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For more information, please visit EnergizeCT.com/passive-house
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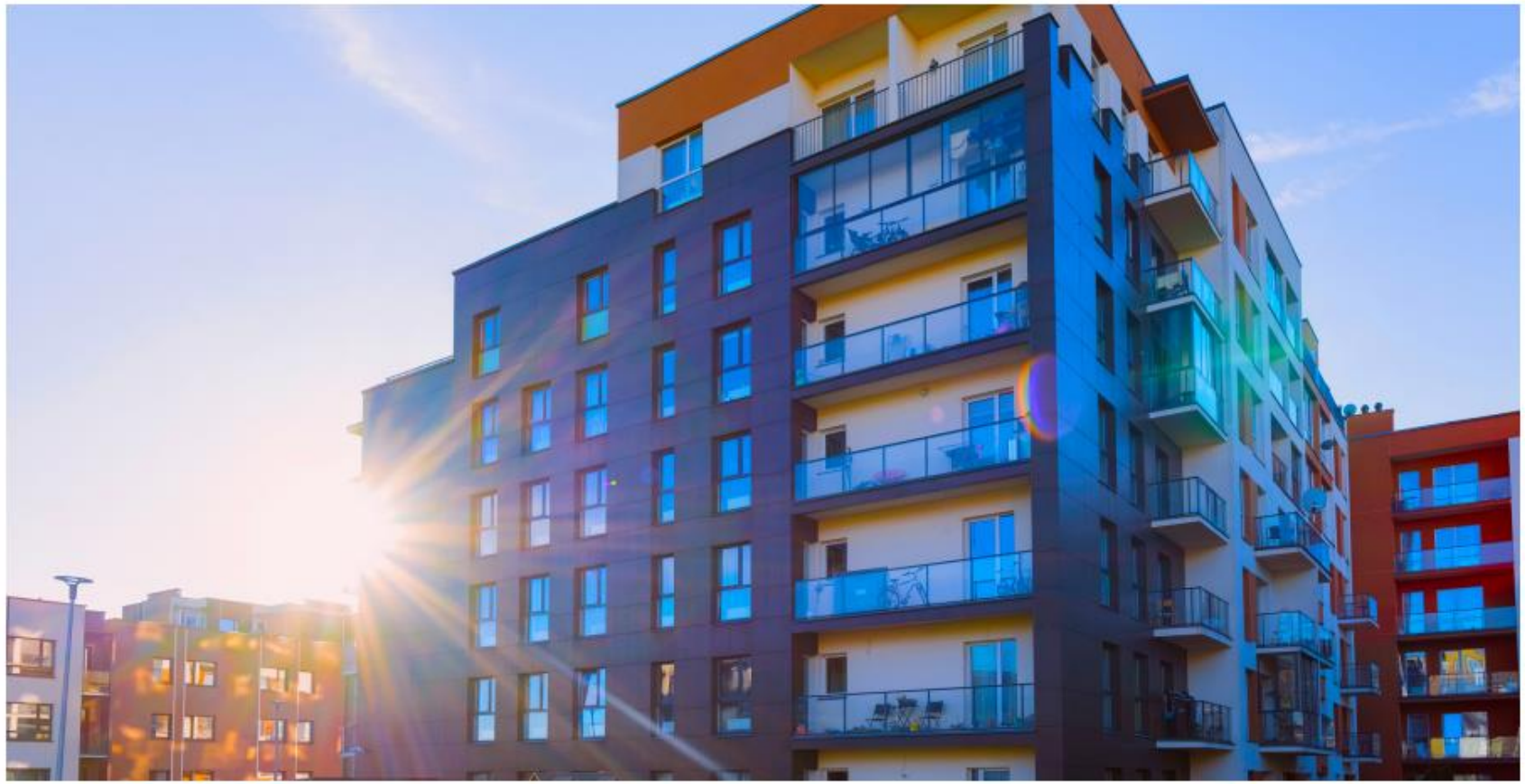
# Take energy efficiency to a new level

**Residential New Construction Passive House Multi-family buildings with five units or more**



| PASSIVE HOUSE INCENTIVE STRUCTURE FOR MULTI-FAMILY (5 UNITS OR MORE) | | | | |
|---|---|---|---|---|
| **Incentive Timing** | **Activity** | **Incentive Amount** | **Max Incentive (Per Unit)** | **Max Incentive (Per Project)** |
| Pre-Construction | Feasibility Study[1] | Up to 100% of Feasibility Study Costs | N/A | $5,000.00 |
| | Energy Modeling[2] | 75% of Energy Modeling Costs (Before 90% Design Drawings) | $500.00 | $30,000.00 |
| | | 50% of Energy Modeling Costs (90% Design/50% Construction) | $250.00 | $15,000.00 |
| Post Construction | Certification[3] | Up to 100% of Certification Costs | $1,500.00 | $60,000.00 |

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 or call 1-877-WISE USE for more details.**

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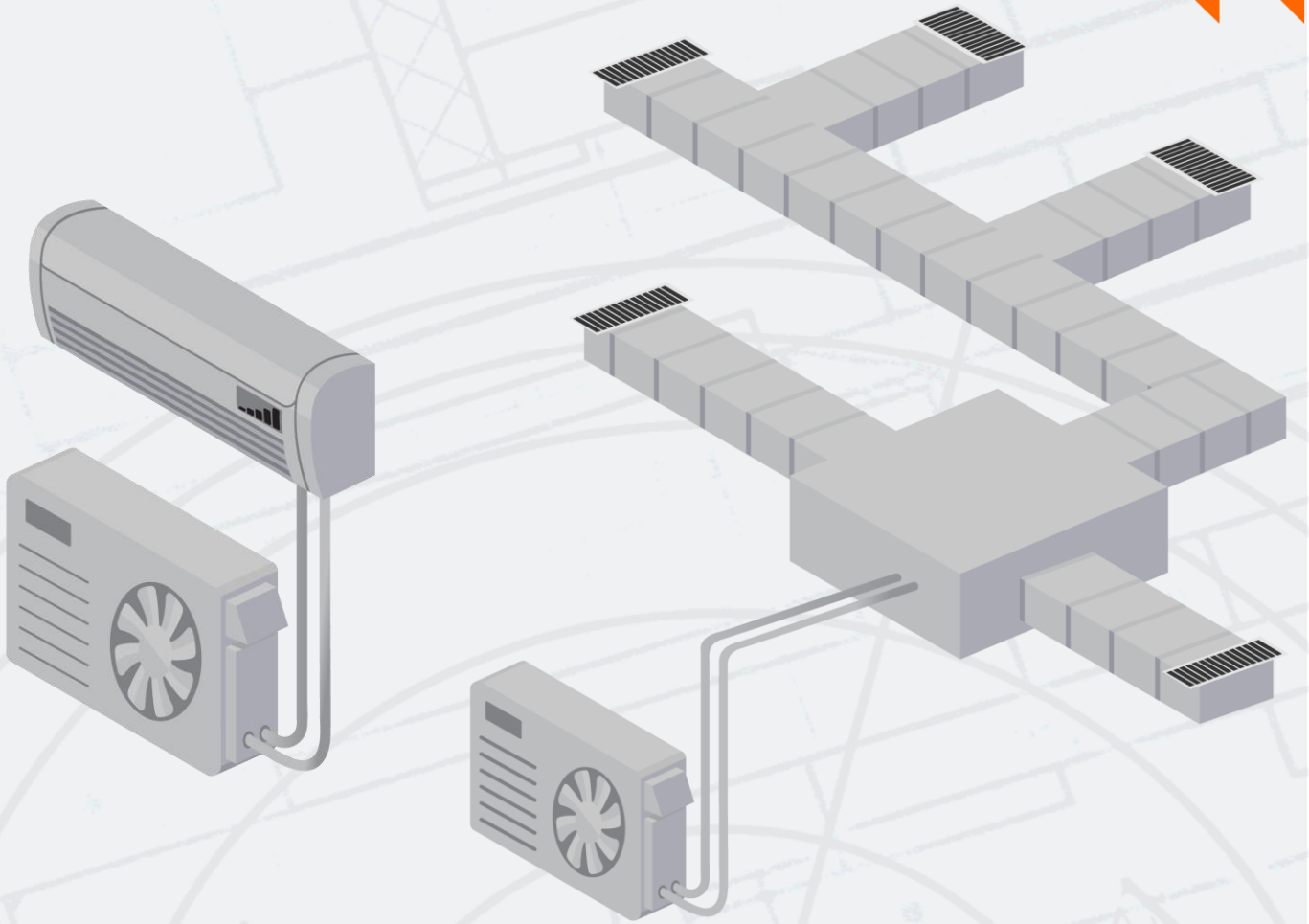
# Reasons for Switching to All Electric



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- Sustainability Consulting
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Adam Romano C.E.M.

Principal Building Systems Consultant

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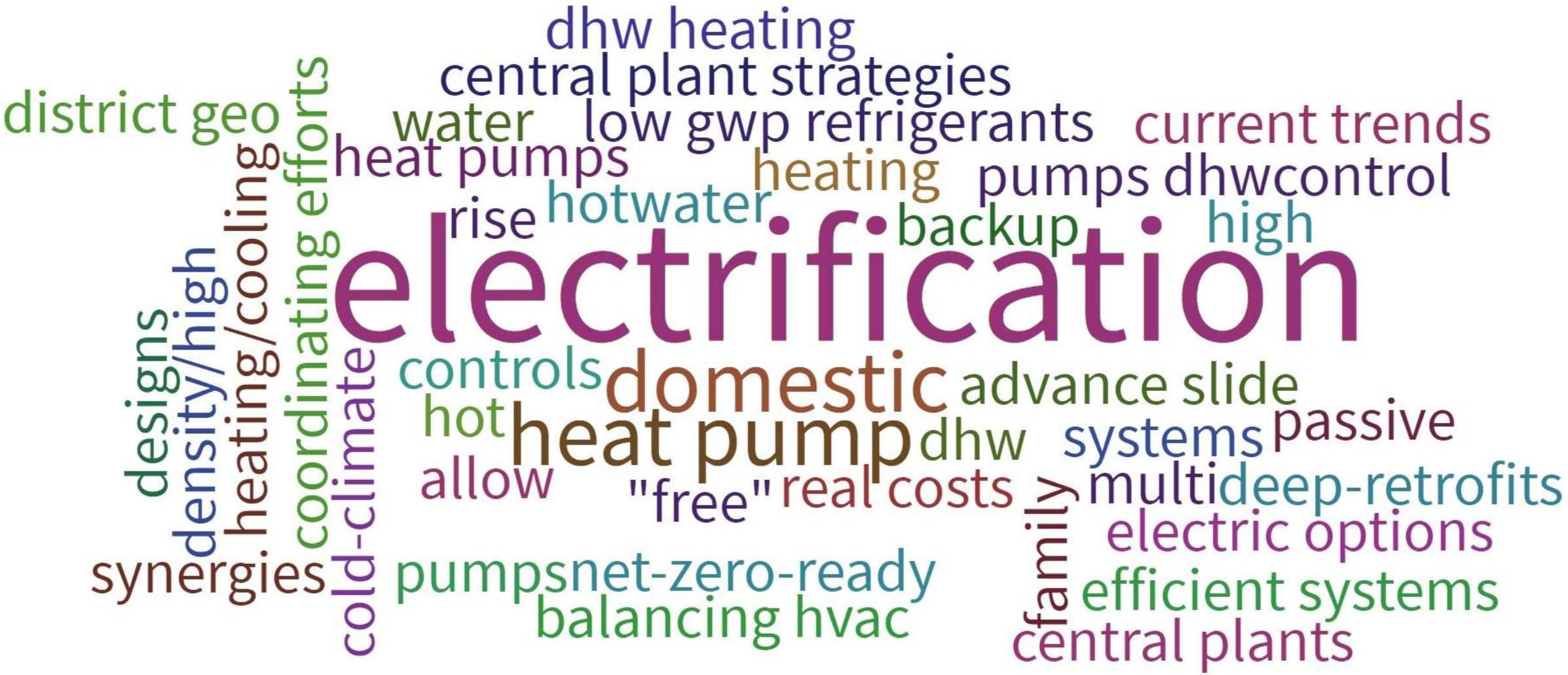
212.564.5800 x1110

# Learning Objectives

- **Summarize** the benefits of electrification
- **Discuss** the major considerations when electrifying residential homes
- **Understand** how heat pump systems operate and where they can be applied
- **Describe** various available options for non-fossil fuel water heating
- **List** the options for electrifying a variety of residential end-uses


dhw heating
central plant strategies
district geo
water
low gwp refrigerants
current trends
heat pumps
heating
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coordinating efforts
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hotwater
backup
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heating/cooling
density/high
designs
controls
domestic
advance slide
hot
heat pump
dhw
systems
passive
allow
"free"
real costs
multideep-retrofits
cold-climate
family
electric options
synergies
pumpsnet-zero-ready
efficient systems
balancing hvac
central plants

# Health Benefits

- Improved Local Air Quality
- Improved Indoor Air Quality
- Reduced Risk of CO Exposure

# Comfort Benefits

- Localized delivery of heating and cooling
- Customizable temperature settings by room or zone

# Cost Savings

- This is all great, but what do the economics look like?

# Carbon Benefits

- Carbon reduction with improved electrical grid

# Where to Begin

# **Ditch** the Gas Meter

- Heat Pump Ready Home
- Space Conditioning
- Water Heating
- Cooking and Clothes Drying
- Additional Considerations

# Heat Pump Ready Home

# Heat Pump Ready Home

- Space heating is closely tied to the energy efficiency of the home.
- Inefficient homes, especially in colder climates, would benefit from bundling insulation and air sealing measures to reduce energy from space heating before sizing/installing a heat pump.

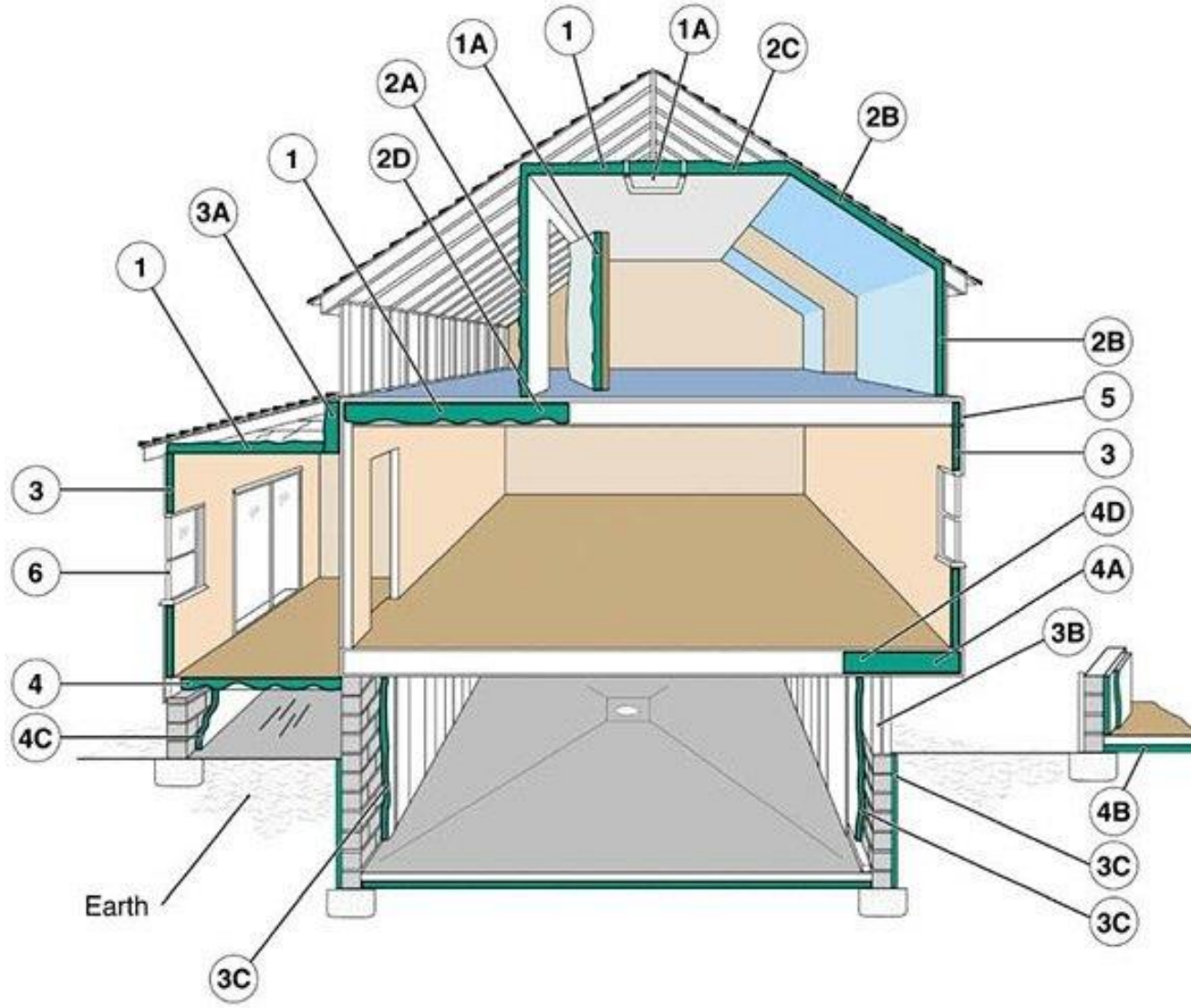
# Air Sealing

- An effective air barrier consists of a continuous system of materials (building wrap, membranes, etc.), components (doors, windows, etc.) and accessories (tapes, sealants, etc.).

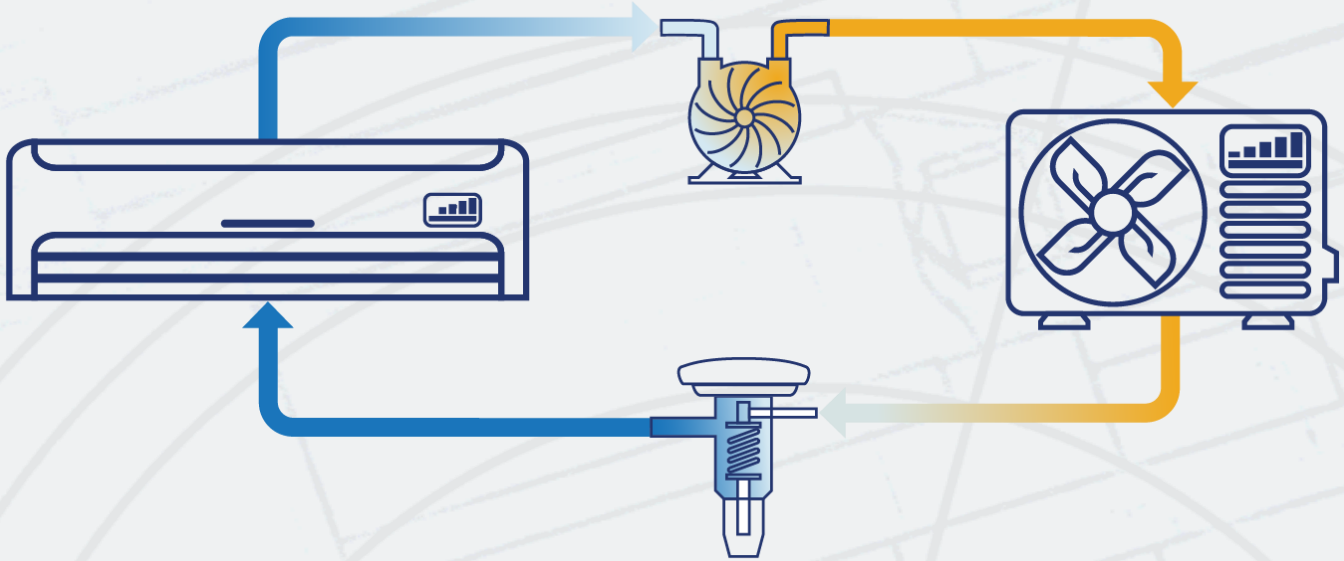
- These air barrier elements must be airtight individually and when used together.

# Insulation

- All insulation work begins with air-sealing.
  - Never insulate a wall, roof, or floor without first making sure the air leaks within the vicinity are addressed.
- Typically the attic followed by the crawlspace are the most cost effective locations to perform insulating work.

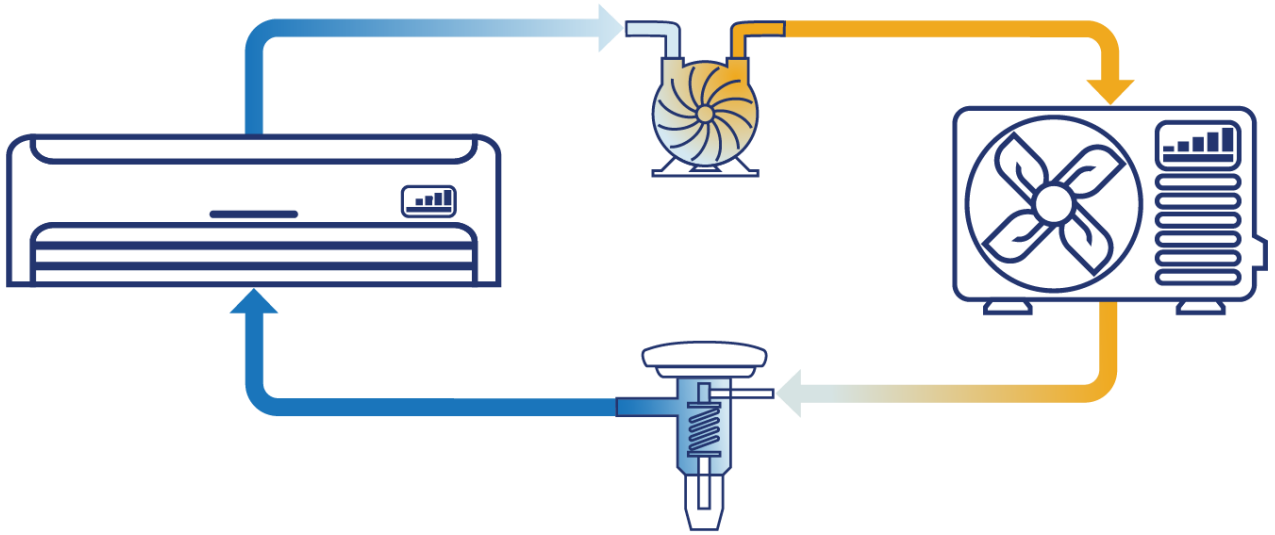


# Heat Pump Operation and Components



# **What** is a Heat Pump?

- Heat Pumps do not generate heat, they move heat.
  - When we discuss energy efficiency of heat pumps, it's all about how much useful heat is pumped or moved compared to the amount of input energy consumed.
  - This work is performed using the vapor compression cycle.



# **Old** Heat Pumps

- Used very often further south.
- Old HP's didn't work well below ~30°F
- BAD reputation in colder climates

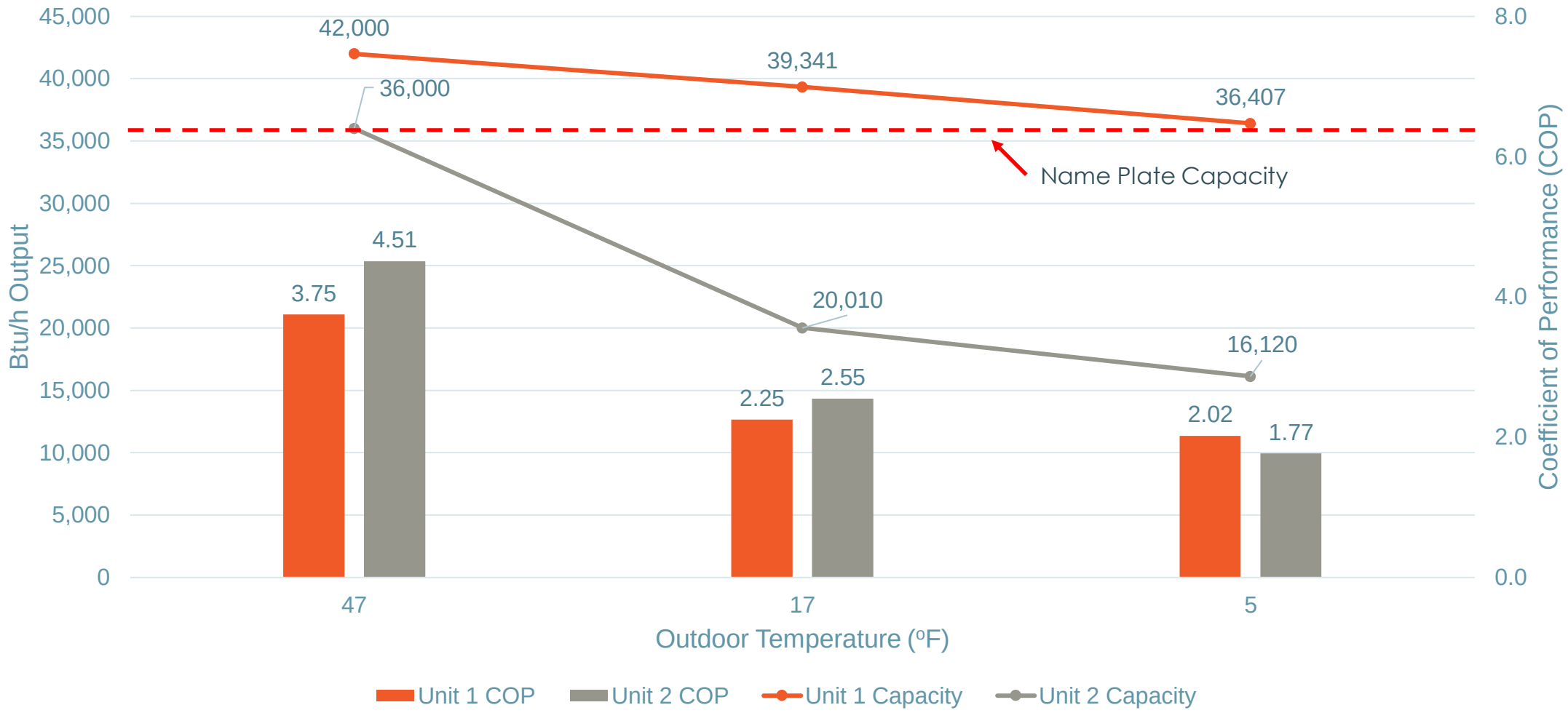
# **New** Heat Pumps

- Cold Climate Air Source Heat Pumps (ccASHPs) systems are an efficient clean energy solution to dramatically reduce the use of carbon-intensive space heating systems

NEEP'S COLD CLIMATE AIR SOURCE
Heat Pump List

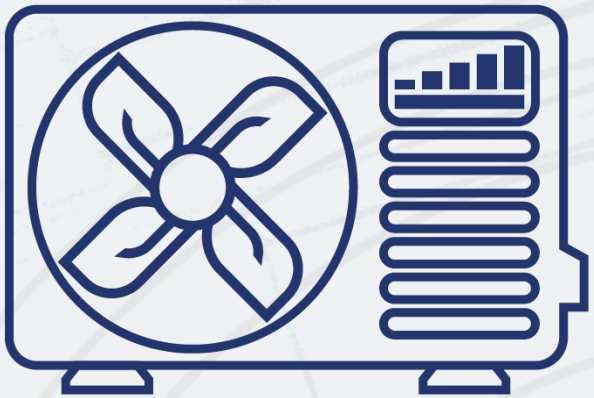
https://ashp.neep.org/

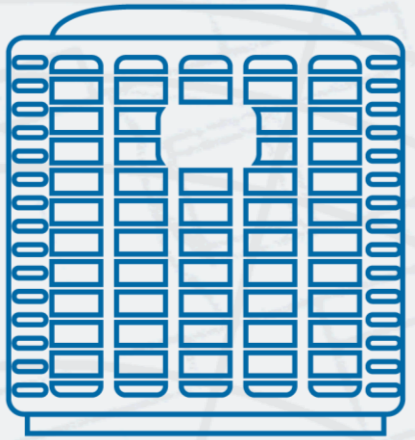
# ccASHP Performance




*Source: NEEP ccASHP Product Listing 01.31.2019, Carrier Performance Data*

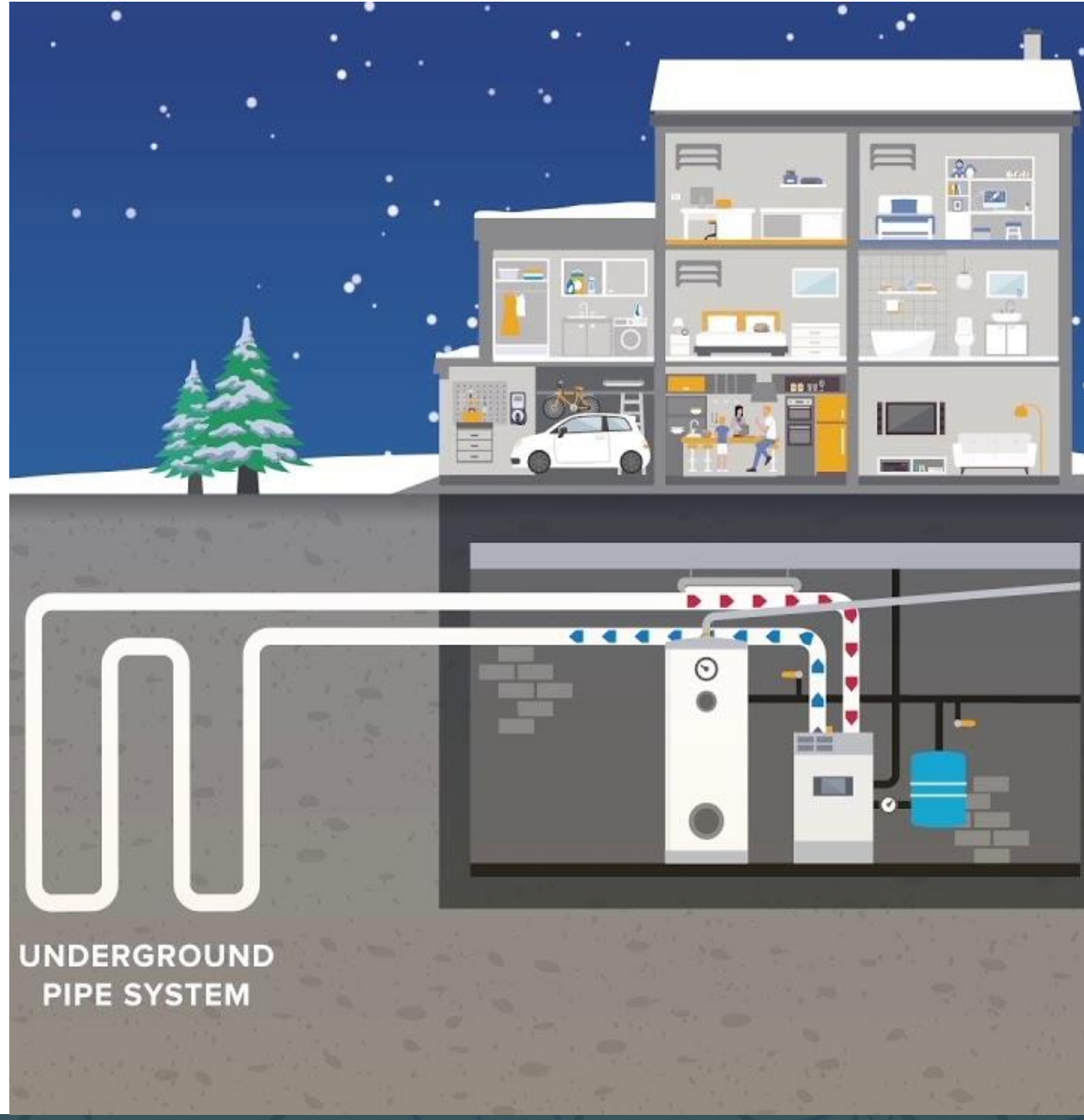
# Heat Pump System Types





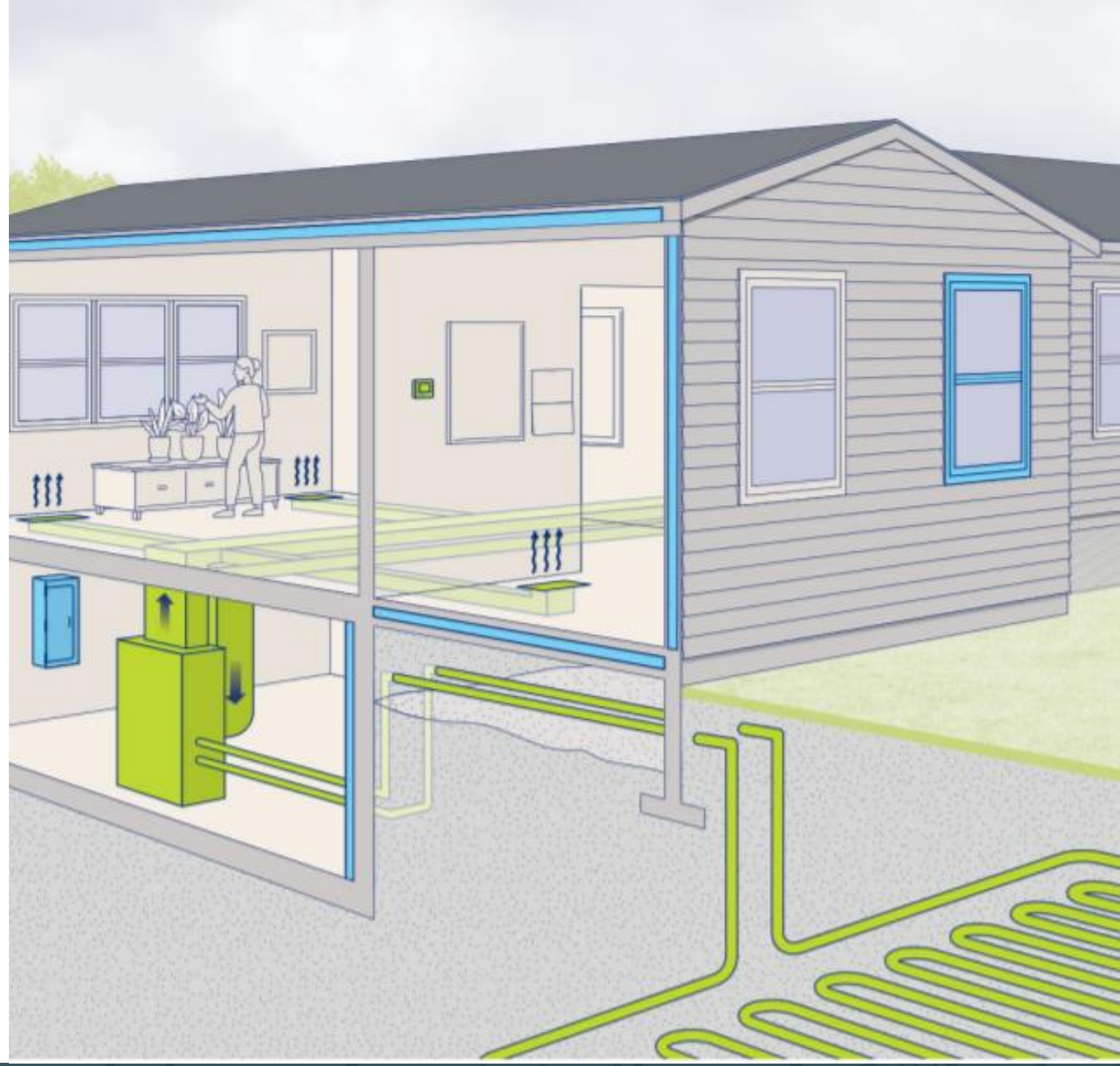
# Ground Source

- Takes heat from the ground and injects it into the indoor air.
- Consist of an indoor unit and ground loop.
  - Ground loops can be horizontal, vertical, or pond/lake



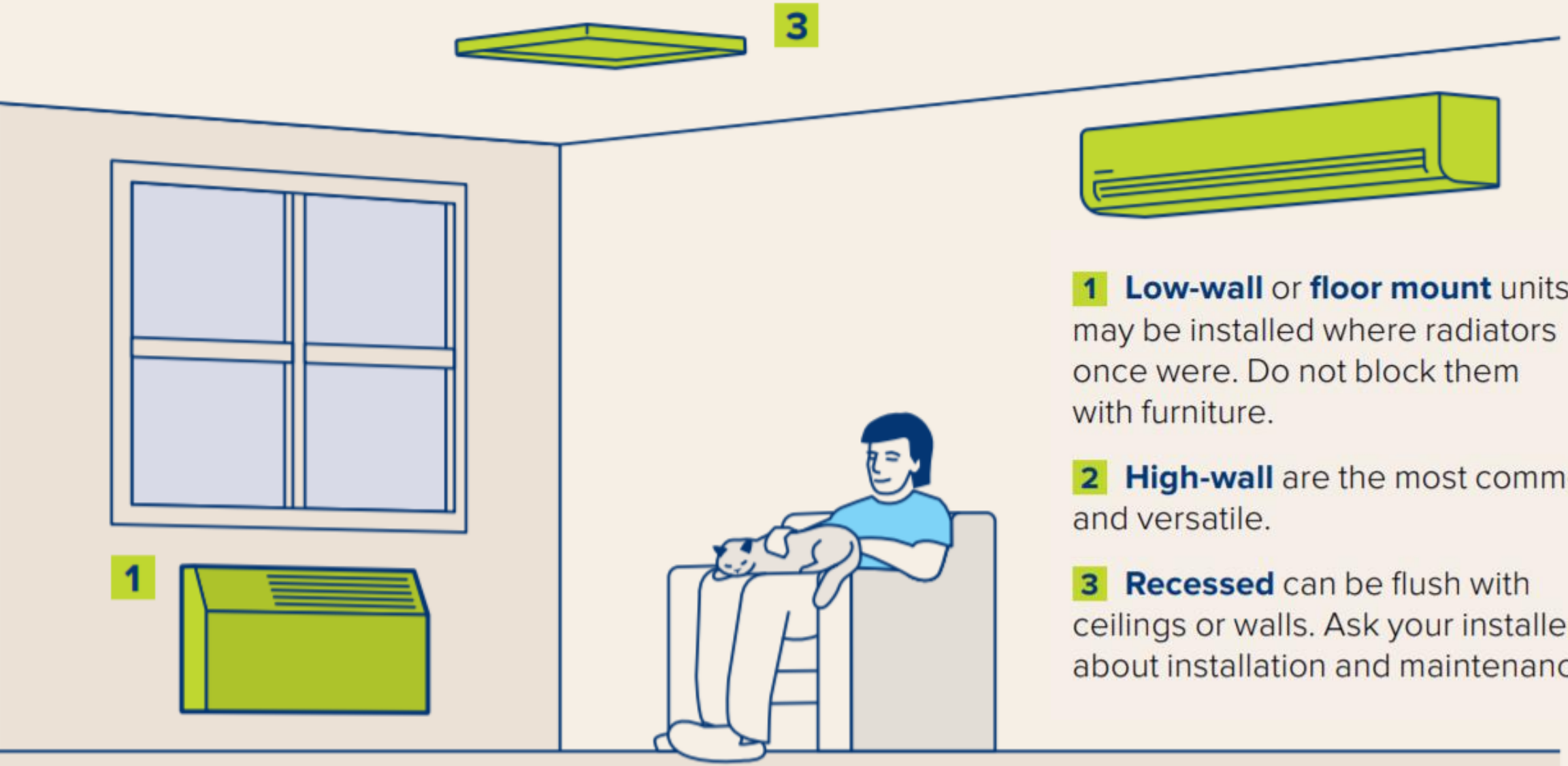
# System Types Geothermal

- One central ducted geothermal unit
- Indoor unit contains a heat exchanger that absorbs/rejects heat to ground loop.
  - Typ. 2 - 5 tons
  - “Fully ducted”



# Air Source

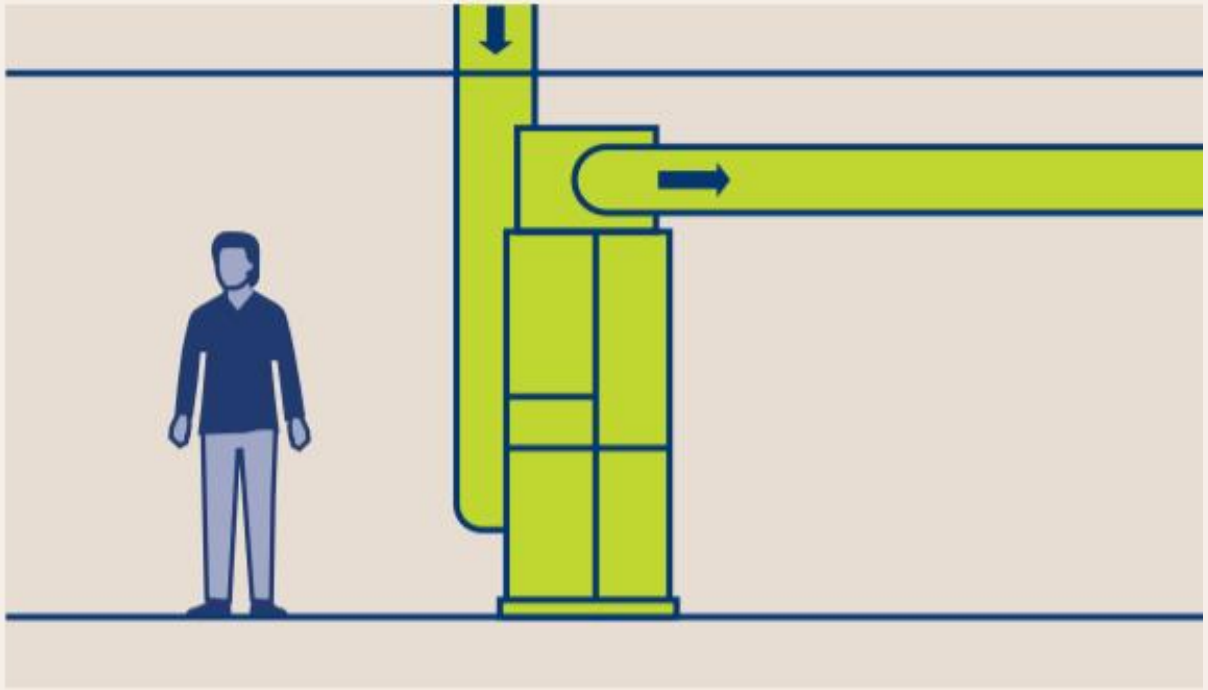
- Takes heat from the outdoor air and injects it into the indoor air.
- Consist of an outdoor and indoor unit connected via a refrigerant line set.



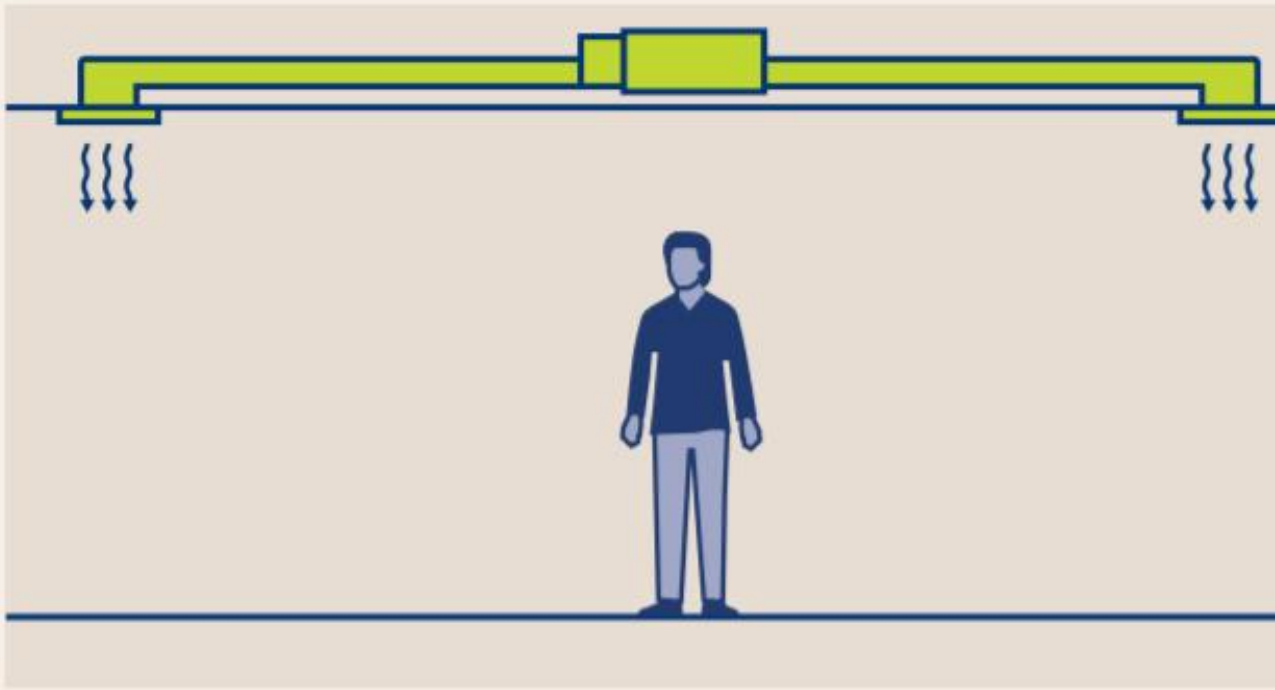

**1** **Low-wall** or **floor mount** units may be installed where radiators once were. Do not block them with furniture.

**2** **High-wall** are the most common and versatile.

**3** **Recessed** can be flush with ceilings or walls. Ask your installer about installation and maintenance.



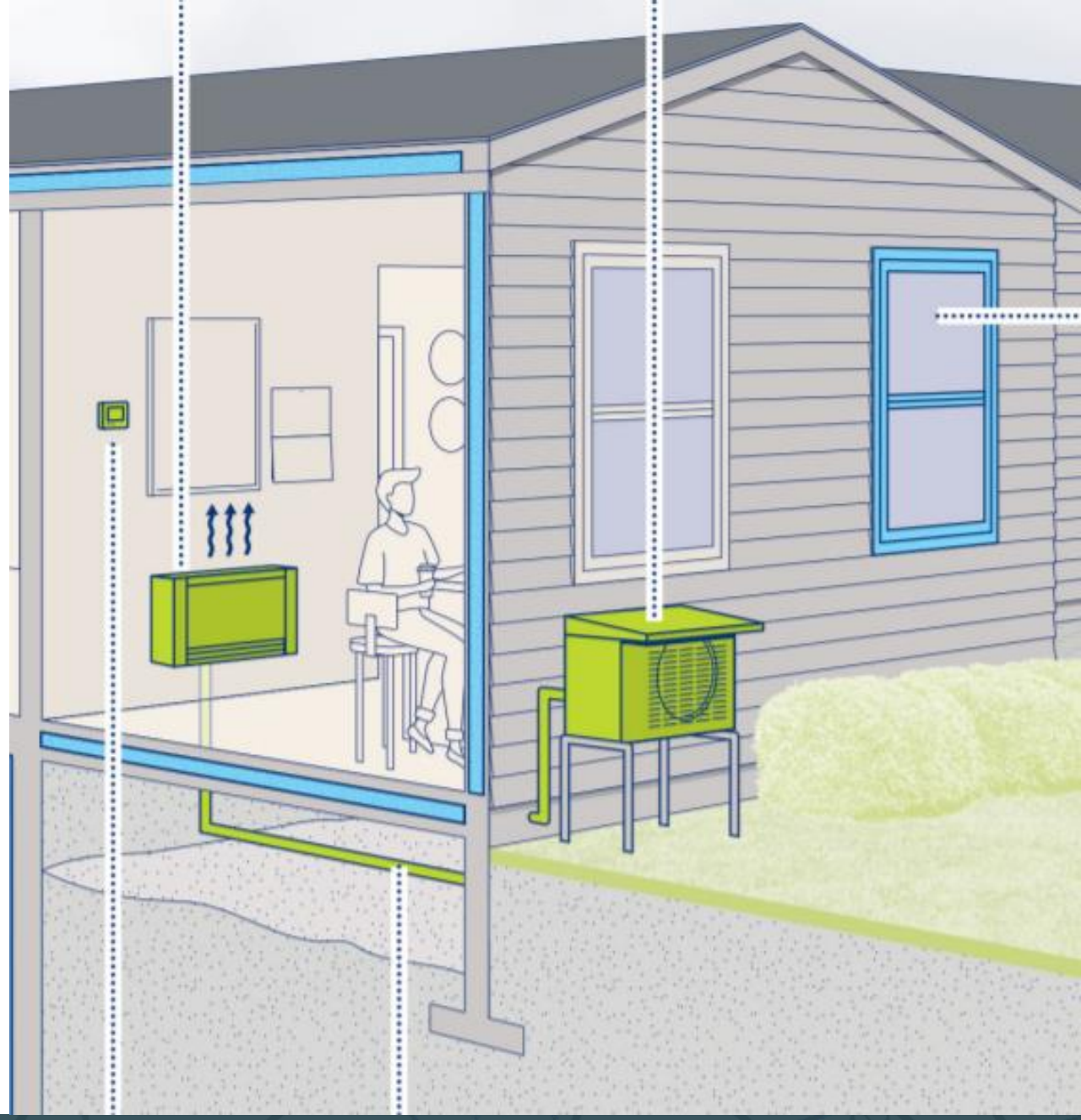
**Conventional air handlers** move air through larger ducts. They are often located in basements, attics, or utility closets. They can be installed to blow air upwards, downwards, or sideways to fit within your home.



**Compact ducted air handlers** usually serve smaller areas such as one to three rooms. Their slim profile means they often fit in dropped ceilings, but leaving access for maintenance is important.

# System Types Mini-Split

- Smaller decentralized air-source heat pump systems
  - Split and Mini Split <1.5 Tons
- Here are one-to-one systems where you'll have one outdoor unit coupled with one.
- Indoor units are typically small and that indoor unit can be either ductless or ducted.

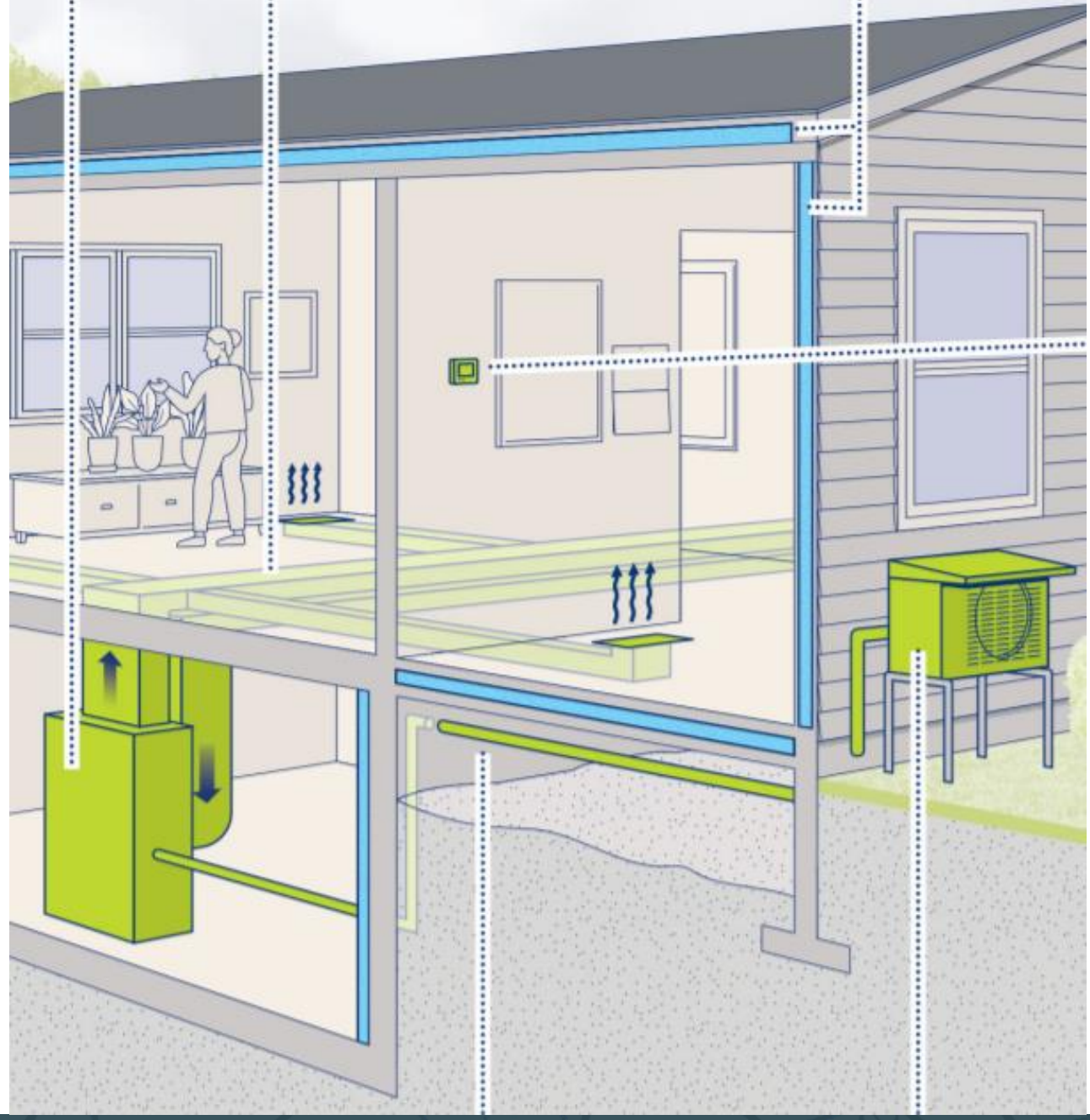


# System Types Multi-Split

- This is again one outdoor unit, but it's connected to multiple indoor units.
- We would have refrigerant piping going from the outdoor unit to a couple of indoor units
  - One outdoor unit
  - 2+ indoor units
  - Ducted, Ductless, or mix
  - 1.5 – 4 tons typ.

# System Types Central Split

- One outdoor unit, one central ducted air handler
- More conventional residential A/C system
  - Typ. 2 - 5 tons
  - “Fully ducted”

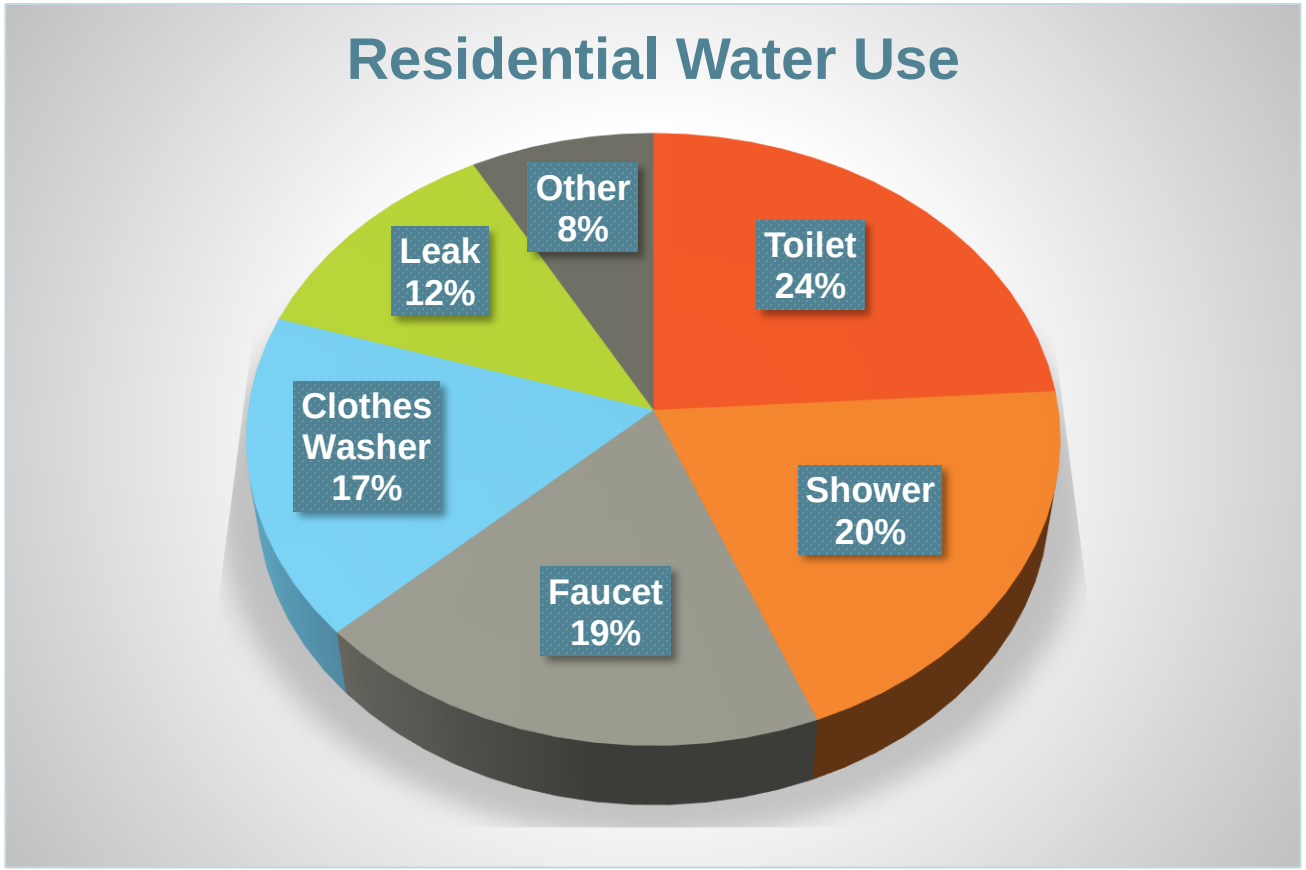


# Questions?

# Water Heating

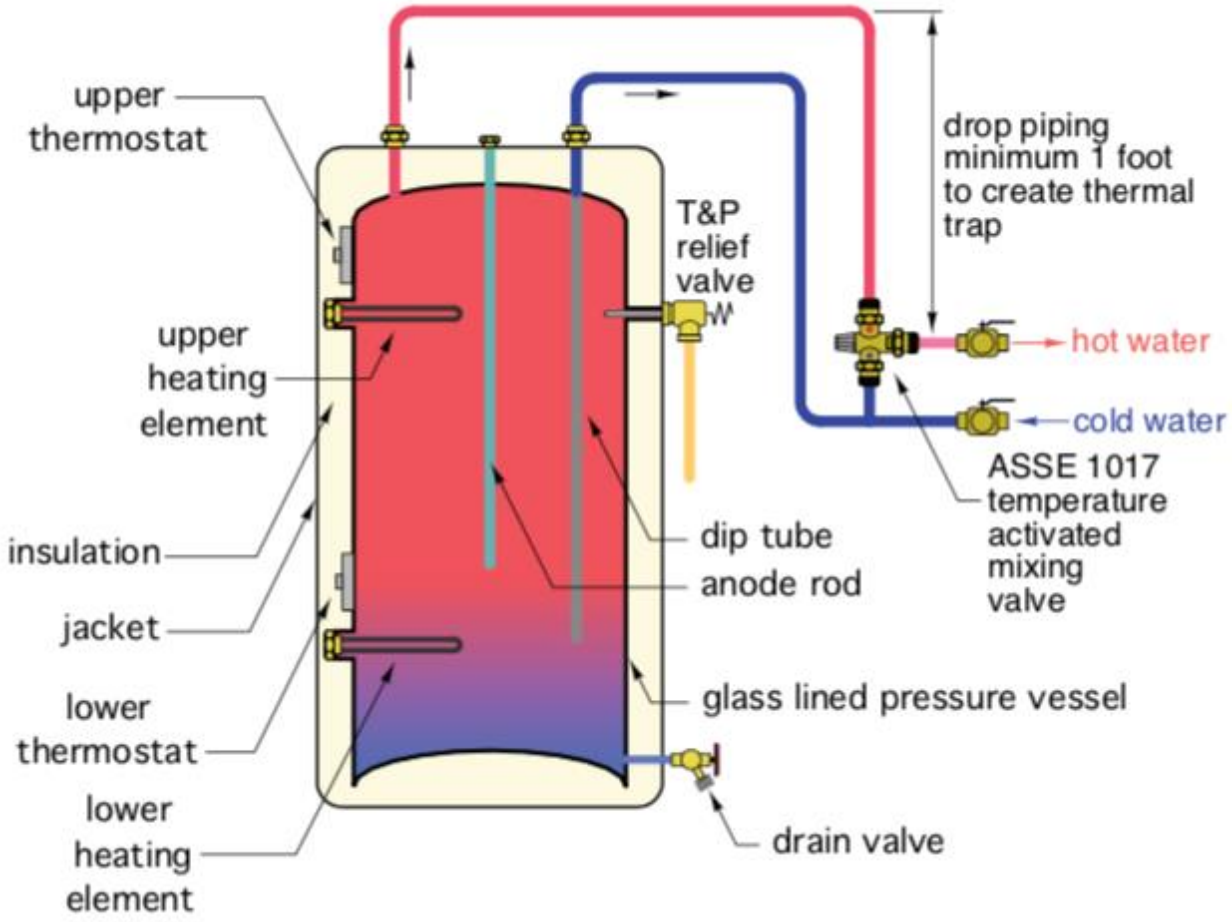
# Flow Rates

- 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



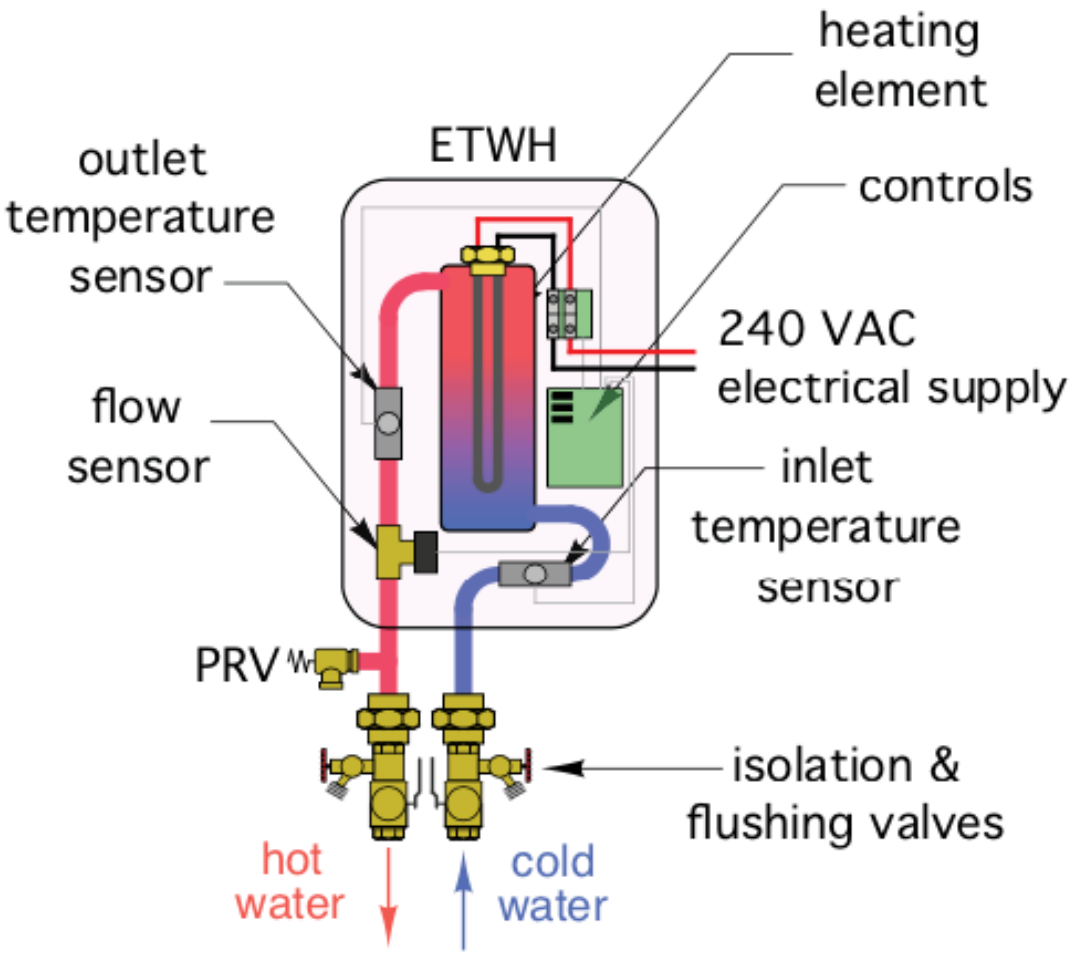
# System Types

## Electric Resistance: Tank Type

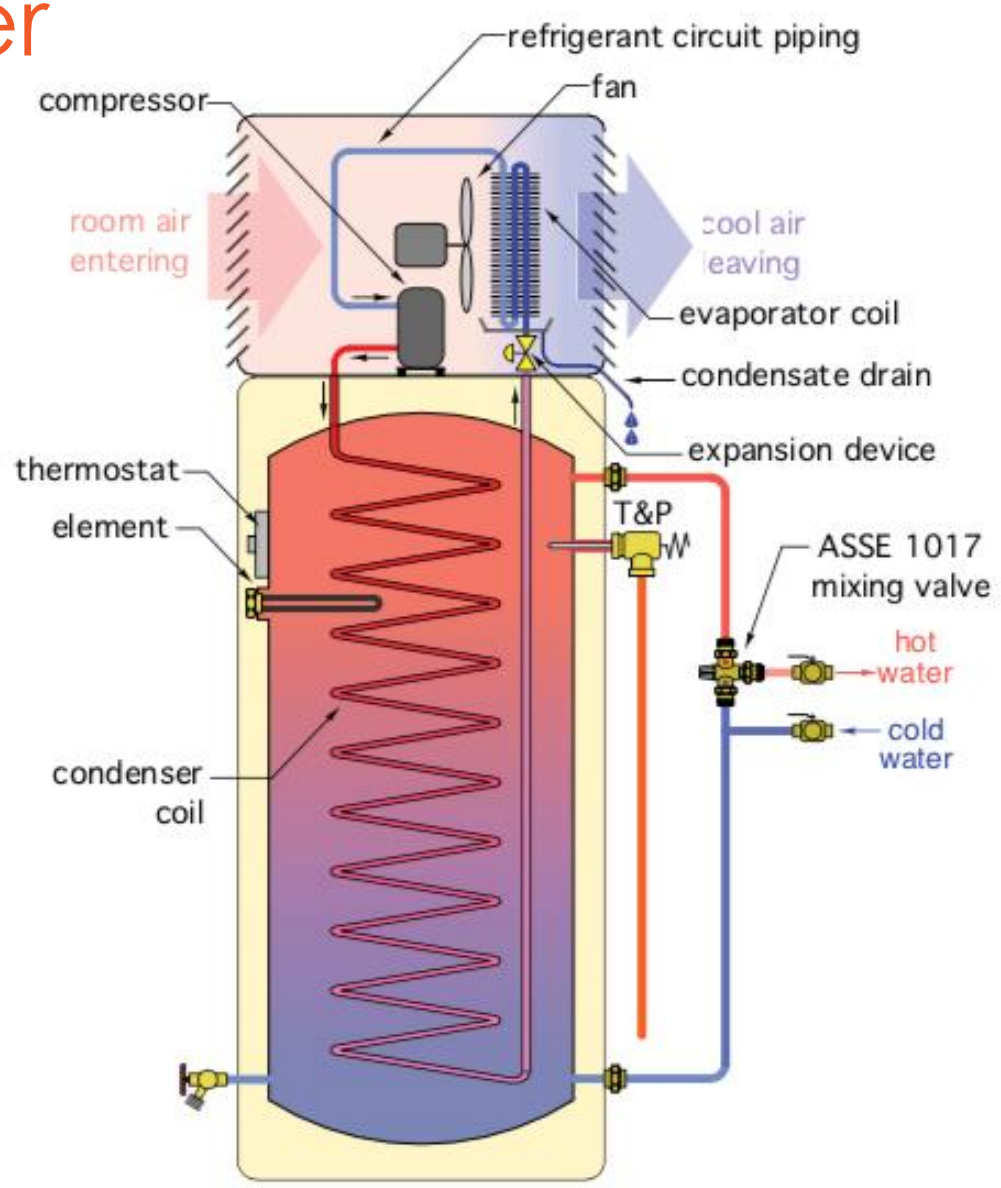



# System Types

## Electric Resistance: Tankless

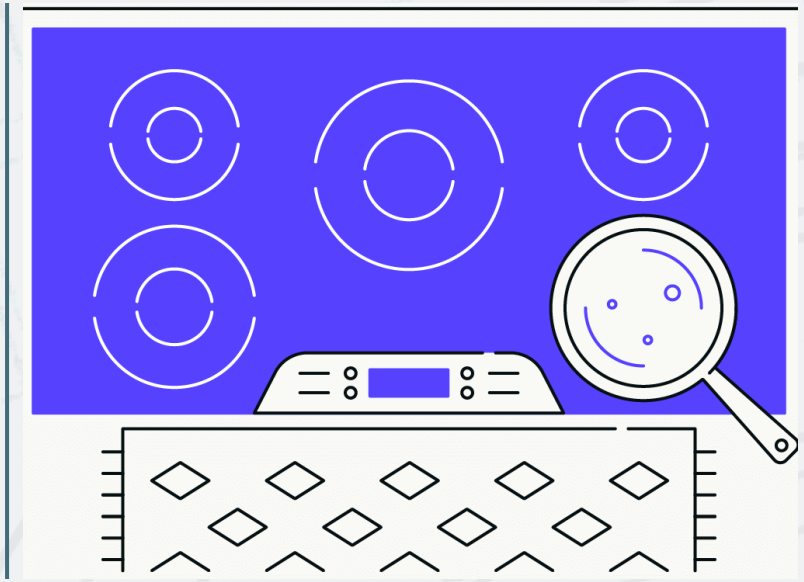



# **System Types** Heat Pump Water Heater (HPWH)

# System Types Split Heat Pump Water Heater

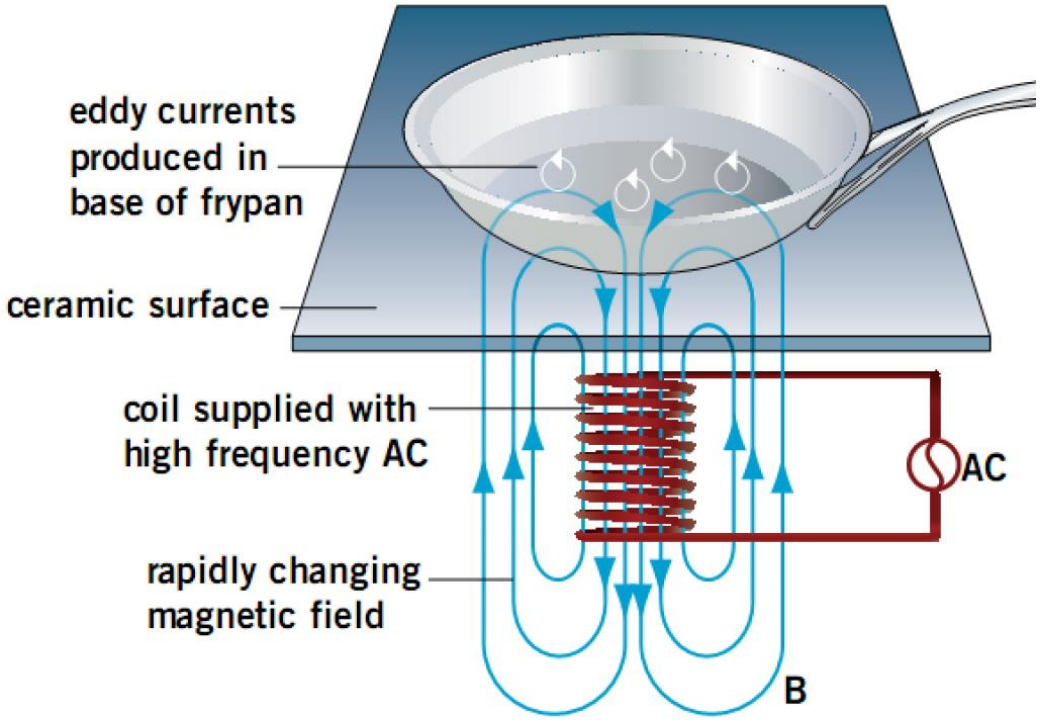

# Appliances

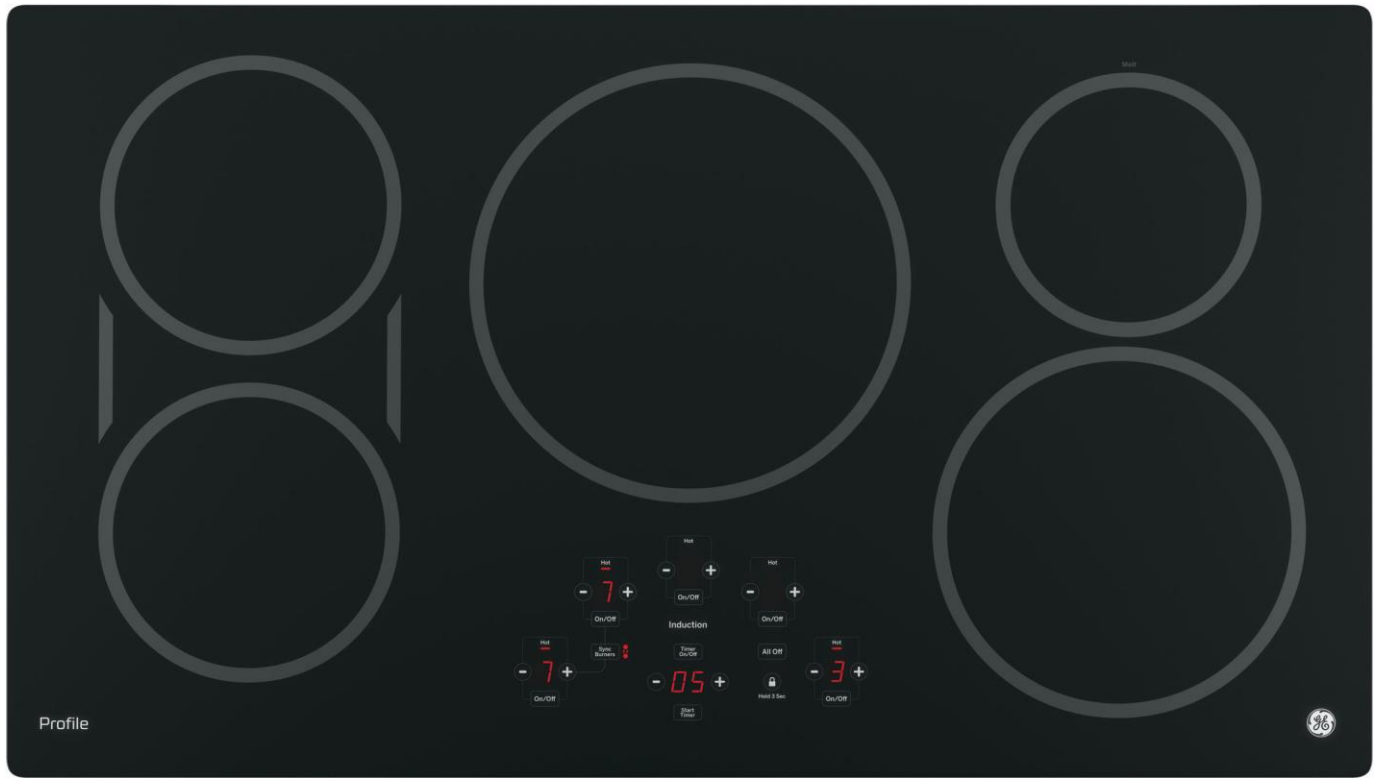


# **Cooktops** Electric Resistance

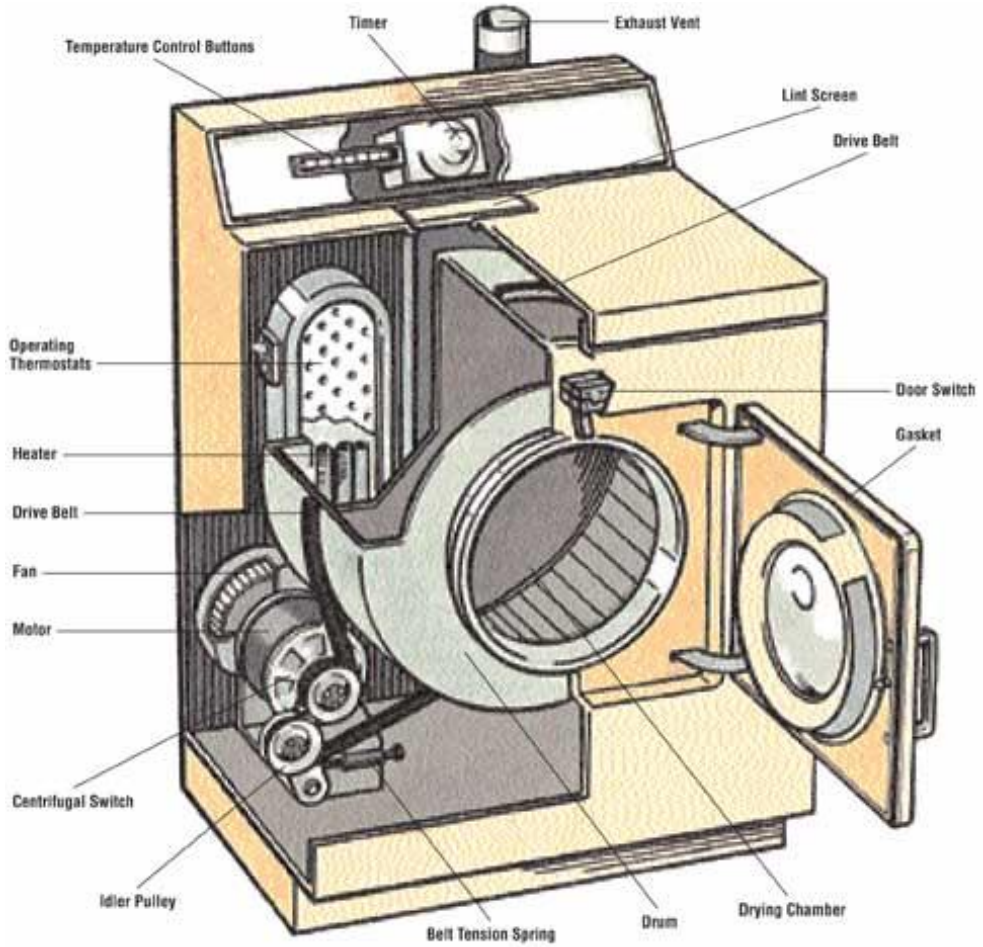
Typical Plug In Element

# Cooktops Induction

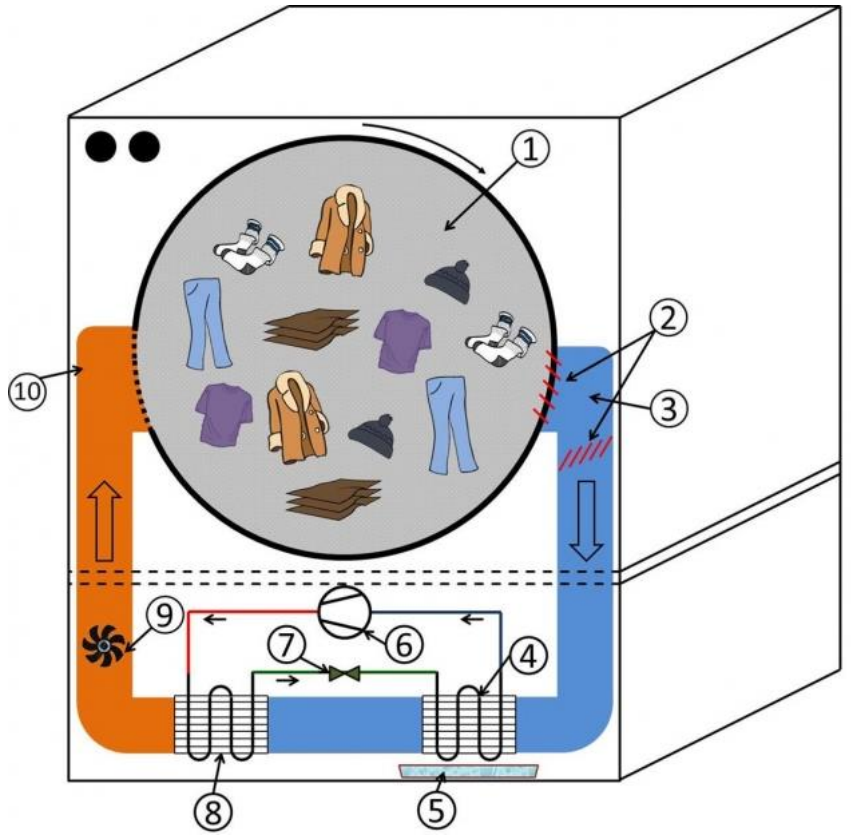


# Clothes Dryer Electric

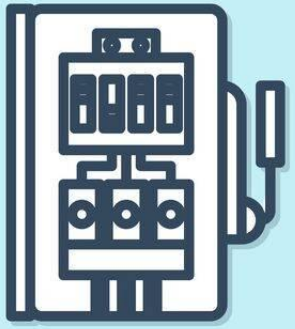



# Clothes Dryer Heat Pump




1. Drum
2. Filter
3. Warm Humid Air
4. Evaporator
5. Condensate
6. Compressor
7. Expansion Device
8. Condenser
9. Blower
10. Hot Dry Air

# Additional Considerations



# Assessing Electrical Capacity

- The electric service in a home is measured in amps. Most homes today have either a 150 amp or 200 amp service.

- Its important to have a professional determine the electrical load before installing the service.

# Electrical Work

- Heat Pump 208/240v 30amp
- Induction Range 208/240v 40amp
- Heat Pump Dryer 208/240v 30amp
- Integrated Water Heater 208/240v 30amp
- Split Water Heater 208/240v 15amp

# Adding Solar PV

- If an electrical upgrade is needed, it may be a good time to evaluate adding solar PV.

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# Thank You

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