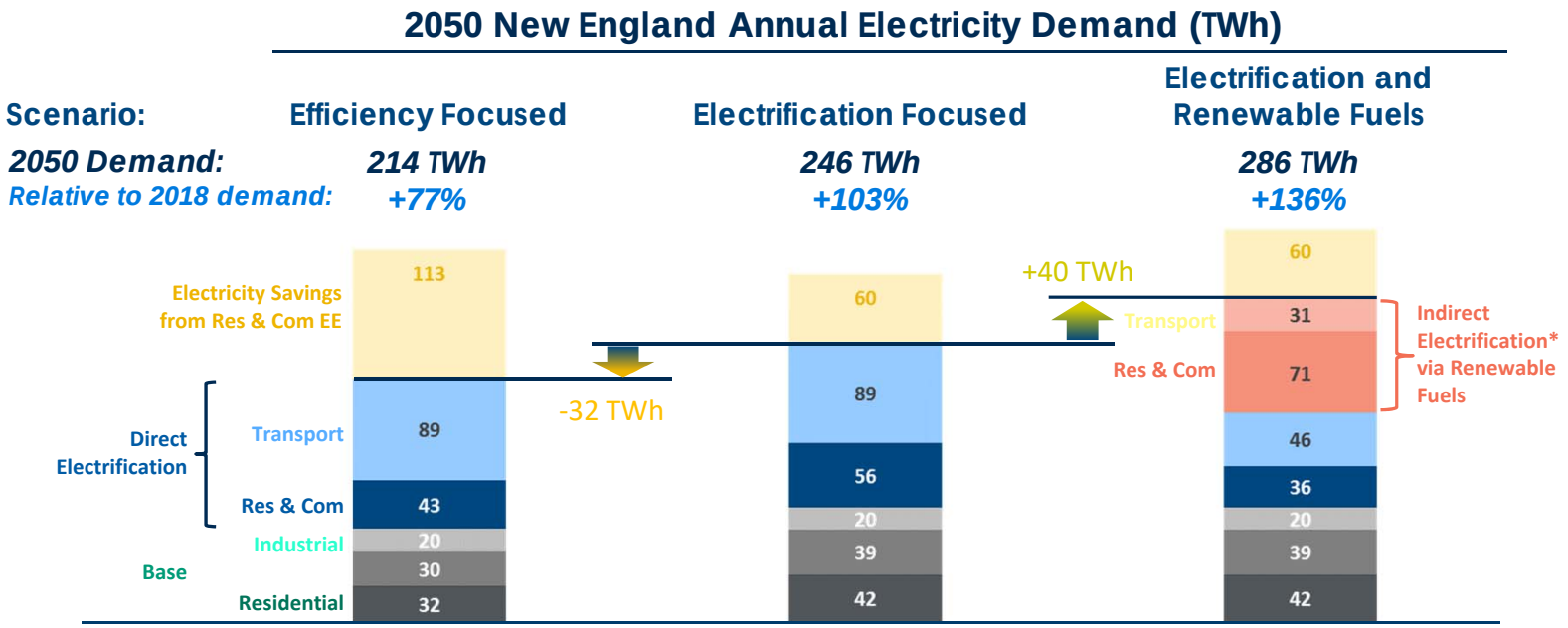
How much do clean energy resource additions in New England have to accelerate to achieve 2050 goals?

Commitments to adding clean energy resources in New England have accelerated substantially over the past decade and are expected to increase.

- About 300 MW p.a. in last decade
- About 800 MW p.a. in coming decade

See Slide 2 Disclaimer

Electricity demand in New England will likely roughly double by 2050 across plausible scenarios



Driven by almost complete electrification of road transport, dominant electrification of buildings (directly or indirectly), and partially offset by continued emphasis on energy efficiency

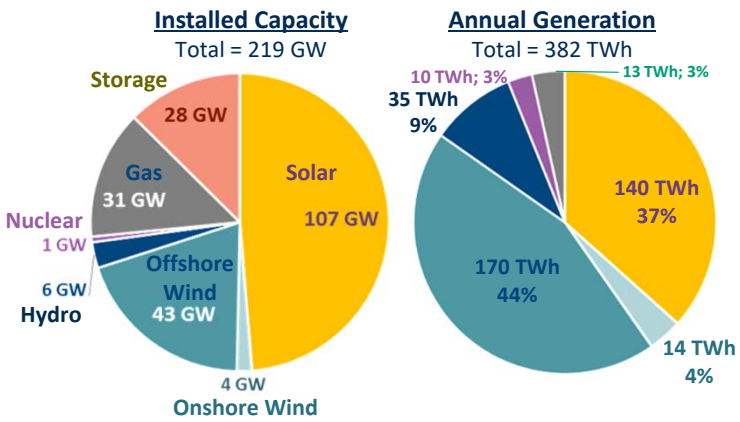
Source: EIA 2019 AEO, Brattle analysis

See Slide 2 Disclaimer

2x demand, lower capacity factors by RE and curtailment mean a total capacity need of >200 GW (6x today)!!

One possible New England Resource Mix

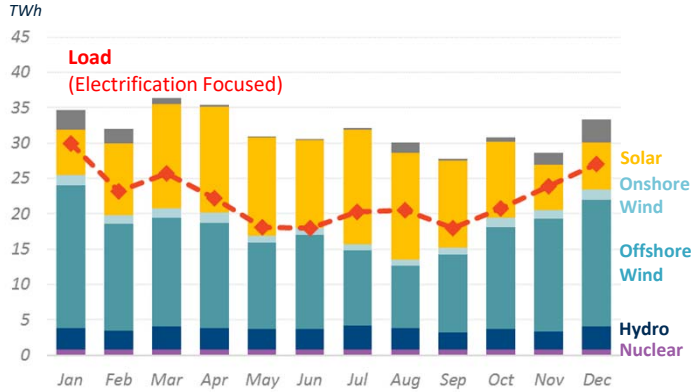
Scenario: Balanced Portfolio



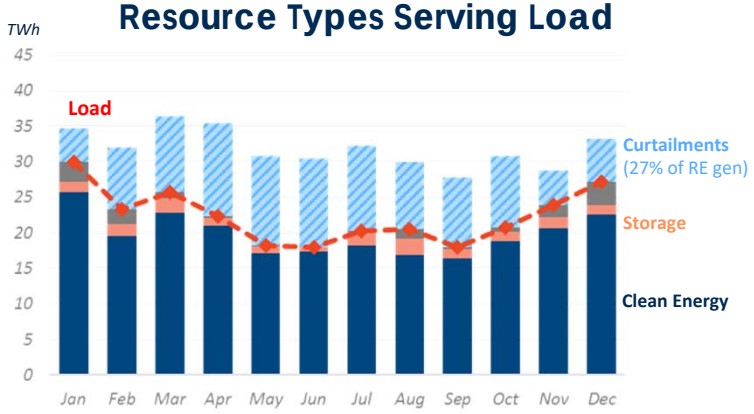
- 107 GW of solar accounts for about 50% of capacity and 37% of generation
- 47 GW of wind, primarily offshore, provides nearly 50% of generation
- 28 MW of storage primarily needed to shift excess solar generation to peak load hours
- 27% of renewable generation is curtailed due to periods of over-generation and limited storage capacity
- Gas capacity could be fueled with RNG to create Zero emissions

See Slide 2 Disclaimer

Monthly Generation by Resource

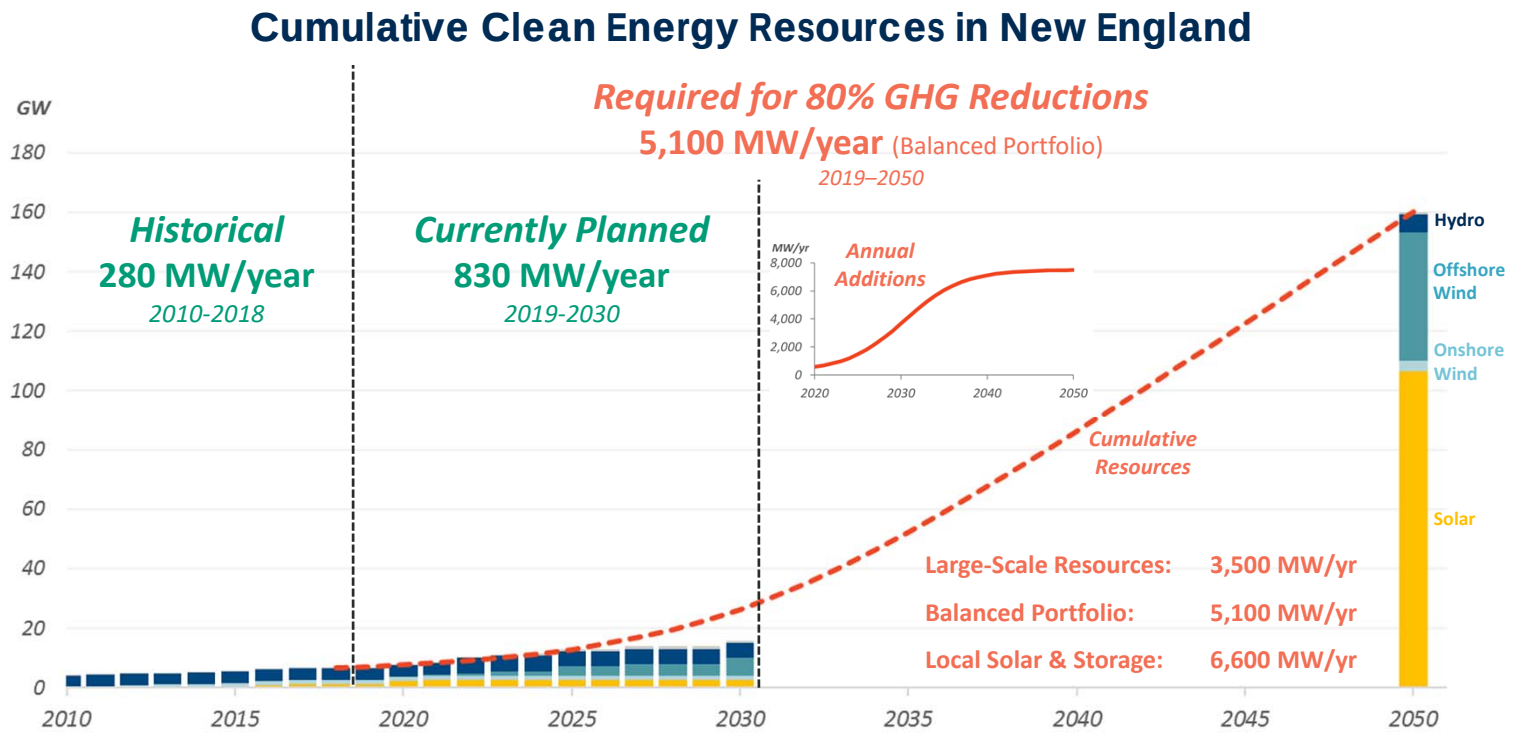


Resource Types Serving Load



Note: Load includes T&D losses. Curtailments include battery losses.

This implies New England needs to increase speed of annual clean energy deployment 4-8 times on average



The **current pace** of adding wind, solar etc. falls **far short** of what is needed to build the needed renewable portfolio of 200 GW by 2050, but **a steady growth rate of 10% or less per year would do it!**

The annual growth rates needed are lower than historic growth rates for all the key technologies needed – if we keep the foot on the accelerator, we can do it!

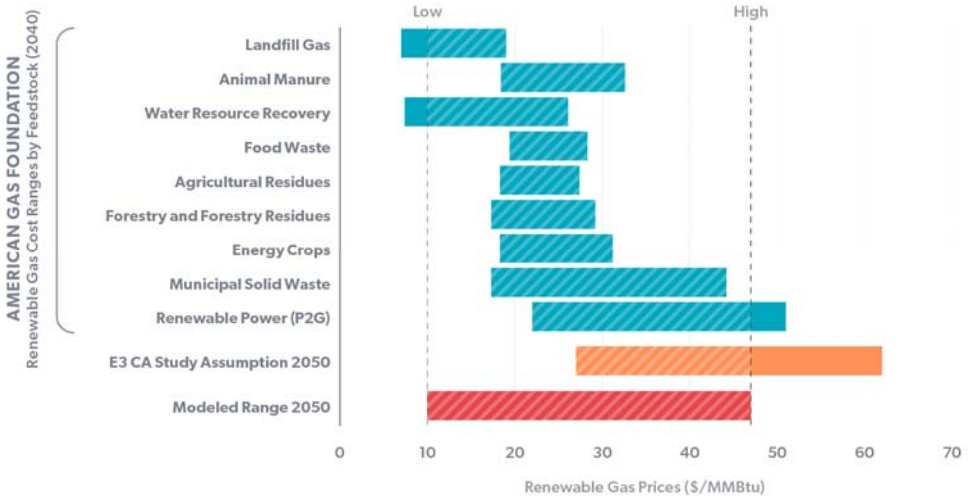
See Slide 2 Disclaimer

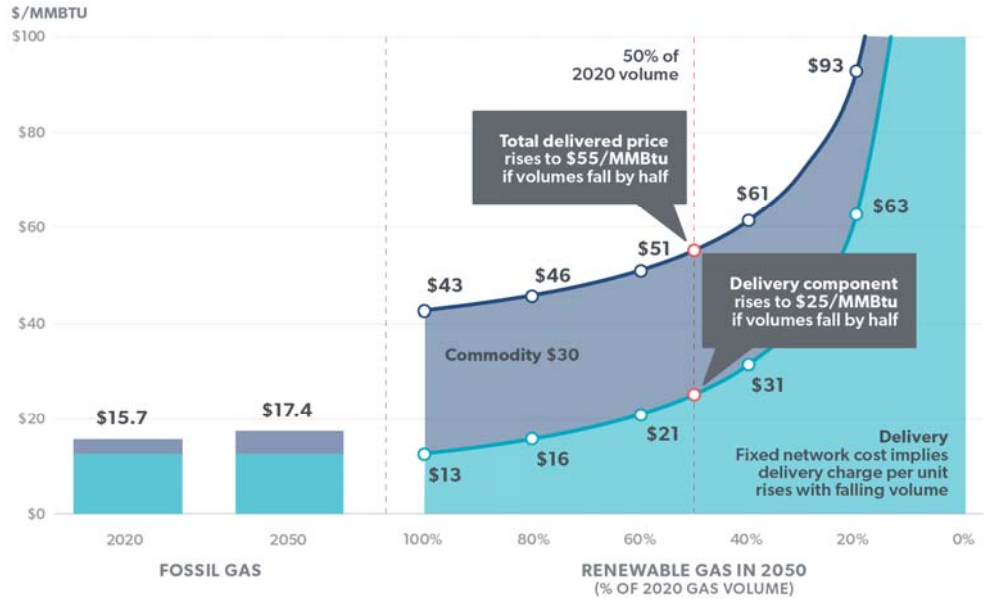
Broad building decarbonization via ASHPs will likely require mitigating peak impacts on the electric grid

- Electrification+decarbonization likely have moderate impacts on retail rates (except ASHPs)
  - RE costs are coming down, increased cost offset by increasing demand (higher use of networks)
- If unmitigated, ASHPs could add another 5 cents/kWh

See Slide 2 Disclaimer

The value of RNG both to decarbonize buildings and to the power sector depends on commodity and network costs



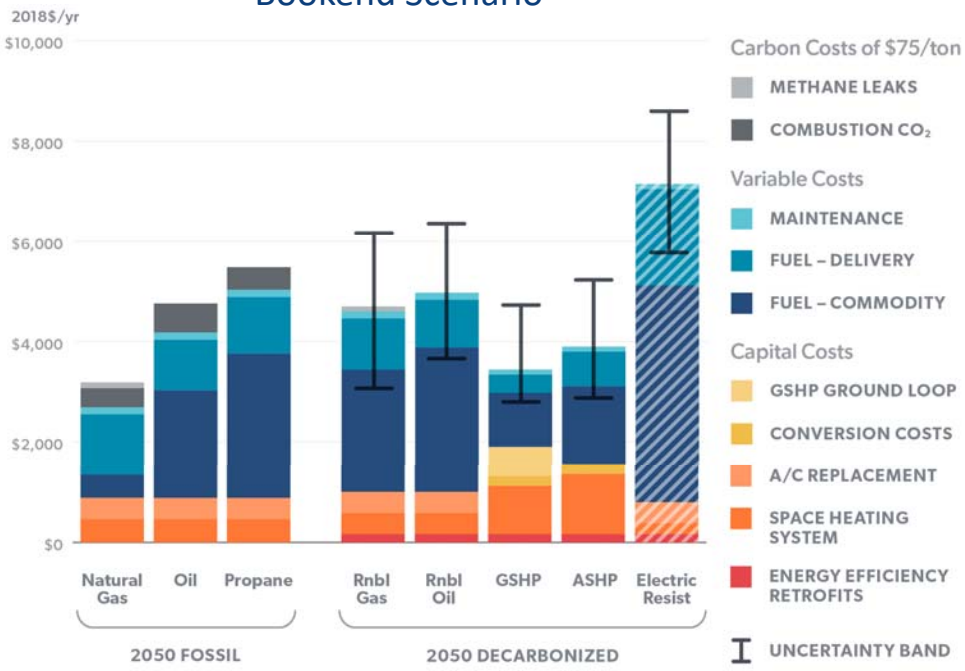


- Large uncertainty about how cheap/expensive producing significant volumes of RNG will be in the long run
- Impact of pipeline fixed cost on rates is significant - volume losses could lead to higher rates (per therm)
- Some volume reduction is likely due to EE, partial electrification, and warmer winters

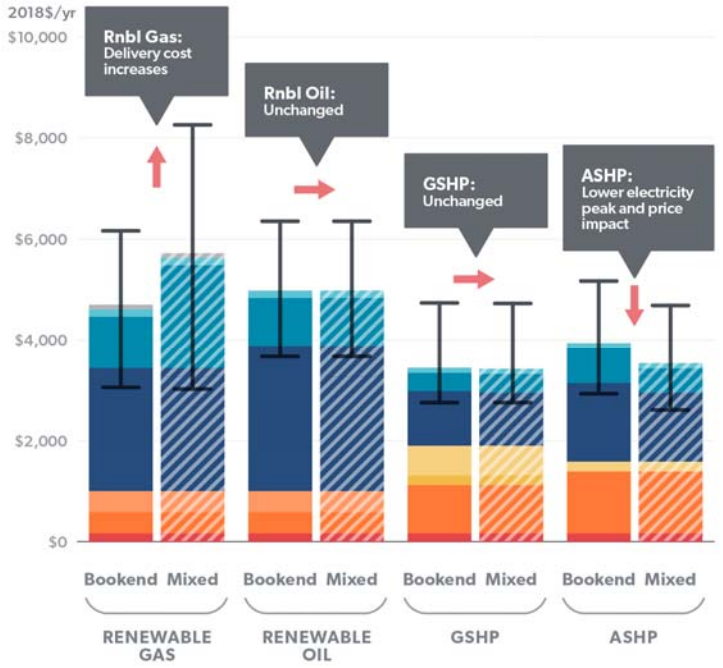
See Slide 2 Disclaimer

We found that for building decarbonization there is no one technology that is clearly cheaper or better than the others

Bookend Scenario



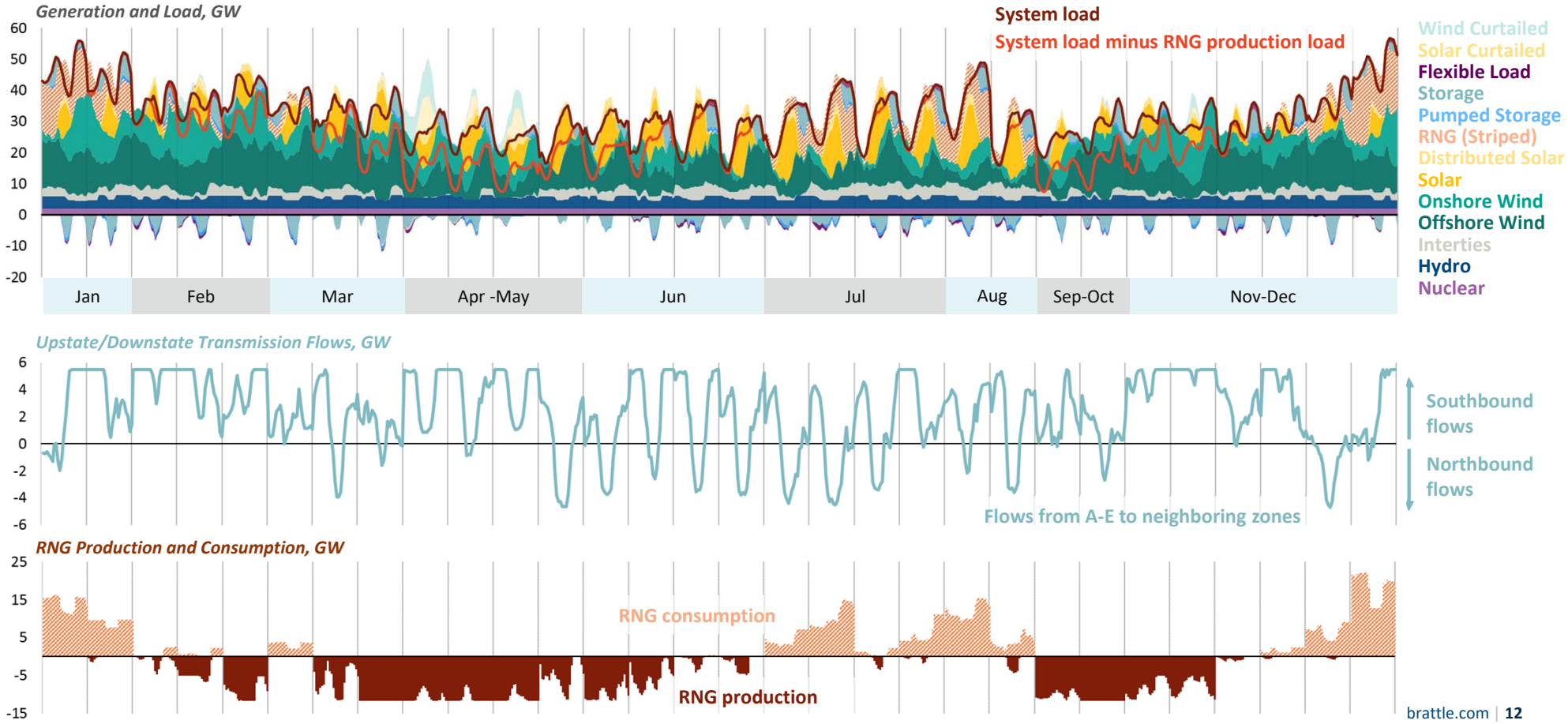
Mixed versus Bookend Scenarios



- Cost is likely to increase for current natural gas customers; cost could remain similar for oil, propane customers.
- RNG becomes more costly and ASHPs less costly in “mixed” scenario – higher gas delivery cost; lower electricity cost

See Slide 2 Disclaimer

Modeling a clean NY electricity system by 2040 including RNG (production and consumption) shows potential benefits



Some high level observations

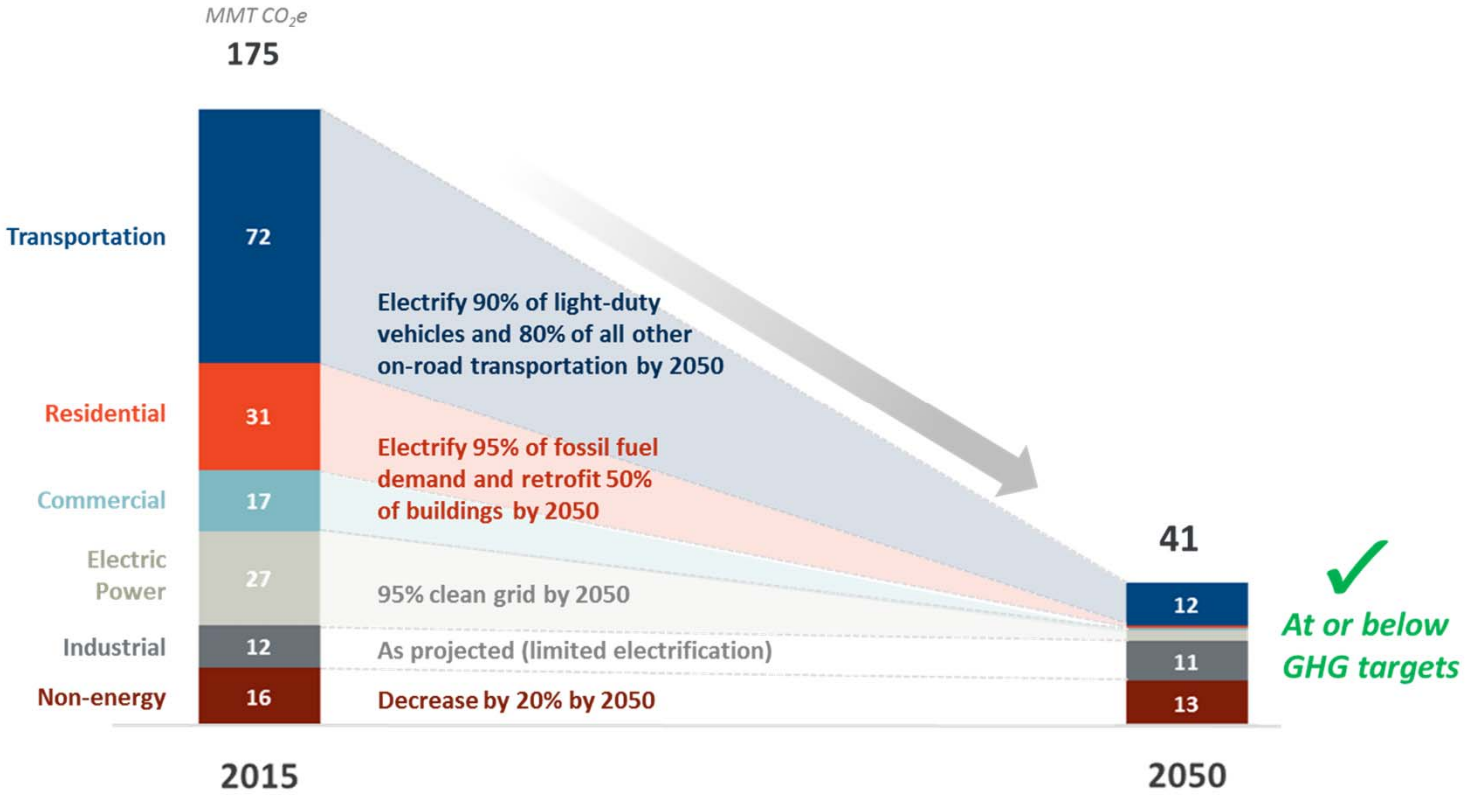
- Moving New England to a fully decarbonized electricity system (and deeply decarbonized economies) will require a gigantic increase and transformation of the power supply
  - Likely “all of the above” for quite a while
  - If the region commits to 10% per year growth of RE (and related), an orderly transition is actually doable – but this will require lots of changes beyond building wind and solar
- The role of “gas” is still somewhat unclear
  - For building decarbonization, (RNG) could be cost effective at least in some areas and under some plausible assumptions, and it may be easier to implement than HPs (or be needed to make building decarbonization by 2050 feasible.
  - Seems likely that some **dispatchable** fuel could be very useful in a fully decarbonized electricity sector, so for sure worth learning/piloting/ramping up.

See Slide 2 Disclaimer

Backup

Vast (in)direct electrification and a (nearly) decarbonized electric sector will likely be needed to meet 2050 goals

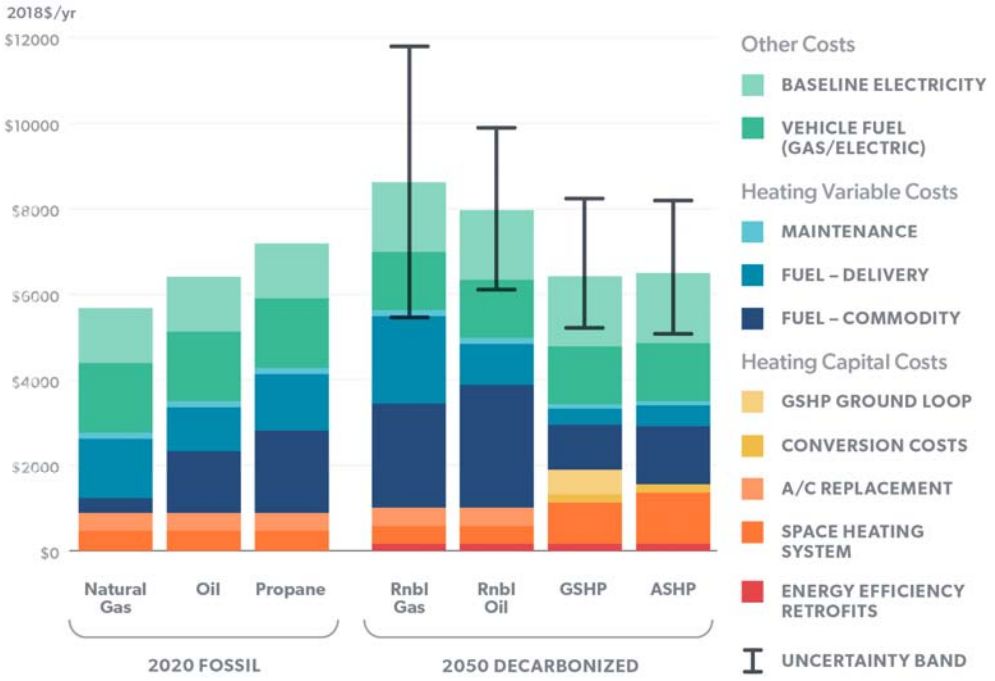
One Potential New England Decarbonization Path



For electric sector, whether remaining emissions need to be "net zero" or not likely has only minor relevance

- If electrified, would add more load

Overall impact of heating decarbonization could be mitigated (somewhat) by decarbonization impacts on energy "wallet"



- Baseline electricity and transportation energy costs are added to heating costs
- Widespread ASHP adoption (bookend case) would make baseline and EV electricity uses more expensive; mitigated in mixed scenario
- EV related savings mitigate cost increases somewhat
  - Impact not as strong as initially expected, after adjusting for gas tax equivalent in EV world
- Must recognize that this does not mean nobody will pay more
  - Particularly important to look at impact on low income populations

See Slide 2 Disclaimer

The core conclusion that there is at present no clear "winner" results in several general policy themes

Some of the policy themes that emerge from the combination of the fact that there is no clear winner and that investments in heating infrastructure are relatively infrequent and long-lived are:

- **Ensure progress**: Implement policies that guarantee emissions reductions independent of which technology is adopted
- **Take advantage of "natural" investment opportunities**: Focus incentives on "incidents" of intervention/investment: Equipment replacement, major home renovations, grid mod, gas system upgrades/replacements
- **Expand planning horizons and explore future proofing**: Include 2050 in planning to assess long-term viability of investments
- **Implement No Regrets policies**, but also do enough to **maintain options**
- **Plan for contingencies:** What if the gas volume drops below some threshold?
- **Learn and get ready:** Gather information and ramp up capabilities to deploy at larger scale

See Slide 2 Disclaimer

Our Offices


BOSTON


BRUSSELS


CHICAGO


LONDON


MADRID


NEW YORK


ROME


SAN FRANCISCO


SYDNEY


TORONTO


WASHINGTON

See Slide 2 Disclaimer

About Brattle

The Brattle Group provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governments around the world. We aim for the highest level of client service and quality in our industry.

OUR SERVICES

Research and Consulting

Litigation Support

Expert Testimony

OUR PEOPLE

Renowned Experts

Global Teams

Intellectual Rigor

OUR INSIGHTS

Thoughtful Analysis

Exceptional Quality

Clear Communication

See Slide 2 Disclaimer