



# Home Electrification

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# Presenters



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# Why Electrification?

David Roberts, the best commentator on all things climate, says: “Electrification is the main course; everything else is a side dish.”

Here’s why: we can clean the electric grid with renewables, and then use electricity for all our energy needs.

(There are important side dishes too, like weatherization and agriculture.)



# Massachusetts and Electrification

Under current law, MA cities and towns have to ask the Legislature for Home Rule authority to be able to enact building electrification requirements.

Several towns and a city (Newton!) are in the process of seeking such authority, but it's a rigamarole.

Rep. Khan and other legislators are trying to change that, with state legislation that would require all new construction and substantial renovation in the entire state to be electric.



# Newton and Electrification

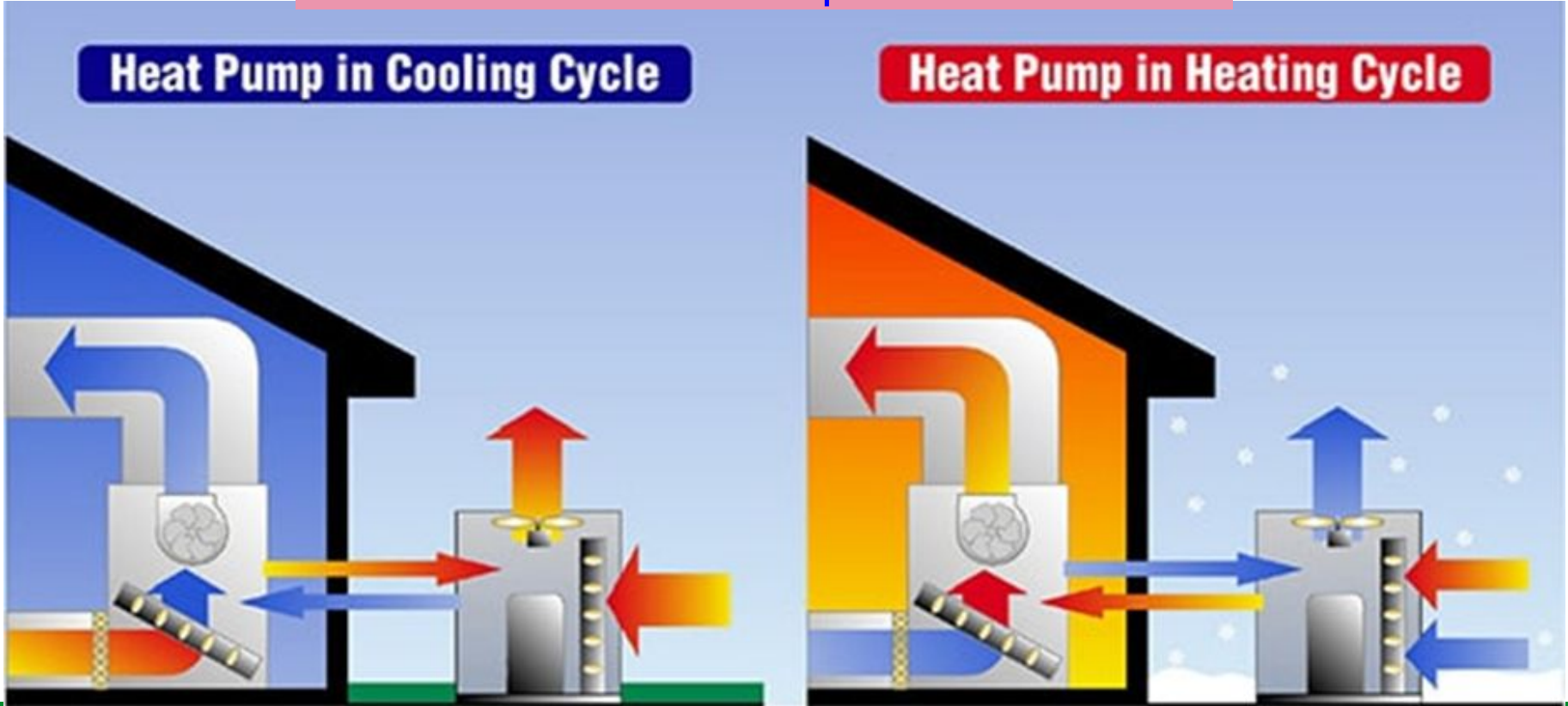
City Council is considering a draft Home Rule petition and draft ordinance seeking legislative authority to require that all new homes and substantial renovations be electric

- Excluding cooking

# Electric Technology: Heat Pumps



Move heat from one place to another



# Electric Technology: Heat Pumps

## Ductless “Mini-Splits”

Single Zone



Multi Zone



## Central Ducted Systems



# Electric Technology: Heat Pumps

**Heat Pumps are for Hot Water Too!**







# Electric Technology: Heat Pumps



— Email: [heatsmartnewton@gmail.com](mailto:heatsmartnewton@gmail.com) for questions

— Web: [heatsmart.greennewton.org](http://heatsmart.greennewton.org)

HeatSmart Newton Coach: **Craig Forman**



# Electric Technology: Induction Cooking

Live Demonstration!





# Costs of Electrification (HVAC - New Construction)

An example new construction project

	Installed Cost	Annual Operating Cost
Gas Furnace Central AC Gas Tankless Water Heater	\$23,700	\$1,511
Mini-split heat pump <i>(ducted indoor units)</i> Heat Pump Water Heater	\$25,100	\$2,007 <i>(\$1,362 powered with solar)</i>

**Reminder:** Costs vary significantly from project to project! In some projects, heat pumps could be cheaper (or significantly more expensive) to install.

Cost comparison **does not account for cost of eliminating gas service and piping** (could be \$10,000+) or gas vs. non-gas appliances

**Source/Assumptions:** Based on building and equipment assumptions from RLPNC 171-4: Mini-Split Heat Pump Incremental Cost Assessment with ductwork requirements and equipment/labor costs increased to reflect higher costs in Newton vs. model in Worcester; Estimate of Solar PPA/cost with financing price from Solarize MA Data



# Costs of Electrification (HVAC - Existing Home)

Retrofit costs vary significantly by home and by application type

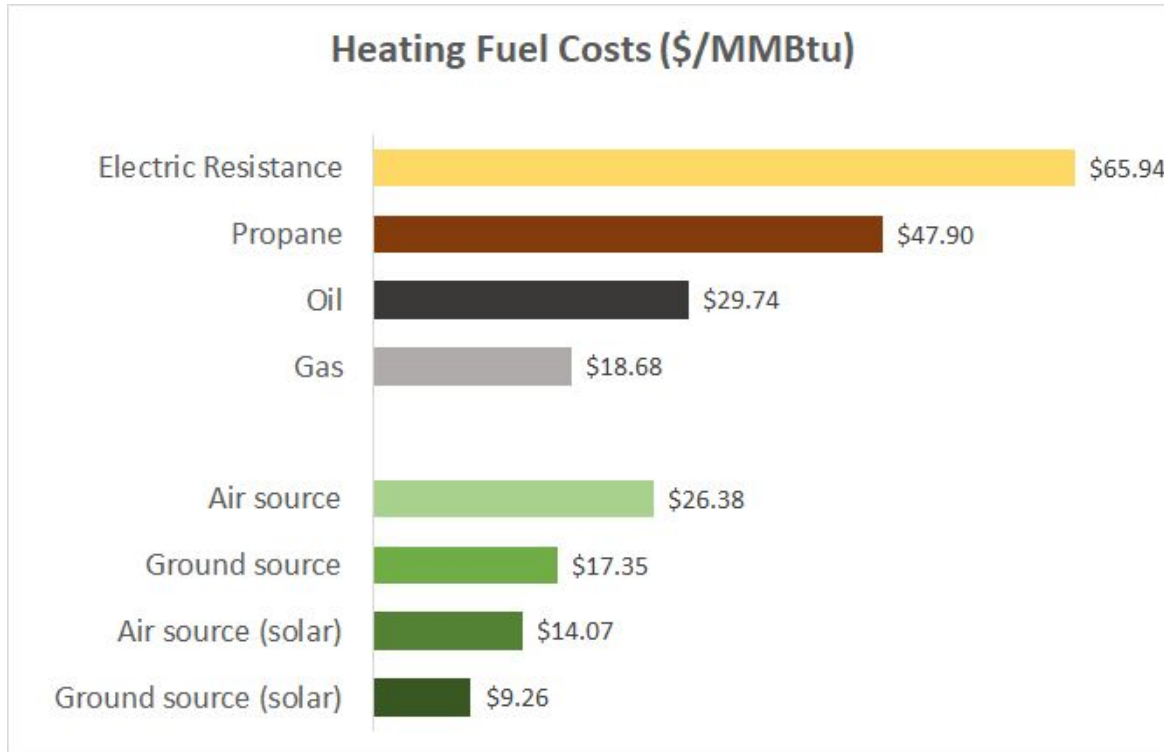
	<b>Capacity (nominal tons)</b>	<b>Avg. Project Cost</b>	<b>Avg. Cost per Ton of Capacity</b>
HeatSmart Newton Average ASHP Project Size and Cost	3.24*	\$17,147	\$5,289
Average GSHP Project Cost (statewide)	4.98	\$63,423	\$12,725
Average Heat Pump Water Heater Cost	n/a	~\$4,000-5,000	n/a

\*HeatSmart Newton included whole-home, primary with backup, and supplemental heat pump systems. For full replacement, a typical Newton home would be expected to need 3.5-4.5 tons of capacity (potentially lower with completion of weatherization work)

**Source/Assumptions:** HeatSmart Newton data for ASHP. MassCEC rebate data for GSHP projects, Massachusetts market data for HPWH.



# Costs of Electrification (Annual Operating Costs)



**Source/Assumptions:** \$0.225/kWh (MA avg. 2020), \$3.30/gal oil (2021 avg), \$3.50/gal propane (2021 avg), \$1.495/therm gas (MA 2020-21 heating season avg. LCOE of solar PV of \$0.12/kWh. AFUE 80 for fossil fuel systems. COP 2.5 for ASHP, 3.8 for GSHP



# Costs of Electrification (Appliances)

High-efficiency electric technologies typically cost more than gas alternatives

<b>Cooking Equipment</b>	<b>Installed Cost</b>	<b>Lifetime Cost</b>	<b>Laundry Equipment</b>	<b>Installed Cost</b>	<b>Lifetime Cost</b>
Gas Stove/Oven	\$820	\$1,180	Gas Dryer	\$1,000	\$1,450
Electric Stove/Oven	\$920	\$2,040	Electric Dryer	\$760	\$3,280
Induction Stove/Electric Oven	\$1,900	\$2,950	Heat Pump Dryer	\$1,520	\$3,320

*Installed Costs derived from National Residential Efficiency Measures Database (NREL, 2018). Operating costs modeled in BEOpt for a single-family home using National Grid and Eversource residential rates. 13 year lifetime assumed. For dryer, operating costs included in lifetime cost only consider (for gas dryer) gas usage and (for electric dryers) incremental electricity consumption over gas dryer.*



# Costs of Electrification

Millions of dollars in incentives are available (and expected to increase next year!)

Measure Type	Specific Requirements	Incentive Amount
ASHP	N/A, any fuel or application	\$250/ton
ASHP	Displacing or fully replacing electric resistance, oil, or propane (req. Integrated controls for oil/propane)	\$1,250/ton
GSHP	Replacing oil or propane heat	\$2,000/ton
HPWH	Rebate varies by size and fuel (non-gas water heaters only)	\$150-600/unit

Pending the approval of the 2022-2024 Three Year Efficiency Plan and finalization of incentive numbers, **all heat pump incentives are expected to increase in 2022**, including for gas-to-electric conversions and the establishment of an all-electric new construction program.



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