Filing Receipt

Filing Date - 2024-08-01 04:19:36 PM

Control Number - 56510

Item Number - 16

TETRA TECH

Heat Pump Working Group
Meeting Notes
Date: 07/30/2024 @ 11:00 CDT

Contacts	Mark Bergum: (608) 316-3630 or mark.bergum@tetratech.com Graham Thorbrogger: (608) 316-3623 or graham.thorbrogger@tetratech.com
Meeting Link	
Access	PUC – Interchange Filing: Case 56510 Interchange - Documents (texas.gov) Teams site: https://tetratechinc.sharepoint.com/:f:/r/teams/PUCTHeatPumpWorkinggroup/Shared%20Documents/General?csf=1&web=1&e=mCHkEh Past Meeting recordings: https://vimeo.com/channels/HPWG
Discussion Schedule	○ May 7: Identification of VSHP, Load Calculation requirements, Consumption calculation (EFLH), EUL ○ May 21: Summer Peak & Consumption ○ June 4: Winter Peak & Consumption ○ June 18: Baseline equipment, upsizing/downsizing calculation, and coincidence factor ○ July 09: Envelope incorporation ○ July 16: Draft measure ○ **July 30: Review measure**
Calculation review	Review tradeoffs necessary for short-term update to TRM AHRI used compared to other data. This provides with limitations of data available - EER2/SEER2/HSPF2 and Rated Capacities (not COP or Max. capacities) - Adjustment to other data sources will require runway to adjust program operations. - Future improvements of AHRI values are being discussed, most likely helpful would be COP values and HSPF for Dual Fuel Cooling equations - Remain with similar equations for kWh and kW - Largest adjustment will be to adjust to Load (from capacity) - Keep EER baseline for VS units at 9.8 EER and other for 1 or 2 stage - Add in a % increase in savings for completing a Load Calculation to account for the likely reduction in load from the baseline. Heating Equations - kWh using HSPF is going to be very conservative because HSPF is set for Region IV (much farther north). <Asking manufactures for ideas to reduce the conservativeness of this approach> - Peak kW is going to have the largest amount of unknowns. Options available below: 1. Assumed winter load divided by HSPF2/Manufacturers COP of equipment then multiplied by % hours auxiliary heat is estimated. 2. Assumed winter load divided by Deemed COP for Technology group then then multiplied by % hours auxiliary heat is estimated.

	- % hours auxiliary heat is estimated: Table of the Top 20 hours percent that the aux. heat is based on Cap/Load ratio at design temp per climate zone. Estimation of the Coincidence factor for electric resistance. <To be provided to group before next meeting> There may be different numbers for the 1 or 2 speed and overdriven VS units. - Cold Climate heat pump which are designed to not have back up heat could have a variable selected which will create a 0% of hours with aux heat. Control strategy has potential for improvements, but it is unlikely to be explicitly included in 2025 calculation.
Long-term research	Review of current questions for long-term research See attached
Next Steps	Review of Next Steps for the HPWG Review heating equation options and comment (attached) Review peak kW heating % variable Review cooling equations and baselines The measure will be passed to the TRM working group after the next meeting. Review Long Term scope and provide comments (Attached)
Next Meeting	**August 13 at 11:00** Topic – Final comments from HPWG and transition to long term scope development

Acronym	Term
ACCA	Air Conditioning Contractors of America Manual J is the sizing calculation from ACCA
AHRI	Air Conditioning, Heating, and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CCHP	Cold Climate Heat Pump (as defined by NEEP)
COP	Coefficient of Performance
CPUC	California Public Utilities Commission
DHW	Domestic Hot Water
DOE	United States Department of Energy
EER	Energy Efficiency Ratio
EFLH	Equivalent Full Load Hours
ER	Early Retirement
EUL	Effective Useful Life
HP	Heat Pump
HSPF	Heating Seasonal Performance Factor
IECC	International Energy Conservation Code
NC	New Construction
NEEP	Northeast Energy Efficiency Partnership
PNNL	Pacific Northwest National Laboratory
PUC	Public Utility Commission of Texas
ROB	Replace on Burnout
SEER	Seasonal Energy Efficiency Ratio
TRM	Technical Reference Manual
VSHP	Variable Speed Heat Pump

Winter Peak Demand FollowUp from July 30 Meeting

The Winter Peak Demand calculation is going to have a general format to have a component of the heat pump performance in cold weather and multiply it by a percentage of the Top 20 hours that are expected to have electric resistance auxiliary heat used (CFw)

In both the options below,

- The Calculation will be completed for the baseline or Pre-retrofit condition and the post retrofit condition. The difference between the results is the demand savings.
- The CFw will be calculated the same.
- The correct conversion factors will be applied to make kW.
- The estimated winter load will be a fraction of the summer load used in the equations or calculated by Manual J.

Calculation Option 1

(Winter Load) ÷ (Rated HSPF2) × (CFw)

Rated HSPF2: This is a estimate of the winter performance of the heat pump in Region IV (northern climate)

Calculation Option 2

(Winter Load) ÷ (COP@17 per manufacturer × 3.412) × (CFw)

COP@17 per manufacturer: At this point, this value can be collected from the manufacturer's spec sheet or NEEP database.

Calculation Option 3

(Winter Load) ÷ (COPstd × 3.412) × (CFw)

COPstd: This value will be a standardized COP based on whether the units are Single Speed, Dual Speed, Variable Speed, or Cold Climate heat pumps. The value will not change based on the heat pump selected.

CFw

(CFw) is the measure of the number of the peak 20 hours where the heat pump matches at least 100% of the heat load.

The table will be based on the Capacity to Load ratio. At 100%, the capacity of the heat pump at the design temperature matches the estimated HVAC load.

Cap/Load ratio at Design Temp	110% or greater	90%-110%	70%-90%	Less than 70%
CZ 1	100%	65%	20%	0%
CZ 2	100%	80%	40%	20%
CZ 3	100%	95%	55%	35%
CZ 4	100%	95%	65%	30%
CZ 5	100%	80%	35%	20%

There may be a second table for Single Speed and Dual Speed heat pumps, which will have slightly different operating profiles at low temperatures.

There will also be several items which will have deemed CFw.

- If a system does not have auxiliary heat installed, the CFw = 100%
- If a system has an alternate fuel for heating, the CFw = 100% or 0% based on whether the alternate fuel is the primary or secondary source of heat.
- Is the heat pump equipment is designated “Cold Climate” the CFw = 100%
- The baseline or existing systems will use the same table, but the TRM will identify the winter capacity and performance based on conditions.

Long term topics

Load

- Commercial review of winter load compared to summer load by climate zone
- Residential review of winter load compared to summer load by climate zone
- Can we better adjust the Peak Demand calculation to match PDPF instead of Design temp?
- How do the peak summer/winter loads adjust by VS units overdriving?
- What is the standard oversizing that happens in the marketplace with units?

Design

- What happens to sizing/savings when a Manual J is completed
- What is the baseline variation in capacity to load ratio
- What happens to winter consumption when CapDh is larger than Loadh
- What is the minimum auxiliary heat need?
- How do we determine if auxiliary heat is used?
- Does the kW of the Auxiliary heat matter?
- Is there a need for rating at 5F or cold climate designation
- Is EER the best metric for peak demand estimation – How much does peak demand match with 100% capacity?

- Does the thermostat type or controller matter
- Is there a cyclical degradation factor for single speed compared to variable speed?

- Do we update the EFLH or use alternate for VS versus SS?
- Can we use actual performance curves?

Other

- What is the alternate to EER/SEER/HSPF that better determines efficiency/consumption And where does the information come from
  - Do we want to use the NEEP database
  - How do utility/implementers adjust API connection to AHRI?
- AHRI - Future COP or Dual Fuel HSPF for Winter?
- Can envelope be used to reduce loadc/h and how is it quantified
- Can auxiliary heat be connected to Emergency DR? fan speed?
- Do we want to manage and what value is created by a 'Quality Install' designation
- How can advanced control of VS control create savings?
-

Studies

- PNNL will do field studies in Texas and needs locations
- Consumption analysis of AMI should be possibleto identify a lot of installs.