Massachusetts Renewable Thermal Webinar

August 15, 2012

Welcome! We will begin shortly...
Agenda

- History and policy development overview
  - Dwayne Breger – Massachusetts Department of Energy Resources

- Renewable Heating and Cooling Opportunities & Impacts Report
  - Neil Veilleux – Meister Consultants Group

- MassCEC/DOER Renewable Thermal Pilot Programs
  - Christie Howe - MassCEC
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US Primary Energy Consumption

Source: New England Wood Pellet, LLC, based on US EIA data

Thermal/Other Primary Energy Use By Sector

- Residential: 20%
- Commercial: 12%
- Industrial: 68%
STATE RENEWABLE ELECTRICITY POLICIES

RPS Policies
www.dsireusa.org / January 2012

- WA: 15% x 2020*
- MT: 15% x 2015
- MN: 25% x 2025 (Xcel: 30% x 2020)
- ND: 10% x 2015
- SD: 10% x 2015
- WI: Varies by utility; ~10% x 2015 statewide
- MI: 10% & 1,100 MW x 2015*
- OH: 25% x 2025†
- AZ: 15% x 2025
- NM: 20% x 2020 (IOUs)
- CA: 33% x 2020
- TX: 5,880 MW x 2015
- HI: 40% x 2030
- OR: 25% x 2025 (large utilities)*
- 5% - 10% x 2025 (smaller utilities)
- CO: 30% by 2020 (IOUs)
- 10% by 2020 (co-ops & large munis)*
- KS: 20% x 2020
- MO: 15% x 2021
- OK: 15% x 2015
- NV: 25% x 2025†
- UT: 20% by 2025*
- KY: 20% x 2020
- IN: 15% x 2025†
- WV: 25% x 2025†
- VA: 15% x 2025*
- NC: 12.5% x 2021 (IOUs)
- 10% x 2018 (co-ops & munis)
- VT: (1) RE meets any increase in retail sales x 2012; (2) 20% RE & CHP x 2017
- ME: 30% x 2000
- New RE: 10% x 2017
- NH: 23.8% x 2025
- MA: 22.1% x 2020
- New RE: 15% x 2020 (+1% annually thereafter)
- RI: 16% x 2020
- CT: 27% x 2020
- PA: ~18% x 2021†
- NJ: 20.38% RE x 2021 + 5,316 GWh solar x 2026
- MD: 20% x 2022
- DE: 25% x 2026*
- DC: 20% x 2020
- PR: 20% x 2035

29 states + DC and PR have an RPS
(8 states have goals)
Integrated policy support for renewable thermal technologies?
Renewable Thermal Benefits

- Economic Growth
- Job Creation
- Reduction of Greenhouse Gas (GHG) emissions
- Improved Energy Security

In 2008, an average MA household spent about:

- Gasoline: $2,200
- Electricity: $1,300
- Space & Water Heating: $1,700

Source: Massachusetts Clean Energy & Climate Plan for 2020
Emerging US RE Heating Policy

- **Federal**
  - REAP Act: PTC for non-electrical RE
  - SHW included in federal RPS proposal
  - Biomass stoves get 30% federal tax credit

- **States considering or having some or all RE thermal in RPS:**
  - NH: carve-out for all thermal technologies in RPS as of 1/1/2013
  - AZ, NV, UT, TX, KS, WI, NC

- **Hawaii** passes solar heating mandate

- **Minnesota** considering legislation to allow utilities to offer rebates for renewable heating (HF 2159)
European approach

- EU: targets and link to building energy performance
- Germany
  - Integrated framework of targets, grants
  - Bonus for combinations of technologies, efficiency
- United Kingdom
  - Renewable Heating Incentive
    - Metering
- Austria (Upper Austria)
  - Solar Hot Water is strategic objective
  - Grants, building regulations, promotion
Renewable Thermal Development in MA

- Global Warming Solutions Act
  - Commits MA to GHG reductions of 25% below 1990 levels by 2020 and 80% below 1990 levels by 2050

- Massachusetts Clean Energy and Climate Plan for 2020
  - Renewable thermal technologies to displace 2 million tons of GHG emissions, or ~2% of total 1990 emissions
  - DOER/CEC commissioned renewable heating and cooling market analysis (published April 2012)

- Energy Bill (S2395, July 2012)
  - Study useful thermal in the Alternative Portfolio Standard
Incentive programs

- Commonwealth Solar Hot Water Programs ($10m)
- ARRA funds: biomass thermal pilots and business transformation (Sandri)
- Alternative Compliance Payment funds from RPS programs
  - Renewable thermal and cogeneration at public housing ($2m)
  - Renewable thermal pilots ($6m)
  - Thermal Business Investment Financing ($3m)
- DOE State Energy Projects
  - Renewable thermal retrofits in public housing and schools ($715k)
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RH&C Opportunities & Impacts Study

- Commissioned by Mass Department of Energy Resources (DOER) and Mass Clean Energy Center (MassCEC)

- Project Team
  - Meister Consultants Group
  - Regional and national renewable thermal professional and business associations (BTEC, NEGPA, MOC, SEBANE)

- Current market status and supply chain
- Market barriers and potential
- Lifecycle cost assessment and simple payback
- GHG emissions and job creation potential
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>RH&amp;C Technology</th>
<th>Fossil Fuel Heating Replaced</th>
<th>Cooling Load Included?</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSHP (elec + cooling)</td>
<td>Ground-source heat pump</td>
<td>Electricity</td>
<td>Yes (commercial only)</td>
</tr>
<tr>
<td>GSHP (FO + cooling)</td>
<td>Ground-source heat pump</td>
<td>Fuel Oil</td>
<td>Yes (commercial only)</td>
</tr>
<tr>
<td>GSHP (NG + cooling)</td>
<td>Ground-source heat pump</td>
<td>Natural Gas</td>
<td>Yes (commercial only)</td>
</tr>
<tr>
<td>Pellets (elec)</td>
<td>Biomass Heating Pellets</td>
<td>Electricity</td>
<td>No</td>
</tr>
<tr>
<td>SHW (elec)</td>
<td>Solar Hot Water</td>
<td>Electricity</td>
<td>No</td>
</tr>
<tr>
<td>B5 (elec)</td>
<td>Biodiesel (5% blend)</td>
<td>Electricity</td>
<td>No</td>
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<td>SHW (FO)</td>
<td>Solar Hot Water</td>
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GHG reductions & lifecycle costs (or savings) for **residential** renewable thermal systems in MA

- **GSHP (Elec)**
- **Pellets (Elec)**
- **SHW (Elec)**
- **B5 (Elec)**
- **SHW (FO)**
- **GSHP (FO)**
- **Pellets (FO)**
- **SHW (NG)**
- **GSHP (NG)**
- **Pellets (NG)**
- **B5 (FO)**
RH&C Study – Commercial Results

GHG reductions & lifecycle costs (or savings) for commercial renewable thermal systems in MA
Example: Residential Biomass Thermal System Costs

[Graph showing the installed cost and system size of various systems, with data points for each system labeled from B1 to B23.]
Example: Residential Biomass Thermal Payback

Assumptions:
• ~$21,000 for a 13 kWth system (44,000 BTU/hr)
• Fossil fuel back-up system in place
Example: Residential Biomass Thermal GHG Emission (Reductions)

<table>
<thead>
<tr>
<th>Fuel Source</th>
<th>Electricity</th>
<th>No. 2 Fuel Oil (High-Efficiency Boiler)</th>
<th>Natural Gas (High-Efficiency Boiler)</th>
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<tbody>
<tr>
<td>Fossil fuel emissions</td>
<td>21</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Biomass emissions (100% thinnings)</td>
<td>10</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Biomass emissions (50% residue, 50% thinnings)</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Biomass emissions (100% residue)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
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Massachusetts – Next Steps

- Study is important foundation
  - MA businesses and stakeholders can evaluate market opportunities
  - Policymakers can assess policy and programmatic needs and options to efficiently stimulate renewable thermal market

- DOER leading next steps
  - Discuss study’s findings with stakeholders and the public
  - Developing renewable thermal pilots with MassCEC
MassCEC/DOER
Renewable Energy Thermal Pilot Programs

- Solar Hot Water
- Biomass Heating Systems (with MassDEP)
  - Residential Whole House Automated Pellet Boilers
  - Woodstove and Outdoor Hydronic Heaters Replacements
  - Commercial Scale Pellet Boiler Systems
    - Focus on Public Schools, Public Buildings, Greenhouses
- Thermal Air- and Ground- Source Heat Pumps
  - Residential and Commercial Scale
- District Energy Project Support
  - Preferred projects utilize Biomass or Heat Pump technologies
- Suite of programs approved by MassCEC Board, June 2012
- Funded by Renewable Energy Trust Fund & FY2010 Alternative Compliance Payments
Program Goals and Benefits

- Increase public awareness of renewable thermal technologies
- Reduce the up-front costs for renewable thermal technologies
- Address concerns about installation quality and performance by creating a well-qualified installer base through inspections and training
- Develop the renewable thermal market supply chain
- Collect baseline data for over 500 renewable thermal systems
  - Consumer demand, installer base, installation costs, actual performance
- Establish goals for larger renewable thermal programs or policy decisions based on assessment of pilot performance
Solar Hot Water Pilot Programs

- Commonwealth Solar Hot Water Pilot Program
  - Awarded 320 residential & commercial-scale solar hot water systems $534,697 in construction rebates
    - Totaling almost 2 MW in thermal capacity
  - Awarded 38 commercial-scale solar hot water feasibility studies
  - 55 participating solar thermal installation companies
  - Monitoring performance of 46 projects

- Low Income Solar Thermal
  - Fully funded 16 large-scale systems (16,784 sq ft in collectors)
    - >$1.6 million in total project costs
CSHW Pilot Program Summary Results

Residential Fuel After SHW Installation
- Oil: 140
- Natural Gas: 71
- Electric: 73
- Propane: 3
- Other: 48

System Use
- Combination: 16%
- Domestic Water Heating: 84%

Collector Type
- Evacuated Tube: 10%
- Flat Plate: 90%

Awarded Solar Hot Water Projects by County

Bar graph showing the number of projects awarded by county:
New Commonwealth Solar Hot Water Program

- $10 million over next 4.5 years through end of 2016
  - $1.5 million budget for FY13 (July 2012 – June 2013)
- For any residential, multi-family or commercial building
  - Displace ANY fuel type
- Feasibility Study Grants (commercial-scale only)
  - Help building owners assess the potential benefits of installing a solar thermal system
- Construction Rebates
  - Help system owners with the upfront capital costs of installing the solar thermal system

www.MassCEC.com/SolarHotWater
## Proposed Program Budget: Biomass Whole Building Heating Systems

<table>
<thead>
<tr>
<th>Category</th>
<th>Type of Grant</th>
<th>Estimated # of Grants</th>
<th>Estimated Total Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Whole House Pellet Boilers</td>
<td>First-come, First-served</td>
<td>40-50</td>
<td>~$500k</td>
</tr>
<tr>
<td>Woodstove Replacement</td>
<td>First-come, First-served</td>
<td>50</td>
<td>$100k</td>
</tr>
<tr>
<td>Outdoor Boiler Replacement</td>
<td>First-come, First-served</td>
<td>15</td>
<td>$150k</td>
</tr>
<tr>
<td>Commercial Scale Pellet Boilers</td>
<td>Competitive</td>
<td>4-8</td>
<td>~$1.5m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>~$2,000,000</td>
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## Proposed Program Budget:
### Ground- and Air-Source Heat Pumps

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<td>First-come, First-served</td>
<td>30-40</td>
<td>$500k</td>
</tr>
<tr>
<td>Residential Air Source Heat Pumps</td>
<td>First-come, First-served</td>
<td>55</td>
<td>$400k</td>
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<tr>
<td>Commercial Scale Ground Source Heat Pumps</td>
<td>Competitive</td>
<td>2-4</td>
<td>$1.1m</td>
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**Total Budget:** $2,000,000
## Proposed Program Budget: District Energy Projects

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<td>District Energy Project Support</td>
<td>Competitive</td>
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<td>$2,000,000</td>
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Thank you!

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