Agenda

» Background

» Market segmentation analysis

» Key findings & customer insights analysis
CNCA: Bringing Renewable Thermal Solutions to New England Cities

Project Team Members

**Sponsor:** Carbon Neutral Cities Alliance

**Participating Cities:** Boston (lead), Northampton, Portland (ME), Providence, Somerville

**Observing Cities:** Cambridge, South Portland

**Partners:** UMass Clean Energy Extension, RI Office of Energy Resources

**Technical Assistance Providers:** Meister Consultants Group (w/ MacWilliams Sanders Communication)
Accelerating deployment of CH&C technologies in cities
Challenges faced by policymakers in building off of lessons learned from other sectors

» Policymakers seek to build off of lessons learned from growing the renewable electricity sector (esp. solar)
  › E.g. incentives, portfolio standards, cost reduction, community-based purchasing campaigns

» ...but CH&C is also fundamentally different from solar and other renewables
  › More complicated
  › Lower public awareness
  › Established existing supply chain
  › Customer acquisition pathway
  › Margins and pricing
What best practices can be carried over from the electricity sector? And how should they be modified to address CH&C?

Key CNCA Project Questions

- How can best practices from community purchasing campaigns best be applied to CH&C?
- What tools can improve city outreach efforts and improve the success of CH&C campaigns?
- How can cities leverage their position and strengths to complement state-level actions?
The CNCA project provides comprehensive technical assistance to support city-led CH&C campaigns

- Host and facilitate regional stakeholder convening
- Discuss experiences with CH&C relevant to campaign design
- Develop preliminary campaign outlines

- Provide comprehensive technical assistance to support campaign design and implementation at each of the five cities

- Identify high-potential prospects for CH&C adoption in each city
- Interview high-potential prospects
- Assess soft cost reduction opportunities for CH&C

- Survey campaign participants
- Develop final report
- Disseminate lessons learned via CNCA webinars
Agenda

» Background and CNCA project introduction

» Market segmentation analysis

» Key findings & customer insights analysis
Goal of the market analysis

» **Challenge**: Not every home is a good candidate for RH&C conversion.
  
  › And it’s not as easy as using a LIDAR map to provide a quick assessment...

» Homes may be poor candidates because...

  › RH&C is uneconomic compared to current gas heat
  › Installations are challenging in rental or multifamily units
  › Current heating distribution system may be challenging for RH&C installation
  › Customers may have recently invested in central AC or a new heating system
  › Specific building attributes may be unfavorable for a given technology (e.g. a small yard for GSHP)

» (And even if a home is a good candidate, what motivates the homeowner?)
Market analysis: approach

» **Approach:** A household-level market segmentation analysis that maps out CH&C potential and identifies priority targets

» Data sources for this analysis include:
  › Municipal tax assessor databases
  › Municipal building permitting databases
  › Neighborhood-level demographic information from the US Census
  › Other analyses completed by cities (e.g. EnerScore)
  › Municipal GIS parcel + neighborhood shapefiles

» CH&C technologies included: MassCEC CH&C Program technologies (ASHP, GSHP, SHW, pellet heating) + heat pump water heaters
  › ASHP treated differently depending on ducted vs ductless

» Limited to 1-4 family residential stock in each city
Market analysis: goal and deliverables

» **Goal**: A ranked index of CH&C suitability at the building level for each city and technology of interest, to be used as a resource in campaign planning and implementation.

  › Include different weightings for “building criteria-only” index, as well as “likely adopter” and “equity-focused” demographics

  › Provide indices with range of GIS maps and shapefiles to each city
Using tax assessor data

Data Limitations
Tax assessor data is imperfect and data quality issues may exist. However, this is the most comprehensive household-level information available from which to assess RH&C Potential.
Building classification

Geographic Distribution of Single Family and Small (2-4 Unit) Multifamily Buildings
Boston, MA
Current heating fuel

Geographic Distribution of Residential Heating Fuels
Northampton, MA
Access to gas heat

Proximity to Natural Gas Infrastructure
Portland, ME
Owner lives in building

Distribution of Owner-Occupied Residential Buildings
Providence, RI
Developing a suitability index
Rank each building criteria

Example ranking for Heating Distribution Type

<table>
<thead>
<tr>
<th>Current Heating System</th>
<th>ASHP, Central</th>
<th>ASHP, Ductless</th>
<th>GSHP</th>
<th>Pellet Boiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Baseboard</td>
<td>-</td>
<td>High</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Floor Furnace</td>
<td>-</td>
<td>High</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Forced Air</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Hot Water/Hydronic</td>
<td>-</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Radiant</td>
<td>-</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Steam</td>
<td>-</td>
<td>High</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hydro-air</td>
<td>-</td>
<td>High</td>
<td>-</td>
<td>High</td>
</tr>
</tbody>
</table>

*Rankings developed in consultation with technology installers*
Developing a suitability index
Weight criteria rankings based on technology and index approach

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ductless ASHP</td>
</tr>
<tr>
<td>Fuel Type</td>
<td>+++</td>
</tr>
<tr>
<td>Heat Distribution Type</td>
<td>+++</td>
</tr>
<tr>
<td>Prox. To Gas Lines</td>
<td>+</td>
</tr>
<tr>
<td>Build/Heat Replacement Year</td>
<td>+</td>
</tr>
<tr>
<td>AC (Y/N)</td>
<td>++</td>
</tr>
<tr>
<td>House Type (SF/MF)</td>
<td>+++</td>
</tr>
<tr>
<td>Lot Size (acres)</td>
<td>-</td>
</tr>
<tr>
<td>Living Area (ft²)</td>
<td>-</td>
</tr>
<tr>
<td>Stories</td>
<td>++</td>
</tr>
<tr>
<td>Average room size</td>
<td>++</td>
</tr>
<tr>
<td>Basement (Y/N)</td>
<td>-</td>
</tr>
<tr>
<td># Relevant Fields</td>
<td>10</td>
</tr>
</tbody>
</table>

Criteria are weighted differently for each technology, with the number of + signs indicating level of influence (i.e. + indicates low weight, ++ medium weight, +++ high weight, - no weight).
### Distribution of suitability scores:

<table>
<thead>
<tr>
<th>Index Range</th>
<th>Parcel Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 – 1.0</td>
<td>3,286</td>
</tr>
<tr>
<td>1.0 – 2.0</td>
<td>2,886</td>
</tr>
<tr>
<td>2.0 – 2.5</td>
<td>4,169</td>
</tr>
<tr>
<td>2.5 – 3.0</td>
<td>394</td>
</tr>
</tbody>
</table>

- i.e. Renters, unsuitable criteria
Site Suitability of Ductless ASHPs (Building Criteria Only)
Somerville, MA
Refining the target market

» Demographics are also valuable for targeting individual homeowners

» Two possible approaches:

  › **Targeting Likely Adopters**, emphasizing owner-occupied parcels and high-income neighborhoods (>$60,000)

  › **An Equity-Focused Approach**, specifically targeting low- & moderate-income neighborhoods (<$60,000), including renters
Ductless ASHP – Likely Adopters (Somerville example)

Distribution of suitability scores:

<table>
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<tr>
<th>Index Range</th>
<th>Parcel Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 – 1.0</td>
<td>4,585</td>
</tr>
<tr>
<td>1.0 – 2.0</td>
<td>2,057</td>
</tr>
<tr>
<td>2.0 – 2.5</td>
<td>3,746</td>
</tr>
<tr>
<td>2.5 – 3.0</td>
<td>347</td>
</tr>
</tbody>
</table>

i.e. Renters, low-income, unsuitable homes
Ductless ASHP – Likely Adopters (Somerville example)

Site Suitability of Ductless ASHPs Among Likely Adopters
Somerville, MA
Ductless ASHP – Equity Approach (Somerville example)

Distribution of suitability scores:

<table>
<thead>
<tr>
<th>Index Range</th>
<th>Parcel Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 – 1.0</td>
<td>8,345</td>
</tr>
<tr>
<td>1.0 – 2.0</td>
<td>529</td>
</tr>
<tr>
<td>2.0 – 2.5</td>
<td>1,570</td>
</tr>
<tr>
<td>2.5 – 3.0</td>
<td>291</td>
</tr>
</tbody>
</table>

High-income, unsuitable homes
Ductless ASHP – Equity Approach (Somerville example)

Site Suitability of Ductless ASHPs Among Likely Adopters
Somerville, MA
Limitations of the analysis

» **Economics.** Heating fuels included, but a customer’s expected energy savings will vary much more widely than can be assessed at this level

» **Data reliability**
  › Could be improved through utility data (significant limitations)

» **Not a substitute for a walkthrough**

» **Can’t predict customer behavior**
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How can key findings support city CH&C planning?

» **Assessment of building suitability**

» Identify clusters of high-potential homes

» Direct targeted outreach (e.g. mailers, IP/geo-targeting)

» Partnerships with contractors?

» Interview “high-potential” customers
How can key findings support city CH&C planning?

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» Partnerships with contractors?

» Interview “high-potential” customers
Customer insights analysis

» Conducting interviews from a sample of residents
  › Focused on ASHP (given suitability score + interest from city leads)

» Select from 5,000 of high-scoring homeowners
  › Selected some homeowners who may have homes that are less ideal

» Test messaging and statements, ask questions

» Provide findings to cities to inform refinement of outreach messaging
Thank you!

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