



# MAINE SCHOOL ENERGY PROJECTS GETTING STARTED GUIDE

# HEAT PUMPS



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## Introduction

In the simplest sense, a heat pump is a “two-way air conditioner” because it can provide both cooling and heating. Unlike traditional heating systems such as boilers or gas-fired rooftop units (RTUs) that generate heat, heat pumps work by transferring heat from an external source, such as the air or ground. They are powered by electricity and there are multiple types of systems, including variable refrigerant flow (VRF), split-system or air-source heat pumps (ASHP), ground-source heat pumps (GSHP), and heat pump water heaters (HPWH). Some heat pump systems, including ASHPs, allow schools to upgrade a building section by section, so the project can be broken into phases, limiting disruption to the building and its occupants.

Heat Pump Types <i>Continued on next page</i>	Description	Upfront Cost	When to Consider
<b>Air-Source Heat Pump (ASHP)</b>	Residential style heat pump distributed to single-zone mini-splits or ducted units.	Low	A smaller school or individual classroom upgrades.
<b>Variable Refrigerant Flow (VRF)</b>	Commercial-sized version of the ASHP that can serve a wing of classrooms.	Medium	Upgrading a whole wing or a larger school with multiple zones.

Heat Pump Types	Description	Upfront Cost	When to Consider
Ground-Source Heat Pump (GSHP)	Uses ground as a “thermal battery” by running closed* water lines into the ground to heat and cool the building.	High	A major retrofit, school with net-zero goals, ample available space, and/or significant funds. Saves the most energy and energy cost.
Heat Pump Water Heater (HPWH)	Air-source heat pump with water storage tank to heat domestic hot water.	Low	A domestic hot water system replacement that is 120 gallons or less.

\* “Open-loop” geothermal systems that use ground water directly are not recommended. “Closed-loop” systems that run pipes underground but keep the water separate have successful applications in Maine.

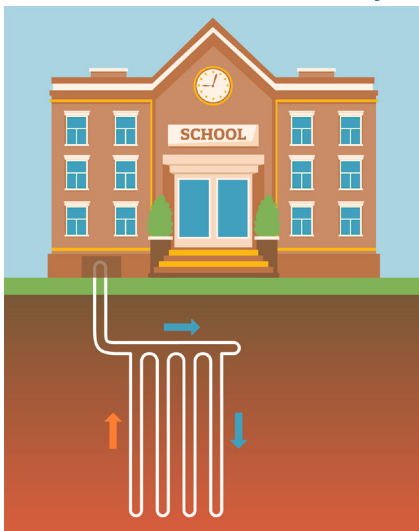
### Heat Pump Water Heater



### Variable Refrigerant Flow



### Ground-Source Heat Pump



### Air-Source Heat Pump



## SIGNIFICANT SAVINGS

Five Maine schools that installed heat pumps estimated **annual cost savings** from **\$13,500** to as high as **\$35,200** over propane or oil. With Efficiency Maine incentives, one school paid back their heat pump in less than a year, despite using more energy for air conditioning.

# Heat Pump Benefits

## Lower Emissions

Heat pumps use electricity, and since Maine's electric grid is one of the cleanest in the country, schools can **cut their carbon footprint by roughly two thirds** by switching from oil-based heating.

## Stability

Electric prices are generally less volatile than natural gas and delivered fuel prices. Since heat pumps utilize electricity, staff do not have to monitor fuel levels and schedule deliveries.

## Cost Savings

While electricity costs increase, heat pumps are less expensive overall than heating with oil, kerosene, or propane.

## Efficiency

Heat pumps are **two to four times more efficient** than electric resistance or fuel burning systems, so schools ultimately use less energy.

## Health

Heat pumps can provide air filtration, dehumidification, and increased air circulation, which improves air quality and reduces the likelihood of mold and mildew. **Better air quality improves student cognition and the health of students and staff.**

## Temperature Control

Heat pumps, which heat and cool, can provide more consistent temperature control compared to traditional heating, ventilation, and air conditioning (HVAC) systems, leading to a more comfortable environment. Educators do not have to open windows or use fans, which keeps classrooms quieter, and schools do not have to close on exceptionally hot days.

# Heat Pumps in Maine Schools

Heat pumps are becoming more common in new and existing schools in Maine and other cold climates.

## LAMOINE CONSOLIDATED SCHOOL

Lamoine Consolidated School had heat pumps installed in their K-8 school in 2023. Prior to the installation, the school relied on opening windows and doors for cooling and ventilation. On some hot days, the school would have to close due to unsafe conditions. Since heat pumps were installed, the building remains comfortable during warmer months, and when other schools in the district have to close, Lamoine can stay open. The heat pumps allow students and educators to focus on learning, rather than coping with an uncomfortable environment.

## FRYEBURG ACADEMY

With the help of Efficiency Maine, Fryeburg Academy installed two VRF systems with heat recovery and are now **saving more than 1,890 gallons of oil each year.**

# Heat Pumps in Curriculum

Incorporating heat pumps into curriculum provides students with real-world examples of technologies that increase energy efficiency and reduce energy usage, which can foster interest in these topics and inspire students to pursue a career in energy. [This lesson plan](#) from Wisconsin covers energy savings associated with different residential heating systems, including heat pumps, for middle and high school students.

As heat pump installations continue to rise across Maine, they are driving job growth in the heat pump installation sector. Exposure to this technology in schools can inspire students to explore careers in green energy and connect the classroom to real-world opportunities. Ultimately, integrating heat pumps into schools helps lay the foundation for future workforce development in the clean energy economy.

## Common Misconceptions

### Misconception

Heat pumps are inefficient in the cold.

### Fact

While heat pump efficiency does drop in colder temperatures, high efficiency heat pumps can still be more than twice as efficient compared to the most efficient boilers or furnaces.

### Misconception

Heat pumps need backup in the cold.

### Fact

Today, cold climate heat pumps can operate at temperatures as low as -22°F. Backup heat is not likely to be needed when the system is sized properly, but some schools may wish to maintain an existing boiler system as backup in case of an emergency during extreme weather situations.

### TIP: INTEGRATED CONTROLS

If an existing boiler is kept for backup, thermostats should be integrated with the new heat pump. Failing to do so may lead to additional energy use when the heat pump and boiler run at the same time.

### Misconception

Heat pumps only work in super-insulated buildings.

### Fact

While a well-insulated building requires a smaller heat pump, as long as they are properly sized, heat pumps operate efficiently and effectively in any building. However, replacing older windows, weather stripping, and air sealing can save energy and money and improve comfort regardless of the type of heating system used.

# Procurement

When a school has decided to install a heat pump, the next step is to create a request for proposal (RFP) which provides the scope of services to contractors for bids. An RFP should include the scope of work and outline of the evaluation criteria, as well as the project goals as to why the school wants a heat pump. To ensure quality work and qualify for incentives, the RFP should require the bidder to be an [Efficiency Maine Qualified Partner](#). The chosen bidder will be able to help select the proper heat pump manufacturer, system type, and size for the school. For large retrofits that address other aspects of the building, the school may need to first engage a design team.

## EXAMPLE OF A REQUEST FOR PROPOSAL (RFP)

Lamoine Consolidated School shared the RFP used for their heat pump project.

## TIP: SET IT AND FORGET IT

Heat pumps work most efficiently with a hands-off approach. Compared to a furnace, heat pumps work harder to reach a desired temperature than maintain one, so it's more efficient to keep the thermostat set to a consistent temperature.

## UPFRONT COSTS

A heat pump or VRF system costs between \$1,000 to \$2,000 more per classroom than installing a new room air conditioner or rooftop unit (RTU). [Rebates from Efficiency Maine](#) can help offset those costs. Depending on the situation, adding a heat pump might even cost less than installing separate heating and air conditioning.





## Heat Pump Funding Resources

- ▶ [Efficiency Maine's education webpage](#) lists current funding opportunities.
- ▶ [Efficiency Maine](#) offers commercial HVAC incentives.
- ▶ The [Community Resilience Partnership](#) offers grant and technical assistance programs.
- ▶ Schools that choose a ground-source heat pump (GSHP) system can receive cash reimbursement for up to 50% of project costs by claiming the Investment Tax Credit (Sec. 48) with Elective Pay, a federal funding mechanism that allows schools to claim the full value of energy tax credits. The tax credit for GSHPs is available for projects that commence construction before January 1, 2035.

*Other decarbonization technologies (i.e., solar, energy storage, thermal storage, clean commercial vehicles, electric vehicle charging equipment) have also been eligible for [federal tax credits](#) that reduce project costs. However, those tax credits are now changing with new federal policy. These changes include earlier phase-out timelines, shortening the period in which these tax credits are available to claim, and additional restrictions that complicate schools' use of these tax credits.*

## Additional Heat Pump Resources

- ▶ [Efficiency Maine](#) offers heat pump user tips.
- ▶ [Efficiency Maine](#) covers common heat pump myths and facts.
- ▶ [Efficiency Maine](#) shares additional information on heat pumps and other HVAC solutions for schools.
- ▶ [Undaunted K12](#) released a report that makes the case for transitioning to all-electric, high-performance HVAC systems in America's schools.
- ▶ The [National Renewable Energy Laboratory \(NREL\)](#) offers a technical heat pump guide.

## Contact

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