# Costs of Non-Gas-Pipe Alternatives (in terms of GSEP)

## Non-gas-pipe alternatives



Air source

heat pump





Networked Geothermal



## How to compare?



Networked Geothermal



## How to compare?

Air source heat pump



- A single unit
- Sometimes just **HVAC**
- Sometimes **100% electrification** (HVAC + gas stove & domestic hot water, etc.)

Networked Geothermal



- Many units
- Sometimes just HVAC or 100% electrification
- Plus shared infrastructure
- Different mechanicals & lifespans





- HVAC retrofits HVAC retrofits
- 100% electrification → 100% elect.

# **Apples to Apples**

- HVAC retrofits HVAC retrofits
- 100% electrification → 100% elect.
- Shared infrastructure + shared infrastructure



## **Retrofits: Common Metric**

#### installation costs / ton / year of expected lifespan

(Ton: heating and cooling metric. The amount of energy needed to melt or freeze one ton of ice.)



# **Expected Lifespans**

Air Source Heat Pump: 15 years\* Ground Source Heat Pump: 19 years\*

\* ASHRAE - https://fortcollinsheating.com/wp-content/uploads/2022/10/Ashrae-Life-Expectancy-Chart-1.pdf

# Data sets

#### Air source heat pumps

• MassCEC data (2019 - 2021. Partial retrofits=80, total=40)

#### Gas Infrastructure

• GSEP data (2022 - GLR-01 & GSEPs from 2022)

#### Networked geothermal

- Eversource Framingham (2023. 132 partial retrofits)
- National Grid Lowell (2024. Not yet installed. Conservatively assumes 1 pilot, 100 full retrofits)
- **Project X** (Not yet installed. 600 partial retrofits, data from the installer. Not a utility install)

#### Just HVAC retrofits



Cost / ton installed / years of expected heat pump life





### Shared Infrastructure Metric: Cost per Customer

#### Networked geothermal calculation

Total cost of shared infrastructure / total # of units

**Gas calculation** 

MA total cost of leakprone infrastructure / MA total # of leakprone customers

#### Shared Infrastucture Cost / Customer



#### Learning Curve and Costs



#### Shared Infrastructure Cost / Customer



## **Factors Not Considered**

• **Reduced electric peaks** (Harvard School of Public Health)



Buonocore, J., Salimifard, P., Magavi, Z., Allen, J., "The Falcon Curve: Implications of Seasonal Building Energy Use and Seasonal Energy Storage for Healthy Decarbonization" DOI: <u>10.21203/rs.3.rs-1054606/v1</u>



## **Factors Not Considered**

- Reduced electric peaks
- Avoided costs (electric grid modernization)

Pays for customer retrofits?





## **Factors Not Considered**

- Reduced electric peaks
- Avoided costs
- Water savings (Colorado Mesa University analysis) >60% per sq. ft.\*





\* https://rmi.org/pipes-or-wires/

• Emissions

MA 2019 Analysis

# **Gas Heating**

#### Networked Geothermal Now

Networked Geothermal 2050



- Emissions
- Safety & security

#### Merrimack Valley Gas Disaster 2018





- Emissions •
- Safety & security •
- Reliability (no transmission)

#### Business

#### 'Perfect Storm' Caused Massive **Newport Gas Outage: Report**

The week-long January gas outage left thousands of Aquidneck Island residents without heat during dangerously cold temperatures.



Posted Wed, Oct 30, 2019 at 2:55 pm ET | Updated Wed, Oct 30, 2019 at 5:04 pm ET







- Emissions
- Safety & security
- Reliability (no transmission)
- Affordability
  - Reduced price volatility
  - Lower customer bill

# MA Energy Bill Projection - gas vs networked geothermal



Inflection Point: When Heating with Gas Costs More; Applied Economic Clinic Jan 2021



- Emissions
- Safety & security
- Reliability (no transmission problems)
- Affordability
  - Reduced price volatility
  - Lower customer bill
- Equity
  - Workers can transition





- Emissions
- Safety & security
- Reliability (no transmission problems)
- Affordability
  - Reduced price volatility
  - Lower customer bill
- Equity
  - Workers can transition
  - Energy burden

#### **Low-income Energy Burden During Decarbonization** (MA Future of Gas docket)



The Role of Gas Distribution Companies in Achieving the Commonwealth's Climate Goals Independent Consultant Report, 2022.



## **Obligation to Serve**

• If gas and thermal service are equivalent, then the local service meets the need

Chapter 164, needed definitions:

- Gas company: can also sell "utility-scale non-emitting renewable thermal energy".
- Define "networked geothermal system", "non-emitting renewable thermal energy", & "non-emitting renewable thermal energy infrastructure project".
- Section 92 of Chapter 164 to permit a gas company to meet its obligation to serve by providing non-emitting renewable thermal energy, through networked geothermal infrastructure, electric heat pumps, or other thermal energy as determined by the Department of Public Utilities pursuant to the priorities of Section 1A of Chapter 25.

