The Sponsors of Energize Connecticut, and in partnership with Connecticut Passive House, are pleased to offer *Passive House Initiative* to support workforce development and help transform the energy efficiency and building construction industries in Connecticut.

For more information, please visit EnergizeCT.com/passive-house or email PassiveHouseTrainingCT@icf.com
Take energy efficiency to a new level

Residential New Construction Passive House Multi-family buildings with five units or more
# Passive House Incentive Structure for Multi-Family (5 Units or More)

<table>
<thead>
<tr>
<th>Incentive Timing</th>
<th>Activity</th>
<th>Incentive Amount</th>
<th>Max Incentive (Per Unit)</th>
<th>Max Incentive (Per Project)</th>
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¹ Feasibility Study will require documentation in the form of a Feasibility Study report and invoice from the Passive House Consultant.
² Incentives will only be awarded prior to 50% Construction Drawings for Passive House projects. No incentives will be granted after 50% Construction Drawing set.
³ Certification may be either through PHIUS, PHI, or EnerPHIT certification offerings.

Next steps you can take...
Contact your Energy Efficiency Representative or

Go to [EnergizeCT.com](https://EnergizeCT.com) or call 1-877-WISE USE for more details.

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Part of the AVANGRID Family
Heat Pump Water Heating Design and Installation Best Practices
Adam Romano C.E.M.
Principal Building Systems Consultant
aromano@swinter.com
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Since 1972, Steven Winter Associates, Inc. has been providing research, consulting, and advisory services to improve the built environment for private and public sector clients.

Our services include:

- Energy Conservation and Management
- Sustainability Consulting
- Green Building Certification
- Accessibility Consulting

We have over 125 staff across four office locations:
New York, NY | Washington, DC | Norwalk, CT | Boston, MA

For more information, visit www.swinter.com
Learning Objectives

- **Discuss** the major considerations when electrifying DHW
- **Understand** how heat pump DHW systems operate and where they can be applied
- **Identify** common installation issues
System Design: Sizing and Selection
Determine the Requirements

- As a first step, gather the information that is needed to determine what the most appropriate heat pump water heater option is for a particular home.
Customer Goals

- Cost Savings
- Environment
Flow Rates

• Lower flow rates to improve efficiency.
• SWA rec flow
  • 1.0 gpm bath sink
  • 1.5 shower and kitchen
• Complaint zone
  • 0.5 gpm in residences
Low Flow Fixtures

• Low-flow fixtures recommended
• Pressure-compensating options available
• Tamper-proof options available
HPWH Resources


Vapor Compression Cycle

Absorption Indoor

medium temperature low pressure VAPOR

high temperature high pressure VAPOR

Rejection Outdoor

medium temperature high pressure LIQUID

Source: Caleffi idronics
System Types Integrated Heat Pump Water Heater
System Types Integrated Heat Pump Water Heater

- Located indoors
- Use R-134a, R-410a
- Have electric resistive backup
System Types Split Heat Pump Water Heater
System Types Split Heat Pump Water Heater

- Located outdoors
- Use R-744 (CO2)
- No backup
What Affects Performance? (Integrated)

- COP depends on:
  - Ambient Temperature
  - Ambient Relative Humidity
  - Mains Temperature
  - Water Draw Profile
    - Total Volume
    - Draw Pattern

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HPWH Monitoring

Hot Water Use

Site 3: COP = 1.8; Concentrated Draws

Ambient Temperature

Site 5: COP = 0.77; Average Ambient Temperature = 48°F
Split Heat Pump Water Heaters

SANCO₂ can always make 145°F water at outside air temperatures to -27°F
Split Heat Pump Water Heaters

• Considerations
  • CO2 refrigerant cycles operate at far higher pressure than standard vapor compression cycle equipment.

• Inlet water temperature has an impact on efficiency.
Installation Considerations
Space Requirements

Minimum room volume:
800 ft³, 10' x 10' x 8'
(22.7 m³, 3 m x 3 m x 2.4 m)

Air flow exhaust

Air flow intake

Air flow exhaust

Air flow intake

42" (220 E)
60" (300 E)

6" (1.8 m)

8" (0.2 m)

14" (0.4 m)

2" (0.6 m)

6" (1.8 m)
Space Requirements

- Properly site outdoor unit
  - Be aware of max horizontal and vertical distance to indoor tank
- Raise the Heat Pump unit 4”-6” from the ground – this will allow defrost condensate to drain
  - In areas with high snowfall, the unit must be installed above the anticipated snowline.
Space Requirements

Corner Installation

> 6”

> 12”

Flat Wall Installation

> 6”
Noise Considerations

- ~ 45 dBa
- ~ 55 dBa
- ~ 70 dBa
Comfort Considerations

1. Heat pump pulls hot surrounding air in
2. Heat pump transfers heat from air to water
3. Condenser coil heats water in tank
   - Backup electric heating elements
   - Water tank

Heat pump pushes cold/dry air out
Managing Condensate

- Install condensate pump, if needed
- Place on blocks
- Install drain pan
Managing Condensate

- Outdoor unit will create condensate during normal operation
- It’s recommended not to pipe condensate in areas with temperatures below 23°F
- Need to pipe condensate away from the unit and ensure that it does not spill on walkways or other areas where it can freeze.
- Drain pan heaters are not necessary in most environments unless temperatures are below 10°F
Installation Guidance

- Piping located outdoor shall be minimized as much as possible
- Piping insulation exposed to weather shall be protected from damage
- A continuous metal jacket shielding shall also be installed to protect the insulation from exposure to solar radiation, which can cause degradation of the material.
Installation Guidance

• Heat trace should be installed on all exterior piping below the insulation and in direct contact with the pipe wall.
• The heat trace shall be self regulating
Installation Guidance

- Once the plumbing connections are made, seal the openings with an approved sealant to prevent air movement and pest intrusion.
- A cover can be installed to protect the piping and help improve aesthetics
Installation Guidance

• Insulate hot water piping to the requirements in accordance with local code.
Installation Guidance

- Heat traps installed on the cold water inlet and hot water outlet, help prevent unwanted convection causing heated water to flow out of the tank.
Wiring

• Ensure that the overcurrent protection device is labeled, and the correct size based on the manufacture's requirements
• Ensure the conductors are the correct size and compatible with the terminals.
A disconnect switch needs to be installed at the outdoor unit to allow for service, and the ability to deenergize the unit in the event of an issue.

The disconnect switch should be located within arms reach of the service panel of the unit.
Maintenance

• Some filters in HPWHs should be regularly cleaned.

• Educate homeowners.
Maintenance

- Outdoor coils require cleaning on an annual basis
- Use a garden hose or coil cleaning machine and avoid high pressure, since you can run the risk of bending the fins.
Thank You

For more information, please visit EnergizeCT.com/passive-house or email PassiveHouseTrainingCT@icf.com