MassCEC VRF Program: Lessons Learned from 2 Years in the Field

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Peter McPhee
Director, Clean Heating & Cooling
pmcphee@masscec.com
MassCEC VRF Program Snapshot

- **Program Goal:** Develop VRF industry and market to decarbonize heating in commercial buildings
- **Launched May 2017**
- **Program ending imminently due to funding limitations**
- **Looking to share lessons learned and best practices with utilities, other states**

### MassCEC VRF Program Stats

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Projects</td>
<td>107</td>
</tr>
<tr>
<td>Total Awards</td>
<td>$5,995,000</td>
</tr>
<tr>
<td>Average Capacity</td>
<td>585 MBH</td>
</tr>
<tr>
<td>Cost (50&lt;sup&gt;th&lt;/sup&gt; Percentile)</td>
<td>$695/MBH (heating)</td>
</tr>
<tr>
<td>Cost (25&lt;sup&gt;th&lt;/sup&gt; Percentile)</td>
<td>$589/MBH (heating)</td>
</tr>
<tr>
<td>Rebate as % of Costs</td>
<td>15-20%</td>
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**Takeaway 1:** VRF is a viable, broadly applicable low-carbon heating solution for commercial buildings.

### Market Advantages
- Market demand exists today
- Industry supply chain is robust
- Technology is advanced

### Market Challenges
- Public, building industry awareness is low
- Contractor experience is low

### Market Development Progress
- Rate of deployment insufficient to meet state GHG goals
- Need VRF to be an option now for all building remodels/NC going forward
- Technology, performance, and awareness will only improve

#### MA GHG Emissions
- Transportation: 10.1%
- Electricity: 9.5%
- Residential: 15.5%
- Commercial: 19.8%
- Industrial: 42.7%

#### Factors for technology success

<table>
<thead>
<tr>
<th>Factors for technology success</th>
<th>VRF Status</th>
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</thead>
<tbody>
<tr>
<td>Consumer and Industry Awareness</td>
<td>Low/Moderate</td>
</tr>
<tr>
<td>Cost-Effective vs. Alternatives</td>
<td>Varies</td>
</tr>
<tr>
<td>Reputation for Efficiency, Reliability</td>
<td>Moderate/Need More data</td>
</tr>
<tr>
<td>Attractive Business Opportunity</td>
<td>Yes</td>
</tr>
<tr>
<td>Limited Implementation Hurdles</td>
<td>Yes</td>
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</tbody>
</table>
Takeaway 2: VRF is new and complex

VRF requires different project design thinking
- Similar challenges as residential ASHPs, including performance dependent on precise indoor/outdoor sizing, proper installation.

Different consumer motivations for VRF
- Operational cost savings, upfront cost savings, A/C, increased comfort, space savings, outdoor aesthetics, air quality, carbon.

Cost savings depend on application
- Operational cost savings for cooling and when offsetting higher-cost heating fuels. Upfront cost savings possible.

Engaging in project development cycle is complicated
- Typically fuel switching
- Primarily stand-alone heating system and not FF displacement
- Most installs occur during building remodels or new construction
- Many companies involved, with different interests and influence
Takeaway 3: Incentivizing VRF is complicated, but worth it!

**Incentives help establish industry best practices**
- Require standards of quality be implemented (e.g. appropriate refrigerant charging, sizing relative to loads)
- Promote bundling of weatherization and on-site renewables

**Incentivizing VRF is fundamentally different from other EE**
- Most EE technologies offer operational savings at increased upfront cost
- When replacing natural gas in New England, VRF delivers energy and GHG savings with increased operational costs and sometimes marginal/lower upfront installation costs
- Because of exceptional GHG/energy benefits, VRF required an adjustment to our thinking on incentive design

**At beginning of long path of heating electrification/decarbonization**
- MA Comprehensive Energy Plan calls for 100,000s heat pumps by 2030
- Regional collaboration will help ensure we’re doing this right