An Introduction to Heat Pump Water Heating Permitting & Inspection Checklist

Questions and Answers

- Ask questions in the chat box
- Use the “raise hand” function

We will answer questions as they come when there is a natural break

Agenda

- Introduction
- Module Goals
- Background
- How to use the resource
- Overview of National Reference Codes
- Overview of Checklist Contents
- Questions

Introduction

About New Buildings Institute (NBI)

We push for **better buildings** that achieve **zero energy, zero carbon, and beyond**—through research, policy, guidance, and market transformation—to protect people and the planet.

NBI's work targets the aspects of the built environment that can make the greatest impact for the climate.

Research and guidance on "best-in-class" measures, practices and technologies

Advanced code and policy approaches

Training and education to build market capacity

Innovative, leading-edge program design and delivery approaches

Updates on issues critical to the utility energy efficiency business models

On-call subject matter experts

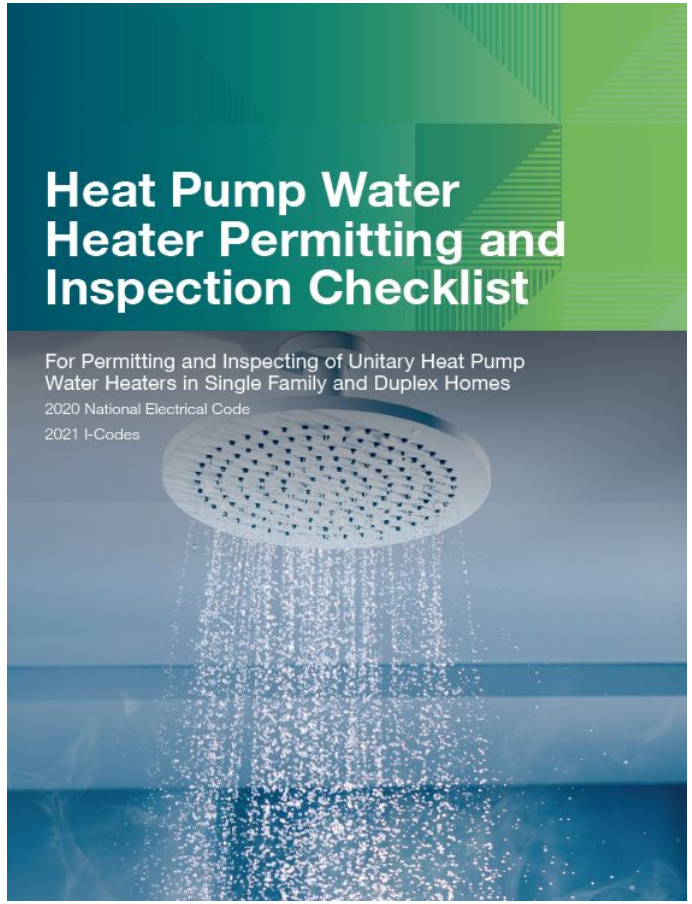
About BENEFIT

U.S. Department of Energy Funded Project

Started in October 2021 and ends March 2025

Key Partners: Nevada GOE, Northeast Energy Efficiency Partnerships (NEEP), Steven Winter Associates (SWA), and International Code Council (ICC)

Goals



What we hope you will get out of this presentation:

- Will learn more about installation requirements for HPWHs
- Consistent enforcement for this technology
- Ensure actionable outcomes and best practices.
- Understand the resource and share with others.

Heat Pump Water Heaters

- Use electricity to move heat from one place to another rather than generating their own heat
- They are 3x more efficient than other water heaters
- Key strategy for increasing building energy efficiency, electrifying building energy loads, and reducing GHGs

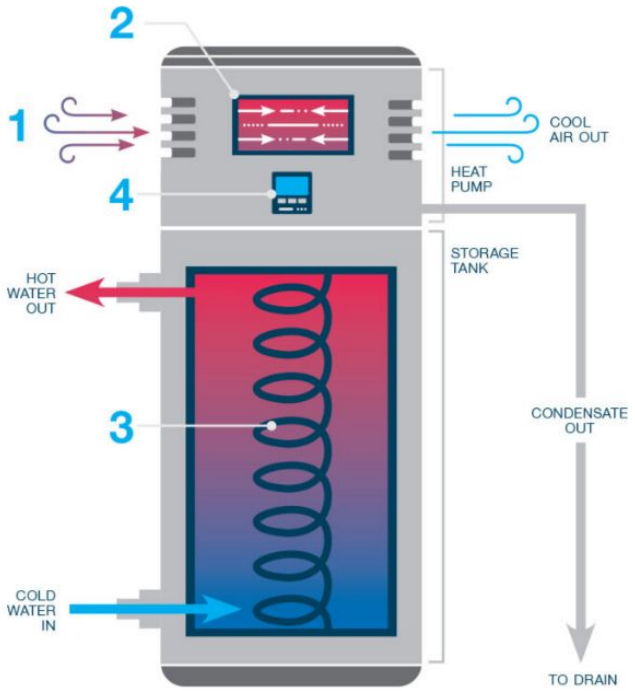
Heat Pump Water Heaters

1 Heat pump pulls in nearby air.

2 The air warms a cold refrigerant which is then compressed, increasing its temperature.

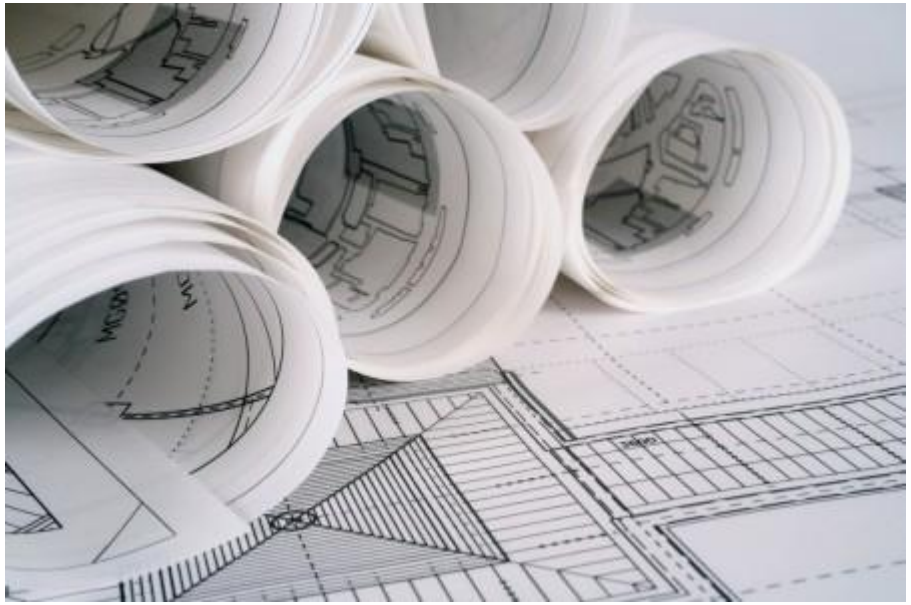
3 The warm refrigerant heats the water in the storage tank. After the heat transfer, the refrigerant then rapidly expands, dropping its temperature, and the cycle starts again.

4 Smart grid connectivity controls help manage energy use.



Source: Advanced Water Heating Initiative (AWHI)

Key Stakeholders



- Building Department
- Designers
- Contractors
- Building Owners

Overview of Checklist

HPWH Permitting and Inspection Guide

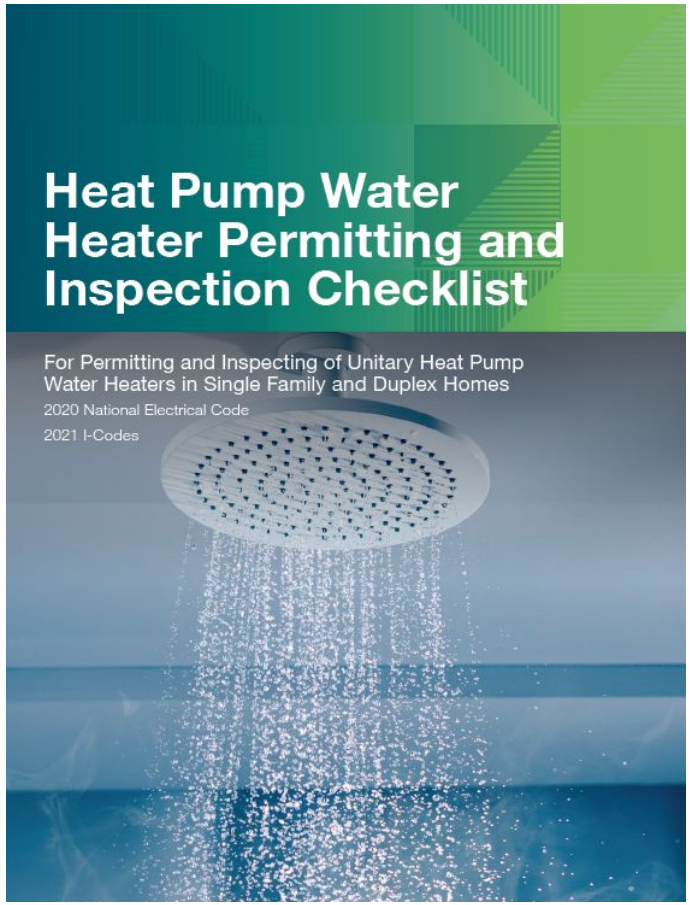


Table of Contents

Limitations

Only addresses unitary HPWH

Does not include any service upgrades or other electrical work

Does not include structural upgrades

Is for domestic and service hot water only

Recommended process is for a 3-in-1 model (mechanical, electrical, and plumbing)

Codes

- 2020 National Electrical Code (NEC)
- 2021 International Residential Code (IRC)
- 2021 International Building Code (IBC)
- 2021 International Plumbing Code (IPC)

- Section
- Requirement with code reference

Permitting and Inspection Checklist

	Plan	Inspection
Minimum Installation Requirements		
1. HPWH is installed according to manufacturer's installation instructions (IPC 502.1) (IRC M2005.1)		❑
2. HPWH is suitable for the environment in which it will be installed (IRC M1305 and IRC P2801.4)	❑	❑
HPWH is third-party certified (IPC 501.5)	❑	❑
4. HPWHs and storage tanks have the maximum allowable working pressure permanently attached and clearly stamped in the metal or marked on a plate. (IPC 501.7)		❑
5. HPWHs have a nameplate with identifying name and rating in volts and amperes, o in volts and watts. (NEC 422.60)		❑
6. HPWHs complies with UL 174 . (IRC M2005.1)	❑	❑
7. HPWH meets capacity and efficiency ratings in plans.		❑
8. If the HPWH is replacing a gas water heater, the gas outlets are capped gastight. (IFGC 404.15)		❑
Location Requirements		
9. HPWH clearances meet the industry standard of 7 X 7 X 3 or as specified in the manufacturer's installation specification and listing. (IPC 502.5)	❑	❑
10. HPWH is installed according to manufacturer instructions. (IRC M2005.1)		❑
a. The HPWH has unrestricted airflow and minimum installation space of 700 cubic feet with 6" clearance above. (depending on size of system). (Manufacturer recommendation)		
b. Where a HPWH is installed in a closet or utility room there is adequate thermal air circulation means or thermal venting of cooled air (ducts or vented doors or door edges trimmed up). (Manufacturer's recommendation)		
c. The HPWH is installed where the ambient air temperature is between 45 and 110 degrees F. (Manufacturer recommendation)		

- Check box to be reviewed either during plan review or inspection

Permit Submission Requirements

To apply for a permit, submit the following

1. Combination permit application
2. HPWH type, size, and efficiency
3. Floor plan drawn to scale
4. Electrical line diagram
5. Mechanical and plumbing piping design
6. Completed electrical load calculations
7. Equipment manufacturer specifications and installation manual

Minimum Installation Requirements

1. HPWH is installed according to manufacturer's installation instructions.
2. HPWH is suitable for the environment in which it will be installed
3. HPWH is third-party certified
4. HPWHs and storage tanks have the maximum allowable working pressure permanently attached and clearly stamped in the metal or marked on a plate.

Minimum Installation Requirements Cont.

5. HPWHs have a nameplate with identifying name and rating in volts and amperes, or in volts and watts.
6. HPWHs complies with UL 174 .
7. HPWH meets capacity and efficiency ratings in plans.
8. If the HPWH is replacing a gas water heater, the gas outlets are capped gas tight.

Location Requirements

Location Requirements

9. HPWH clearances meet the industry standard of 7 X 7 X 3 or as specified in the manufacturer's installation specification and listing.

10. HPWH is installed according to manufacturer instructions.

11. Access to the HPWH is provided for inspection, service, repair, or replacement without compromising the operation of a fire-resistance-rated assembly or removing permanent building fixtures, other appliances, or piping ducts that are not related to the appliance being inspected, serviced, repaired, or replaced.

Location Requirements Cont.

12. A level service space at the front or side of the HPWH is at least 30 inches (762 mm) in length and 30 inches (762 mm) in width.

13. HPWH supported from the ground are level and firmly supported on a concrete slab or other approved material 3 inches above ground. HPWH suspended from the floor have a clearance of not less than 6 inches from ground.

14. Where a HPWH is located in an attic.

15. HPWH is installed in a location where leakage from the tank will not cause damage

Location Requirements Cont.

16. Where earthquake loads are applicable
17. HPWH relocated the new length of hot water piping from the HPWH to fixtures that require hot water does not exceed 50 feet.
18. HPWH located to provide protection between the HPWH and adjacent combustible materials.
19. If installed in a garage, HPWH is protected from vehicular impact.
20. HPWH installation location matches approved floor plan.

Electrical Requirements

Electrical Requirements: Panel Capacity

21. For HPWH installations, the electrical service rating is greater than or equal to the electrical service load as demonstrated by electrical service load calculations.

22. The HPWH branch circuit is properly identified on the electrical panelboard.

Electrical Requirements: Water Heater

23. The rating of the branch circuit serving the water heater is not less than either

24. Appropriately sized overcurrent protection (e.g., circuit breaker) is provided for the branch circuit serving the HPWH.

25. The branch circuit overcurrent device may serve as the disconnecting means where the switch or circuit breaker is within sight from the appliance or be capable of being locked in the open position.

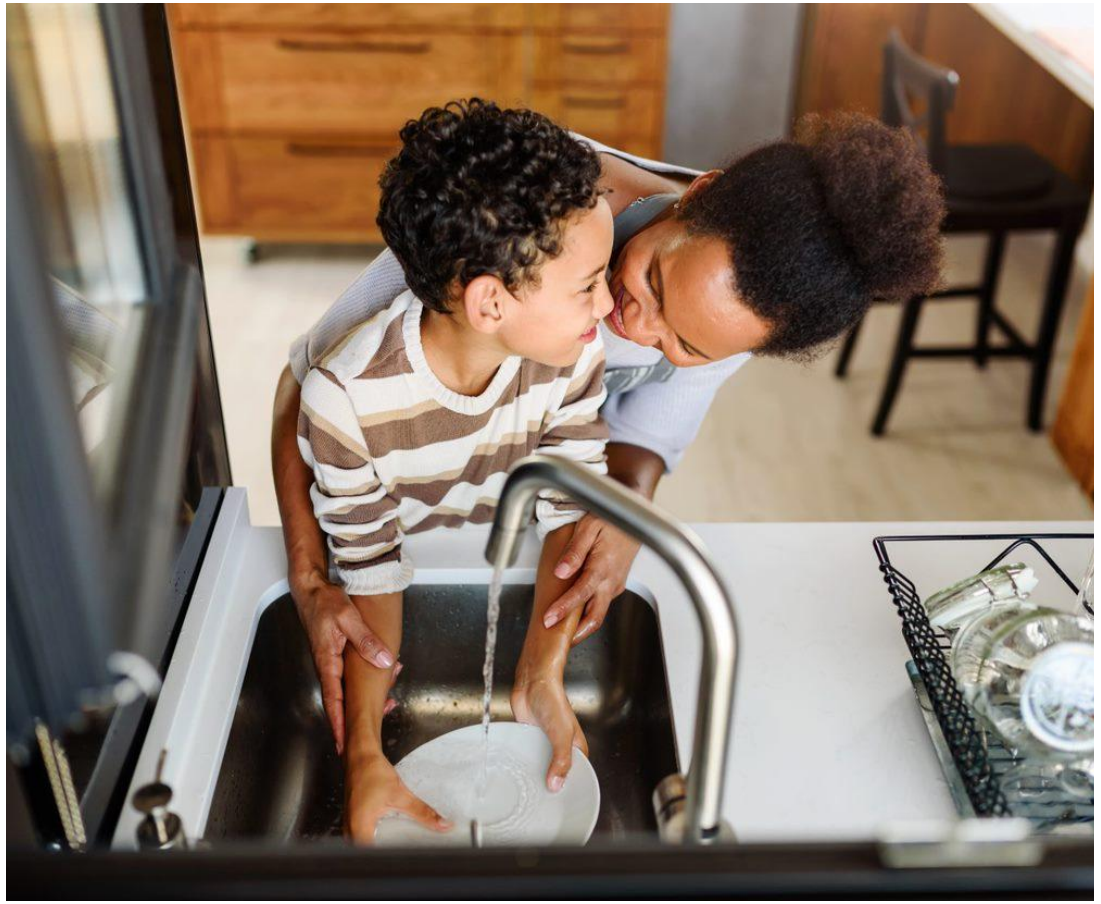
26. A means for disconnecting an electric hot water supply system from its energy supply is provided according to NFPA 70. A separate valve should be provided to shut off the energy fuel supply to all other types of hot water supply systems.

27. All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground have ground-fault circuit interrupter (GFCI) protection if HPWH is installed: outdoors, in crawlspaces or basements, indoor damp and wet locations, laundry rooms or bathrooms.

Plumbing Requirements

Plumbing Requirements: Water Heater

28. The method of connecting a circulating water heater to the tank provides proper circulation of water through the water heater. The pipe or tubes required for the installation of appliances that will draw from the water heater or storage tank comply with the provisions of this code for material and installation.



Plumbing Requirements: System

29. All piping is properly installed, sealed, and protected from exposed elements. (IRC M2101, IPC Chapter 6)

30. The cold water branch line from the main water supply line to the HPWH is provided with a valve, located near the equipment and serving only the hot water storage tank or water heater. The valve does not interfere or cause a disruption of the cold water supply to the remainder of the cold water system. The valve is provided with access on the same floor level as the water heater served. (IPC 503.1)

31. Hot water supply systems are equipped with automatic temperature controls capable of adjustments from the lowest to highest acceptable temperature settings for the intended temperature operating range. (IPC 501.8)

Plumbing Requirements: System Cont.

32. Shutoff valve is installed on the water supply pipe of the HPWH.
33. The HPWH is protected by one of the following two relief valve types which have a minimum rated capacity for the HPWH, conform to ANSI Z21.22, and meet discharge pipe requirements:
34. Hot water pipes are insulated with a minimum R-3 applied to the following
35. Connections are inspected for leaks or drips.

Mechanical Requirements

Mechanical Requirements: Exhaust

36. Direct exhaust away from any thermostats if present or within ten feet.

37. Exhaust openings that terminate outdoors are protected with corrosion-resistant screens, louvers or grilles. Openings in screens, louvers and grilles are not less than ¼ inch and not larger than ½ inch.

Mechanical Requirements: Condensate

38. Condensate from cooling coils and evaporators are drained from the drain pan outlet to an appropriate place of disposal (e.g., not a street, walkway, crawl space, above outdoor equipment, or other area where it would cause a nuisance). The condensate drain piping slopes downhill with a minimum 1-percent slope (1/8 unit vertical in 12 units horizontal).

39. Condensate drains are not directly connect to any plumbing drain, waste or vent pipe. Condensate drains are not discharge into a plumbing fixture other than a floor sink, floor drain, trench drain, mop sink, hub drain, standpipe, utility sink or laundry sink. Condensate drain connections to a lavatory wye branch tailpiece or to a bathtub overflow pipe is not to be considered as discharging to a plumbing fixture. Except where discharging to grade outdoors, the point of discharge of condensate drains is located within the same occupancy, tenant space or dwelling unit as the source of the condensate.

Mechanical Requirements: Condensate Cont.

40. Components of the condensate disposal system is ABS, cast iron, copper and copper alloy, CPVC, cross-linked polyethylene, galvanized steel, PE-RT, polyethylene, polypropylene, PVC or PVDF pipe or tubing. Components selected for the pressure and temperature rating of the installation. Joints and connections are made according to the applicable provisions of Chapter 7 of the International Plumbing Code relative to the material type. Condensate waste and drain line size are not less than ¾-inch pipe size and do not decrease in size from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing are sized according to Table 307.2.2.

41. secondary drain or auxiliary drain pan is installed for each cooling or evaporator coil where damage to any building components will occur as a result of overflow from the equipment drain pan or stoppage in the condensate drain piping.

Appendices

Appendix: Example Permit Application

Appendix: Example Permit Application

❑ New Application ❑ Revised Application

SECTION 1: General Info

Project Address

( ) -

Property Owner's Name | Phone Number | E-mail

Property Owner's Mailing Address (if different from Project Address)

SECTION 2: Project Details

❑ Single-Family ❑ Multi-family ❑ Other _____

Project Scope:

Make & Model #: | Gallons Storage:

Model Volts and Ampacity: | Uniform Energy Factor:

Tank Size: | NEEA Tier:

Location:
- ❑ In conditioned space
- ❑ In conditioned space with venting
- ❑ Garage or basement
- ❑ Attic

Venting origin and destination:

Dimensions of room or closet:

Installed in the location of the existing tanked water heater ❑ Yes ❑ No

SECTION 3: Contractor Information

Business Address

( ) -

Contractor Contact Name | Phone Number | E-mail

Contractor Business Name | Contractor License Number

Electrician/Subcontractor Business Name | Electrician/Subcontractor License Number

Business Address

( ) -

Electrician/Subcontractor Contact Name | Phone Number | E-mail

SECTION 4: Permit Fee

[Include fee schedule/options and/or instructions for calculating fee, directions on how and when to submit the permit fee.]

SECTION 5: Important Notice

A permit must be obtained for all installations or alterations of electrical equipment BEFORE WORK STARTS. Refer to Permitting Checklist for additional documents required. Failure to provide all required documents, will delay permit approval. All permits expire six (6) months after date of issuance. Failure to start the work authorized by a permit within this six-month period renders the permit invalid and a new permit must be obtained. Once work begins, noticeable progress must continue until completion. All work must be complete within eighteen (18) months of a permit issue date.

Please Submit the following additional documents with the HPWH Permit Application

- ❑ Site Plan or Floor Plan
- ❑ Electrical Load Calculations
- ❑ Structural Load Calculations (if required)
- ❑ Equipment Manufacturer Specifications
- ❑ Energy Compliance Forms
- ❑ [Additional Document—edit or delete as necessary]

Submit Permit Application

[Describe the submission process, how should the permits be submitted? In-person, on-line, e-mail, fax, etc.]

SECTION 6: Applicant Signature

I, the undersigned, certify that I have proper authority to apply for this permit, that the Contractor has obtained a signed contract from the Property Owner for the specified work, that all contractors have consented to being listed, and that all the information contained on this application is true and accurate to the best of my knowledge.

Name | Title

Signature | Date

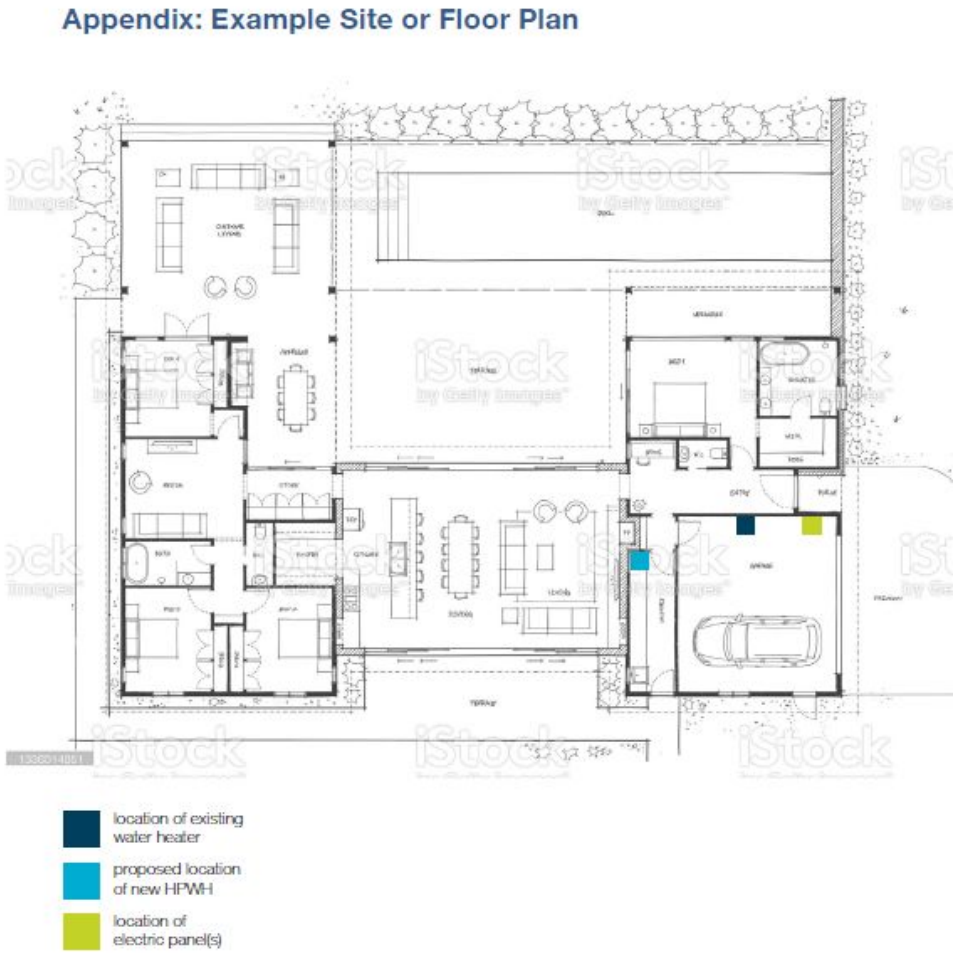
For Office Use Only

Application Number: | Date Applied:

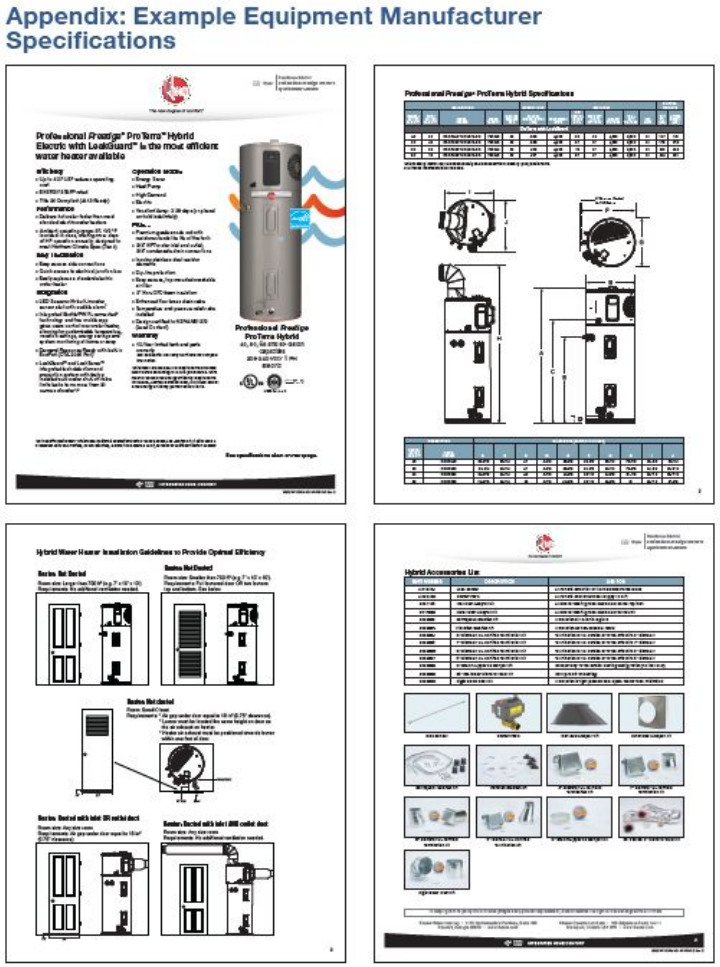
Permit Number: | Date Issued:

Issued By:

Appendix: Example Site or Floor Plan



Appendix: Example Equipment Manufacturer Specifications



Questions?

SECTION 2

Sizing Electric Water Heating Swaps

Best Practices for Multifamily Central Systems

Questions and Answers

- Ask questions in the chat box
- Use the “raise hand” function

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- Module Goals
- Background
- Domestic Hot Water System Sizing Steps
- How to use the resource
- Questions

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Updates on issues critical to the utility energy efficiency business models

On-call subject matter experts

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
- Decarbonization
- Sustainability Consulting
- Green Building Certification
- Accessibility Consulting

Our teams are based across four office locations:
New York, NY | Washington, DC | Norwalk, CT | Boston, MA

For more information, visit
www.swinter.com

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Module Goals

Goals

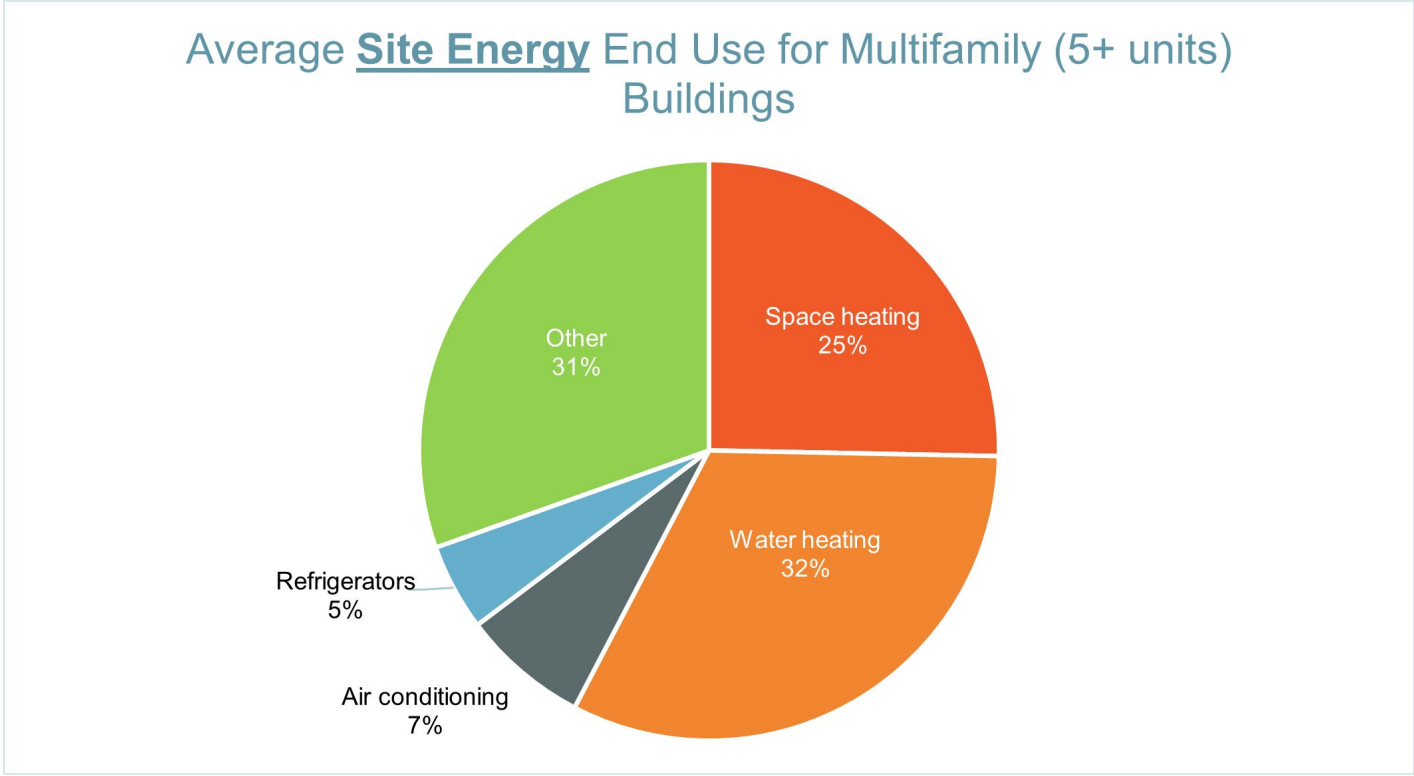
What we hope you will get out of this presentation:

- Understand the challenge of decarbonizing multifamily water heating
- Recognize the importance of appropriately sizing DHW in multifamily buildings when switching to electric.
- Identify the basic steps to take when considering replacing the DHW system.
- Understand the resource and share with others.

Background

The Opportunity

- Decarbonize
- Increase Efficiency
- Consolidate Utility Bills



Source: U.S. IEA 2015 Residential Energy Consumption Survey

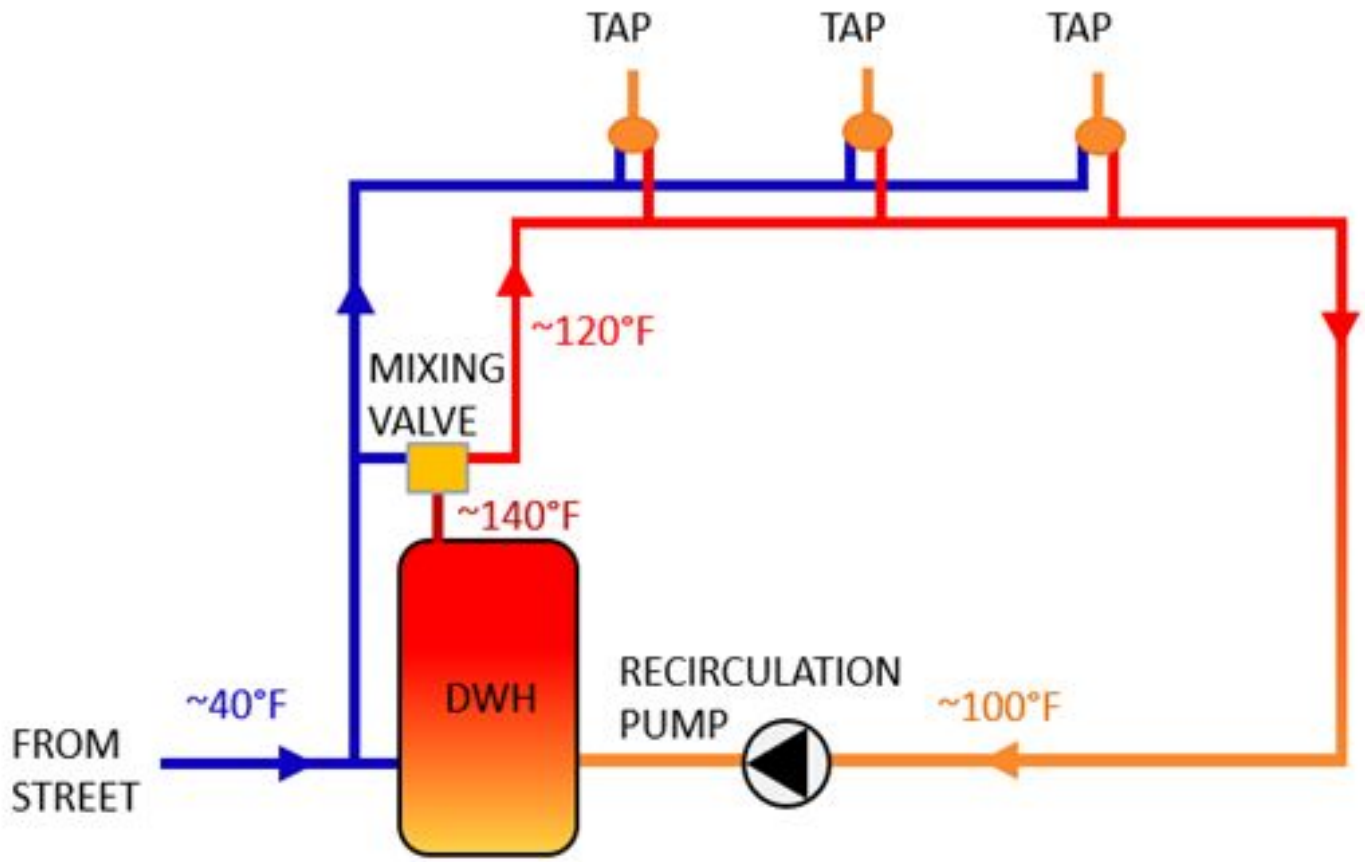
Electrifying DHW

Heat Pumps

- Not electric resistance boiler
- Not a simple swap
- Ripple effects

Old, inefficient boiler

Multifamily Centralized DHW Systems



Heat Pump Sizing Steps

Step 1: Evaluate Current Conditions and Understand True Demand

Step 1: Evaluate Current Conditions and Understand True Demand

https://www.shutterstock.com/image-photo/stainless-steel-kitchen-faucet-sink-running-55062781

Items to consider:

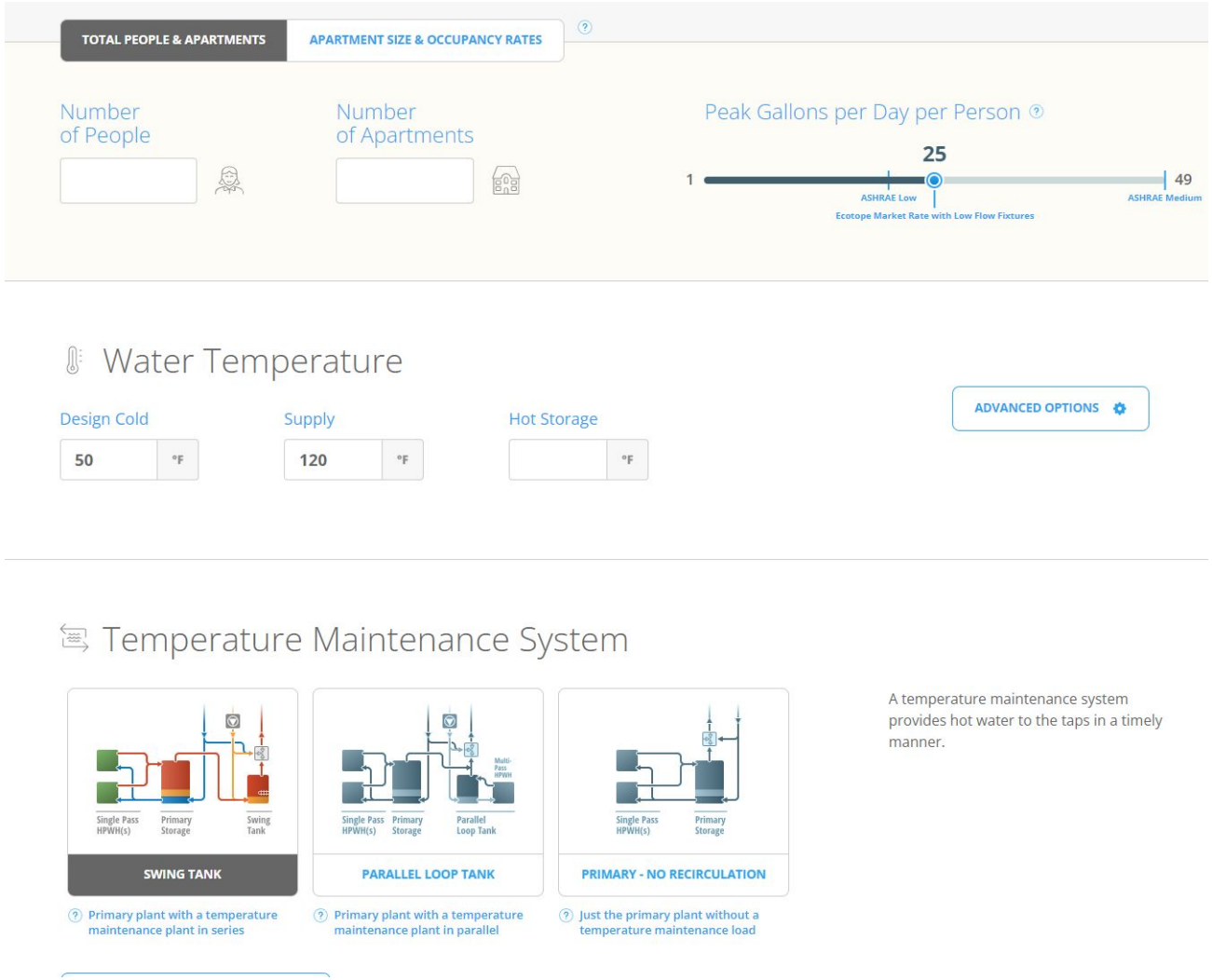
- Current system architecture
- Availability of roof space for equipment
- Flow rates of plumbing fixtures

Remember:

- ASHRAE has profiles for many typologies in Applications chapter on Service Water Heating
- MEPs typically oversize
- Measuring actual loads is much cheaper than oversizing

Step 2: Calculate Loads Accurately

Step 2: Calculate Loads Accurately



Step 3: Identify Appropriate Equipment and Properly Install

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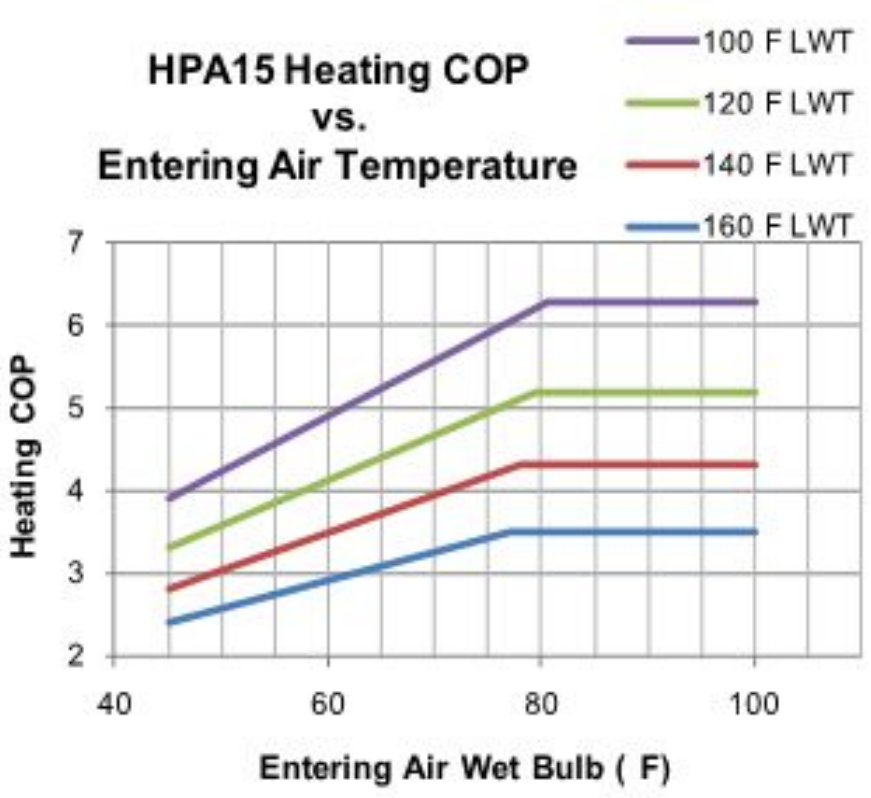
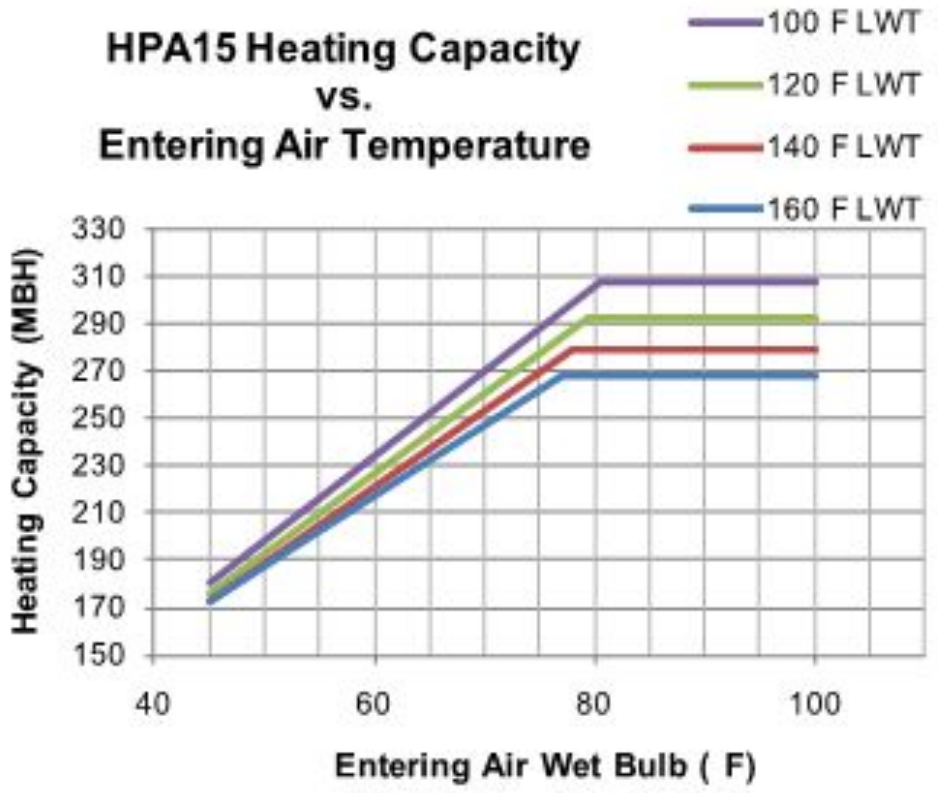




Step 3: Properly Install

Step 3: Properly Install

Challenges to Consider

» Finding space outdoors

» Very few outdoor use options in the US market today

» Potential system upgrades required:

- Electrical service to roof
- Plumbing penetrations/ties ins
- Pumps

» Potential rooftop installation trouble with larger units:

- Small halls, door openings + large components

How to Use This Resource

Sizing Electric Water Heating Swaps

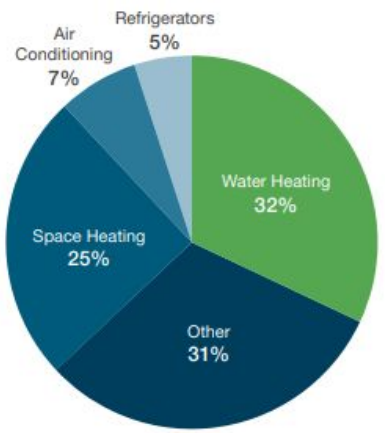
Introduction

This fact sheet is intended to assist those looking to make the transition to all-electric water heating systems from systems that rely on fossil fuel combustion. Electrifying building water heating systems allows building owners to futureproof and decarbonize their property while improving indoor air quality and streamlining utility bills.

Domestic hot water (DHW) represents, on average, almost 20% of the site energy use for multifamily buildings.

Multifamily buildings generally provide DHW to occupants in one of two ways: a central boiler with a recirculation system or individual hot water heaters in dwelling units. This guide focuses on replacements for buildings with central systems.

Average Site Energy End Use for Multifamily (5+ units) Buildings



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