



Clean Heating & Cooling in Massachusetts

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Josh Kessler

Project Manager – Clean Heating & Cooling

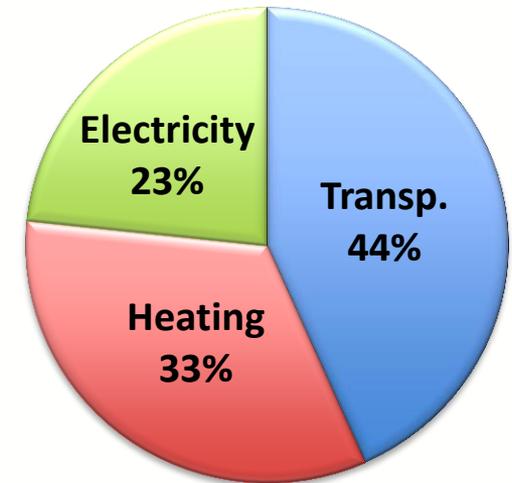
MassCEC's Support for Clean Energy Deployment

- **Technologies we support:**
 - **Electric:** Solar PV, Wind, Small Hydro, Anaerobic Digestion
 - **Thermal:** Air-Source Heat Pumps, Ground-Source Heat Pumps, Biomass Pellet Boilers, Solar Hot Water
- **Support of the deployment of clean energy through:**
 - Grants, rebates, and loans for installation/construction
 - Grants for early-stage project feasibility assessment
 - Technical guidance, research, market assessment
 - Marketing, outreach, training

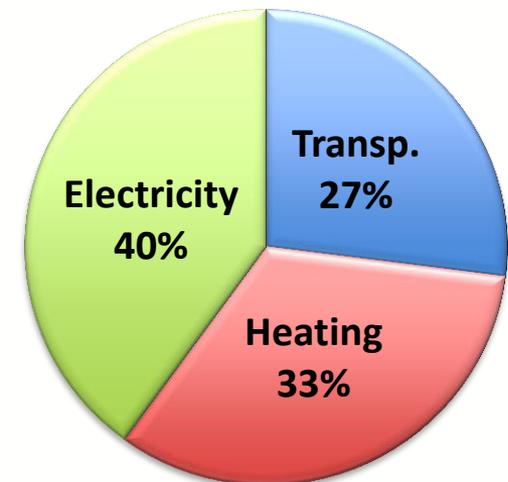
Thermal Energy in MA

- National focus:
 - Renewables for electricity
 - Electric vehicles, biofuels
 - Limited focus on renewable heating
- Thermal energy accounts for:
 - 1/3 of MA energy use
 - 1/3 of energy-related GHG emissions

MA Energy Use



MA GHG Emissions

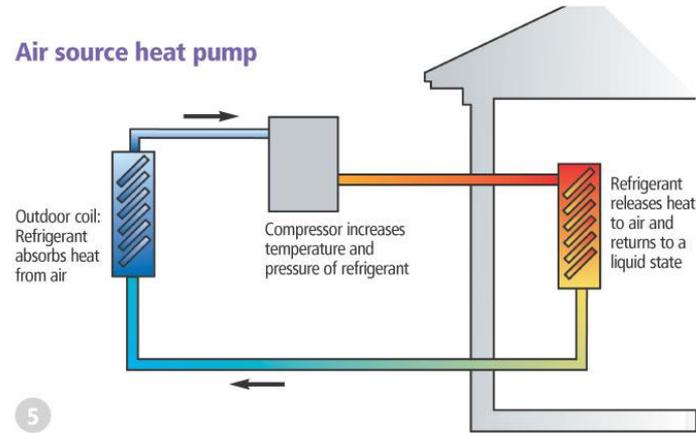


Clean Heating & Cooling Options

- Traditional technologies:
 - Heating/Hot Water: natural gas, oil, or electric
 - Cooling: electric (central/ducted, wall-mount, or window-mount A/C)

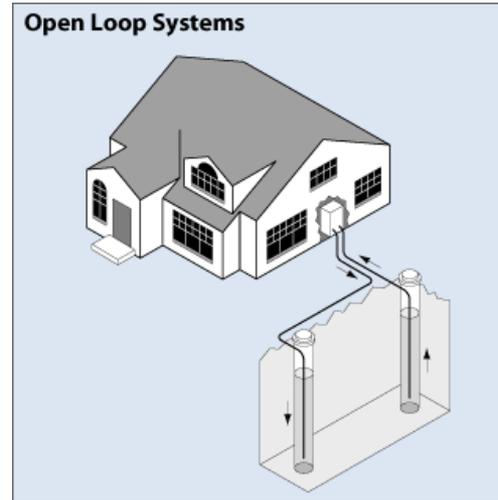
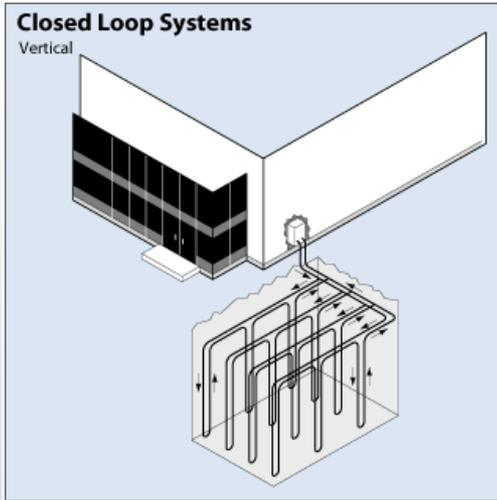
| Technology | Uses | | | Vs. Traditional Tech. | |
|-----------------------------|----------------------------------|---------|--------------|---------------------------|--------------------|
| | Heating | Cooling | Hot Water | GHG & Energy Cost Savings | Installation Costs |
| Air-Source Heat Pump | Yes – Whole home or supplemental | Yes | No | Medium | Low |
| Ground-Source Heat Pump | Yes | Yes | Supplemental | High | High |
| Wood Pellet Heating Systems | Yes | No | Yes | Medium | Medium |
| Solar Hot Water | No | No | Supplemental | High | High |

How Does an Air-Source Heat Pump Work?



- Heat pumps work by capturing heat by extracting heat from the outside air and move it inside (or vice versa in cooling mode). Because they're moving heat, they generate more thermal energy than the electricity it takes to run them.
- ASHPs have traditionally been a supplemental technology for shoulder seasons. Recent engineering improvements now allow ASHPs to work effectively in cold climates like Massachusetts all year long.
- Modern ASHPs typically produce between 2 and 4 units of thermal energy per unit of electricity input, depending on outdoor temperature.

How Does a Ground-Source Heat Pump Work?



GSHP's can transfer 3 to 5 times as much heat from the ground as they require to operate.

As the name suggests, ground-source heat pump (GSHP)'s work by capturing heat from the ground.

1. The system circulates cold water into plastic pipes that typically extend hundreds of feet into the ground. This works because ground temperatures remains about 47-52 degrees year round in Massachusetts.¹
 - Closed-loop systems pump a water/anti-freeze mixture, capture heat from the ground, and return the water to the heat pumps.
 - Open-loop systems exchange water directly with an underground well and return water at ground temperature.
2. The heat pumps extract heat from the water through a compression process
3. Heat is distributed throughout the house (usually using forced air, but baseboard or radiant systems are possible too).

How Does a Biomass Pellet Boiler Work?



- Central biomass pellet heating technologies use wood pellets to produce heat, much in the same way traditional boilers or furnaces use natural gas, oil, or propane.
- Biomass heating systems can often integrate into existing heating systems, and can fulfill all of a building's heating and hot water needs.
- Most systems are fully-automated and require limited maintenance.
- Wood pellet delivery is available in most parts of the Commonwealth.
- These systems are typically installed in buildings with baseboard hot water heating.



MassCEC Residential Clean Heating & Cooling Programs

- Launched Nov 2014
- Awards to date:
 - ASHP: Over 2,000
 - GSHP: 90
 - Central Wood Pellet (Biomass): 40

| Technology | Funding | Cap |
|----------------------------|---|----------|
| ASHP (ductless mini-split) | \$625/unit | \$1,875 |
| ASHP (multi-head) | \$625/ton | \$3,000 |
| GSHP | \$1,500/ton + efficiency adder | \$12,500 |
| Central Wood Pellet Boiler | 40% of costs + \$2,000 for thermal storage | \$12,000 |

Higher rebate levels are available to customers earning less than 120% of state median income levels.

Commercial Pilot Program: Overview

- **Solicitation Timeline:** Sept. 2013 - Sept. 2014
 - Funding reserved for ongoing projects
- **Grantees:** public entities, non-profits
- **Technologies:** GSHP, wood pellet boilers, district energy

Commercial Pilot: Process & Incentives

Process

1. Feasibility study: \$5,000
 - Review study with CEC and technical consultants
 - Decide whether to proceed with project
2. Design & engineering: \$20,000
3. Construction
 - GSHP: \$4,000/heating ton; max. \$108,000
 - Biomass: % of project costs

Upcoming Commercial Programs

- Will support ASHP, GSHP, and Pellet Boilers
- Launch expected Q1 2016
- Supports all building types (business, public, non-profit, multi-family)
- Streamlined application process
 - Requires basic technical information (heat load, equipment to be used, site layout, etc.)
 - No formal feasibility process
- Designer & installer training/certifications required
 - ASHP: Manufacturer training
 - GSHP: IGSHPA or PE
 - Biomass: Manufacturer training

Commercial-Scale Incentive Mechanisms

- Incentive mechanisms are still forthcoming
 - Structure likely to reflect current residential incentives (i.e. based on capacity, efficiency, percent of project costs, etc.), with declining incentive values as project sizes increase.
- Caps may be higher than Commercial-Scale pilot
- Adders for public/non-profit and affordable housing

Other Incentives

| Incentive | Link |
|---|---|
| Clean Heating & Cooling Rebates (MassCEC) | http://www.masscec.com/residential/clean-heating-and-cooling |
| Alternative Energy Credits (DOER) | http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/rps-aps/rps-and-aps-program-summaries.html |
| Heat Pump Rebates (Mass Save) | http://www.masssave.com/en |
| HEAT Loan (Mass Save) | http://www.masssave.com/en/residential/heating-and-cooling/offers/heat-loan-program |
| Renewable Energy Tax Credits (IRS) | http://www.energystar.gov/about/federal_tax_credits |

Questions?



Josh Kessler

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jkessler@masscec.com

617-315-9319