Installer Guides for Sizing, Selecting and Installing Air-Source Heat Pumps in Cold Climates

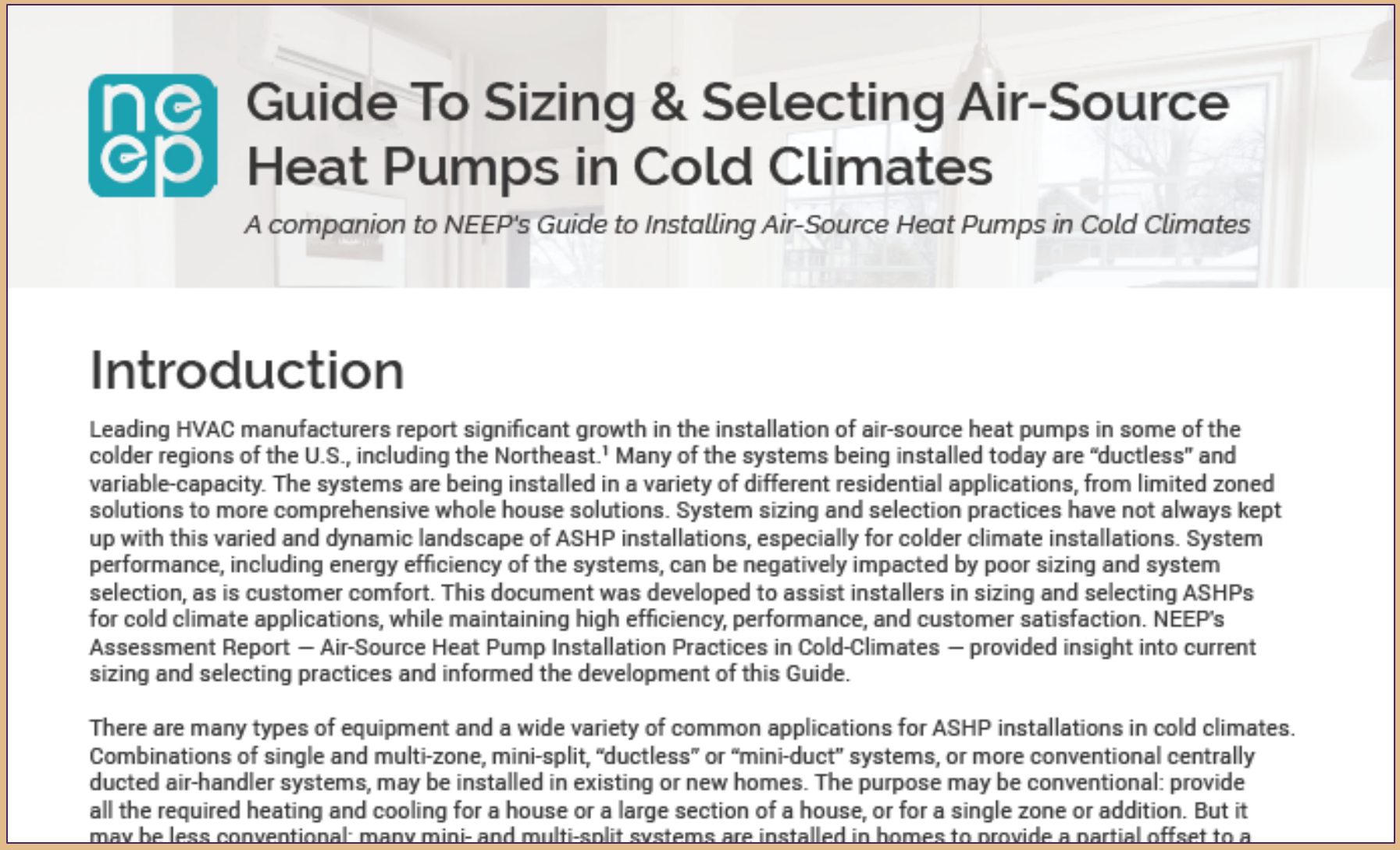
Bruce Harley

June 27, 2017

Outline

- Introduction to Cold Climates ASHP Guides:
  - Sizing/Selecting
  - Installing ASHPs
  - Checklist version
- Q&A / Next steps

Sizing and Selecting Guide



Guide To Sizing & Selecting Air-Source Heat Pumps in Cold Climates

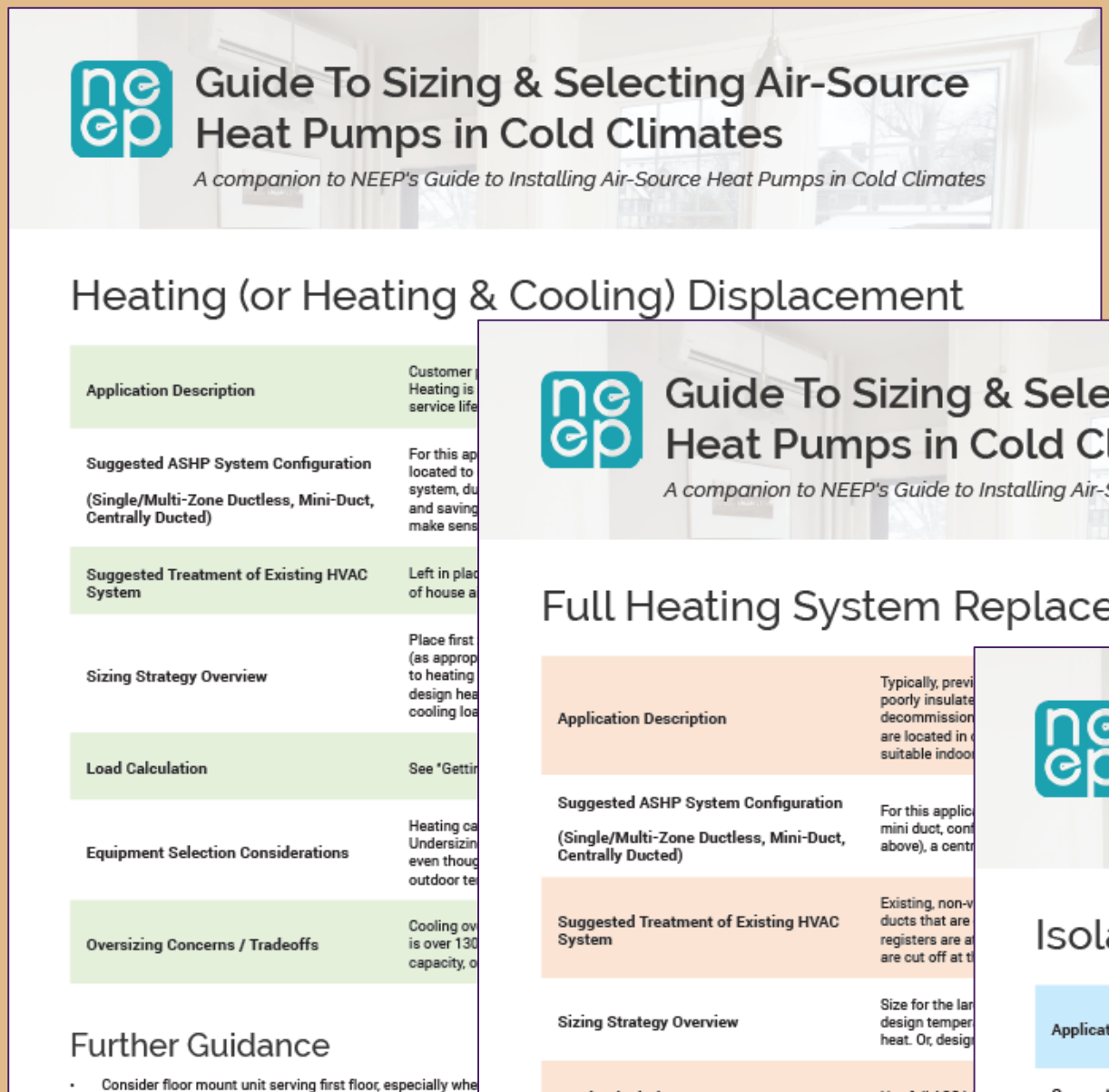
A companion to NEEP's Guide to Installing Air-Source Heat Pumps in Cold Climates

Introduction

Leading HVAC manufacturers report significant growth in the installation of air-source heat pumps in some of the colder regions of the U.S., including the Northeast.[1] Many of the systems being installed today are "ductless" and variable-capacity. The systems are being installed in a variety of different residential applications, from limited zoned solutions to more comprehensive whole house solutions. System sizing and selection practices have not always kept up with this varied and dynamic landscape of ASHP installations, especially for colder climate installations. System performance, including energy efficiency of the systems, can be negatively impacted by poor sizing and system selection, as is customer comfort. This document was developed to assist installers in sizing and selecting ASHPs for cold climate applications, while maintaining high efficiency, performance, and customer satisfaction. NEEP's Assessment Report — Air-Source Heat Pump Installation Practices in Cold-Climates — provided insight into current sizing and selecting practices and informed the development of this Guide.

There are many types of equipment and a wide variety of common applications for ASHP installations in cold climates. Combinations of single and multi-zone, mini-split, "ductless" or "mini-duct" systems, or more conventional centrally ducted air-handler systems, may be installed in existing or new homes. The purpose may be conventional: provide all the required heating and cooling for a house or a large section of a house, or for a single zone or addition. But it may be less conventional: many mini- and multi-split systems are installed in homes to provide a partial offset to a

Application Sheets



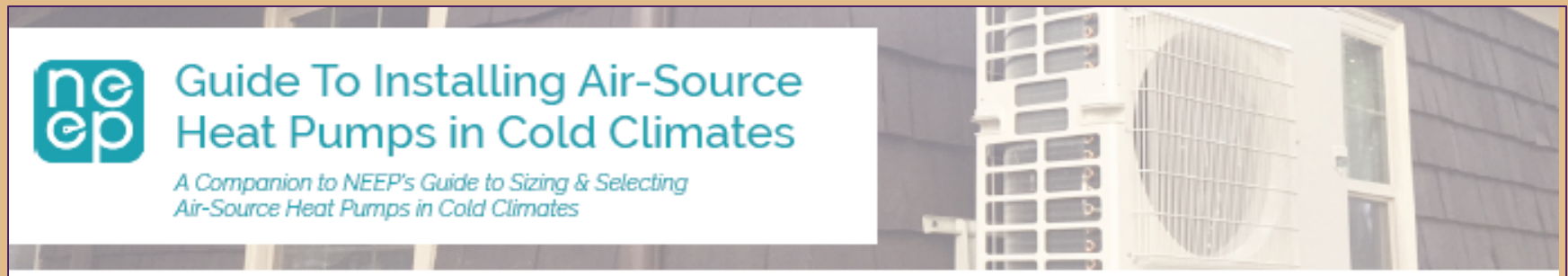
Heating (or Heating & Cooling) Displacement

Application Description	Customer primarily desires to reduce heating (and/or cooling) cost for central area of home. Heating is supplemental when the existing heating equipment is not at or near the end of its service life. The main tradeoff is between initial cost vs. savings and comfort in remote zones.
Suggested ASHP System Configuration **(Single/Multi-Zone Ductless, Mini-Duct, Centrally Ducted)**	For this application, typical configurations include 1-zone ductless, or 1-3 room mini-duct located to serve central living space (for reduced installed cost). Alternatively, larger 2-5 zone system, ductless and/or mini duct, can be configured to serve home widely for better comfort and savings (higher installed cost). In some cases, a new single-zone central heat pump may make sense but that is more likely a whole-house replacement.
Suggested Treatment of Existing HVAC System	Left in place, provides heat only as needed. A centrally ducted system may also provide mixing of house air for improved comfort.
Sizing Strategy Overview	Place first zone where heat will cover most central living area. Establish any additional zones (as appropriate) to strategically cover key living areas per customer needs. Size each zone to heating load of area(s) to be served (block load): total will be undersized for whole-house design heating load. If cooling comfort is desired by customer, size to larger of heating or cooling load for each zone.
Load Calculation	See “Getting Load Calculations Right” to ensure accurate load calculations.
Equipment Selection Considerations	Heating capacity of system at or near outdoor design temperature is a secondary concern. Undersizing somewhat for heating should improve efficiency and reduce overall heating costs, even though central system may be used slightly more. High efficiency at predominant winter outdoor temperatures will reduce operating cost.
Oversizing Concerns / Tradeoffs	Cooling oversize is mitigated by variable-speed equipment; if minimum speed cooling capacity is over 130% of design cooling load, look for equipment with a higher ratio of heating to cooling capacity, or a larger turn-down ratio (a lower minimum capacity), or both.

Sizing / Selection: Notable Items

- Flexibility on load calculations for displacement applications
- Incorporate low speed cooling capacities in cooling-oversize limits (based on Manual S)
- Recommend floor-mounted consoles for lower floor applications
- Recommend mini-duct systems for multiple small rooms to avoid oversizing

Installation Guide



Guide To Installing Air-Source Heat Pumps in Cold Climates

A Companion to NEEP's Guide to Sizing & Selecting Air-Source Heat Pumps in Cold Climates

Introduction

High-quality installations of air-source heat pump (ASHP) systems generate referrals, increase sales, reduce callbacks and improve customer comfort and satisfaction. Installation practices also have a major impact on efficiency and performance of an ASHP system. Efficient ASHPs have seen significant sales growth in colder climates in recent years. The recent generation of cold-climate ASHPs, combined with insights from large-scale installation programs and installers, has led to a better understanding of the full range of practices to ensure maximum system performance and customer satisfaction. This guide provides a list of these best practices, as well as homeowner education and system setup guidance, to help ensure efficient air-source heat pumps and happy customers in cold climates.

Heat pumps should always be installed by licensed, trained professionals. Always follow manufacturer's specification and installation instructions, and all applicable building codes and regulations. All installers should attend a manufacturer's training or preferred installer program.

ASHPs come in a number of configurations, and in some cases the following guidance may be specific to one or more of those system types. There are many variations and terms used, but these guidelines will focus on the following broad categories: "ductless ASHP" refers to any non-ducted cassette type indoor unit (including wall-mount air handlers, floor mounted consoles, in-ceiling cassettes, etc.); "mini-duct ASHP" refers to remote air handlers that are typically designed for compact, concealed-ceiling or short-duct configurations; and "centrally ducted ASHP" refers to whole-house systems with central air handlers. The icons shown here are used below to indicate when guidance is specific to a certain system type. All items without icons are generally applicable to all ASHP configurations.

Applies to: Ductless ASHP Mini-Duct ASHP Centrally ducted ASHP

Installation: Notable Items

- Protecting line set entry point from rodents
- Protecting outdoor unit from eaves/drip/snow
  - De-emphasize pan heaters
- Recommend surge suppressors
- Recommend floor-mount / console units
  - For heating-focused applications, lower floors
- Controls set-up
- Customer education: operation & maintenance

Installer Setup Examples

- Use wall-mounted control
  - Except for small rooms
- Integrated controls: ASHP + central HVAC
- Use “efficient home” or similar settings to minimize cycling in low load conditions
- Avoid continuous fan operation for temperature sensing

ASHP Installation Guide Checklist

Line Set

Manufacturer's instructions were followed for minimum and maximum line set length and height change

- [ ] Yes

Actual Length (ft)

Your answer

Height Change (ft)

Your answer

Insulation covers entire line set length (both pipes) to avoid condensation and energy loss

- [ ] Yes

The outdoor portion of insulated line set is protected with a rigid cover to avoid insulation damage

- [ ] Yes

Any remaining exposed insulation is protected by UV tape or other

Access/Use of Guides

- Guides developed to be shared/used broadly
- Guides posted on NEEP's public website, available to download
- Guides available to co-brand
- Seeking opportunities to disseminate resource
- Please send ideas about key venues to share the Guides

Contact

- Dave Lis, NEEP
  - djlis@neep.org
  - 781-860-9177 (x127)
- Bruce Harley, Bruce Harley Energy Consulting
  - bruceharleyenergy@gmail.com
  - 802-694-1719
- NEEP's ASHP web resources

  http://www.neep.org/initiatives/high-efficiency-products/emerging-technologies/ashp