**Building Science Education Solution Center – External Resources**

Proficiency Level 1: Remember

**Learning Objective 1.1:**

* What other resources are available for information and learning?

**Lecture Notes 1.1:**

The Building Science Education Solution Center (BSESC) website is a valuable source of training tools and information on heat pump water heaters (HPWHs). However, for those seeking further knowledge and additional information on HPWHs, a selection of external resources is listed below.

The inclusion of any external resource in the list below does not imply a preference or endorsement by PNNL. The list is provided solely for the purpose of offering additional options for continued learning and supplemental information on HPWHs. Users are encouraged to explore these resources at their own discretion and in no particular order.

**Installation Guidance and Best Practices**

* **Installation Best Practices Guide, Northwest Energy Efficiency Alliance (NEEA)**

<https://hotwatersolutionsnw.org/assets/documents/uploads/hws-installation-best-practices-guide.pdf>

***Key topics:*** *Anatomy of a HPWH, installation considerations, installation best practices*

***Target audience:*** *Professionals in the plumbing and HVAC industries, homeowners and building owners interested in installing a HPWH*

This guide provides information on heat pump water heater (HPWH) benefits, installation best practices of HPWHs, and basic anatomy of how a HPWH works. HPWHs have become more readily available, efficient, and reliable, with many products offering a 10-year warranty. By reducing energy consumption and operating costs by up to 60% compared to standard electric water heaters, heat pump water heaters can have a substantial impact on overall energy usage throughout their lifetimes. The guide describes the benefits of heat pump water heaters and their potential to improve energy efficiency in various settings.

* **Love Electric, Heat Pump Water Heaters in New Townhomes, presentation by NEEA**

<https://loveelectric.org/wp-content/uploads/2023/04/Heat-Pump-Water-Heaters-Installation-in-Townhomes-NEEA-Mar-2023.pdf>

***Key topics:*** *Recommended installation locations, specific installation examples, climate considerations*

***Target audience:*** *HPWH installers, building designers, and others making decisions about water heating for new construction*

This presentation discusses information on heat pump water heaters (HPWHs) in new townhomes. HPWHs are electrically powered and can reduce energy use by 2-4 times compared to traditional water heaters. They use heat from the ambient environment to heat water and have the lowest lifetime greenhouse gas emissions of all consumer water heating technologies. The presentation shows recommended locations for HPWHs, such as garages, basements, and interior spaces, and provides guidance on clearances and climate implications. It also includes specific examples and options for installing HPWHs in different scenarios.

* **Love Electric, Heat Pump Water Heater Technical Guide, New Buildings Institute, Southern California Edison, and Advanced Water Heating Initiative**

<https://loveelectric.org/wp-content/uploads/2023/05/SCE_HeatPumpWaterHeaterTechnicalGuide.pdf>

***Key topics:*** *Design considerations, installation, and maintenance of HPWHs, how HPWHs work and their benefits, code and inspection checklists for compliance with regulations*

***Target audience:*** *Professionals in the plumbing and HVAC industries, homeowners and building owners interested in installing a heat pump water heater*

This guide provides a technical guide for heat pump water heaters (HPWHs) that outlines the features, benefits, and installation considerations of this technology. HPWHs are a proven technology that can be used as a component of going electric in homes and businesses. By switching to HPWH technology, installers can meet growing consumer demand for healthier and more efficient options. The guide also highlights the advantages of HPWHs over traditional electric and gas water heaters, such as lower installation costs, elimination of toxic condensate management, and greater flexibility in temperature and operational modes.

* **Building America Solution Center, Home Improvement Expert Checklist** <https://basc.pnnl.gov/home-improvement-expert/checklists/heat-pump-water-heater>

***Key topics:*** *Preparation and inspection before installation, installation requirements and specifications, commissioning, and maintenance procedures*

***Target audience:*** *Contractors and professionals involved in the installation and maintenance of heat pump water heaters*

This resource gives a checklist for the installation of heat pump water heaters (HPWHs) to ensure a complete and quality installation. It includes specifications for inspecting existing water pipes for leaks, sizing the replacement water heater based on first-hour rating, and installing the HPWH in a space with adequate clearance. The checklist also covers requirements for emergency drain pans, temperature and pressure relief valves, thermal expansion control, insulation of hot water pipes, and commissioning and maintenance procedures. Additionally, the resource offers tips for selling quality installed home improvements and emphasizes the importance of trust, knowledge, clarity, value, and showcasing experiences.

* **Best Practices for the Retrofit Installation of Heat Pump Water Heaters, Richard Heath & Associates (RHA)**

[https://frontierenergy-tech.my.site.com/contractorsupport/s/article/Heat-Pump-Water-Heater-Trainings-and-Resources](https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Ffrontierenergy-tech.my.site.com%2Fcontractorsupport%2Fs%2Farticle%2FHeat-Pump-Water-Heater-Trainings-and-Resources&data=05%7C01%7Cmax.martell%40pnnl.gov%7C85a52ac1022a4948c21008dbae362dd1%7Cd6faa5f90ae240338c0130048a38deeb%7C0%7C0%7C638295319977208953%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=SeUkyaVMyEIhEwFR7bDbPwKP8tdFfyEBK0zge4cYWMM%3D&reserved=0)

***Key Topics:*** *Installation best practices, curriculum development, retrofit, California*

***Target audience:*** *Instructors, educators, textbook authors, guideline/standards developers*

This document, developed for the TECH Clean California initiative, supports the correct installation of HPWHs in the field by providing a comprehensive set of best practices that can be used as a checklist for instructors creating new curricula, as a guide for those developing guidelines, standards, or certifications, and as a resource to be incorporated into manuals, field guides, and job aids. The best practices are not meant to serve as a comprehensive training tool. Instead, this document was developed to help instructors and others cross-reference existing content to identify potential gaps.