Northeast Energy Efficiency Partnerships

2016 NORTHEAST/MID-ATLANTIC AIR-SOURCE HEAT PUMP WORKSHOP

FACILITATED BY

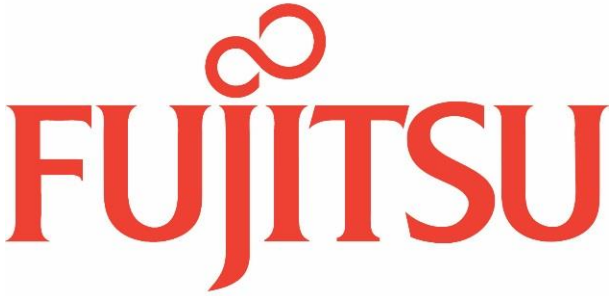
DAVE LIS

Director of Market Strategies

NORTHEAST ENERGY EFFICIENCY PARTNERSHIPS

July 21-22, 2016

Thank you to our Workshop Sponsors!



WORKSHOP DAY 2- ASHP SIZING&INSTALL/ROUND-ROBIN

- 7:30am- Breakfast
- 8:30am- Welcome Back
- 8:40- 10:10 ASHP Size/Select/Install Session
- 10:10-10:30 AM Break
- 10:30-12:30- Manufacturer “Round Robin”

Sizing/Selecting/Installing ASHPs in cold climates

PURPOSE OF TODAY'S SESSION

- NEEP is working with DOE to develop ASHP installer sizing/selection and installation guidance resources. This session is meant to gather stakeholder input on the guidance resources content and format.

Session Agenda

- Current installer sizing/selection/installation practices; Share findings from installer assessment (20 min)
- Discuss Application-based sizing/selection guidance ("decision tree" approach) (30 min)
- Discuss/Prioritize cold climate install best practices (20)
- Best vehicles to disseminate resources (10 min, time allowing)
- Next steps

Contractor Practices Assessment Report Sections

- Current Contractor practices for Information collection prior to heat pump selection
- Current Contractor practices for sizing/selecting ASHPs in cold climates
- Current Contractor practices for installing ASHPs in cold climates
- Summary of existing Guidance resources related to Sizing/Selecting/Installing ASHPs in cold climates

Typical information of interest to installers		Common methods of gathering
Intended use of ASHP	Heating/Cooling/Both	Homeowner interview
Extent of coverage	Whole house solution/Zoned solution	Homeowner interview
Size of desired conditioned space(s)	Sq footage (by zones)	Measure
Existing Heating system(s)	Furnace/Boiler/Heat Pump/other	Homeowner interview/site inspection
Existing Cooling System(s)	Central AC/Window AC/No cooling	Homeowner interview/site inspection
Existing HVAC distribution system(s)	Air ducts/No air ducts	Homeowner interview/site inspection
Heating Load (@ heating design temp)	Btu	"Rule of Thumb" estimate, Manual J calculation
Cooling Load (@ cooling design temp)	Btu	"Rule of Thumb" estimate, Manual J calculation
Cooling loads (Latent and Sensible)	Btu	
Design Temperatures (Winter and Summer)	° F	Manual J/ASHRAE Temperature Tables
Availability of energy sources	Electricity/natural gas?	
Energy prices	$/kWh, $/gallon of oil, $/therm of propane, $/therm of gas, $/cord of wood	

Equipment Information

Heating Season Performance Factor (HSPF)	Energy Guide Label, AHRI, Design and Technical Manuals
Seasonal Energy Efficiency Rating (SEER)	Energy Guide Label, AHRI, Design and Technical Manuals
ENERGY STAR Certification	Energy Guide Label
Cooling Capacity (Across range of temperatures)	Cooling Capacity Tables in Design and Technical Manuals
Heating Capacity (Across range of temperatures)	Heating Capacity Tables in Design and Technical Manuals
Heating Capacity ("Rated" at 47 F)	AHRI, Design and Technical Manuals
Heating Capacity ("Rated" at 17 F)	AHRI, Design and Technical Manuals
Heating Capacity (@ 5F)	Heating Capacity tables (in some instances) NEEP's Cold Climate ASHP Specification Tables
Cooling Capacity (@ 95 F)	AHRI, Design and Technical Manuals, "nameplate" value
Partial load efficiencies (COP)	Design and Technical Manuals (in some instances) NEEP's Cold Climate ASHP Specification Tables

Observations related to information collection

- Many interviewees highlighted the importance of understanding the homeowner/building owner's intended use of the heat pump
- Formal load calculations very rare
- Most common load being developed is cooling load. Heating loads usually only calculated in applications where the heat pump is being relied on to deliver full heating load, which is rare.
- Determination of shell efficiency very rare, many installers overestimate building leakage.
- Installers utilize only a portion of potential information, both on the home/building side as well as the equipment side, to inform system sizing/selection

Sizing Methods

Sizing method	Basic Process	Information utilized	Existing Tools/ Resources
Cooling Load Sizing	Match cooling load of applicable zone to cooling capacity of ASHP	Calculated/Estimated Cooling load, Cooling capacity of ASHP (Nameplate capacity)	Manual S, rules of thumb
Heating Load Sizing	Match heating load of applicable zone to heating capacity of ASHP	Calculated/Estimated Heating Load, Heating capacity of ASHP at design temperature	Manual S, rules of thumb
"Balance point" Sizing	Finding intersection of capacity graph (heating capacity table) to load line		
"Economic balance point" Sizing	temperature at which the supplemental heat is less expensive than the heat supplied by the heat pump		

Observations related to Sizing/Selecting

- Challenge- Designing a system that is appropriate for extreme heating and extreme cooling conditions
- No clear guidance on when it is most appropriate to size for heating/cooling/both.
- Variable-capacity equipment helps offset this difference. Careful equipment selection and/or the use of existing central heating equipment to offset peak heating loads can also help optimize the balance between heating and cooling needs.

Observations related to Sizing/Selecting

- Large majority of ASHP systems installed in “cold-climates” are ductless. Ducted systems typically installed in new construction or in applications with existing air distribution (ducts).
- Use of heating design temperature and system low temp capacity/performance is very uncommon
- Oversizing- “Oversizing” for cooling is still the norm. Multiple sources also support ‘oversizing’ of heat pumps as being beneficial due to the advantages of inverter technologies and multi-stage compressors..Some think it eliminates worry of being oversized especially in displacement scenario

Observations related to Sizing/Selecting

- In scenario where ASHP will serve as primary heating, strategies to size/select /control “back up” heating system are needed
- Industry not receiving consistent messages related to when it make sense to invest in “cold climate” system. When is it wise to size for worst case scenario?
- Aux heat options- fireplace insert, portable, electric strip or existing system
- ACCA resources need to be simplified/streamlined to be used by contractor industry
- Installer main desire should be to provide comfort efficiently. However, quick sale is bigger driver. Customers not yet aware/willing to pay for time it takes to use sophisticated methods to properly size systems.

Observations related to Selection

- Most installers work with 1 or 2 manufactures n scenario where ASHP will serve as primary heating, strategies to size/select /control “back up” heating system are needed
- Industry not receiving consistent messages related to when it make sense to invest in “cold climate” system. When is it wise to size for worst case scenario?
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Applications-based Guidance

- New construction / gut remodel
  - Low-energy new homes/deep retrofits
  - Conventional construction
- Existing home
  - Partial offset of conventional high-cost heating
    - New cooling and/or offset of window or other room cooling
    - Multi-zone approach
    - Single-zone “high-value” approach
  - Full heating system replacement
    - With existing ductwork
    - Without existing ductwork
- Isolated zones
  - Solution for isolated comfort problem(s) in existing home
  - Provide conditioning for addition or basement remodel

New construction/gut remodel

- Low-energy new homes/deep retrofits
  - Typically 1 – 3 zones mini split (ductless or mini-duct)
  - Plan to supply 100% of heating load with ASHP at design conditions
- Conventional construction
  - Typically needs more zones in mini split
  - Or, central ducted system(s) depending on size of house and load
- Both cases: easier to justify time for load calculation

Existing home - Partial offset of heating

- Existing, conventional high-cost heating (resistance, LP or oil)
  - Single-zone “high-value” approach
    - Targeted towards most-occupied, most open area of home
    - Provide the most heat/savings for lowest investment
    - Plan for staged multi-zone later when central equipment fails
  - Multi-zone approach
    - Targeted when house is spread out; needs multiple cooling zones; higher savings but bigger initial investment.
- Both cases:
  - customer control/integration of existing central heating is key
  - Detailed load calculations not critical - better places to spend attention

Existing home - Full heating system replacement

- With existing ductwork
  - Typically central ASHP replacing existing system
- Without existing ductwork
  - Multi-zone and/or multiple single mini-split
  - Possibly including new mini-duct system in attic or basement

- In both cases
  - Sizing system for full heating and cooling load
  - Make sure existing / new ductwork is tight/well insulated
    - If existing ductwork is lousy / inaccessible, consider scrapping for multi-zone ductless

ISOLATED ZONES

- Solution for isolated comfort problem(s) in existing home
- Provide conditioning for addition or basement remodel

- Both cases:
  - Typically single-zone mini split, possibly mini-duct
  - Detailed load calcs not critical *especially* if the application includes some spillover “offset” of existing heat

NEXT STEPS

- NEEP to draft guidance resources over the next few months, circulate with interested stakeholders
- Finalize/Disseminate by December

Join us to our next events

- **Sept 20**: Residential Lighting Workshop
- **Sept 21**: Home Energy Management Systems Workshop
- **Sept 22**: EM&V 2.0 Workshop
- **Oct 21**: Rhode Island High Performance Schools Summit
- **Nov 9**: New Hampshire High Performance Schools Summit

THANK YOU!

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