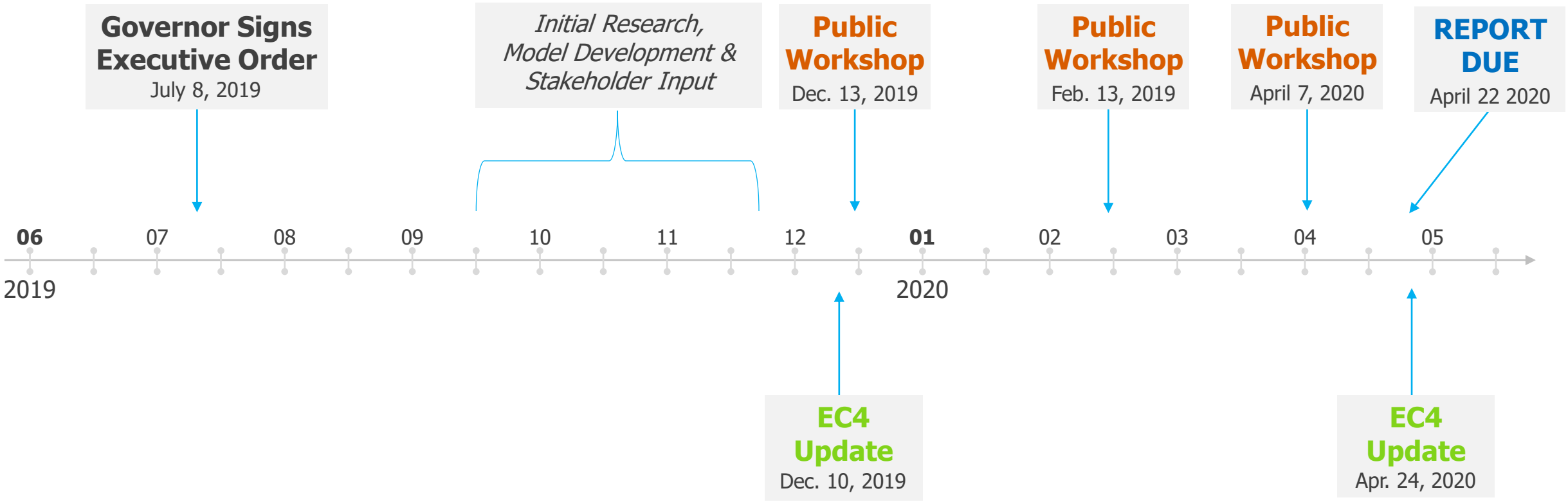
Heating Sector Transformation

Update to the EC4

April 24, 2020

Project Timeline

Report due by April 22, 2020



Heating Sector Transformation Project Leads

STATE PROJECT TEAM

GOV

Maria Messick | *Policy Advisor*

OER

Nicholas Ucci | *Acting Commissioner*

Dr. Carrie Gill | *Chief, Program Development*

Becca Trietch | *Administrator of Energy Programs*

DPUC

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Al Mancini | *Gas Infrastructure Lead*

CONSULTING TEAM

THE Brattle GROUP

An economic and energy consulting firm with 11 offices in North America, Europe, and Asia-Pacific, with over 50 principals and 350 professionals.

Dean Murphy

Jurgen Weiss

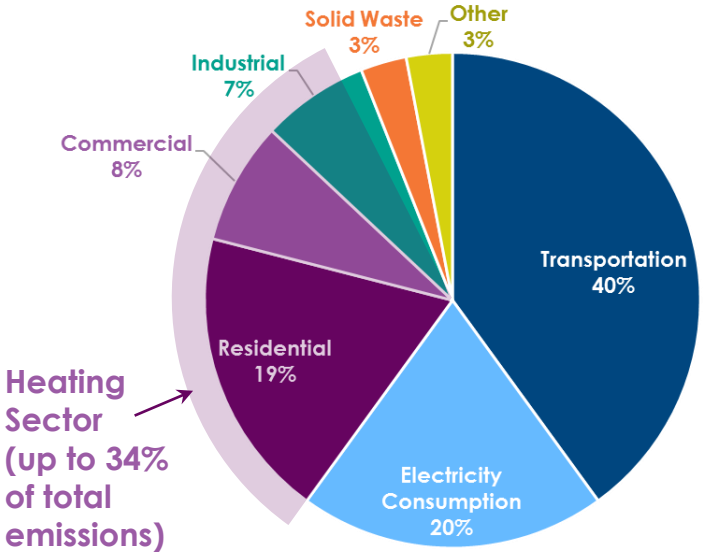
BUROHAPPOLD ENGINEERING

An international, integrated engineering consultancy operating in 23 locations worldwide, with 60 partners and over 1,900 employees.

Adam Friedberg

Resilient Rhode Island Act targets 80% reductions by 2050

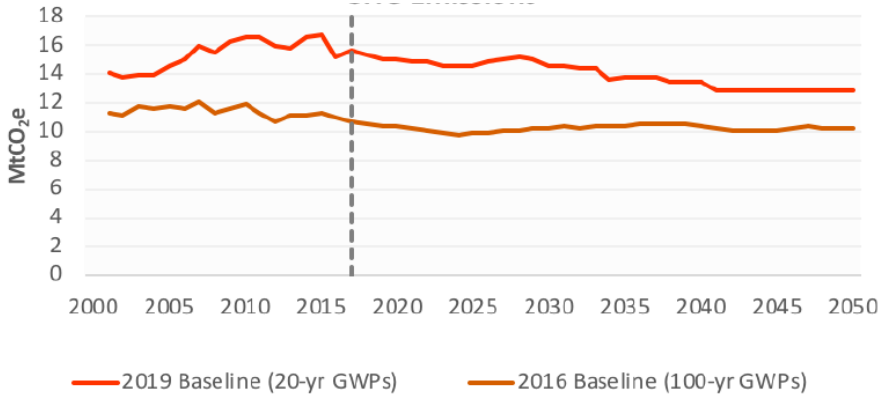
Rhode Island GHG Emissions by Sector (2015)



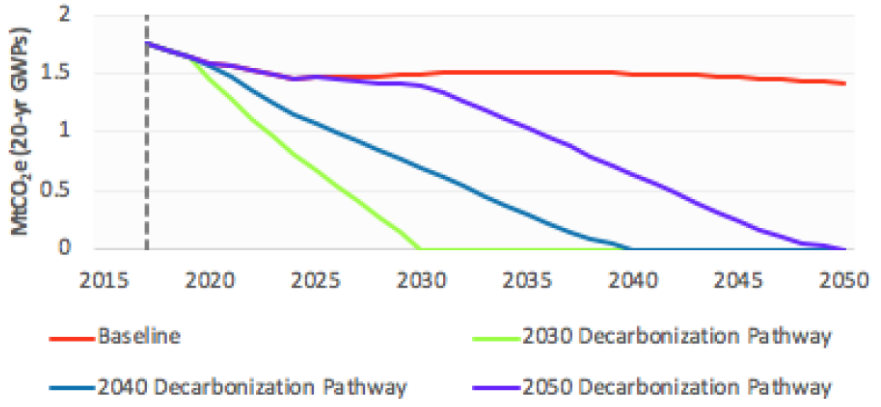
Note: Most but not all industrial GHG is related to heat generation, often for process heat.

"80x50" likely means (near) full decarbonization of residential and commercial heat – since full decarbonization of industrial and transport sectors is unlikely

Rhode Island GHG Emissions

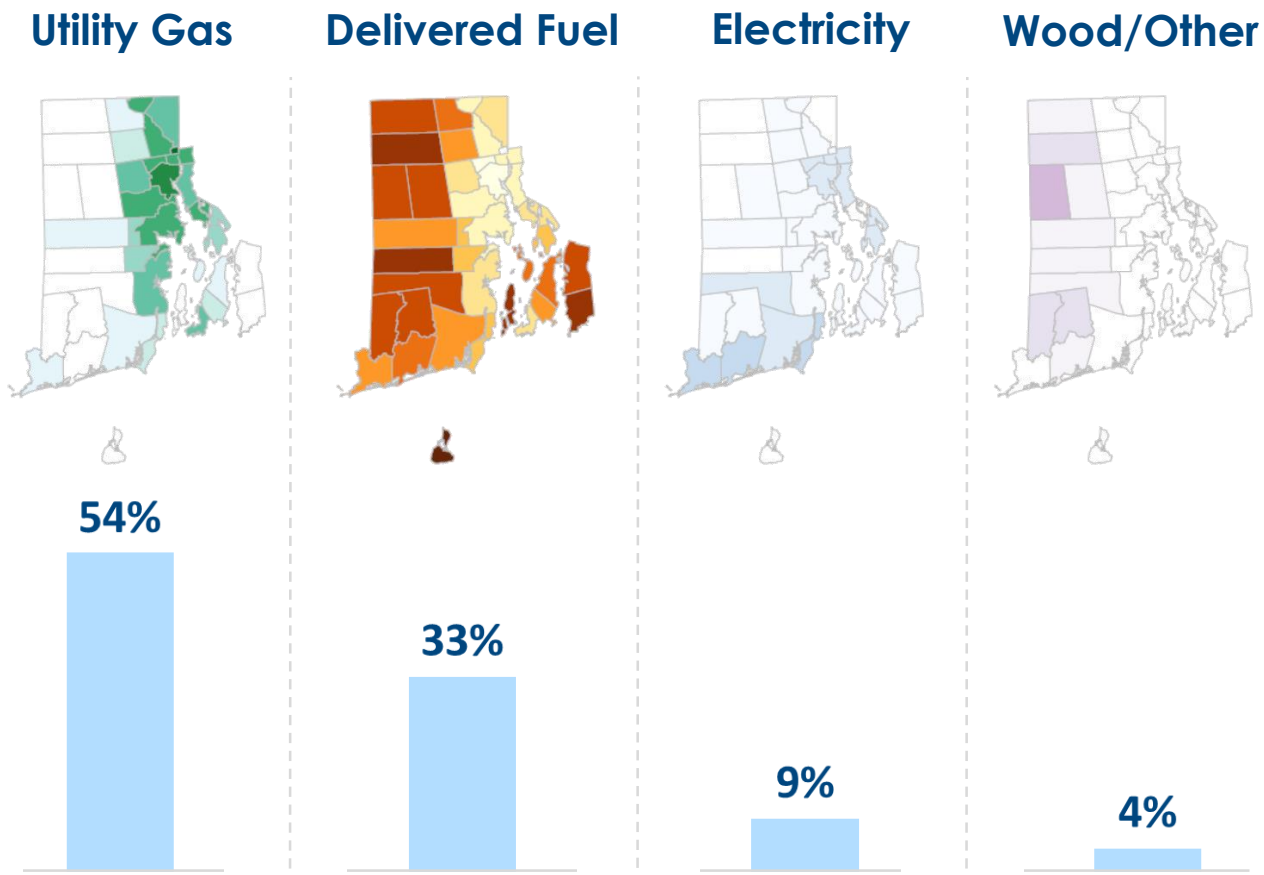


Rhode Island GHG Emissions from Heating and Cooling



Source: *Deeper Decarbonization in the Ocean State: The 2019 Rhode Island GHG Reduction Study,* September 12, 2019.

Rhode Island heating sector dominated by gas and delivered fuel, with urban/rural split



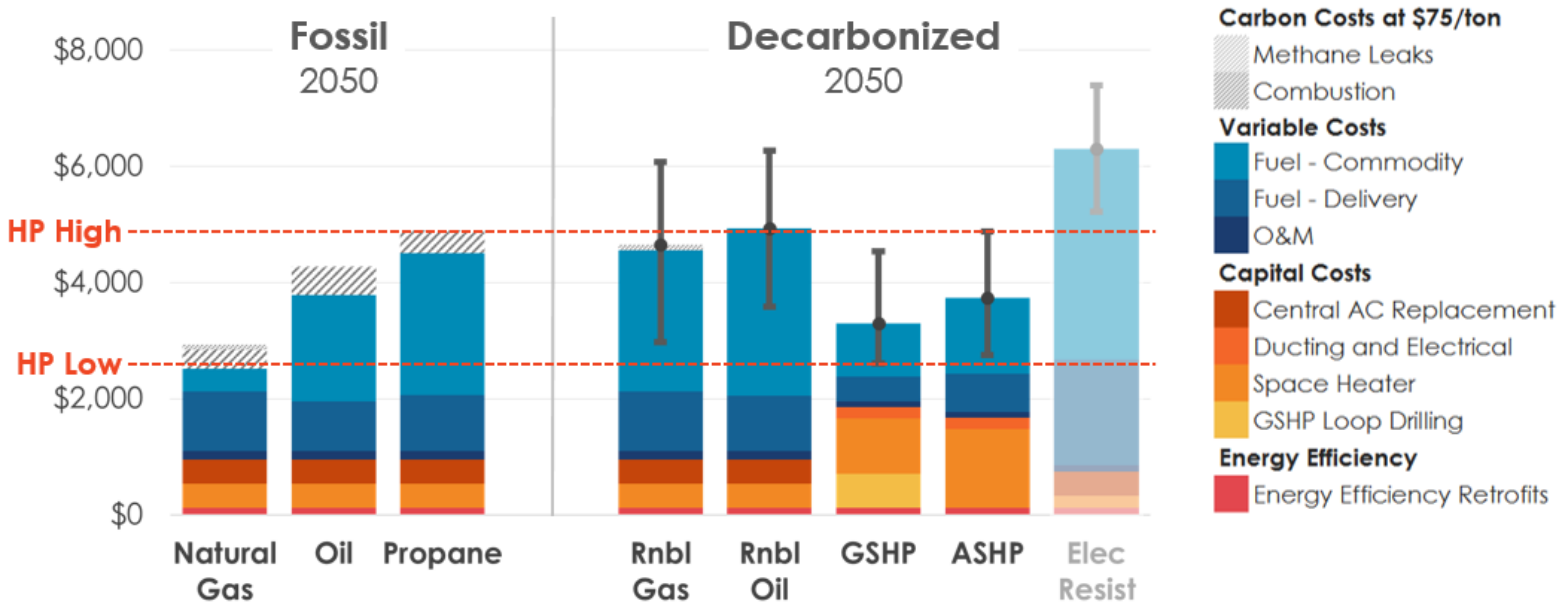
Source: *Rhode Island Renewable Thermal Market Development Strategy*, prepared by Meister Consultants Group for Rhode Island Office of Energy Resources, January 2017.
Notes: "Other" includes propane, kerosene, solar, and no heat.

The primary options

Space and water heat *Several primary options feasible across many applications/buildings*	**Decarbonized Fuel** ***Limited supply from less-costly sources***	**Renewable gas/power-to-gas (P2G)** for gas customers – Landfill gas, anaerobic digesters, gasification, synthetic gas
		Biofuel or power-to-liquids (P2L) for most other customers – Biodiesel, ethanol, synthetic fuels
	Heat Pumps	**Air source heat pump** (ASHP)
		Ground source heat pump (GSHP) – Including GeoMicroDistrict
Industrial heat	– *May be more specialized (e.g., high-temp)* – *Possibly requires (decarbonized) fuel including hydrogen*	

Economics for representative single family home with bookend scenario show no one "best solution"

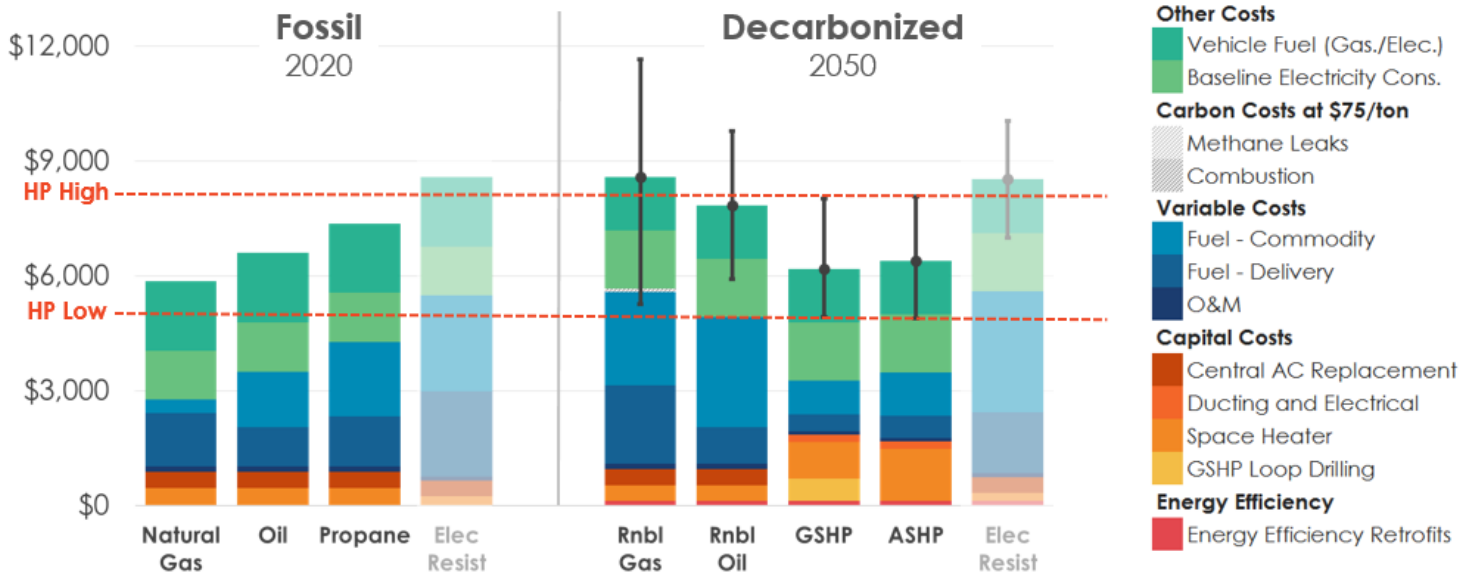
Space Heat Economics – Average Annual Cost *(2018 $/yr)*



- Bookend scenario assumes current fossil shares are retained (Rnbl Gas, Rnbl Oil), or that all heat is provided by GSHPs or ASHPs
  - ASHP bookend has higher electric peak and prices, natural gas volume unchanged
- **Broadly similar costs when recognizing large uncertainty ranges**
  - "Central" projections are quite uncertain; ranges likely more reliable
  - Annualized costs of decarbonized heating comparable to oil or propane, more than gas

Typical energy spending will likely be comparable to today (except perhaps for current gas customers)

Average Annual Total Energy Cost*(2018 $/yr)*
Current (2020) Fossil vs Projected 2050 Decarbonized (Mixed Scenario Example)



Total energy wallet likely comparable to today for typical consumer (within uncertainty range)

- May be slightly higher for customers now using fossil gas heat (which is at historic lows)
- **EV charging is likely cheaper** than current motor fuel, offsetting other energy costs
- Not everyone is "typical" – **must recognize and mitigate impacts on disadvantaged consumers**

Qualitative factors are also very relevant for understanding attractiveness of solutions

- **Feasibility in 30 years –** Weatherization/heat pump installations pose significant implementation challenges, given >400,000 residential/commercial buildings
- **Work force** requirements, especially for widespread heat pump deployment
  - Also workforce transition issue in fuel industries
- **Customer preferences**
  - Reluctance to give up gas for cooking, to endure disruption, etc.
- **Existing codes, standards, zoning rules etc.** may inhibit some technologies
- **Long life of heating infrastructure** creates challenges for altering it
- **High up-front cost and cost uncertainties** of heat pumps
  - The need for financing creates a barrier to adoption
- **Geology** may limit GSHP implementation
- To decarbonize heating, heat pumps **require decarbonized electricity**
- **Air quality** impacts of fuel burning (indoor from gas cooking; outdoor from gas and especially oil)
- **Safety concerns** of any gaseous fuel

Policy framework

Ensure	Increase efficiency and reduce carbon content of all fuels to zero over time – ensures progress no matter which technologies are used
Learn	Data collection, R&D, pilot projects to understand technologies, infrastructure, and customers
Inform	Educate stakeholders – customers, installers, policy-makers – about pros and cons of options, system interactions, etc.
Enable	Facilitate deployment with incentives; target natural investment opportunities; align regulation, rules, codes; expand workforce
Plan	Expand planning horizon; develop long-term, high-level contingency plans now (don’t commit yet) and use to guide near-term policy

Key Insights

- There are foundational steps that we can do now – at reasonable cost and low risk – to enable heating sector transformation at scale.
- As heating sector transformation progresses, it will be important to take advantage of natural investment opportunities and deploy capital, incentives, and other market strategies that enable residents and businesses to overcome financial barriers to adoption.
- When examining heating within the broader context of energy system decarbonization, our study found that, by 2050, total consumer energy wallets are likely to be within range of what they are today in a fossil fuel-based society.
- Long-term extension of the state's least-cost procurement and energy efficiency programs will be vital to any future in which Rhode Island successfully achieves its greenhouse gas emissions reduction targets.
- Given the large uncertainty related to how the costs of various decarbonized heating solutions will evolve over the coming decades, no one solution is clearly more economically attractive than all the others.
- Rather than establish discrete technology mandates that may prematurely dictate technological and economic outcomes, we recommend a set of guiding principles for further policy development.

HST Webpage

www.energy.ri.gov/HST/

Workshop materials and final report are posted on this webpage.