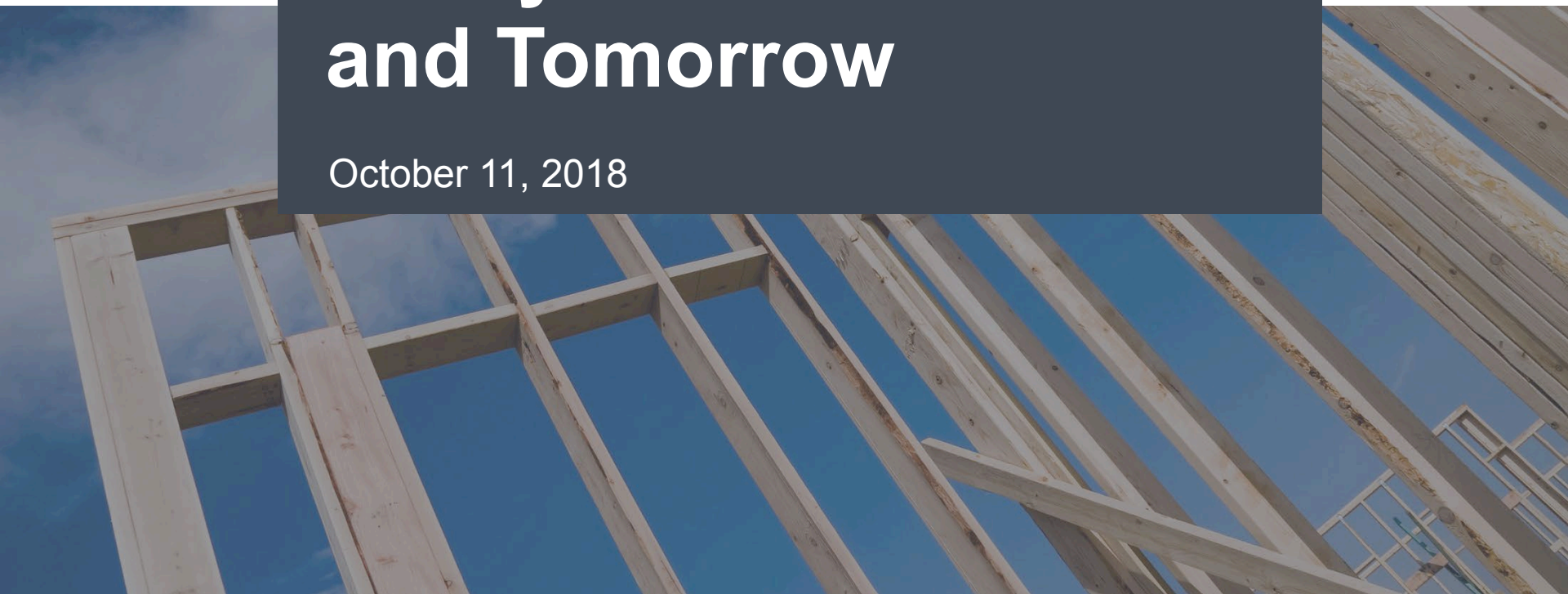




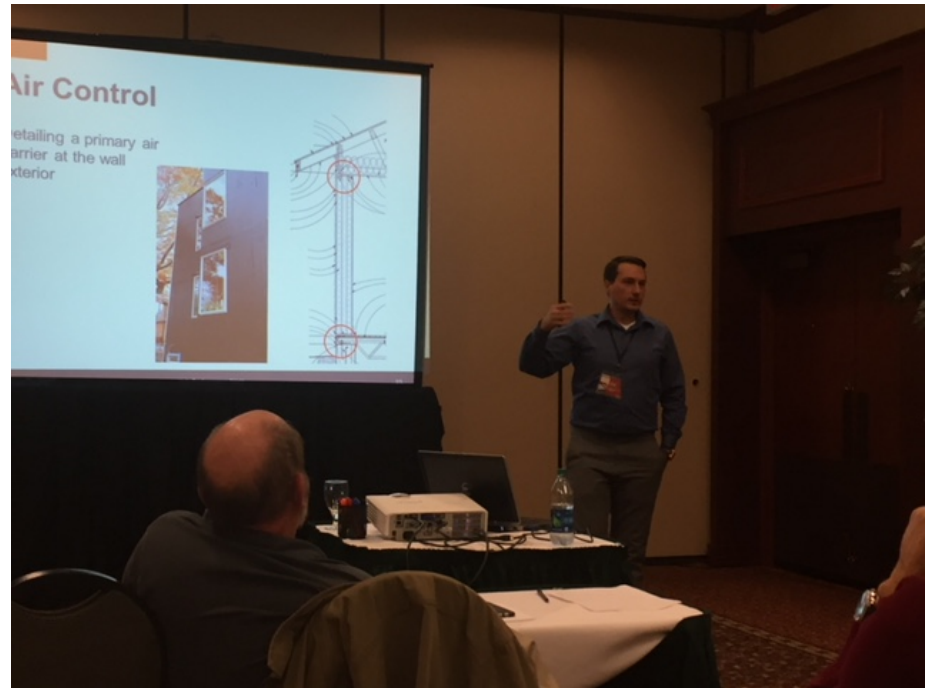
HVAC Technologies for Today's New Homes and Tomorrow

October 11, 2018



Class Introduction

- Name
- Company
- Role
- Years in your field
- What you want to get out of the course



To receive BPI or NATE CEUs, please write your name and correlating ID numbers on the session sign in sheets.




Agenda

Current HVAC Options

Design Implications

The future of HVAC in New Homes

A photograph of two construction workers on a new home's wooden frame. One worker, wearing a white shirt and a white hard hat, is pointing towards the upper part of the frame. The other worker, wearing a blue shirt and blue jeans with a tool belt, is looking in the same direction. The background shows the wooden skeleton of a house under construction against a clear blue sky. An orange square graphic is positioned to the left of the text.

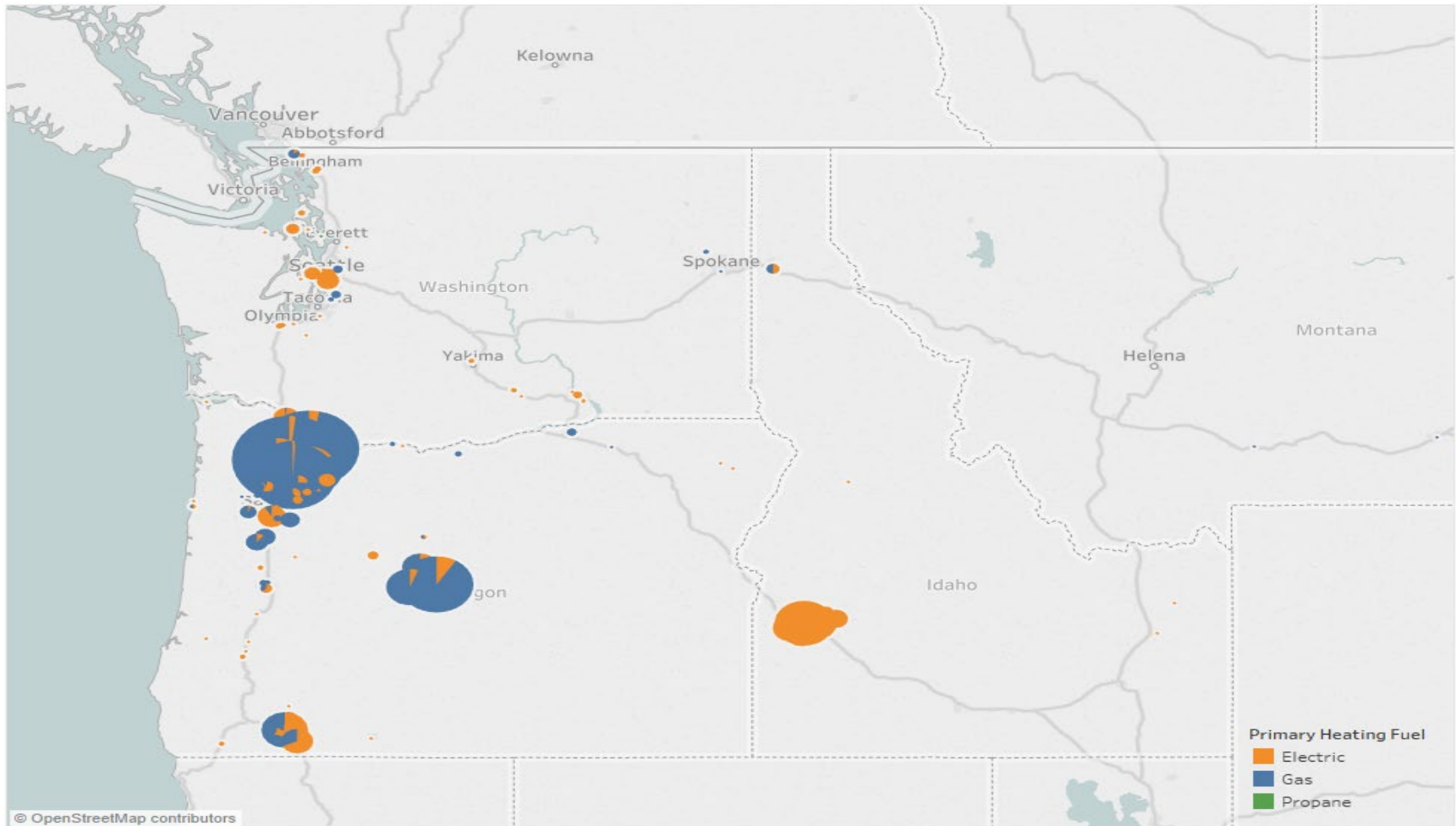
The Current State Of HVAC Options In New Homes

What is the Most Common HVAC System in New Homes?

- Gas
- Electric
- Heat Pump
- DHP
- Alternative options
 - GSHP
 - Hydronic
- Any Others?

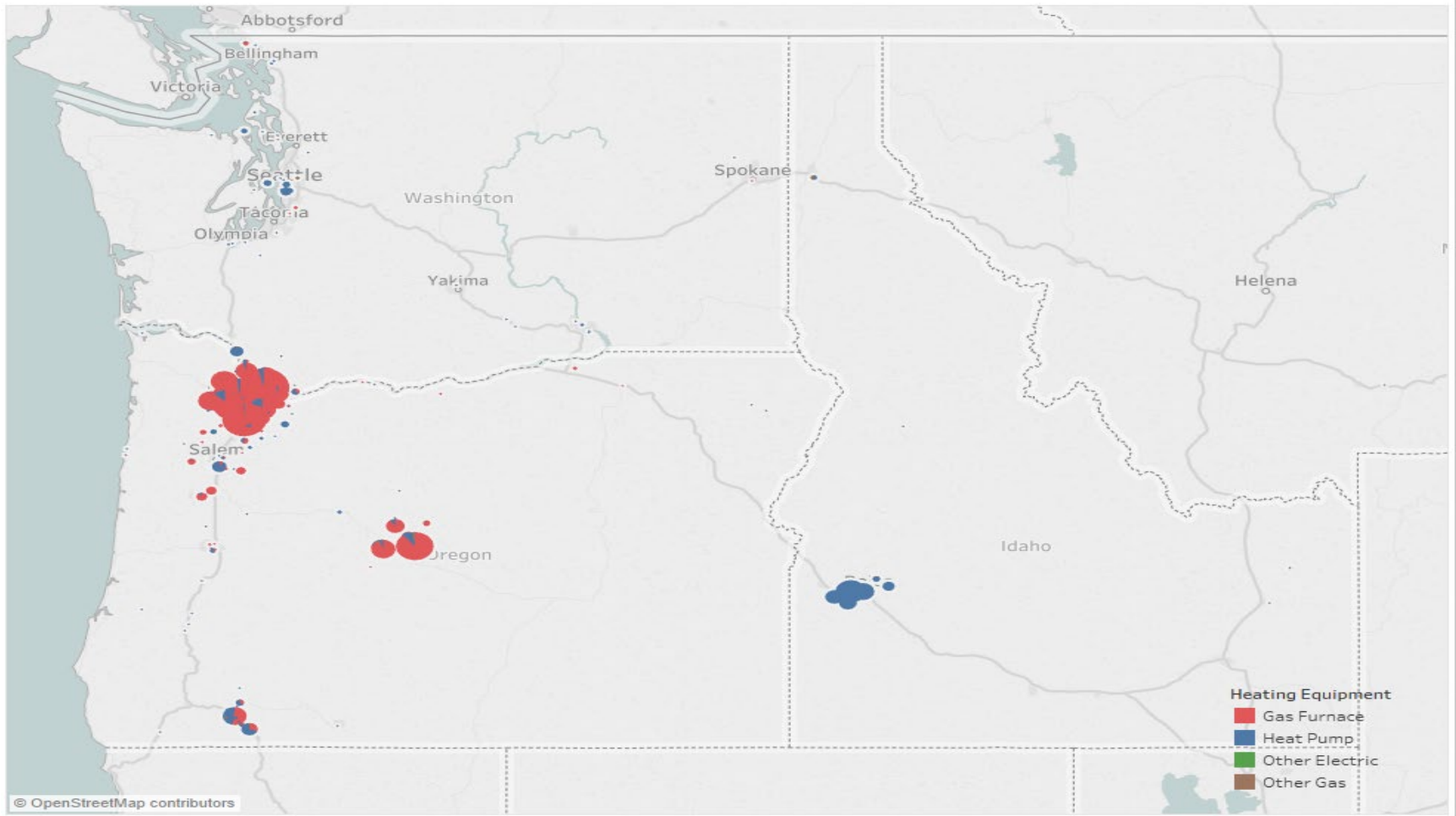
Fuel Type Region Wide

New Homes by Fuel Type



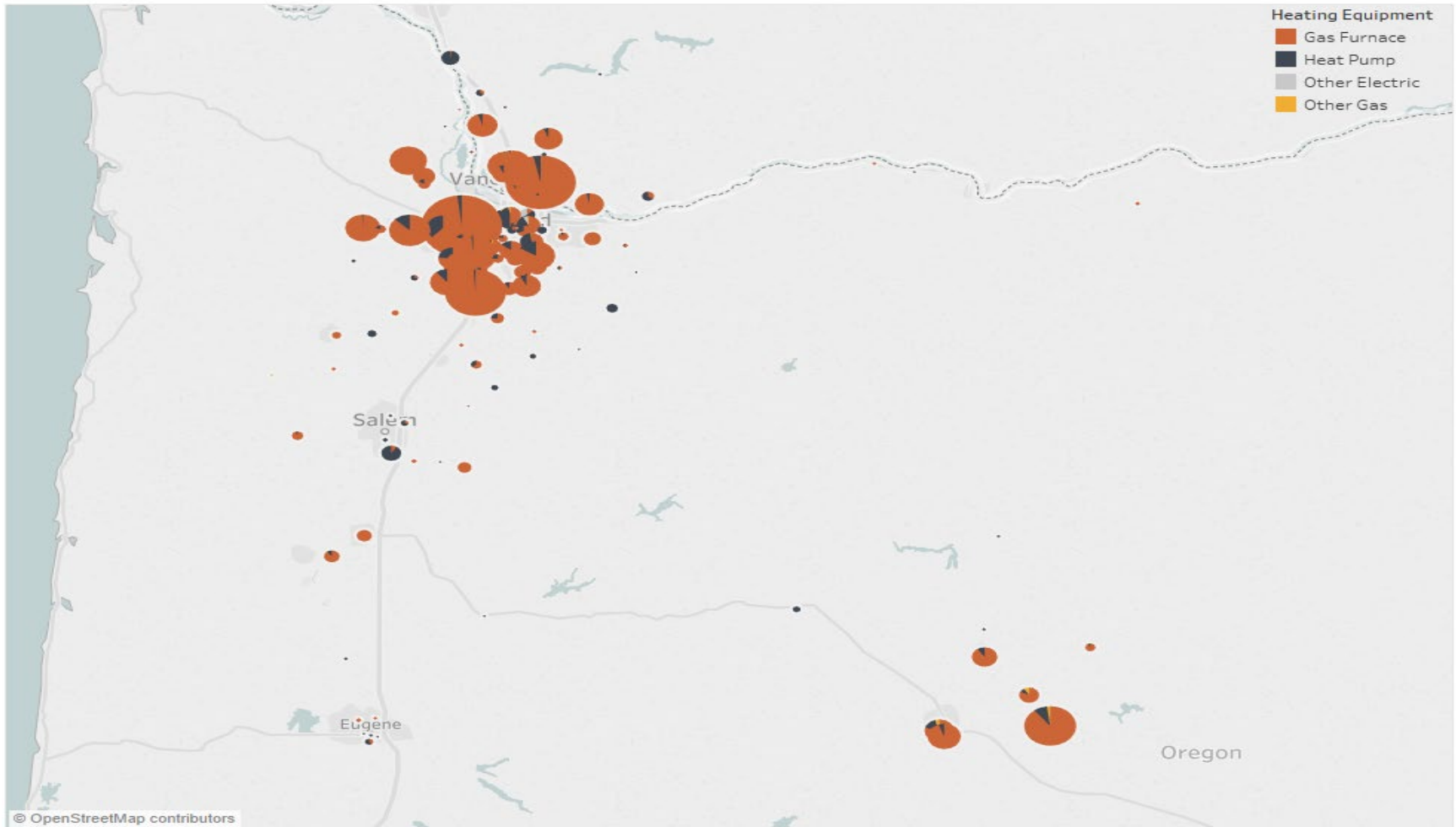
Equipment Type Region Wide

New Homes by Heating Equipment



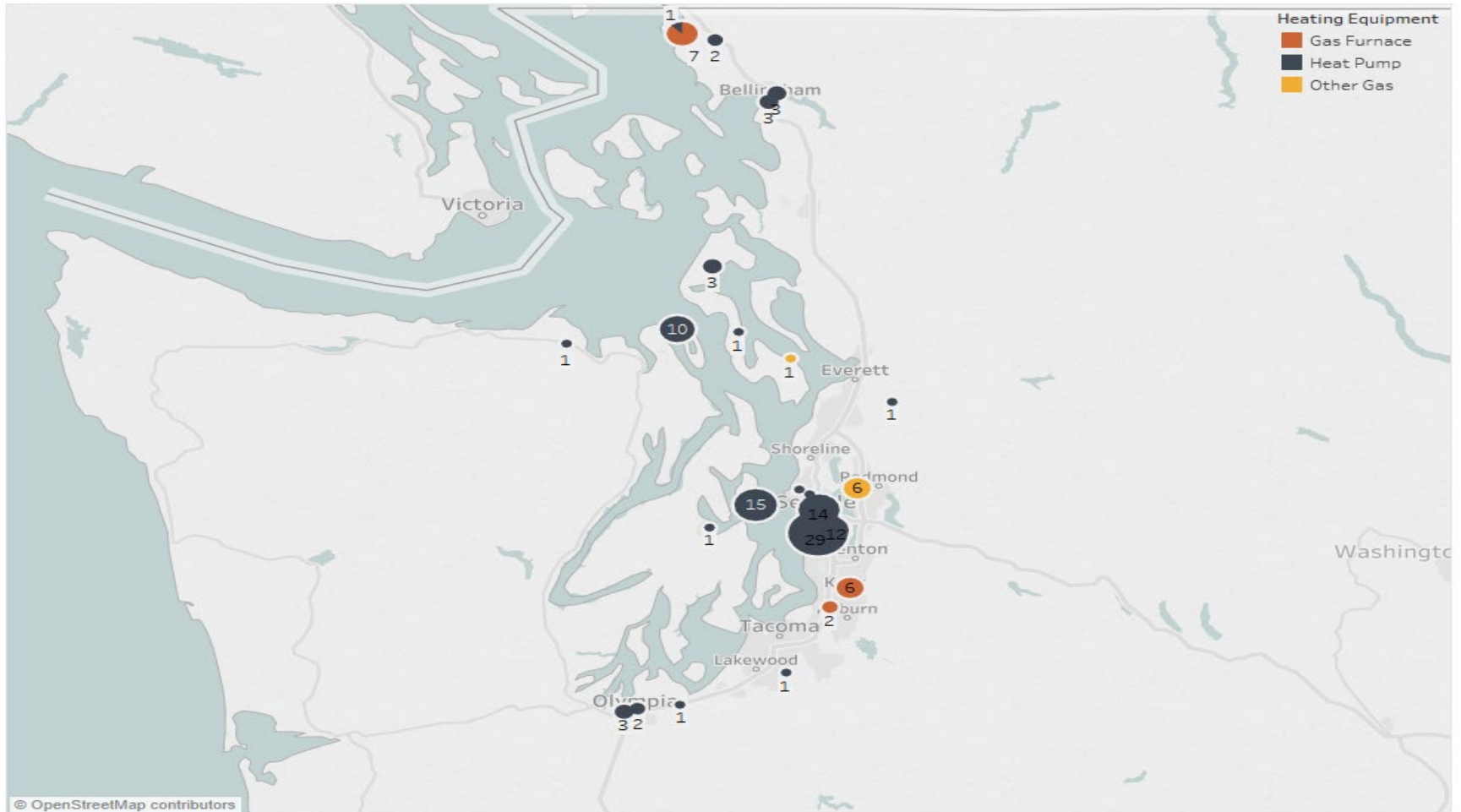
Portland Area

New Homes by Heating Equipment



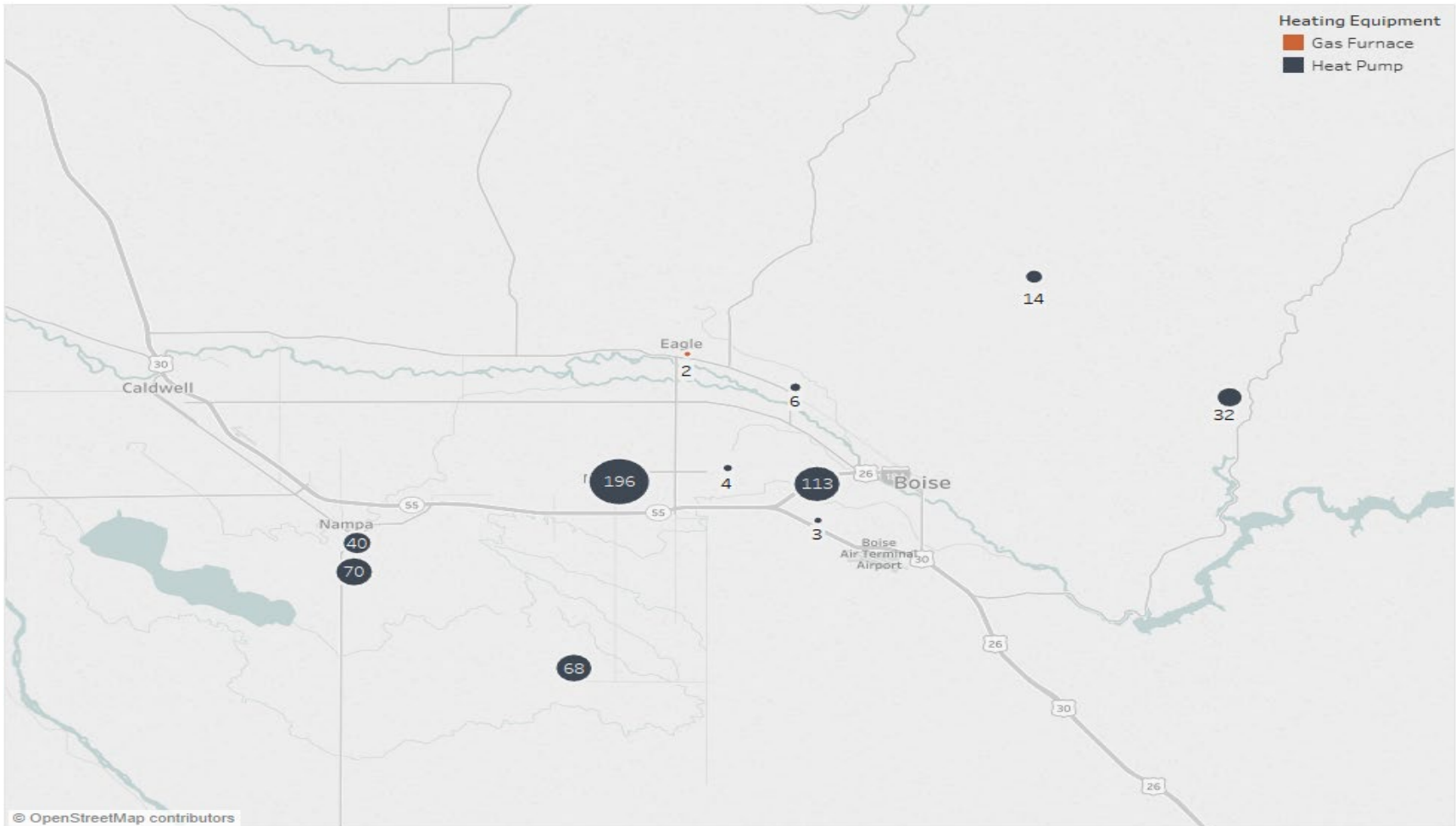
Seattle Area

New Homes by Heating Equipment

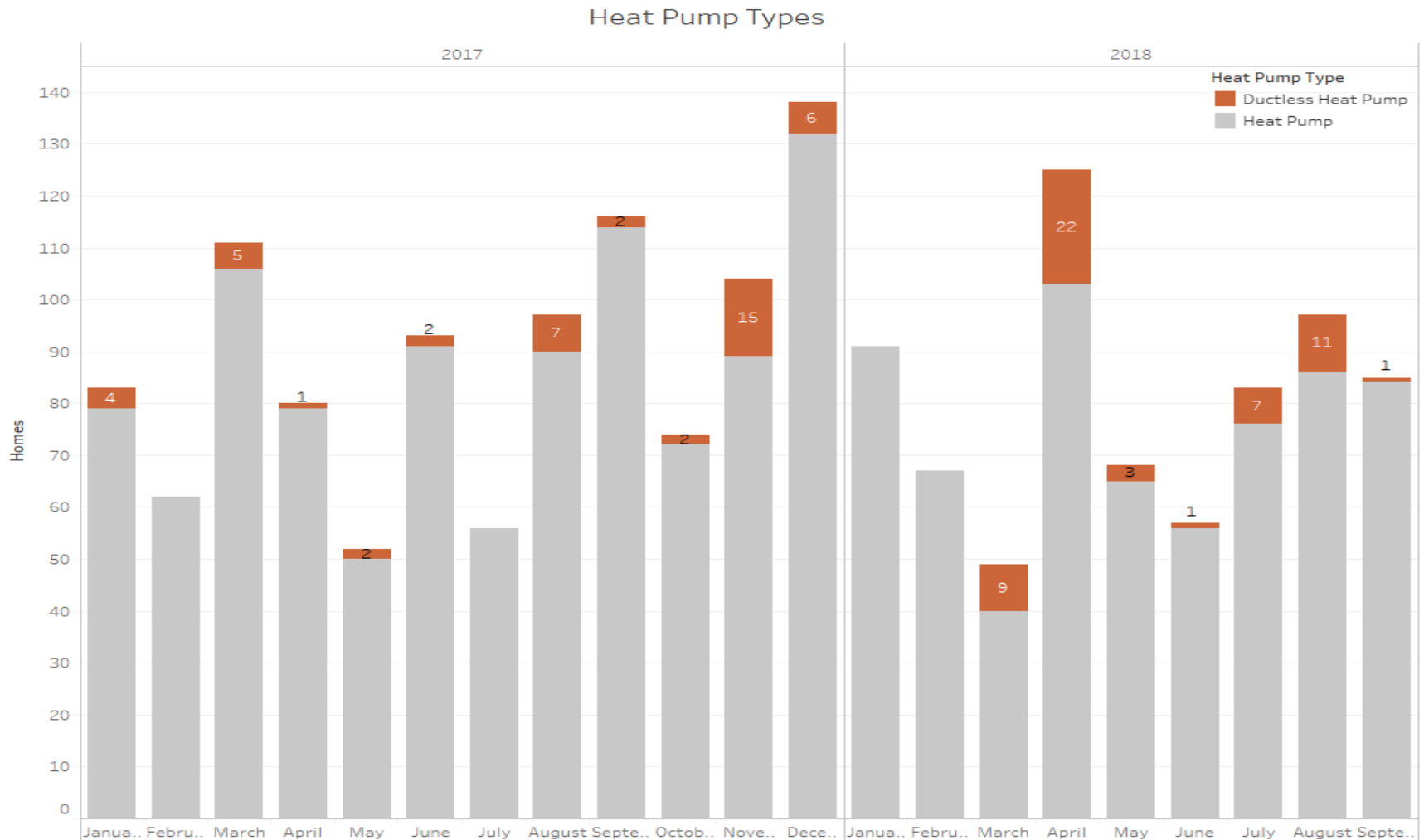


Boise

New Homes by Heating Equipment



DHP vs Heat Pump





HVAC Design Considerations

What is HVAC Design?

- Sizing
 - Load Calculation
 - HVAC Equipment Selection
 - Duct System Design
- Who Does the Design?

Heat Loss/Heat Gain Analysis

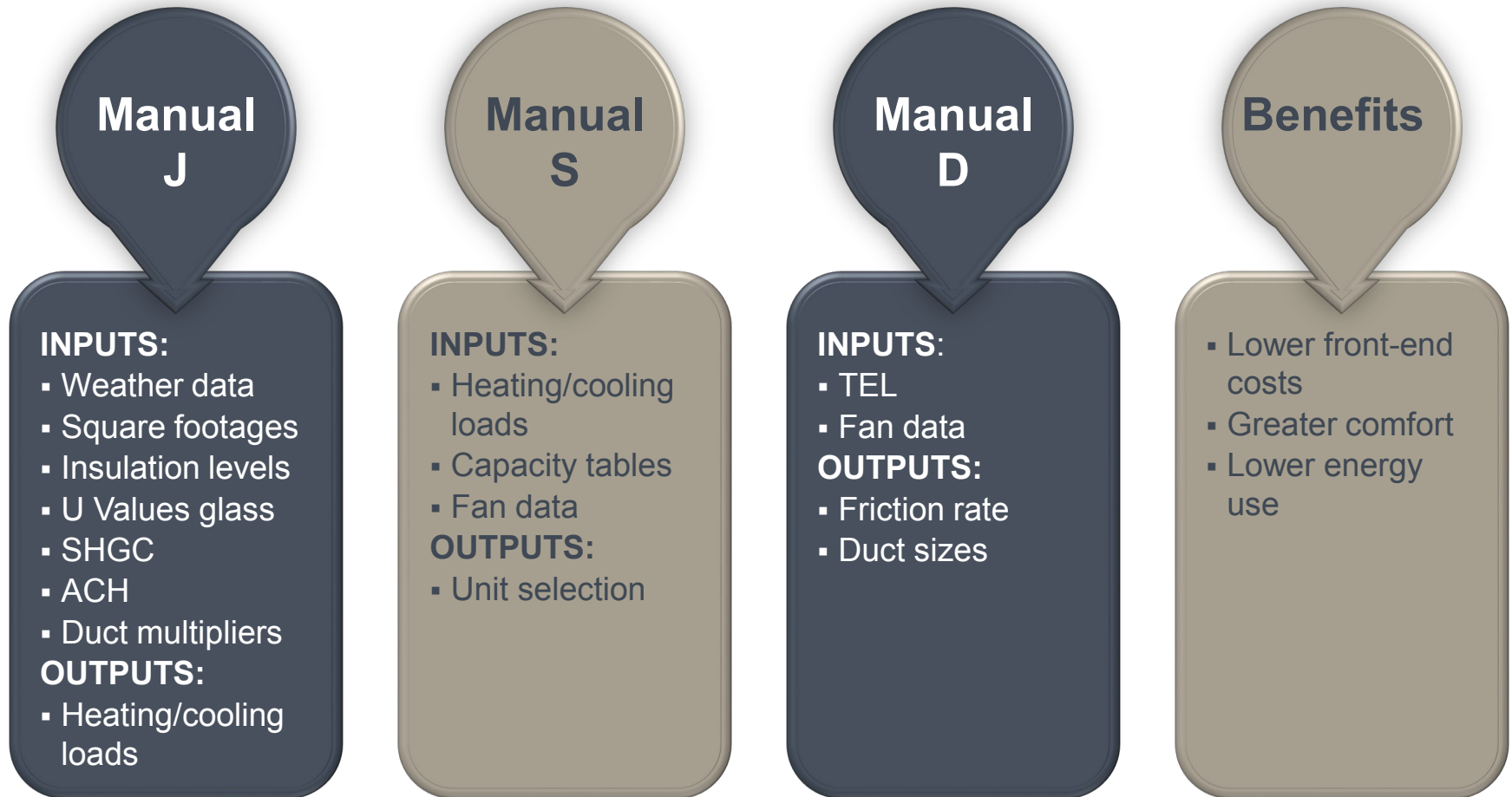
The ACCA Process Work

- Manual “J” calculates heat loss/heat gain
- Manual “S” guides in the selection process
- Manual “D” guides in the duct design process

Various Sizing Manuals



The ACCA HVAC Design Process



Heating Load Inputs: Gas Furnace Choices

This is the old Greek formula: $UA\Delta T$

Square Footage and R-U Values

Duct Multiplier

It's an educated guess

Limited range in new construction

ACH

Selection Process

40K

60K

80K

100K

120K

5 choices

Heating Load Inputs: Heat Pump Choices

This is the old Greek formula: $UA\Delta T$

Square Footage and R-U Values

Duct Multiplier

It's an educated guess

Limited range in new construction

ACH

Selection Process

24K

30K

36K

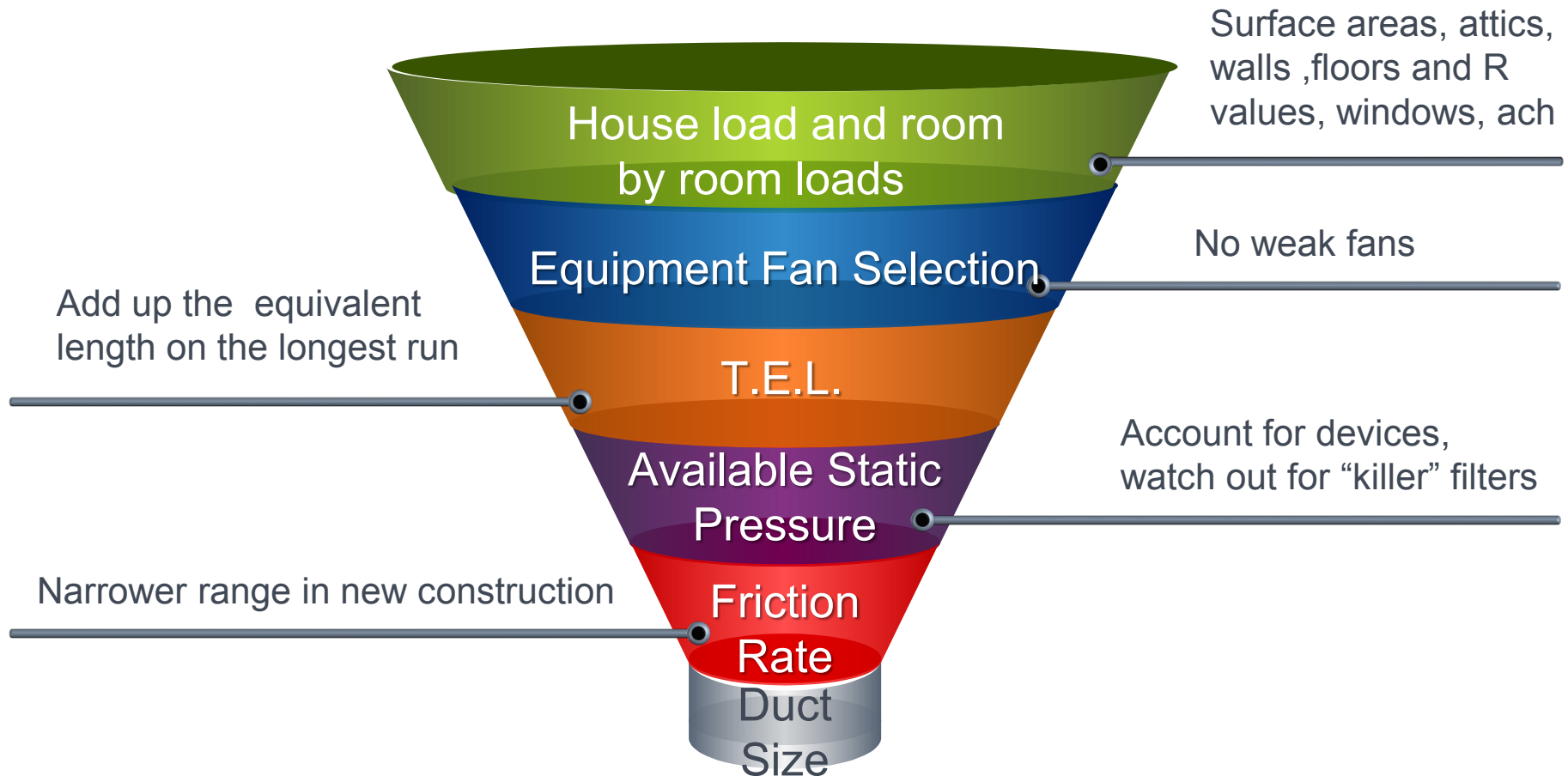
42K

48K

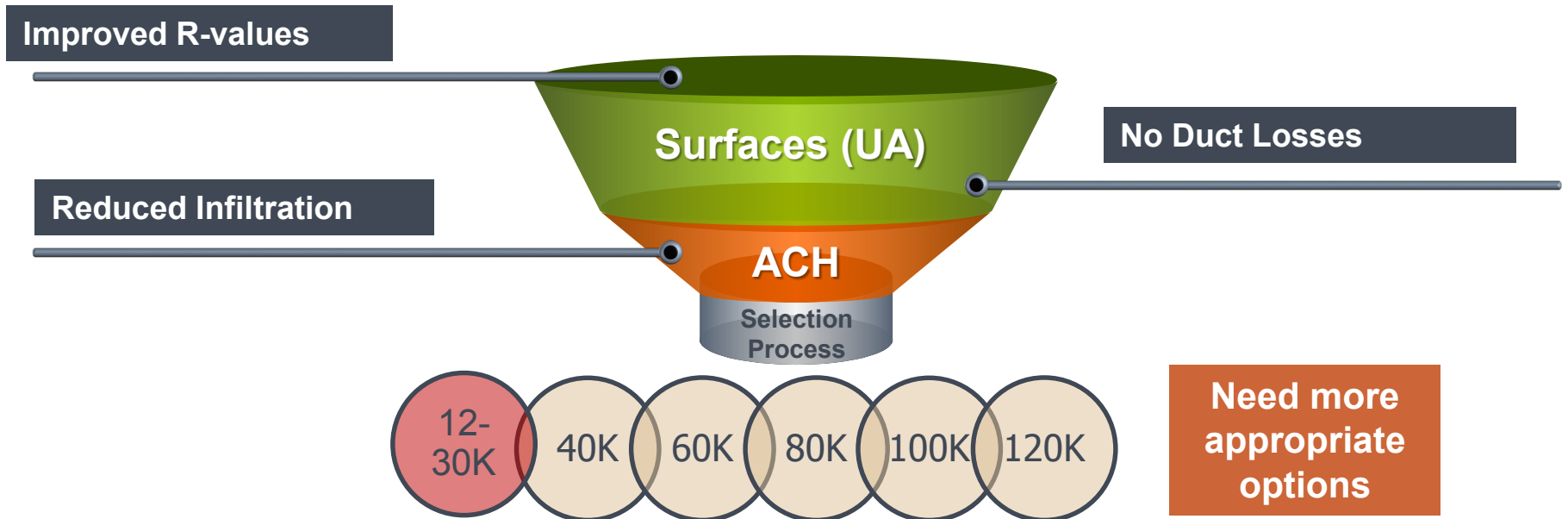
60K

A few more choices

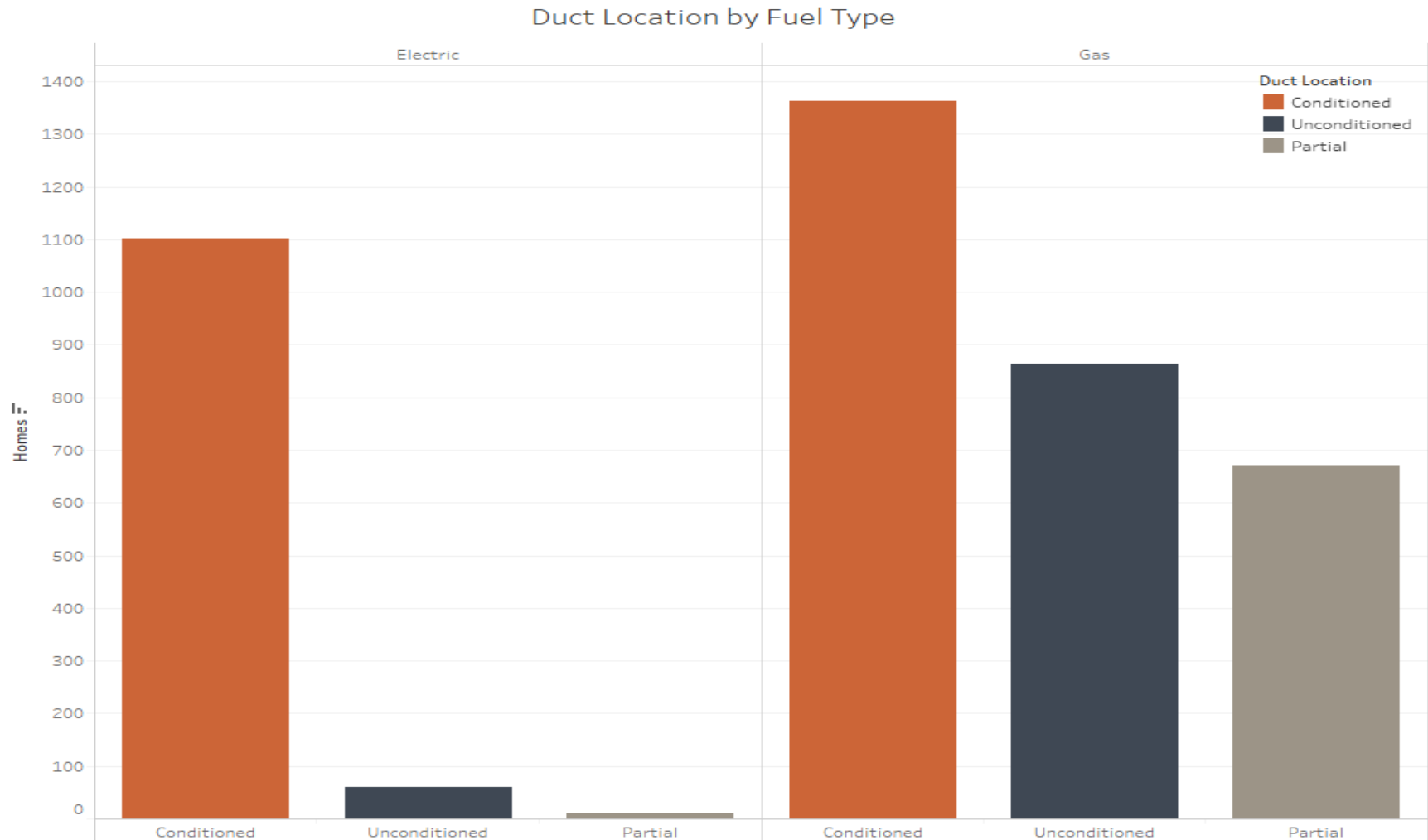
Duct Sizing Inputs



Heating Load Inputs: Ducts Inside Home



Ducts in Conditioned Space



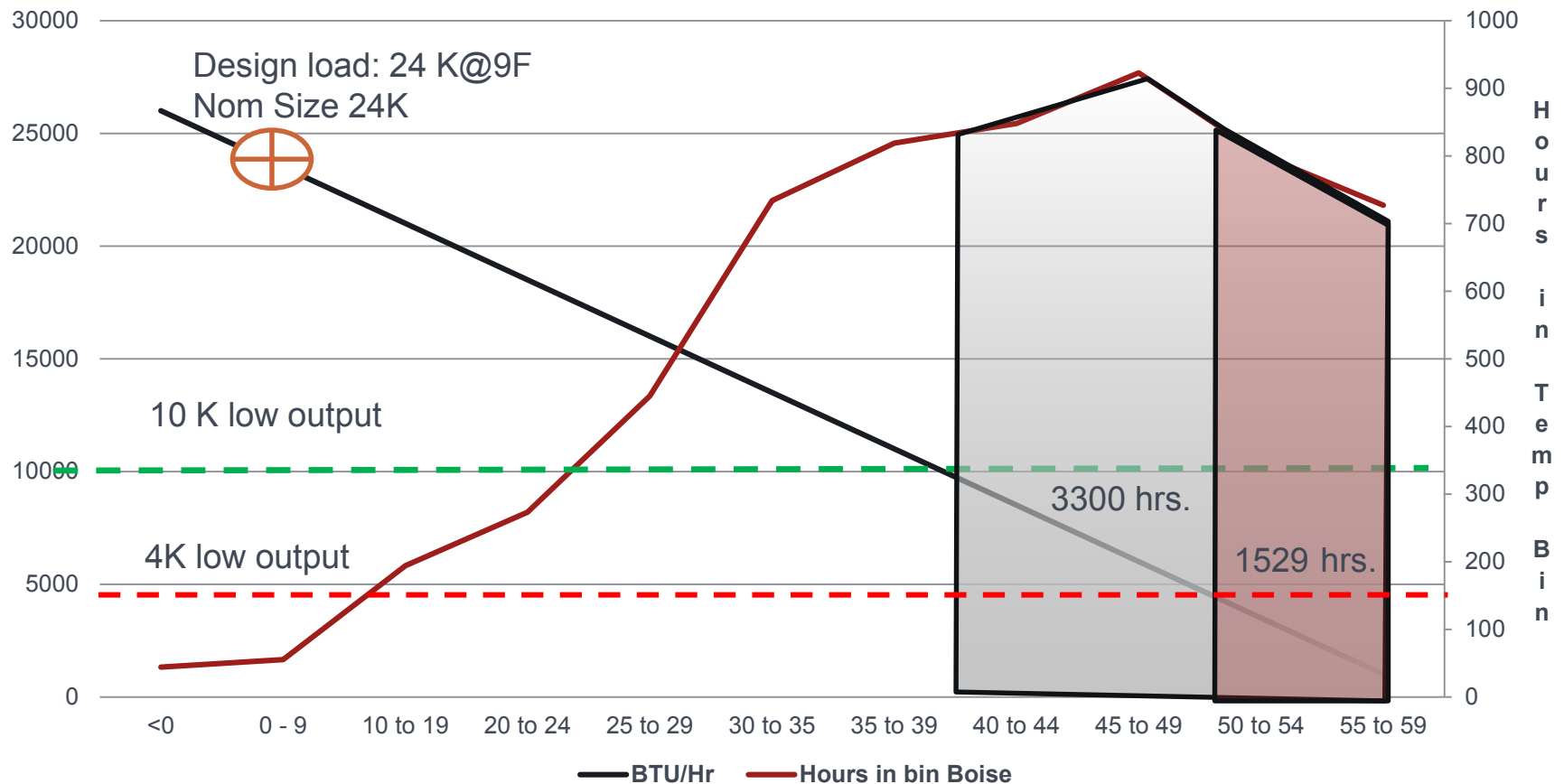
Ducted Mini-Split Design

- Select equipment with at least a 4:1 ratio between its maximum capacity and minimum capacity at 47°
- Place and orient indoor heads to allow for maintenance/ service
 - Closets and dropped ceiling are good options
 - Locate ducts and equipment in conditioned space

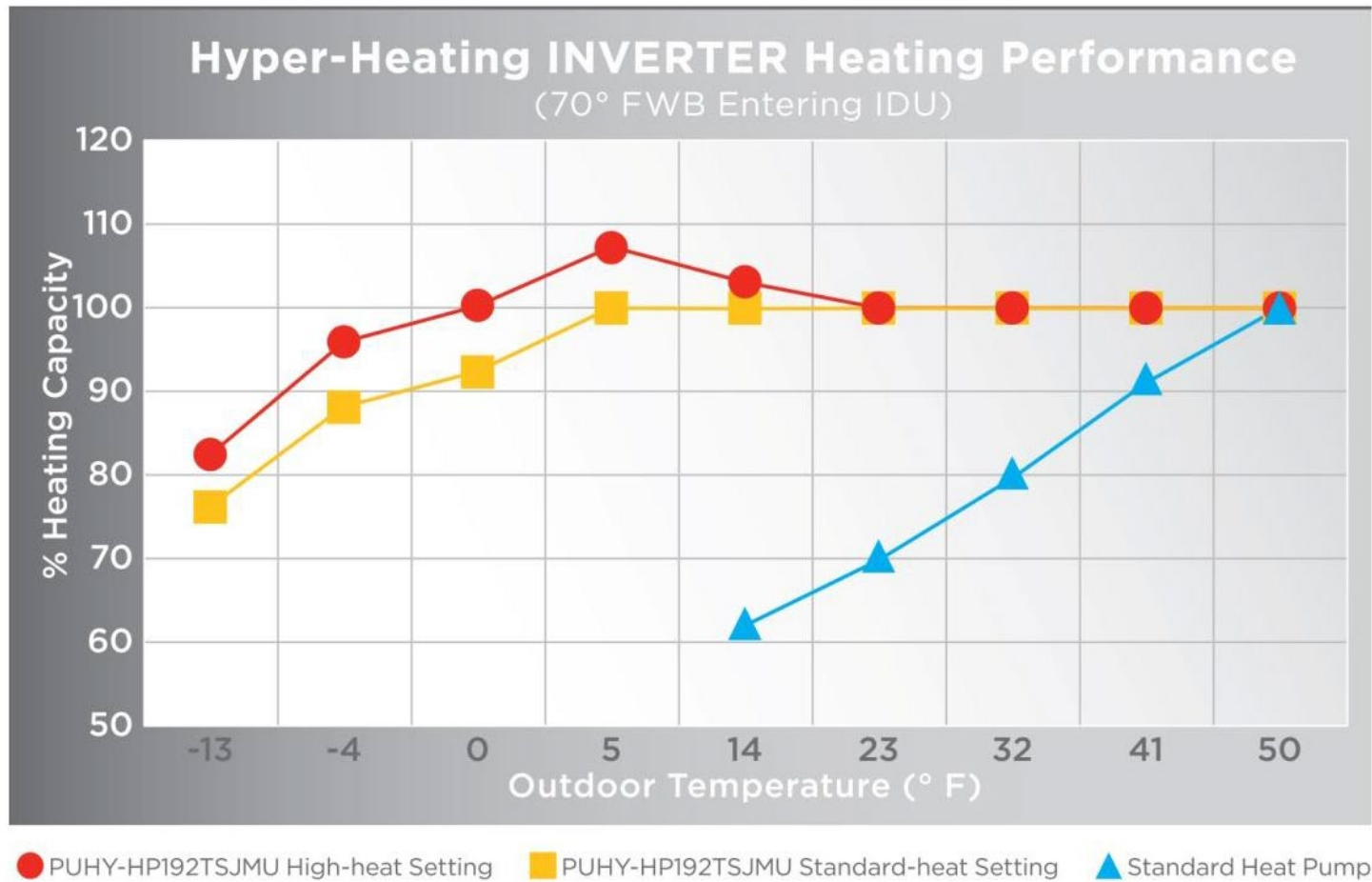


Sizing Ductless Heat Pumps in Boise

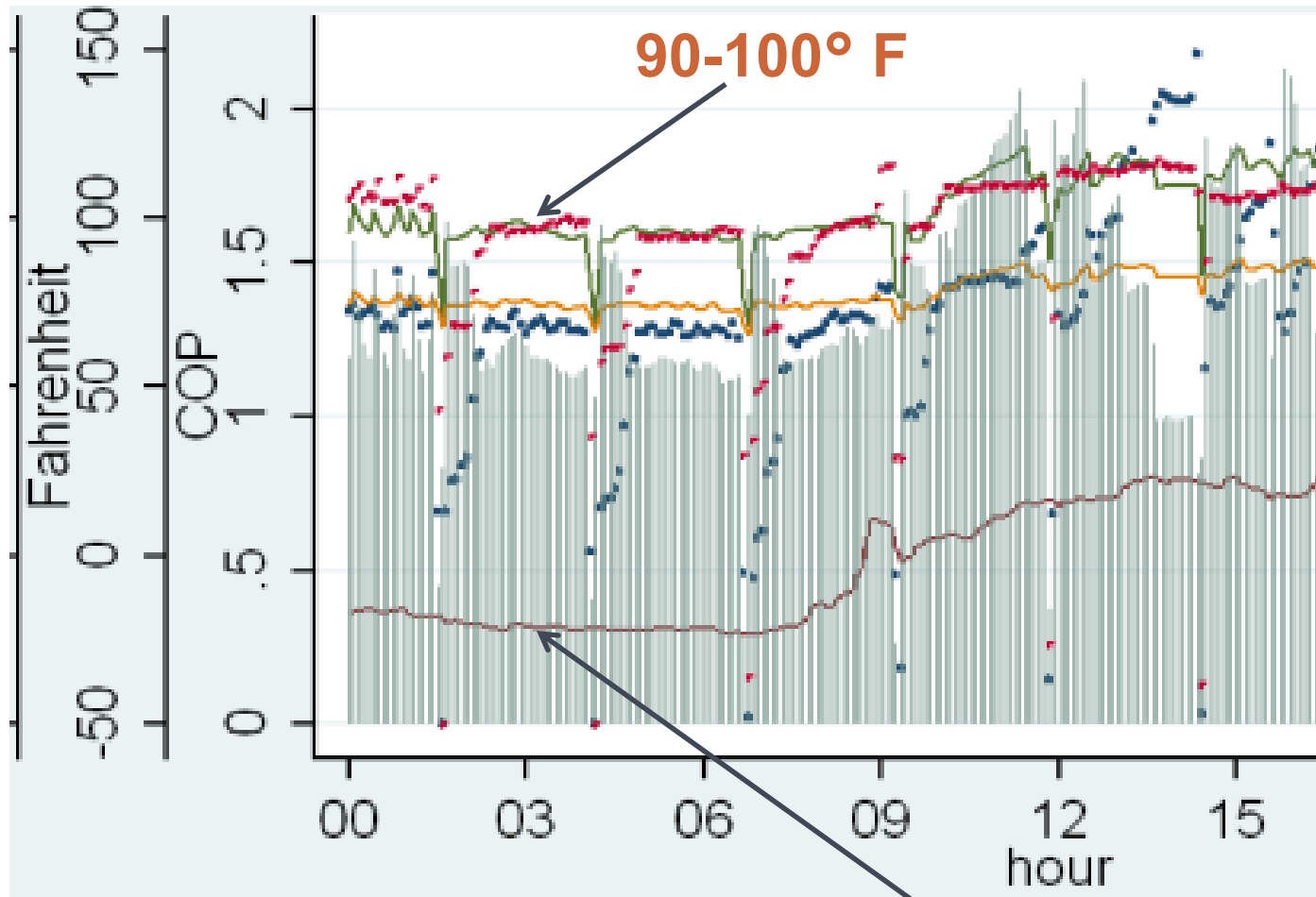
DHP Sizing



Cold Climate DHP



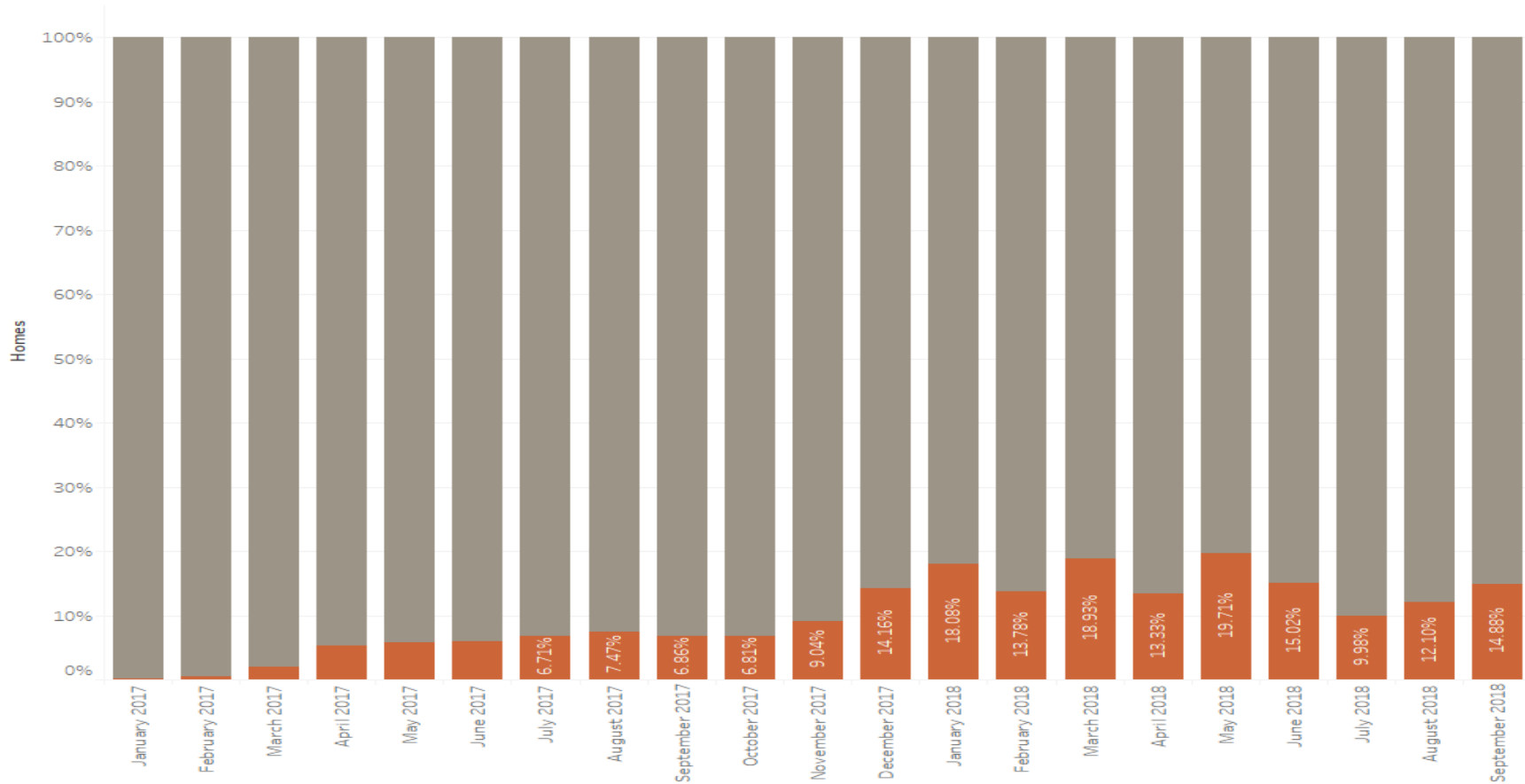
DHP Hot Supply Air Temperature



Well below 0° F

Smart Thermostats

Percentage of Homes with Smart Thermostat



Above Code Programs

Two easiest ways to reduce HERs score:

1. DHP
2. HPWH

Easiest way to jump to higher EPS tier:

1. HPWH
2. DHP

CO₂ HPWH

Combination Heating & DHW

- Sanden as a HWPH only – AWESOME!
- Design challenges as a Combi system
- Significant research



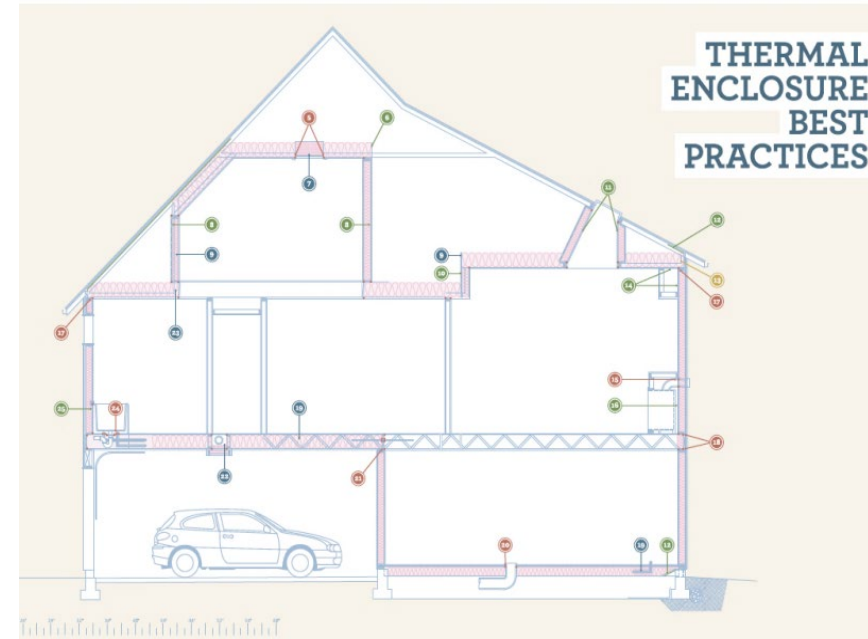
Research on CO²

EcoRuno



The Present and Future of New Construction

- Stringent energy codes and legislated code cycles following in the wake of above-code programs
- Growing market demand for more energy-efficient and sustainable homes
- Heating and cooling loads dropping sharply in new homes
- Existing technology limitations are giving way to highly efficient emerging technologies and practices
- Homeowners view this technology as a part of a Net Zero life style





Future of HVAC

Heating and Cooling

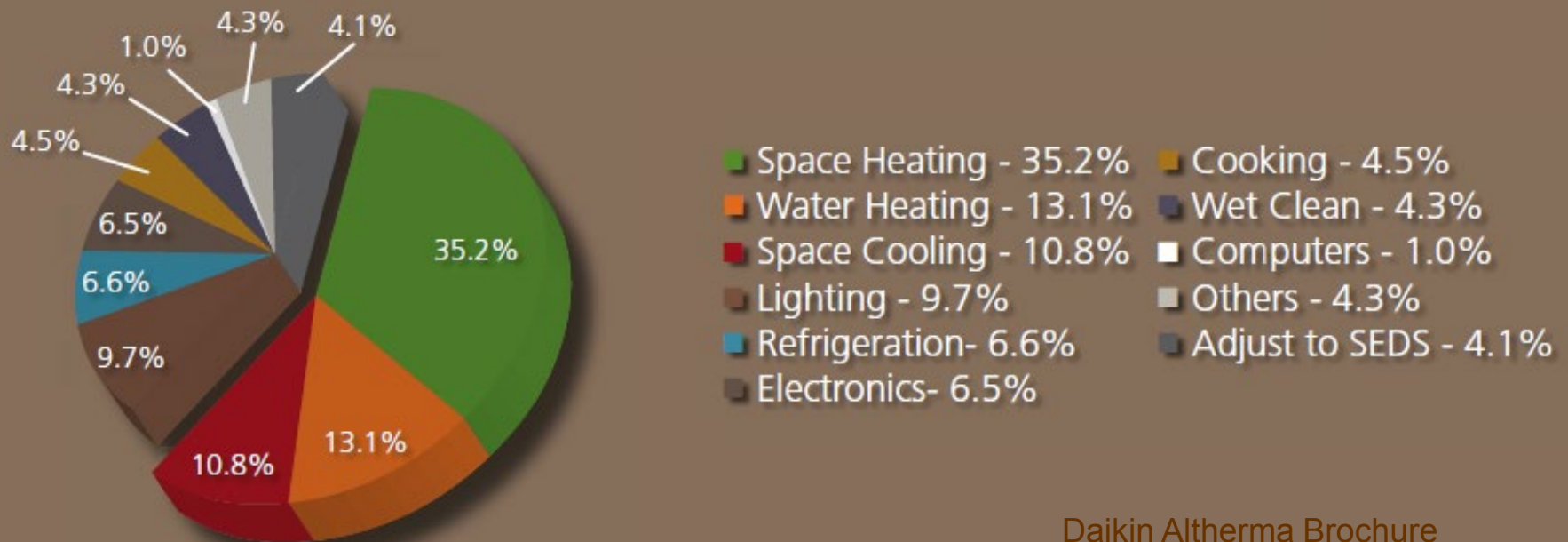
50+%

of Residential Energy Use

How We Use Energy in Our Homes

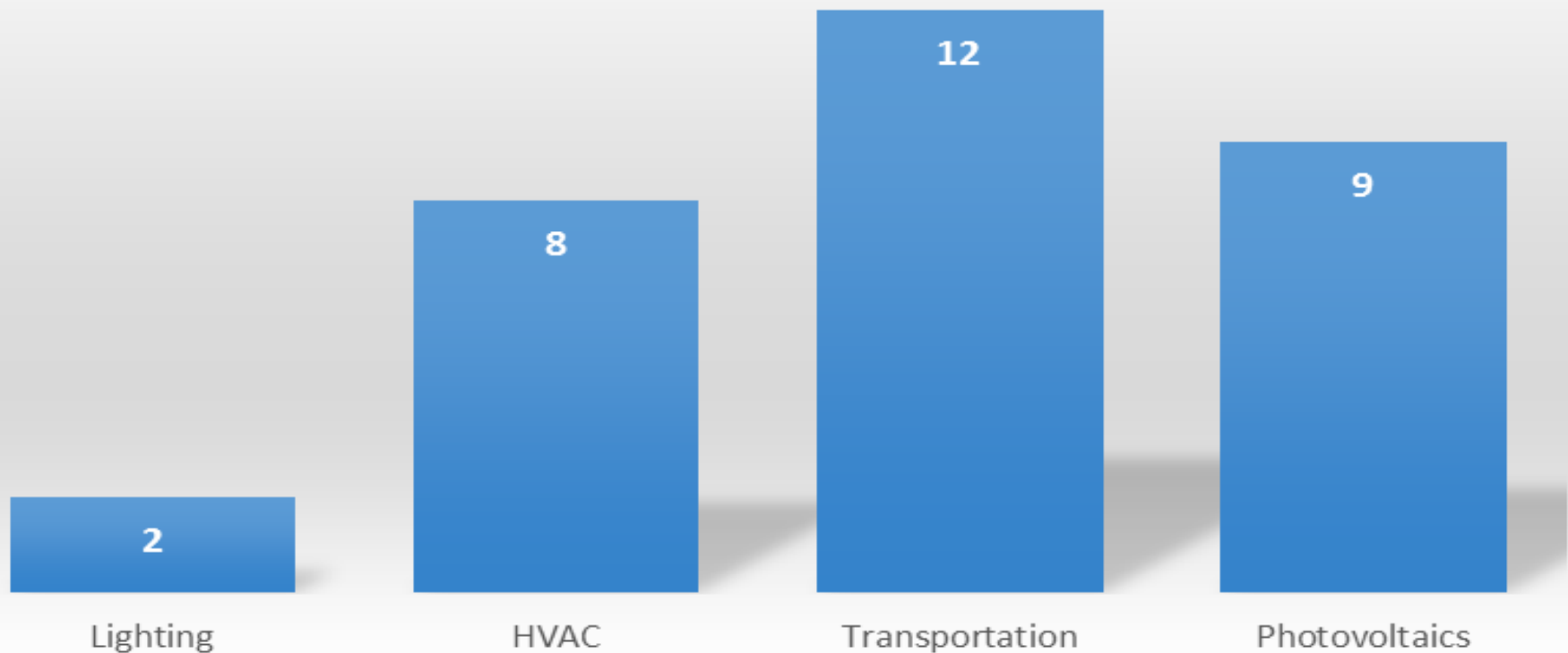
Heating and cooling account for the largest portion of a typical utility bill.

Source: 2007 Buildings Energy Data Book, Table 4.2.1., 2005 energy cost data.



Potential Savings Comparison

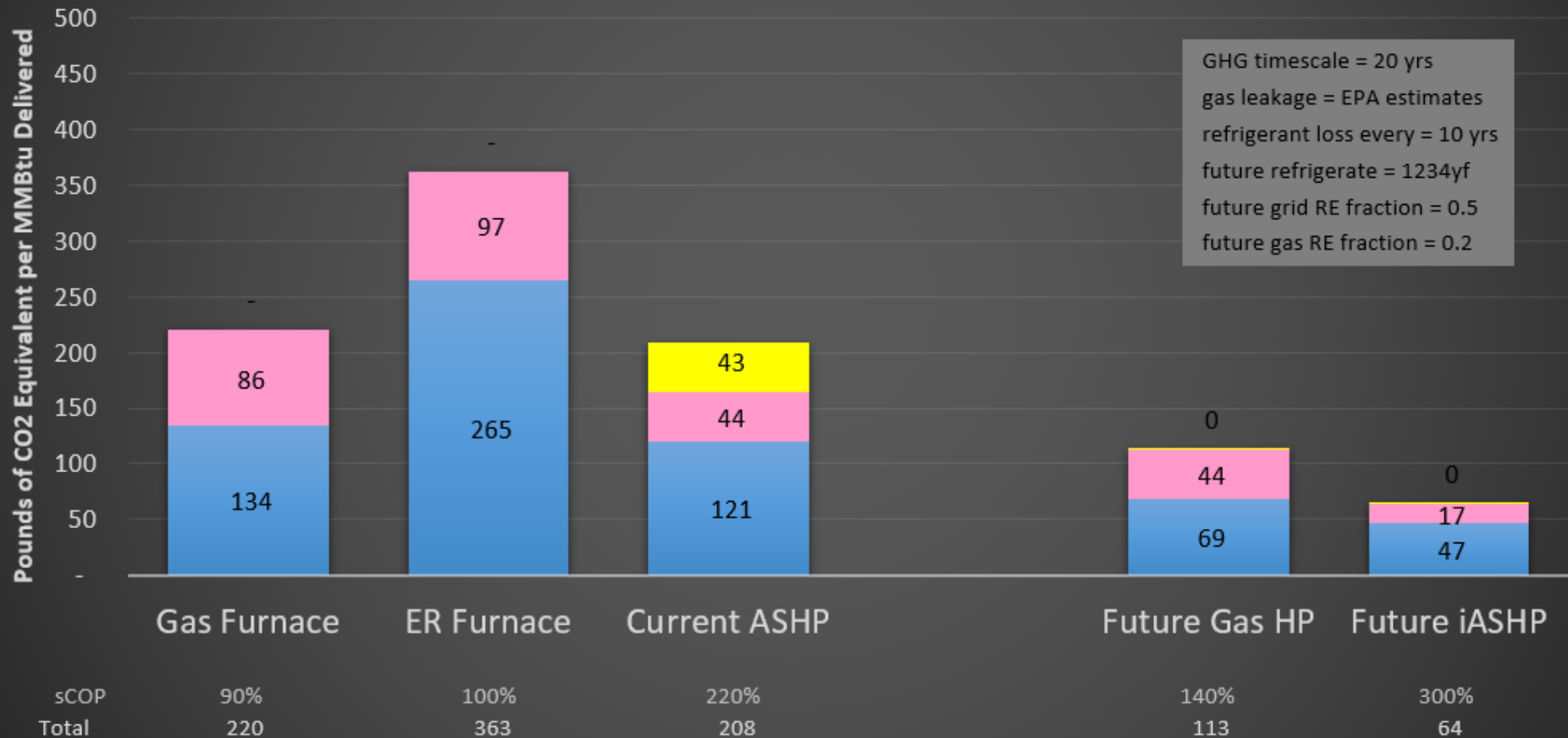
2050 Technical Potential (Quads/yr)



Future GWP Reduction

Global Warming of Space Heating

■ CO2 from Source ■ Methane Leakage ■ Refrigerant Leakage



6 Big (Potential) Market changes

- 1. inverter driven compressors**
- 2. advanced heat exchangers**
- 3. new refrigerants**
- 4. distributed intelligence**
- 5. carbon neutral policy goals**
- 6. trades workforce**

Early Examples

Ductless HP



HPWH



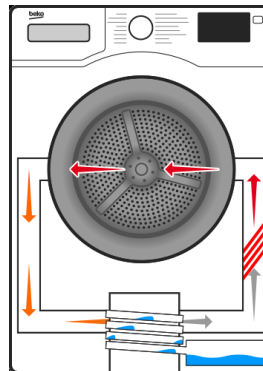
VHE DOAS + VRF HP



CO₂ Hydronic HP



Appliance HPs

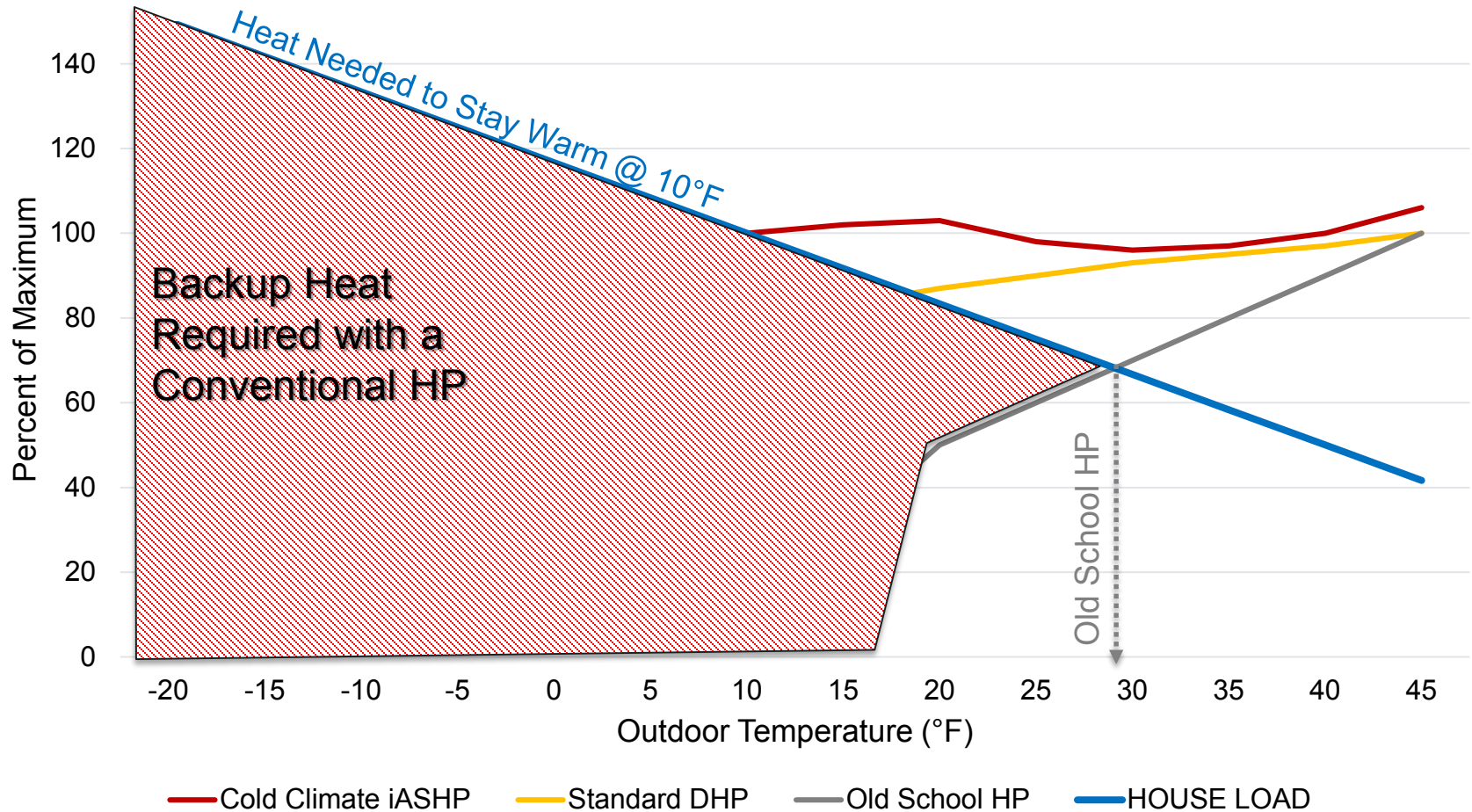


VRF Residential



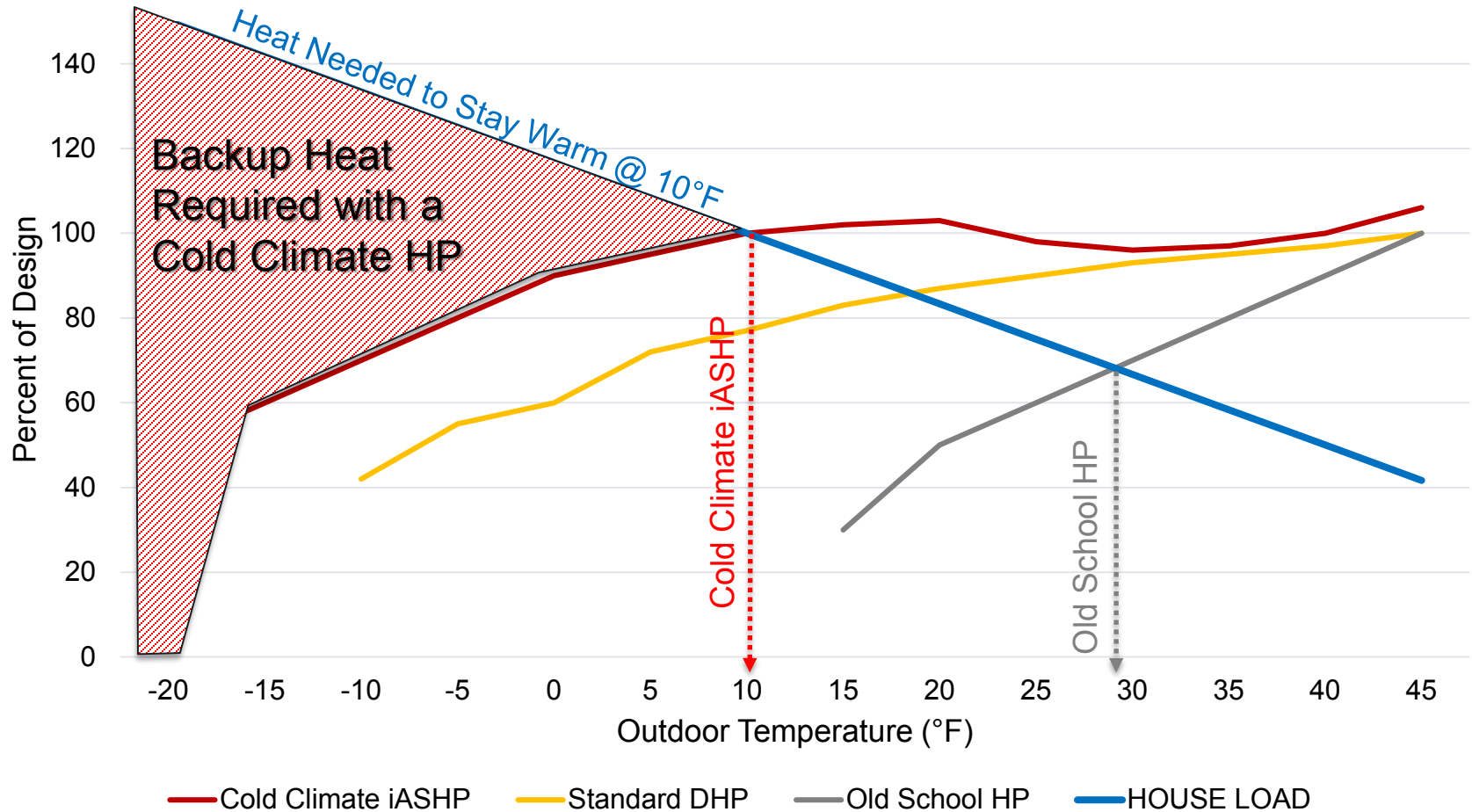
Old School HPs

Heat Pump Capacity & House Heating Need



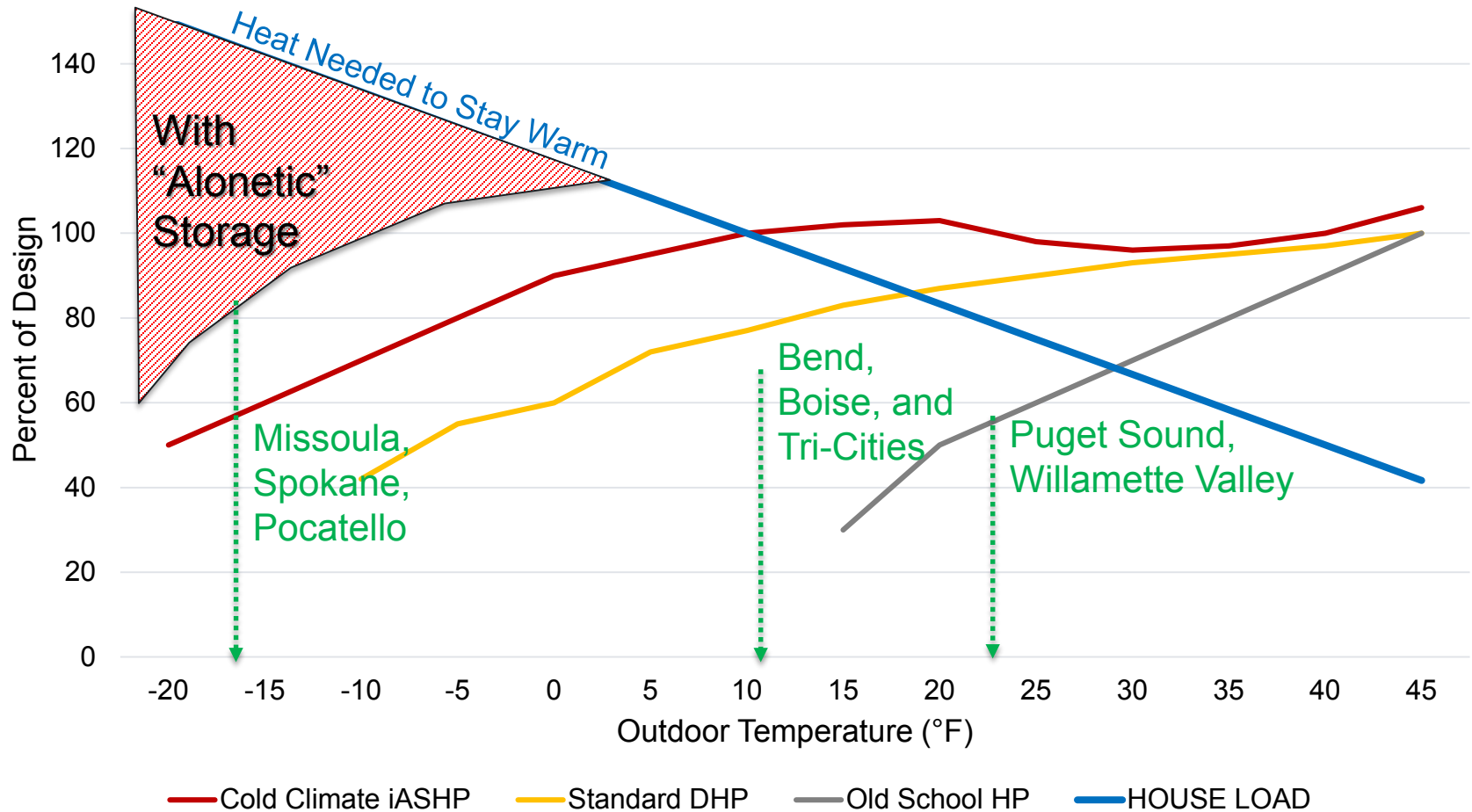
Cold Climate HP

Heat Pump Capacity & House Heating Need



Alonetic iASHP

Heat Pump Capacity & House Heating Need



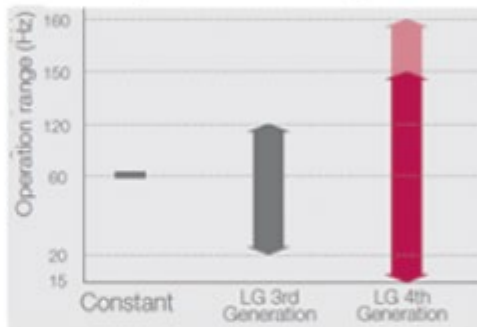
Inverter Driven Compressors

Vapor Injection

- Maximize heating capacity via two-stage compression
- Provide powerful heating in low temperature conditions
- Improve energy efficiency and heating performance

Extended Compressor Speed 150Hz

- Rapid operation response
- Capable of reaching required temperature quickly
- Increase part load efficiency



HiPOR™ (High Pressure Oil Return)

- Resolves
- Improves
- all oper

Smart

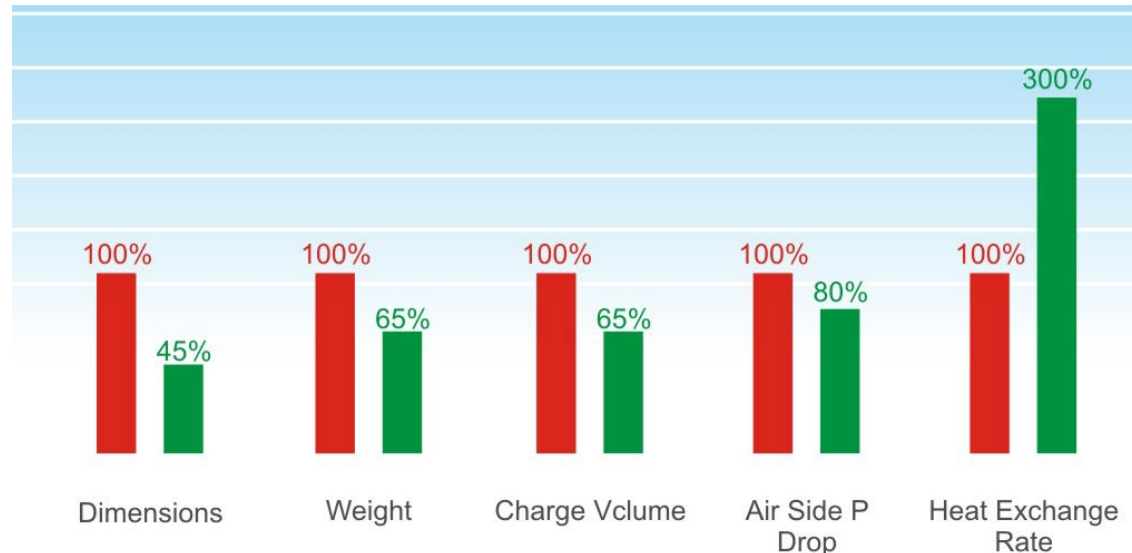
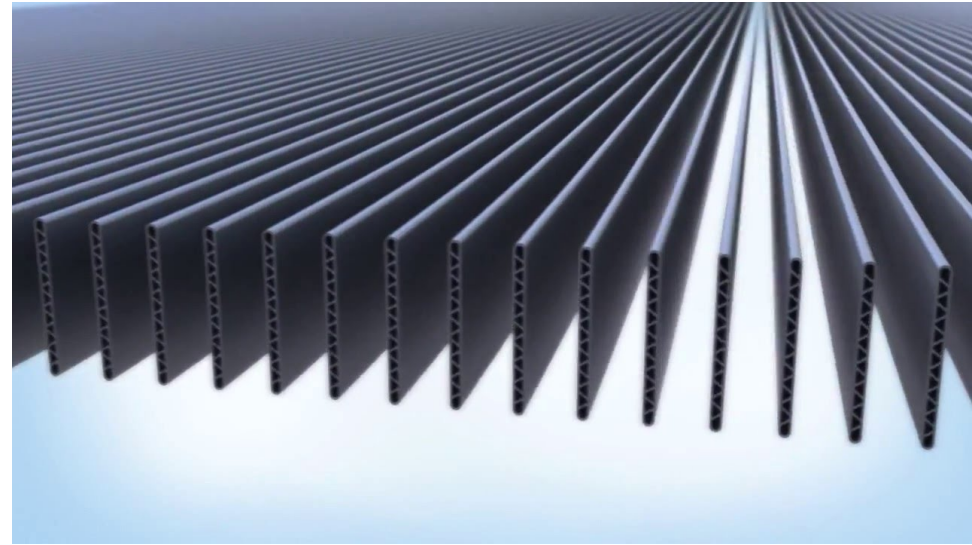
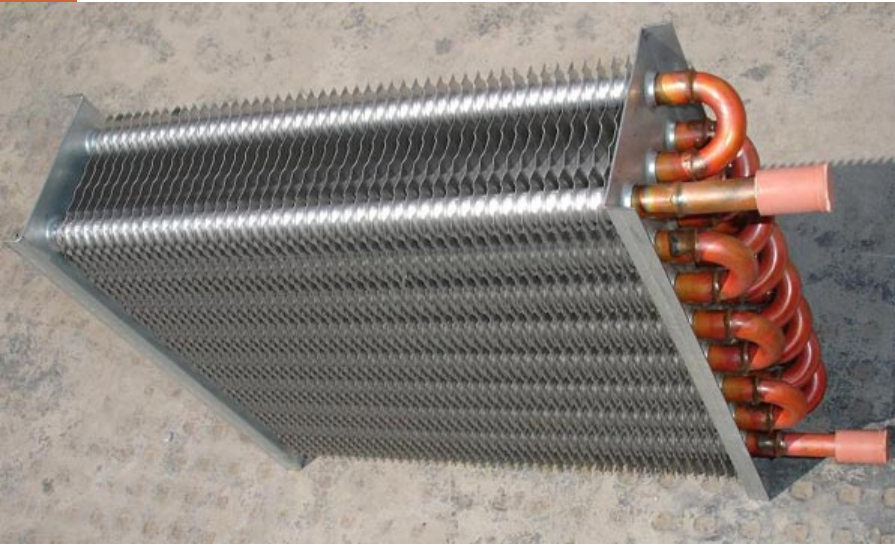
- Oil level
- Oil rec
- Enhance



**Low Temperature Operation
Modulated Output
Demand Responsive**

*Operation available up to 160 Hz dependent upon operating conditions

Advanced Heat Exchangers



T&F ■

MICRO CHANNEL ■

New Refrigerants

Phase out of high GWP refrigerants by ~2035*

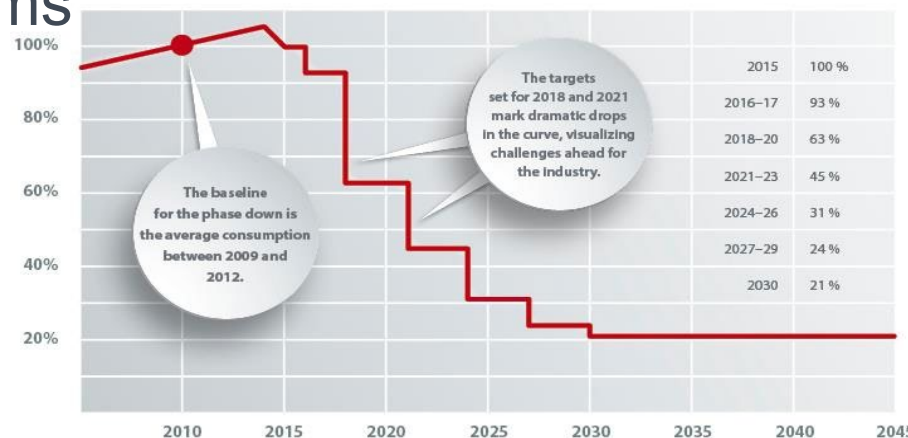
North America phase out

- R134a (automotive, refrigeration) banned Jan, 2021
- R410a (heat pumps, air conditioners) delisted Jan, 2024

New refrigerants will shift systems to hydronic distribution

- Quicker defrost
- Improved DR capability
- Higher efficiency

EU HFC Phase-Down schedule



*Developed Countries - Kigali Amendment to the Montreal Protocol

Intelligence

DATA GATHERED

Homeowner Preferences

Weather Forecast

House Info

Utility Info



The system ***learns*** how to optimize comfort and operational cost

Smart Thermostats and HEMs don't know how to optimize the HP operation

Demand Response Protocols

OpenADR 2.0

- Smart Grid Communications standard
- No hardware
- California's preference



ANSI/CTA 2045

- “the USB drive” of DR
- PGE and EPRI Study – validated concept with water heaters
- Get to scale = cheap peaking power plant

What if?

- HVAC pricing was transparent
 - Sizing didn't matter
 - Commissioning and QC was automatic
 - As-built performance provided – via an App
 - HVAC was sold as a service, not a product
-
- How would these make a difference?

The background of the slide is a photograph of a workshop or lumber yard. In the foreground, there are several stacks of lumber. On the left, a stack of thick, dark-stained wooden planks is visible, showing prominent wood grain and growth rings. To the right and slightly behind, there are stacks of lighter-colored, unfinished wooden planks. The background is softly blurred, showing more stacks of wood and possibly some workshop equipment. Overlaid on the left side of the image is a large, solid orange L-shaped graphic element. A dark gray rectangular box is positioned over the center-right of the image, containing the word "Discussion" in white text.

Discussion



THANK YOU

Mark Jerome

541-670-8495

Mark.Jerome@clearesult.com

Christopher Dymond

503-688-5454

cdymond@neea.org