

Getting to Zero: Bringing Residential Electrification to Scale

April 2nd 1:00-2:00pm

Q&A with the Presenters

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- Ellen Tohn from MassEnergize

The questions are organized by topic:

- General (1-4)
- Heat Pump (6-18)
- Mass Save (19-20)
- Contractors (21-22)
- Multi-family (23-25)
- MassEnergize (26-29)

1. Please explain a Net Positive home?

- a. A net positive home is a home that produces more energy than it uses. So, in that example, it generates more energy from its solar panels than it uses for its all-electric appliances. The house puts the extra electricity back onto the grid through net metering.

2. How do you propose to deal with the typical 3 to 4 to 1 ratio between the quantities of heat required to cooling required? I.E. my house 50,000 BTU/Hr at zero F and 18,000 btu/hr on the hottest day of the summer.

- a. Since the cooling load is almost always smaller than the heating load, we usually recommend that installers size heat pumps to meet the heating load of a home. This does tend to oversize the cooling load, but this will eliminate the need for a fossil fuel backup to use to heat a home in the winter.

3. What percentage of households in MA are low-income households?

- a. About 10-11% of MA residents (about 680K people) were living below the federal poverty line before the COVID-19 outbreak (income of about \$24,000 per year for family of four). But low income as defined by the MassSave Program and federal fuel assistance guidelines is a different threshold of 60% of state median income (\$71,800 for family of four). This is the threshold we used in the presentation to indicate "Low Income" and energy burden. The 60% SMI income level triggers benefits such as fuel assistance toward home heating costs, the R-2 discount electric rate, free insulation/air

sealing/lighting and free eligible appliance/heating upgrades. The % of households below 60% State Median Income (SMI) in MA is fairly elusive, but number of households on the discount electric rate (R-2) has generally been around 300,000 in recent years. About 185,000 of those households are served in the fuel assistance program (difference between the R-2 numbers and fuel assistance number is primarily households in subsidized housing where owner pays heat but low income tenant still pays the unit electric bill and gets the discount electric rate). These numbers would indicate that only about 13% of MA households are under 60% SMI, however the discount electric rate numbers do not include residents who are in affordable housing where owner pays electric bill a well. This is common practice in senior affordable housing and public housing. It is also extremely likely than many people who qualify for discount electricity and fuel assistance do not realize they qualify or aren't successful in getting to local Community Action Agencies in person with correct paperwork to demonstrate eligibility as required by federal guidelines. If the COVID-19 job losses are similar to what was seen in the 2009 recession, we would likely see a 15-20% increase in households seeking and qualifying for assistance.

4. Do you have suggestions for electrification options for hot water systems? (hydronic & radiators)

- a. Through our Whole Home Air-Source Heat Pump Pilot program, we have seen applicants use solar hot water, heat pump water heaters, and electric resistance hot water tanks to heat the domestic hot water.

5. Am I right that gas-heated condos are not eligible to apply for Home MVP?

- a. Condo units that are in 1-4 unit buildings are eligible for Home MVP.

6. Aren't heat pumps more efficient in climates where we need both heating and cooling?

- a. By efficient, do you mean that in climates where heat pumps are used for both heating and cooling? Cold climate heat pumps that are used in Massachusetts can be used for both heating and cooling. They differ than non-cold climate heat pumps because they can also heat homes at below 0 degree Fahrenheit temperatures in addition to cooling homes, so they are optimal in climates like Massachusetts that are heating dominated. As Massachusetts' climate gets warmer, it will also be more important to install air conditioning, especially on upper floors of buildings, so heat pumps are a great solution because they provide both heating and cooling with one system.

7. In the case of ground source heat pumps, do we not have to put the heat back in the ground, so as to keep it running?

- a. We do not need to put the heat back in the ground for ground-source heat pumps. The ground stays at a constant temperature and the loop field bore holes are placed at least 20 feet apart for a ground-source heat pump system so warming up the refrigerant to be used in the heat pump and then provide heating for a home does not cool down the temperature of the ground.

- 8. Does it make sense to add one or two air source heat pumps with the plan to reduce the overall temperature on our thermostats to use less gas heat (maybe just enough to keep the pipe from freezing?)**
- That is what I am doing at my home. 1 head one compressor in main kitchen, dining room, and living room which is well suited to an ASHP. Bedrooms for now I am leaving off and keeping doors open to see how much gas I can offset.
- 9. Can heat pump filters be replaced by homeowners?**
- Yes, they can! They can be cleaned and replaced by homeowners.
- 10. Is there discussion / concern that encouraging heat pumps will lead people to use air conditioning rather than passive cooling methods? What are electrification options for hydronic heating (radiators)?**
- That's a great question. On one hand, the demand for AC is going up no matter what, and heat pumps are typically 30% more efficient than traditional systems. With a warming climate, it might also be necessary for more sensitive individuals to have AC. AC is also a relatively small portion of our energy use, so if someone installs a heat pump, we expect it to be more efficient than a traditional AC system and also develop some significant carbon savings in the winter.
- 11. If we already have adequate PV but changing to ASHP from propane will create more demand, is there a program to combine the 2 upgrades?**
- Currently, there is not a program to combine the two upgrades. However, there are programs for each of the upgrades. For solar PV, you can receive credits from DOER's SREC program. For the ASHP, you can receive incentives for Mass Save and Alternative Portfolio Standard credits (APS) from DOER.
- 12. The first speaker mentioned that heat pumps work more efficiently when you do weatherization first. that's "more efficient" in the sense of less input of heat for the same temperature inside -- not that the heat pump behaves differently (or has a different COP) in a tighter home? Am I understanding of correctly?**
- Great question. Air source heat pumps are most efficient when sized correctly to the load where they aren't under or oversized compared to the load. On one level, it means that you can't have a system that's too small because it's in a leaky house, as it would be running full power often which isn't efficient. On the other hand, if it's oversized to its load, it can also be inefficient. But overall, heat pump systems are cheaper and use a lot less energy though in an efficient shell. Though as you mentioned, it's a little nuanced...
- 13. Will the whole-home air-source heat pump pilot also support transition from gas to electric dryers?**
- For new construction homes- there can be no gas hookup to be eligible for the MassCEC incentive. If it is an existing home on gas going to all heat pumps for heating- the incentive is available no matter what you do for dryers, cooking etc.

14. A MassCEC question: As many appliances today do not last 20 years, I wondered what number do you use and should consumers use when estimating the life time (years) of heat pumps, both Air source and Ground source?

- a. We typically assume that air-source heat pump and ground-source heat pumps will last 15-20 years before they need to be replaced. For a ground-source heat pump system, the ground loop piping will last 50-100 years.

15. Are there incentives for Ground Source Heat Pumps?

- a. The federal tax credit (ITC) is available for Ground-Source Heat Pumps. It is 26% in 2020, 22% in 2021, and goes to zero after that.

16. What is the maintenance/cost of heat pumps

- a. The maintenance/cost of heat pumps is highly dependent on the specifics of a home. MassCEC has a cost comparison tool that was calculated using data from the Residential Air-Source Heat Pump Program (which closed in March 2019, so some of the data may be outdated): <https://www.masscec.com/cost-residential-air-source-heat-pumps>. Mass Save may also have recent cost data from their Air-Source Heat Pump Incentives.

17. What's the average cost to switch from gas furnace to ducted heat pump?

- a. The answer is INCREDIBLY home specific. You can add one compressor one heat Air Source heat pump for about \$3,500. If you want to not use your gas heating at all for back-up a whole home solution might cost about \$20,000 or more depending on set-up, how well home is insulated and size. Ducting can be even more for retrofits.

18. Which air-to-air heat pump maker is frequently used in MASS?

- a. MassCEC has data for its old Residential Air-Source Heat Pump Program, which closed in March 2019, so some of the data may be outdated: <https://www.masscec.com/cost-residential-air-source-heat-pumps>. The most common manufacturers through that program were Mitsubishi and Fujitsu, but our site lists all of the manufacturers that were used for the MassCEC program.

19. Do you happen to know if there are similar programs to mass save that cover assessments and insulation in New York State?

- a. I believe NYSERDA does offer similar programs.

20. Are condo owners and/or renters eligible for Mass Save and DOER incentive programs?

- a. Condo owners have the same benefits as single family owners for both programs. Renter can get a free assessment for the in-unit energy that they control. With coordination with the owner of their building you can get the insulation and air sealing.

21. What is the thinking about engaging / incentivizing / educating contractors about installing clean technology? As opposed to or as a complement to direct-to-consumer engagement.

- a. I think it needs to be an all of the above strategy. To really increase adoption, we need to get the market and industry onboard. Traditionally, though, our main strategy was to

drive consumer demand and the industry will follow. But it's still necessary to have educational and workforce resources at a minimum.

22. Given the concern among consumers about picking the right contractor to do the work, should we be thinking about a contractor certification for the green heating / cooling superstars?

- a. That is a great question! There is not currently a uniform contractor certification for air-source heat pumps, but there is an IGSHPA certification for ground-source heat pumps (<https://igshpa.org/>). When deciding on a contractor, MassCEC recommends homeowner ask about manufacturer training for the products they plan to install and if contractors can provide any references from past projects that have worked on.

23. How can we counteract the "default" HVAC systems (gas-based heat) in multifamily buildings? Developers/Owners are unfortunately still primarily interested in lowest initial cost. Every building that is built today with gas-fired heating systems will use fossil fuels for the next 2 decades.

- a. In MA multi-family new construction, heat pumps for heating and cooling are usually priced as one of about 5 different heating and cooling solutions. It is our experience that heat pumps are generally one of the two lowest cost options for upfront construction. In terms of operating, with new construction levels of building envelope construction in Massachusetts stretch code communities, operating costs for a combination of heating and cooling should be relatively comparable to a gas heating system with central air conditioning. Part of this is because cooling quickly becomes dominant in equipment sizing in efficient building envelopes. Heat pumps can also be a good retrofit solution for first costs on multi-family retrofit if cooling (non window a/c) are included in the retrofit since ducting for cooling is not needed. But going from an existing multi-family building with a poor envelope with gas heating to heat pump heating will likely lead to an increase in heating costs because currently pricing in MA of electricity is high and pricing due to fracking is quite low. This big mismatch in MA gas and electric is not present everywhere in the NE and it is unlikely to be this dramatic in 10 years once offshore wind is built and gas infrastructure replacement costs begin to be factored into gas pricing. Any kind of elimination of subsidies for fossil fuels or carbon pricing would also change that pricing mismatch.

24. For multifamily buildings on which we work, switching to heat pump dryers is a significant challenge to electrification.

- a. Yes- agreed. As is central hot water heat pump systems. We understand they are available in Europe and other parts of world but not yet in the USA.

25. Where is the funding coming for the BYOB triple decker challenge coming from?

- a. Mass Clean Energy Center. It provides prizes for designs. To actually build the idea we are seeking other state funding sources to incentivize. The competition will also lay out more clarity about how paths an applicant might use to tap MassSave incentives.

26. Does MassEnergize have some statistics for the towns involved such as a before and after energy consumed per person in the towns

- a. Not yet. We will be tracking what is reported in terms of reduced GHGs for all those who set up profiles Green Newton is hoping to launch Earth Day 2020 and Wayland has only been live for a few months.

27. Is the Mass Energize program pushing for heat pumps, but stressing the need for air sealing and insulation for most homes first?

- a. Yes, a core element of MassEnergize is to promote multiple actions and the core energy efficiency of air sealing and insulation to reduce the load is important. We generally recommend a big focus on envelope before heat pumps and especially whole home heat pumps.

28. Is the MassEnergize software intended to engage homeowners?

- a. Yes! That is the primary purpose of this software. Community groups can customize with local content for local homeowners but can also use templates developed already. Team challenges are possible and communities can set goals for actions taken and households engaged.

29. In larger cities, would you be open to collaborating with non-governmental orgs focused on a neighborhood level?

- a. Yes, we are open to a variety of collaborations. Most of the organizations involved so far are community non-profit organizations such Green Newton, Energize Wayland, and the Jewish Climate Action Network. In many of these communities, our community partners are also working with their city.