



Clean Heating and Cooling Technology Overview

Automated Wood Heat/Wood Pellet Boilers

Residential wood pellet boilers burn wood pellets much more efficiently and with drastically less particulate pollution emissions than in the past. These systems are often fully automated and tie directly into central heating and hot water systems. They can operate much like fossil-fuel based central heating systems and meet all the heating needs of a building. Boilers that are listed on Massachusetts or New York's eligible wood pellet boiler lists comply with national and state standards for particulate matter emissions. See the Massachusetts list [here](#) (under Eligible Boiler and Furnace List) and the New York eligible boiler list [here](#). NYSERDA also maintains a qualified installers list, available at the same link.

Ground Source Heat Pumps

Ground source heat pumps (GSHP) are highly efficient systems that take advantage of the ground's constant temperatures to heat or cool a building by circulating a liquid through tubes that are placed horizontally or vertically in the ground. The heat pump amplifies the temperature to provide high-efficiency heating or cooling into the building. These systems can also supply hot water.

Cold Climate Air Source Heat Pumps

Cold climate air source heat pumps (CCHP) use electricity to extract heat from the outside air and deliver it indoors. They operate in reverse when operating in cooling mode. Heat pumps can provide high-efficiency heating or cooling. They are available as ducted and ductless units. The former are generally whole-home heating solutions, whereas the latter can provide either whole-home heat or single-zone/single-room heating.

Solar Hot Water Systems

Solar hot water systems provide supplemental hot water by using the sun's energy to warm fluid in collectors; pumps circulate this warmed fluid to heat water in a tank. The solar collectors can be placed on roofs or on the ground. In the Northeast, solar hot water systems generally cannot provide sufficient hot water for a home on a cloudy or snowy winter day. Therefore, a backup system is needed. Solar hot water systems provide up to 80 percent of a home's water needs and reduce greenhouse gas emissions from water heating up to 80 percent.

Heat Pump Water Heaters (HPWH)

Heat pump water heaters are highly efficient systems that use electricity to move heat from the air through a heat exchanger, which is then transferred into a water storage tank. HPWHs should be installed in a room with plenty of clearance and an ambient year-round temperature above fifty degrees. HPWHs are the most cost-effective technology for heating water, using up to 63 percent less energy than a traditional water heater and lowering operating costs by 50 percent. HPWH can be paired with smart controls to enable the homeowner to remotely control and monitor the water heater.

You can learn more about these technologies in the following resources:

- A Vermonter's Guide to Residential Clean Heating and Cooling
<https://www.cesa.org/resource-library/resource/vermont-guide-residential-clean-heating-cooling/>
- Massachusetts Clean Energy Lives Here <https://goclean.masscec.com/clean-energy-solutions/>
- Tips on Getting the Most out of Your Heat Pump
<https://neep.org/sites/default/files/GettingTheMostFromYourHeatPumpConsumerGuide.pdf>