BUILDINGENERGY BOSTON

Scaling Residential Decarbonization

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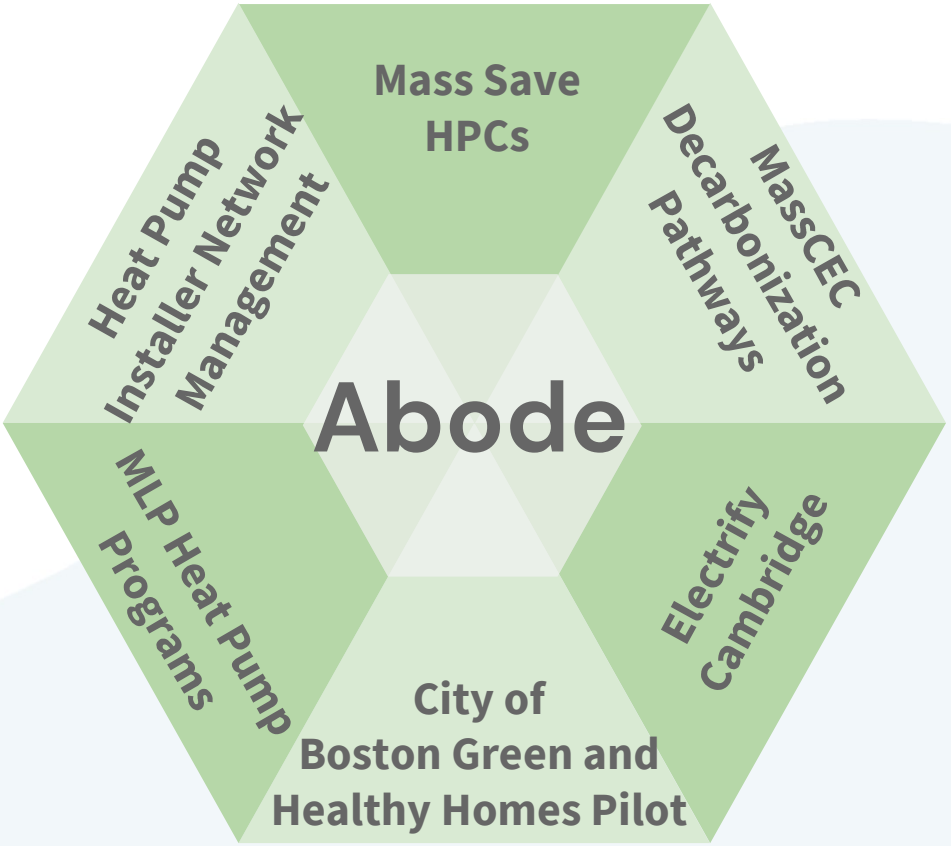
Northeast Sustainable Energy Association (NESEA) | March 20, 2024

MassCEC's Work Spans Four Main Areas of Climate Impact for MA

Climatetech Innovation & Investment	Accelerating Decarbonization	Large Scale Deployment: Offshore Wind	Clean Energy & Climate Workforce Development
			
We help new climate-focused businesses grow faster by backing a vibrant community of researchers, startups, and established industry players - creating an ecosystem where they connect and thrive.	**We contribute to meeting our state's ambitious climate goals by tackling barriers to widespread use of clean energy and climate technology** in buildings, transportation, and the grid.	**We're building a cutting-edge offshore wind industry, marshaling world-class ports** while addressing supply chain and workforce development challenges**.**	**We partner with schools and other education partners to build a skilled and diverse workforce,** essential for achieving our climate goals.

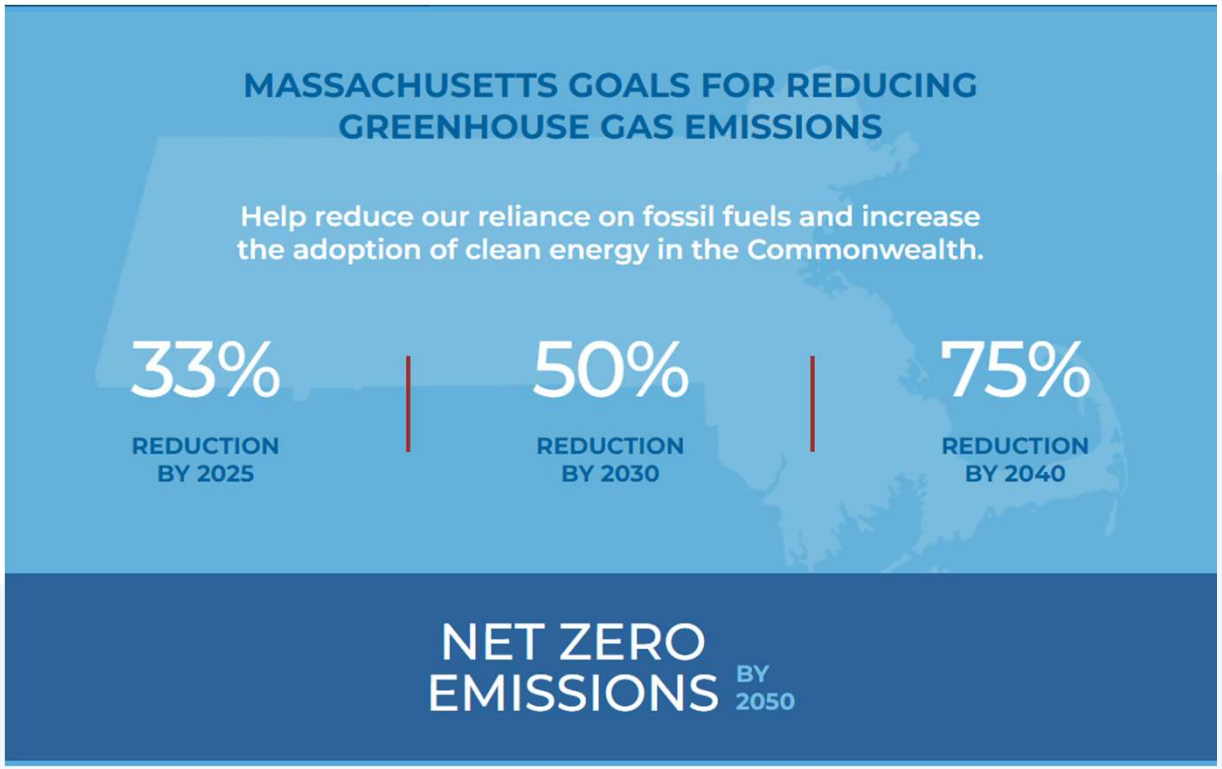
Abode's Work to Scale Decarbonization

- Abode is at the center of many large-scale decarbonization initiatives
- Oversee 15 Home Performance Contractors conducting ~50K assessments annually
- Manage Heating and Cooling Initiative
- Bringing our learnings from all our decarbonization programs to the Mass Save program to scale the impact

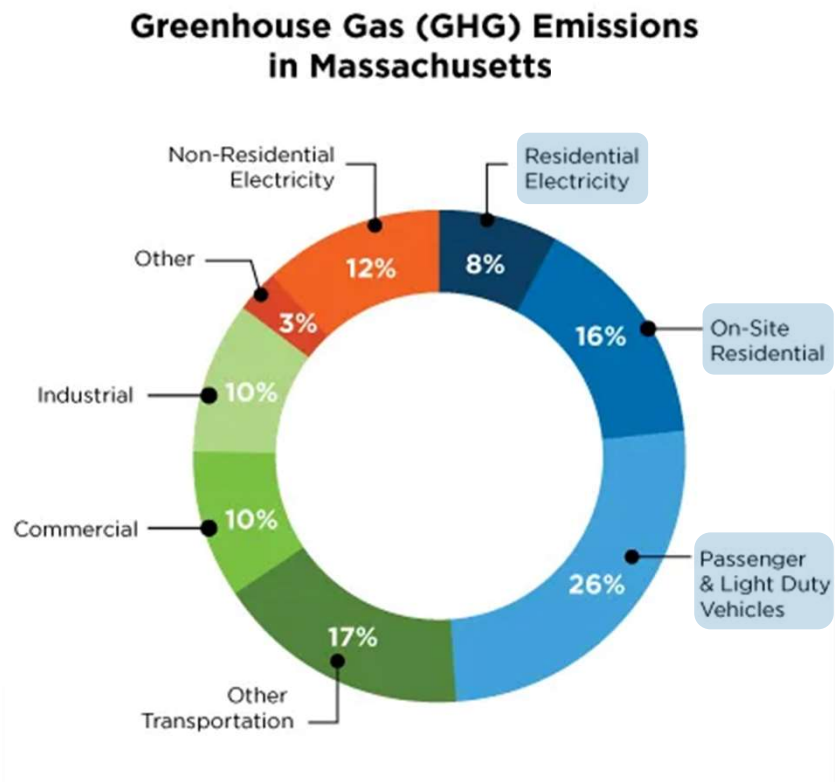


Why do we need to scale residential decarbonization?

Massachusetts has committed to significant greenhouse gas reduction goals.



Millions of individual residents need to adopt decarbonization solutions.



Source: MassEEA and MassCEC analysis of MassDEP 2017 Greenhouse Gas inventory data and EIA's State Energy data

What is residential decarbonization?

Energy Efficiency

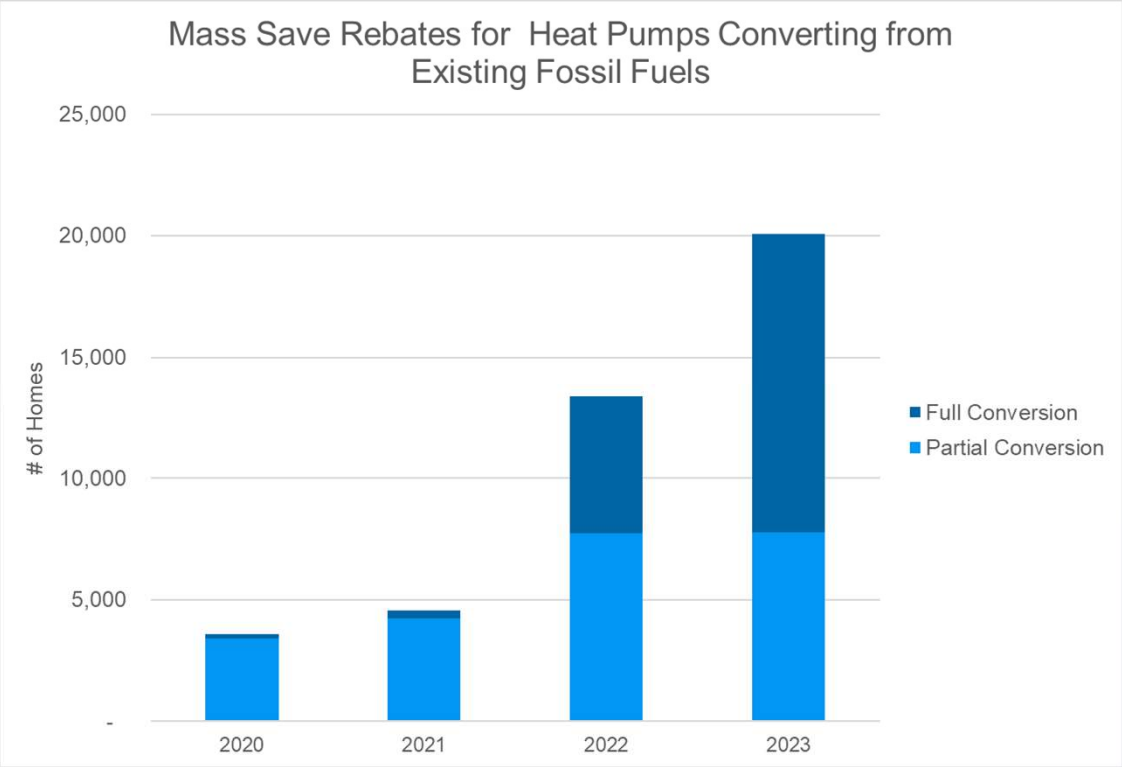
+

Electrification

+

Renewable Electricity

Pace of residential decarbonization needs to accelerate rapidly to hit goals.



- Massachusetts' heat pump goals:
  - 2020-2025: 100,000 homes
  - 2020-2030: 500,000 homes
- Adoption accelerating rapidly
- Adoption needs to find another gear to hit 2030 targets, while ensuring positive outcomes for residents.

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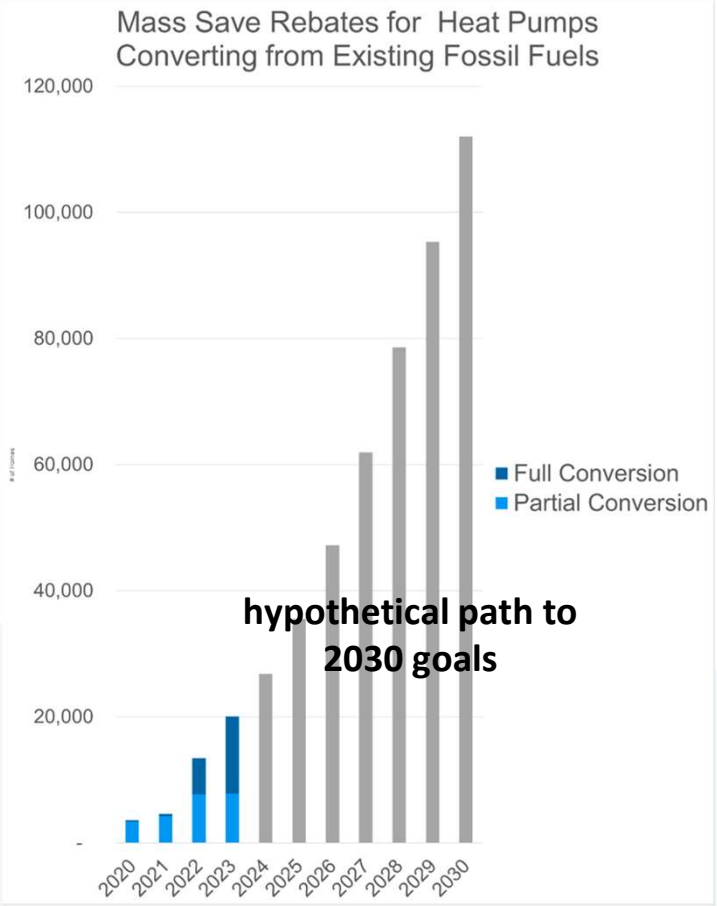

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Overview of MassCEC's residential decarbonization pilots

	Decarbonization Pathways	Triple Decker Retrofit Pilot
Building Type	Mostly single family, some two family	Triple deckers (3 units)
Target Outcome	Plan for full decarbonization with significant progress during the pilot	Full decarbonization during the pilot
Timeline	**Cohort 1: Started fall of 2022, focus of this presentation** Cohort 2: Started fall of 2023 Cohort 3: Planning now	Started accepting applications in 2022, but most projects are now in planning phase
Financial Incentives	<80% of SMI: $30k 80%-120% of SMI: $20k >120% of SMI: $10k	Affordable housing owners: $120k Market-rate owners: $70k
Technical Assistance	Abode provides generous technical assistance to the building owner, but does not act as a project manager or general contractor.	
Monitoring	Bill analysis & electrical metering	

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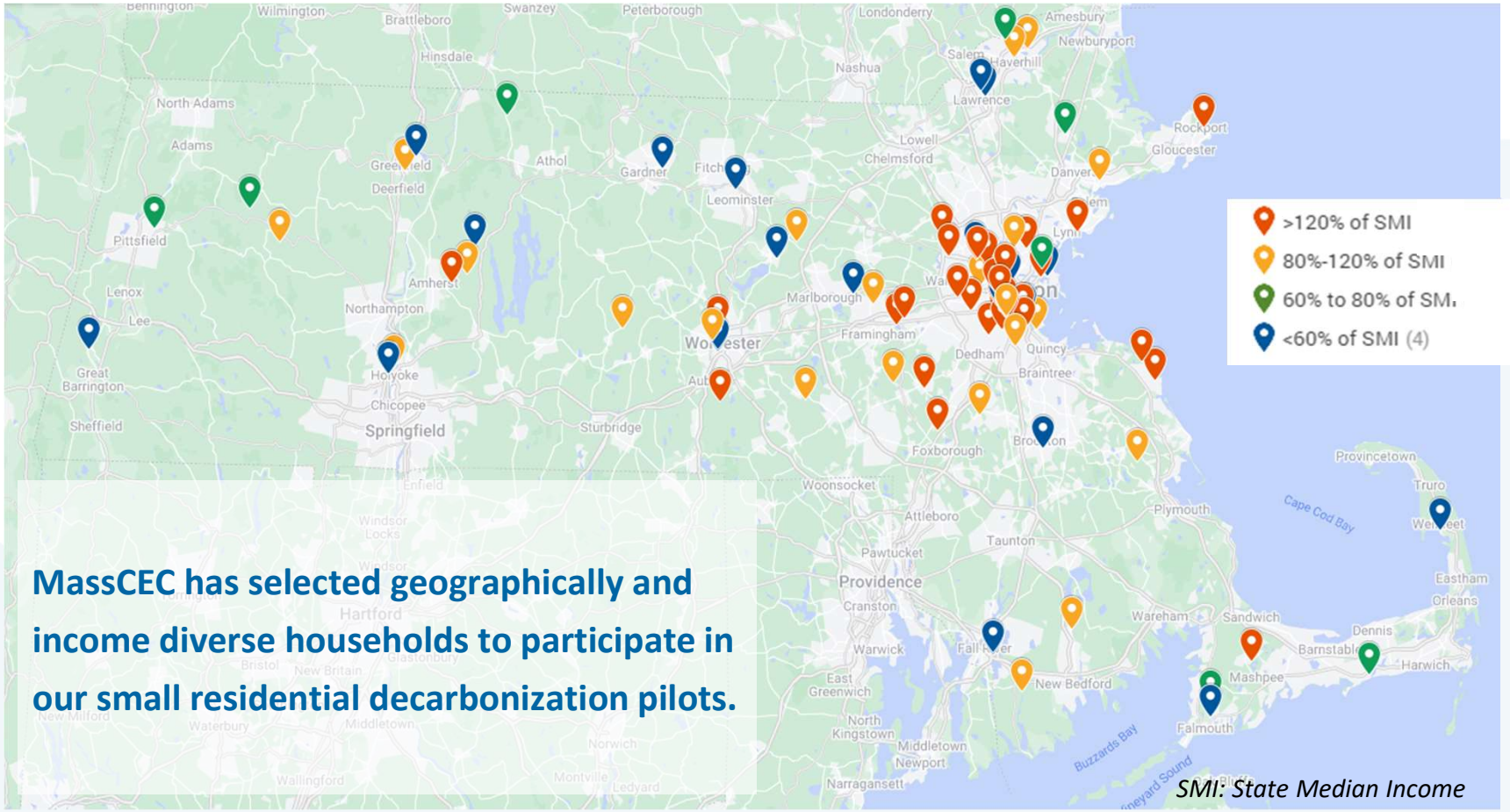
1 Alternative version. Thoughts?
Meg Howard, 3/18/2024

MassCEC is testing approaches to serve all MA residents.



MassCEC has selected geographically and income diverse households to participate in our small residential decarbonization pilots.

SMI: State Median Income

Pilot Goals & Outcomes

Create and Test Scalable Approach

Create and test a holistic approach to decarbonizing homes that could be scaled by Mass Save® and/or other entities.

- Does this approach get people to take action?
- Is it scalable?

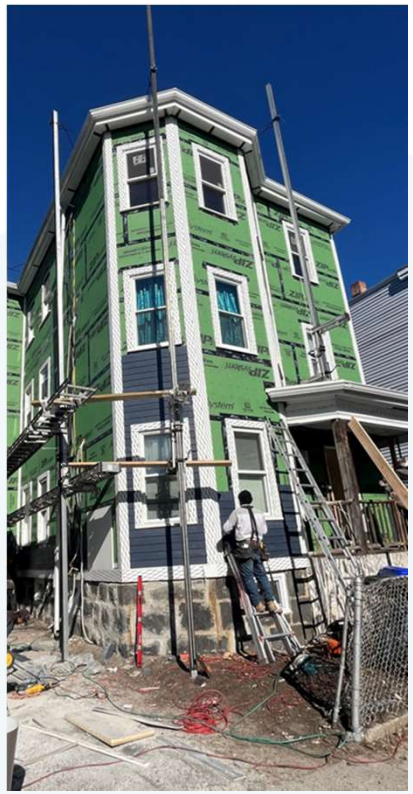
Collect Data

Collect data on costs, best practices, and performance of decarbonization measures.

- Feedback from participants and contractors
- Final report with case studies
- 2 years of bill analysis (as an addendum to final report)

Lessons Learned & Case Studies

Develop lessons learned, resources, and case studies to support homeowners, landlords, and contractors that are ready and able to decarbonize their buildings now.



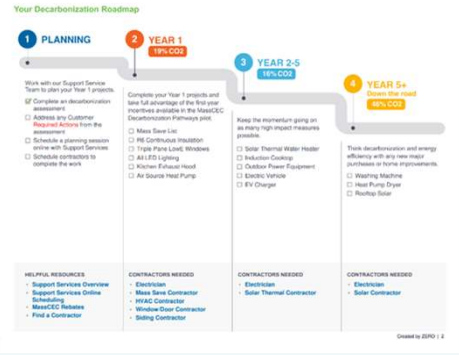
Decarbonization Pathways Participant Journey & Case Studies

Pilot Participant Journey

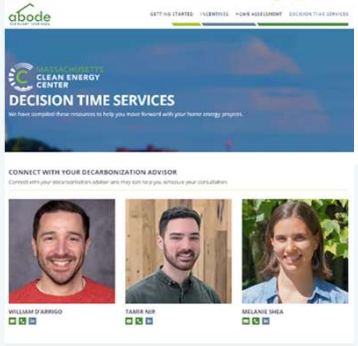
Decarbonization Assessment

Discuss Assessment & Participant Goals

Customized Report & Plan

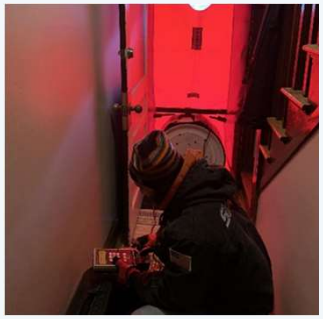


Decision Time Support



Project Implementation

Final Visit



Types of Decision Time Support

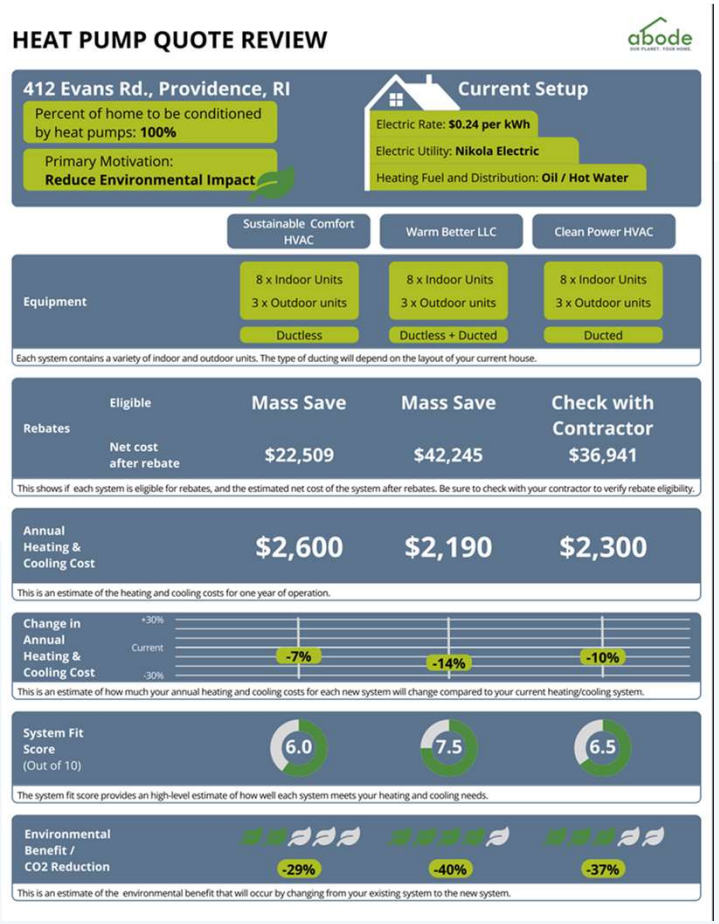
Average Time per Participant

Final Visit + Quality Assurance, 3 hours

Decision Time Support, 11 hours

Assessment, 4 hours

- Understanding their home
- Understanding technologies
- Planning/prioritizing/budgeting
- How to be their own GC
- Navigating marketplaces
- What to ask contractors
- Quote considerations beyond price
- Hand Holding through utility programs
- Manual Js
- Contractor engagement



Average Year-1 Costs by Income Group

	All Participants	<60% SMI	60-80% SMI	80-120% SMI	>120% SMI
Avg Total Cost	$52,996	$50,489	$41,826	$39,076	$64,703
Avg Net Cost to Owner	$19,716	$1,745	$2,501	$7,340	$36,861

- Net cost accounts for all federal, state, Mass Save, Mass CEC pilot incentives applied
- Low out of pockets costs for <120% SMI
- Participants focused on maximizing rebates
- Does not include the cost of solar PV or electric vehicles

Holyoke Case Study

Homeowner Focus: Climate Impact and Equipment End of Life

Home Overview

- Year built: 1920
- Area: 1645 square feet
- Starting Heating Fuel: Gas

Measures Implemented During the Pilot

- Mass Save insulation & air sealing
- Electrical service upgrade
- Ducted & ductless Air-source heat pump
- Heat pump water heater
- Kitchen hood/bath fan

Measures Planned for Later

- Solar PV (Years 2-4)
- Battery (5+)
- Heat pump dryer (Year 2-4)
- EV & Charger (Year 5+)

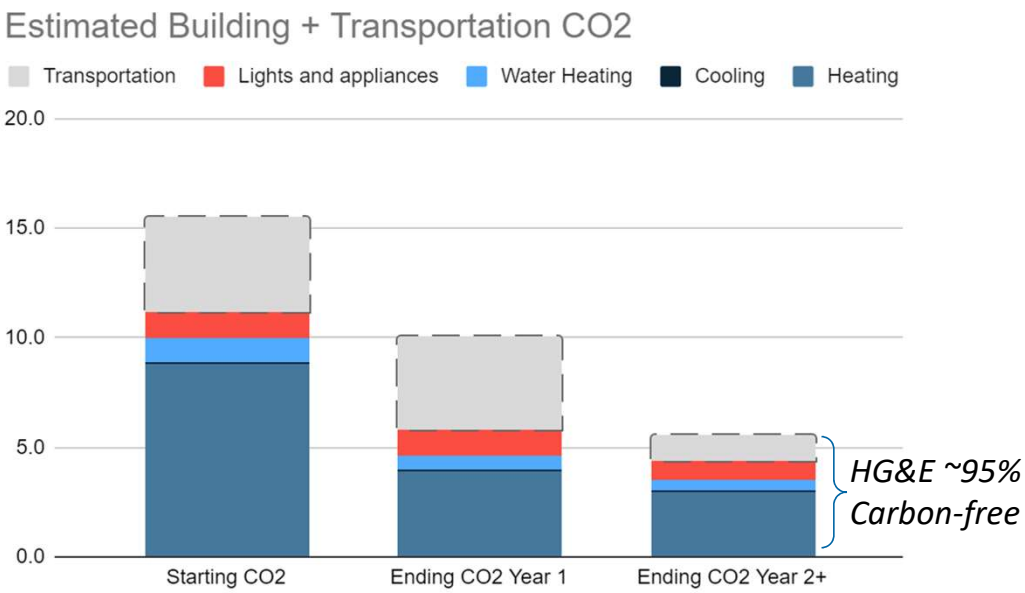
Challenges

- Original heat pump proposal was ~15% less efficient
- Ductless distribution was problematic for small rooms
- Added time navigating IE electric rate/fuel assistance

Successes

- Worked with the HVAC contractor to find better heat pump solution
- 40% air leakage reduction
- Essentially no out of pocket cost and lower operating cost

Holyoke Case Study Outcome



Total measure costs:	$32,660
Net cost without Mass CEC incentive:	$25,260
Net cost with Mass CEC incentive:	$38

Millis Case Study

Homeowner Focus: Climate Impact and Operating Cost

Home Overview

- Year built: 1965
- Area: 1600 square feet
- Starting Heating Fuel: Oil

Measures Implemented During the Pilot

- Mass Save wall insulation + mechanical room insulation
- Triple pane windows & new doors
- Ground-source heat pump
- Solar assisted heat pump water heater
- Community solar
- Attic mold remediation (pending)

Measures Planned for Later

- Electric panel upgrade
- Solar PV + Battery (Year 2-4)
- Heat pump dryer (Year 2-4)
- EV + Charger (Year 2-4)
- Kitchen hood (Year 2-4)

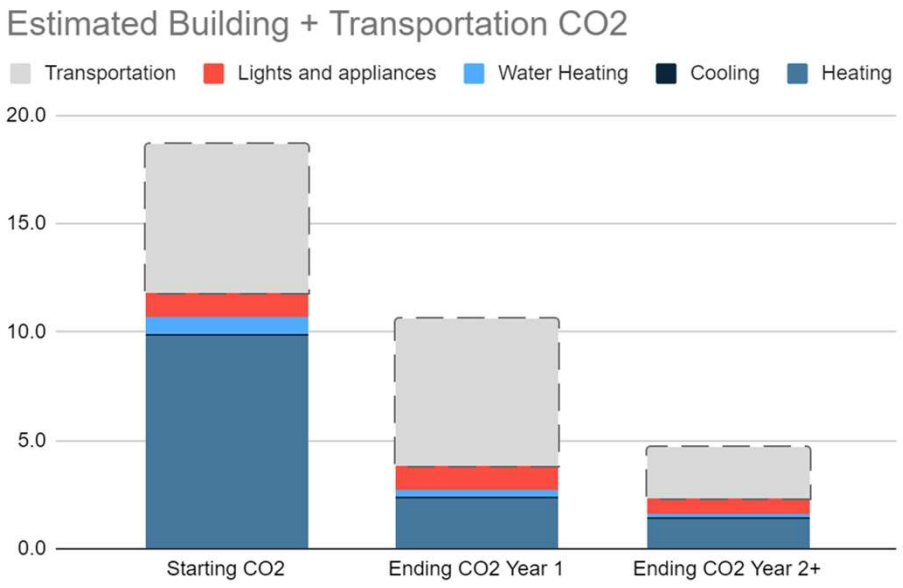
Challenges

- Budget pushed measures to year 2 (EV, charger, panel upgrade)
- Tax credits and rebates are not immediately available
- Aesthetics of solar PV and shading

Successes

- Extremely affordable geothermal project ($32K starting)
- Atypical equipment choices: GSHP and SAHP
- Deeper envelope (TP Windows, doors)
- On track to fully decarbonize

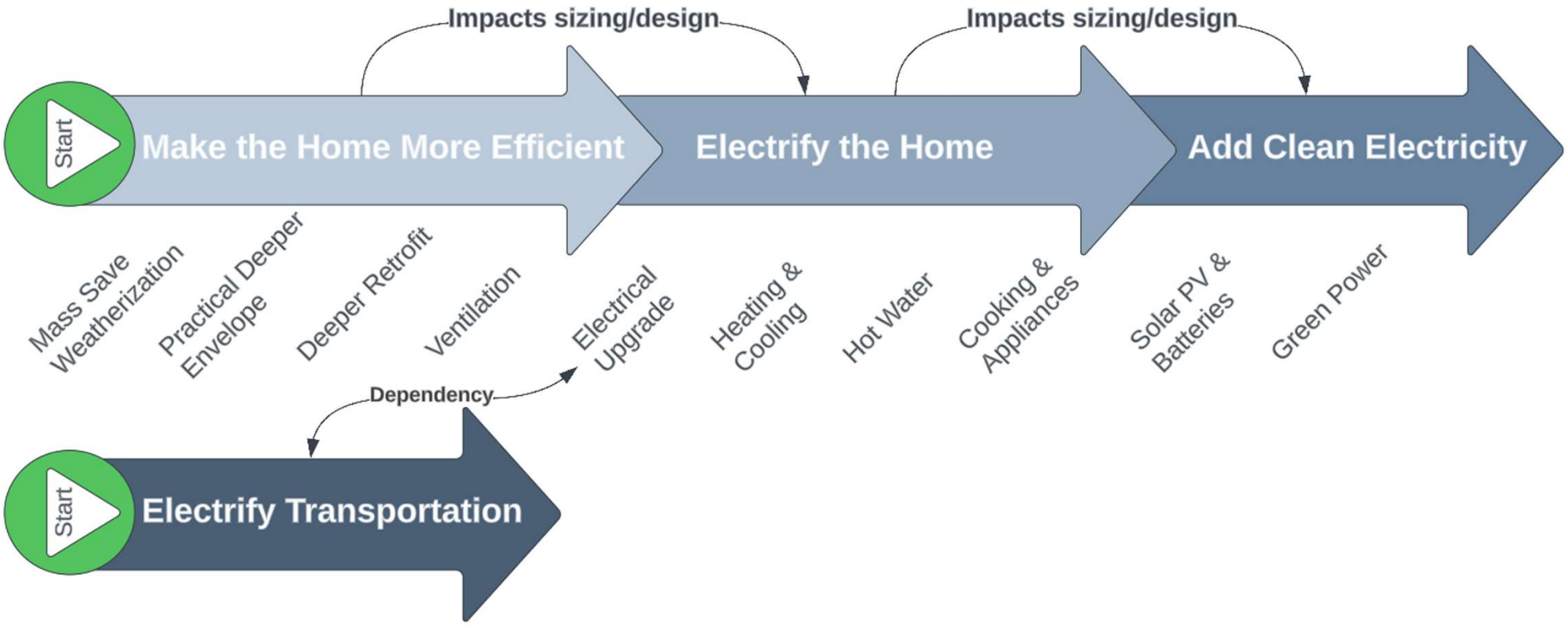
Millis Case Study Outcome



Total Measure Costs:	$65,853
Net Cost without MassCEC incentives:	$46,554
Net Cost to Homeowner:	$18,210

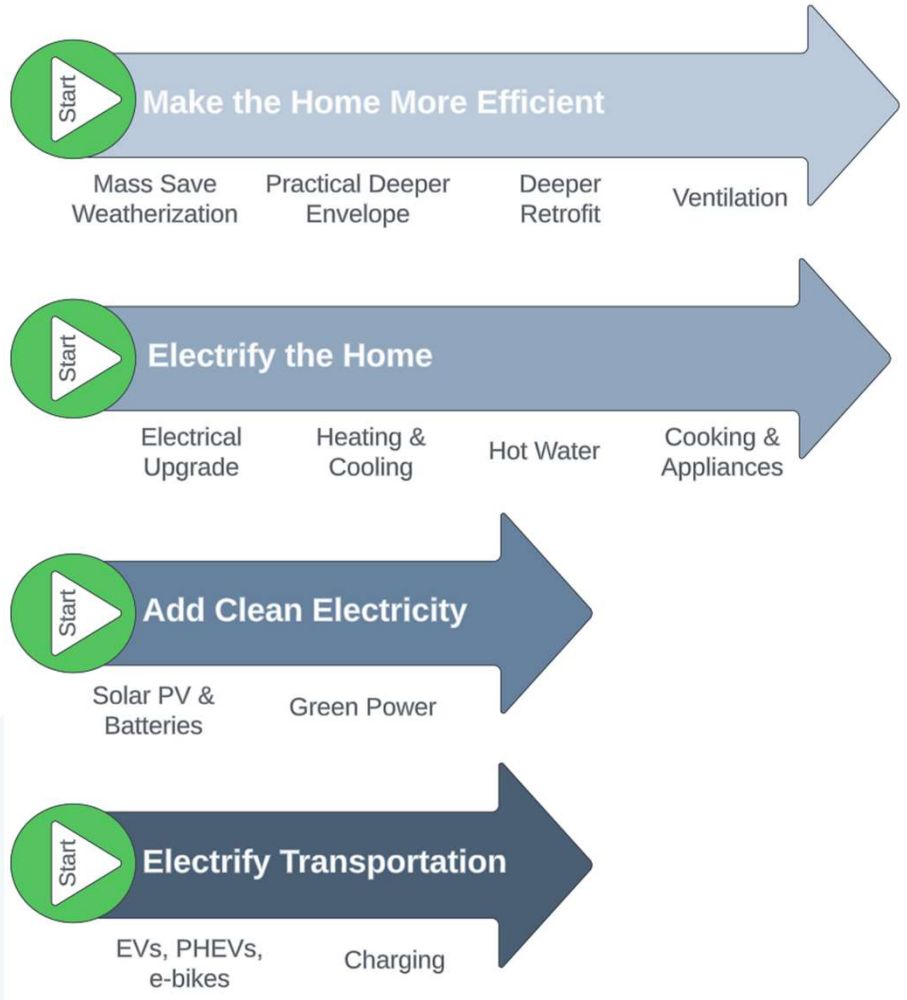
Lessons Learned

"Ideal Path" to Decarbonize
Optimizes for Operating Cost, Comfort, and Climate Impact



The Reality for Most Consumers Looks More Like This

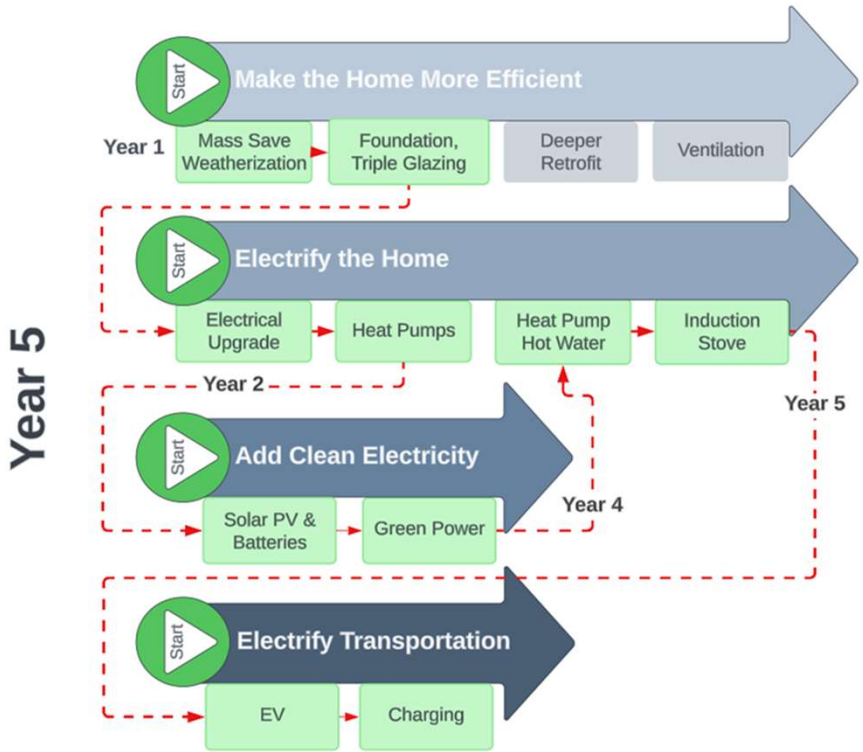
- **4 starting points - Often done out of order over multiple years**
- **Driven by**
  - Range in age of equipment
  - Budget/time constraints
  - Lack of decarbonization GCs
  - Different interests & levels of risk tolerance
- **Why it matters**
  - Major CO2 and comfort measures more easily skipped
  - More variability operating cost
  - Order can impact design/sizing (e.g. heat pumps, PV)
  - More difficult to maintain momentum



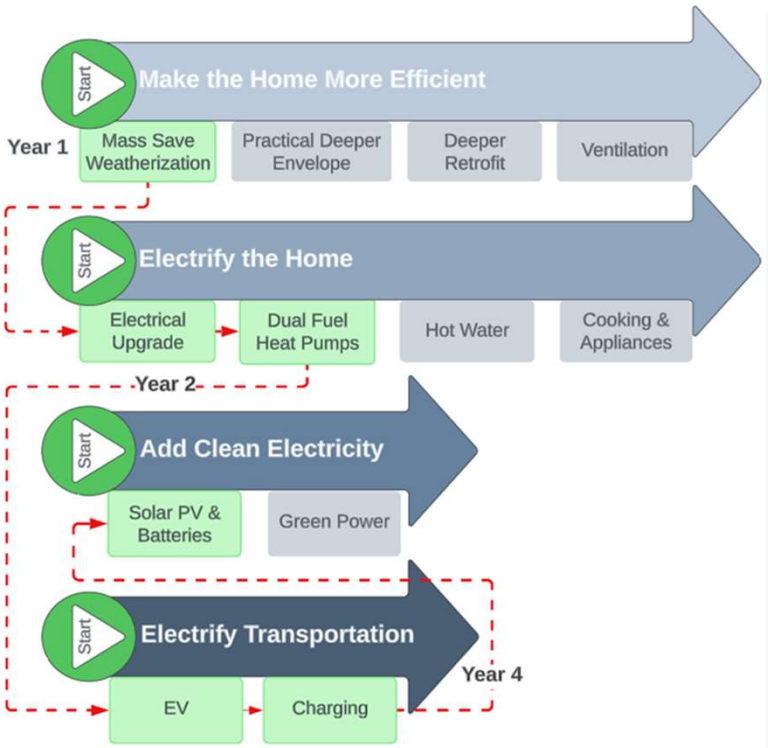
Same Example Home:
Different Pathways, Timelines and Outcomes

- *Siding and windows (10 years)*
- *Water heater (7 years)*
- *Cooking appliances (5 years)*
- *Car (2 years)*

Primarily Climate Focused Customer



Primarily Operating Cost Focused Customer



Lessons Learned and Program Strategies

Lessons Learned	An Effective Decarbonization Program:
1) Everyone needs education and a roadmap	• Maximizes simplicity & standardization • Identifies customer specific needs/trade-offs and sets expectations • Provides a comprehensive roadmap to decarbonize
2) Navigating the marketplace and taking action is complicated and challenging	• Provides technical support post-assessment • Guides customers through the more challenging marketplaces
3) Decarbonizing can take years and significant effort to maintain momentum	• Promotes “electrification ready” homes • Collects data & re-engages over time

Lessons Learned and Program Strategies

Lessons Learned	An Effective Decarbonization Program:
4) Decarbonization complexity increases for multi-family buildings	• Allocates more coordination time for owners and tenants • Promotes appropriate heat pump solutions
5) Many households have limited ability and/or willingness to pay for decarbonization	• Supports thoughtful over time approach • Provides added incentives/support for low and moderate income • Leverages other home-improvements for decarbonization
6) Phasing in deep envelope improvements is key to comfort & state climate goals	• Leverages other planned investments (siding, windows, remodels, etc.) • Incentivizes comprehensive approach in renovations

Slide 25

2 I think I would slightly reframe the lesson to be: "Deeper envelope improvements can be cost prohibitive, but are key to comfort & climate goals"

What do you think? I'm also ok with sticking with this wording.
Meg Howard, 3/17/2024

1 happy to discuss. That point would be true if we were talking about deep energy retrofits. Most of what we're talking about are off-menu Mass Save measures. Some are more expensive than others but so are heat pumps and solar. The lesson I planned to speak to is customers are focused on the interesting technologies (heat pumps/solar). When we introduce the value of deeper measures, it's a tough sell since it's less interesting. Once you layer on the unexpectedly high cost of heat pumps and other technologies, it means deeper envelope is first to go., There's also the timing component of making deeper envelope an incremental cost on something you already plan to do which ties to the strategies on the right.
Mike Ostiguy, 3/17/2024

Proposal for Next Pilot Cohort

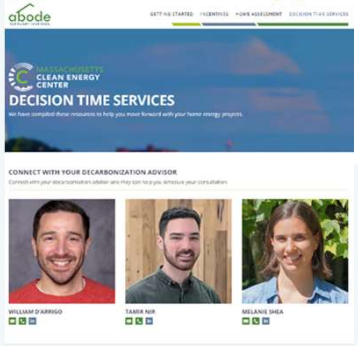
Pilot Participant Journey

Decarbonization Assessment

Discuss Assessment & Participant Goals

Customized Report & Plan

Decision Time Support



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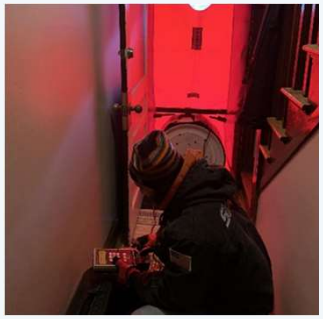
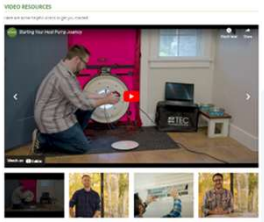


Testing a New Approach

Participants selected based on requesting a Mass Save home energy assessment.

Decarbonization "Lite" Assessment

Summary of Decarbonization Opportunity & Educational Content



Some participants may opt not to engage further with the pilot.

Participants may opt into a Virtual Decarbonization Consultation & Decision Time support.

Questions?