All Things HVAC

Fall 2022 Trade Ally Forums

EnergyTrust of Oregon

State of the Market

- HVAC industry constantly navigating change, often this change is out of our control
- No shortage of examples in today's market
  - Inflation Reduction Act
  - M1 Testing Procedures
  - Supply chain issues
  - Unprecedented price increases
- Estimated savings/performance ratings not aligned with actual field results

Today’s Discussion

1) Regulatory Updates: Overview of revised testing procedures and changes to the Federal Standard
2) Matchmaker: Choosing the right HVAC system for your customer
3) Getting the most out of your HVAC diagnostic tools

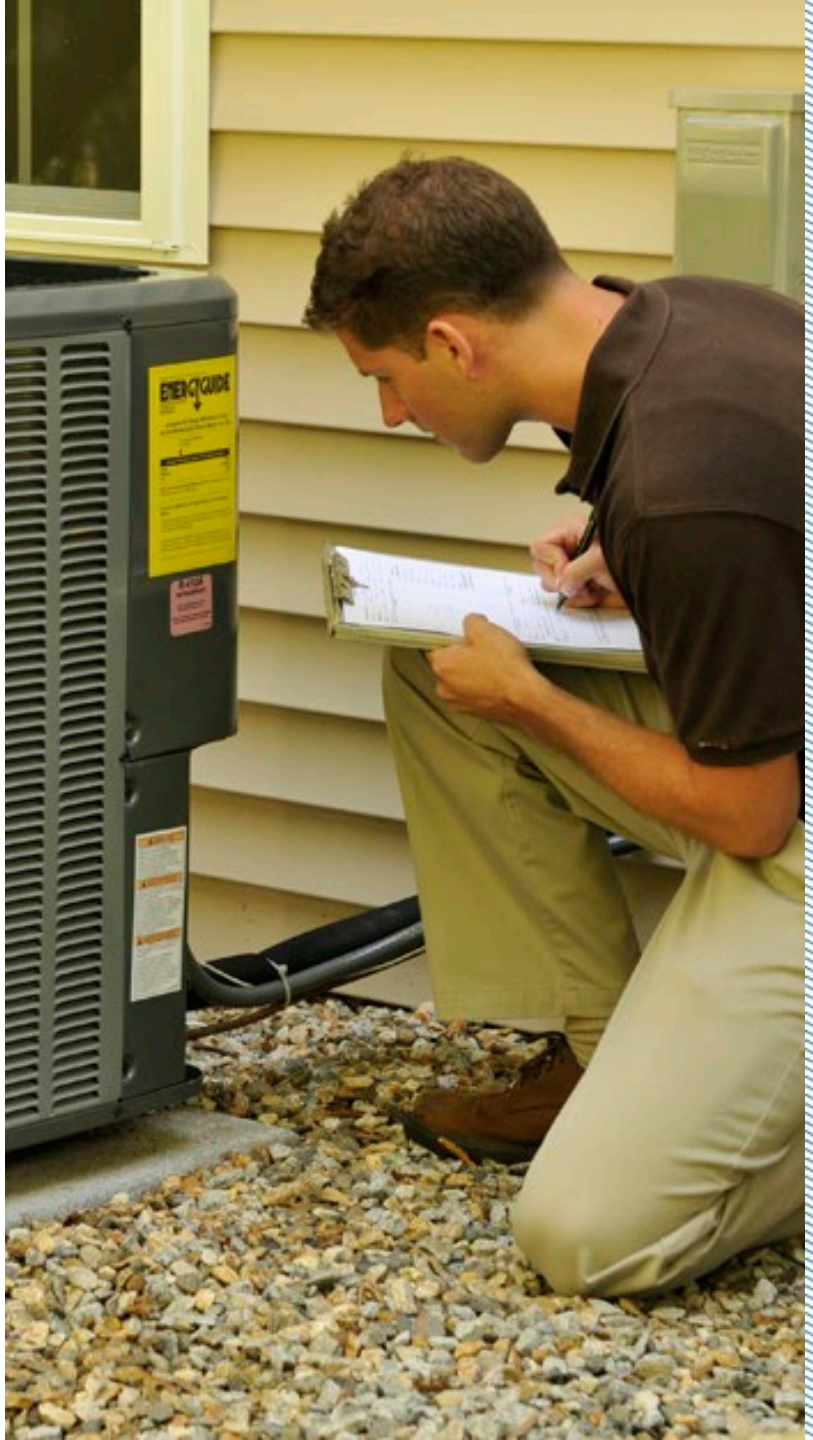
Regulatory Updates: Overview of revised testing procedures and changes to the Federal Standard

Upcoming changes

- SEER, EER, and HSPF ratings will become SEER2, EER2, and HSPF2 in 2023
  - Due to changes in the test procedure
  - Applies to single phase equipment

- Minimum energy efficiency is increasing by approximately 7%
  - Effective date Jan 1, 2023
  - Different rules for North, Southeast and Southwest regions
    - DOE Guidance Document on Regional Standards

- R-410A/R-407C refrigerants will begin phase out in 2025 or 2026, depending on the product



Key Changes in Test Procedures

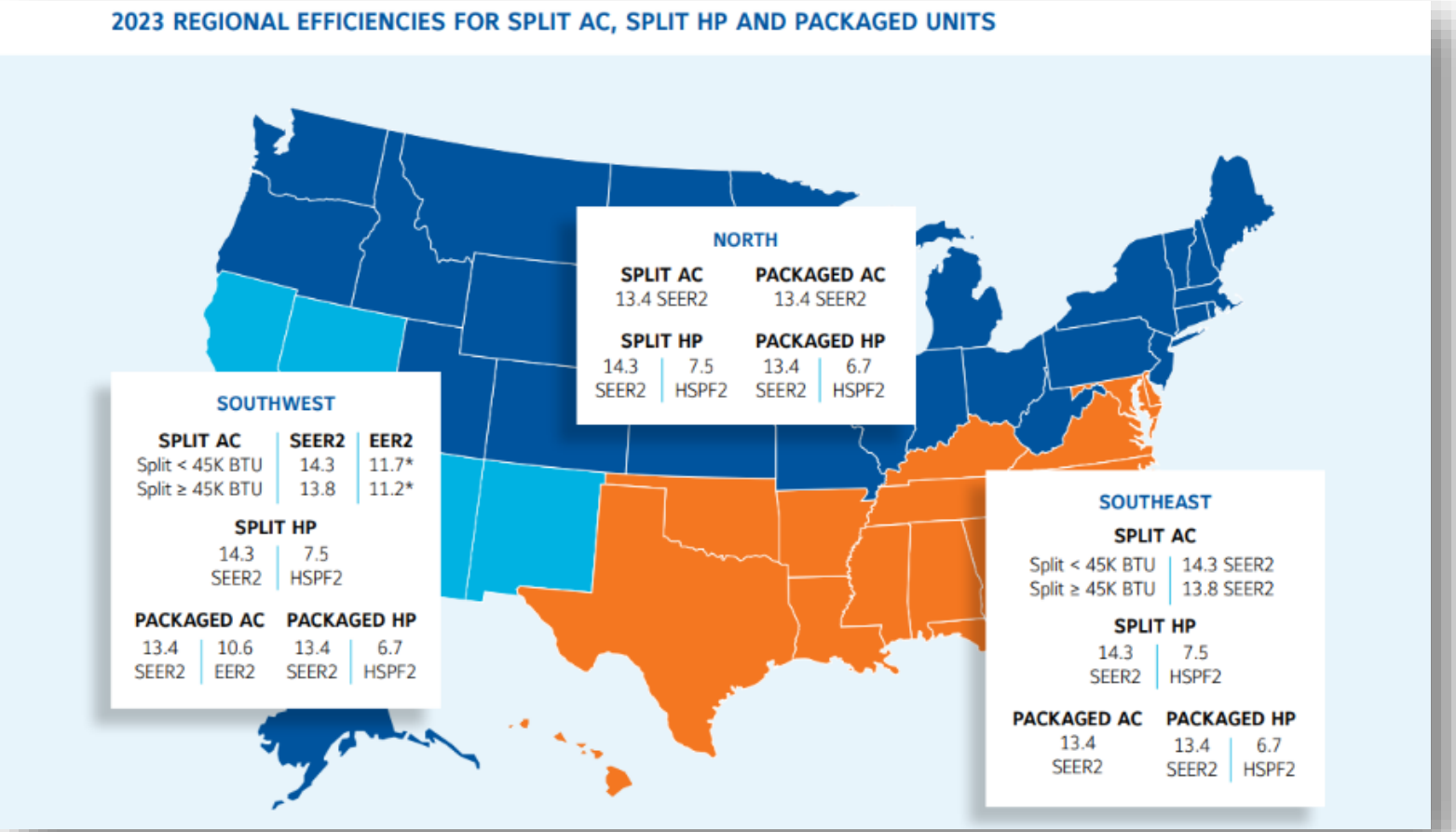
- DOE's Appendix M change to Appendix M1
  - Changes represent improvements that more accurately reflect field conditions
- Key changes:
  - Minimum air handler static pressure
  - Fan power for coil-only units
  - Heating load calculation
  - Heating mode test
  - Variable speed factor for SEER2
  - Off-mode power test
    - Note: Off-mode power test does not affect SEER2/HSPF2 and is regulated separately

Regional Standard Map*

Minimum AC & HP ratings vary by region

Oregon:

- Heat Pump (Split)
  - 14.3 SEER2
  - 7.5 HSPF2
- AC (Split)
  - 13.4 SEER2



*https://www.achrnews.com/articles/146585-prepare-now-for-2023-energy-efficiency-standards

HARDI Resource*

2023 Energy Efficiency Standards for Residential Cooling

RESIDENTIAL SPLIT-SYSTEM AIR CONDITIONERS				
Region:	NATIONWIDE	SOUTH	SOUTHWEST	
Compliance Deadline:	Date of manufacture	Date of installation	Date of installation	
Inventory Management:	Any noncompliant equipment manufactured prior to January 1, 2023 can be sold and installed	All noncompliant equipment must be sold for installation prior to January 1, 2023 or shipped to the North for installation		
Split-System Air Conditioners with a Certified Cooling Capacity <45,000 Btu/h	13.4 SEER2	14.3 SEER2	14.3 SEER2	11.7 EER2** (**9.8 EER2 if ≥ 15.2 SEER2)
Split-System Air Conditioners with a Certified Cooling Capacity ≥45,000 Btu/h	13.4 SEER2	13.8 SEER2	13.8 SEER2	11.2 EER2** (**9.8 EER2 if ≥ 15.2 SEER2)
See next page for determining if existing inventory meets the new efficiency standard for the South and Southwest Regions				

*2023 Energy Efficiency Standards for Residential Cooling (hubspotusercontent40.net)

Energy Star

LEARN MORE AT
energystar.gov

- Current specification, v5.0 will end 12/31/21
- Specification v6.0 optional starting in 2022, mandatory in 2023
  - Higher efficiencies
  - Cold climate products
  - Controls verification procedure
  - Communicating products
- AHRI is an EPA–recognized certification body (CB)
  - Find ENERGY STAR certified products on AHRI's Directory

Energy Star Criteria

B. Energy Efficiency Requirements:

a. Certification Metric Criteria

Table 1: Energy-Efficiency Criteria for Certified Residential Central Air Conditioners

Product Type	SEER2	EER2
CAC Split Systems	≥ 15.2	≥ 12.0
CAC Single Package Equipment[1]	≥ 15.2	≥ 11.5

1. Including gas/electric package central AC units.

Table 2: Energy-Efficiency Criteria for Certified Residential Heat Pumps

Product Type	SEER2	EER2	HSPF2
HP Split Systems	≥ 15.2	≥ 11.7	≥ 7.8
HP Single Package Equipment[1]	≥ 15.2	≥ 10.6	≥ 7.2

1. Including gas/electric package heat pumps, which are not eligible for the Cold Climate designation.

i. For purposes of ENERGY STAR certification, a Heat Pump model may be designated as Cold Climate as per the associated requirements in Table 3.

Table 3: Energy-Efficiency Criteria for Certified Residential Cold Climate Heat Pumps

Product Type	SEER2	HSPF2
HP Split Systems (Non-Ducted)	≥ 15.2	≥ 8.5
HP Split Systems (Ducted)	≥ 15.2	≥ 8.1
HP Single Package Equipment[1]	≥ 15.2	≥ 8.1

1. Excludes gas/electric package heat pumps, which are not eligible for the Cold Climate designation.

Matchmaker: Choosing the right heat pump for your customer

Today's Heat Pump Landscape

- HP measure facing savings and cost effectiveness challenges
- HSPF not strong indicator of actual energy consumption
- Variable speed technology does not play well with poor ductwork

Today's Heat Pump Landscape

Good News!

These are challenges we can minimize through thoughtful design and installation best practices

- HP measure facing savings and cost effectiveness challenges
- HSPF not strong indicator of actual energy consumption
- Variable speed technology does not play well with poor ductwork

Special thanks to NEEA

Majority of the following content was made available by Christopher Dymond and Suzi Asmus (NEEA), with collaborative support and input from:

- *Isaac Smith – MN Center for Energy and Environment*
- *Ben Schoenbauer – MN Center for Energy and Environment*
- *Ben Larson – Energy Research*
- *Matt Christie – TRC*

HSPF vs. high-COP at mild temperatures

Energy efficient heat pumps are currently identified by high HSPF ratings (heating mode)

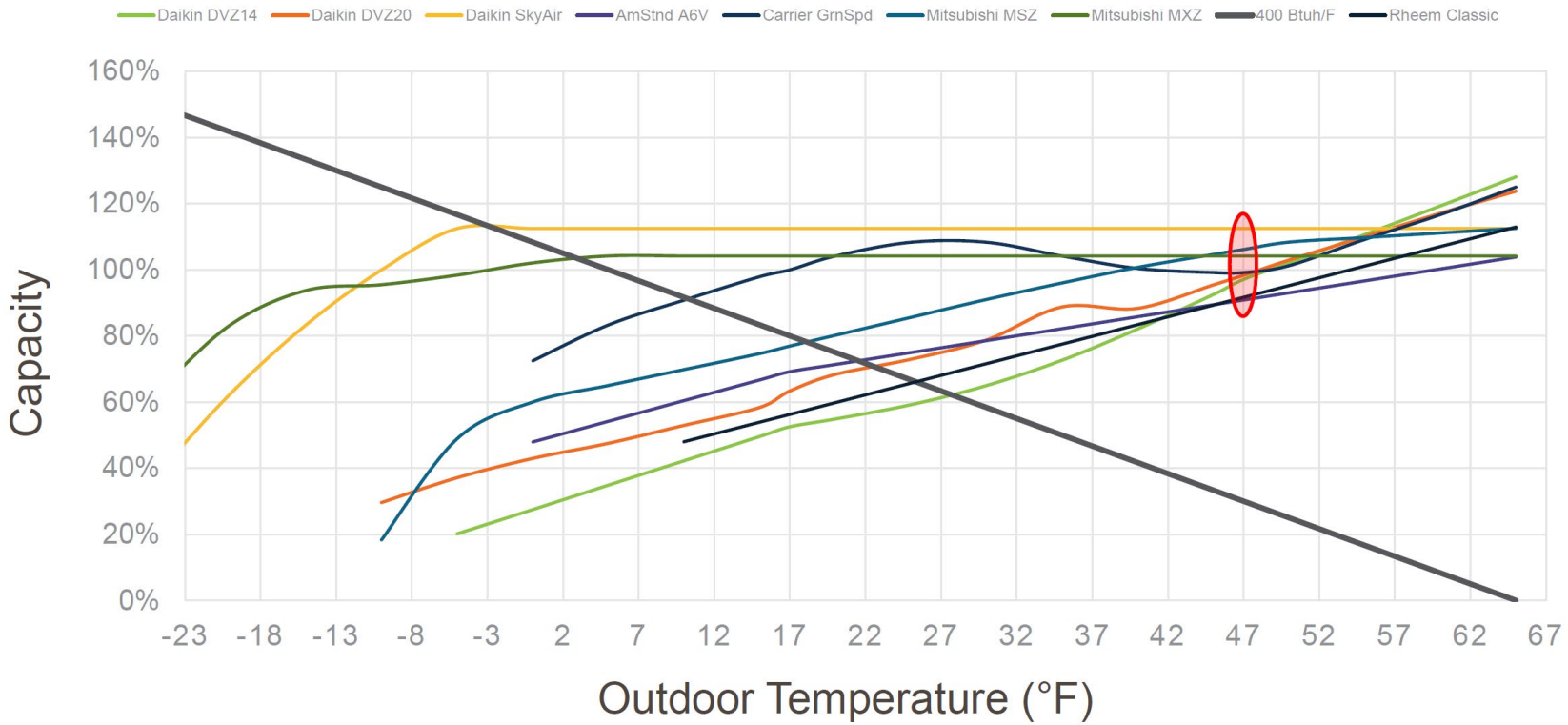
What if there was a better indicator of energy savings for our climate?

What We Know

- Ratings do not reflect real world performance

Not all Heat Pumps are the Same

Not all 2 Ton Heat Pumps are the same



#1

Low Load Efficient

#1 – Low Load Efficient

When sized right,
a variable speed heat pump spends most of its time running at part load.

Good VSHPs are 20-30% more efficient at part load than at full load

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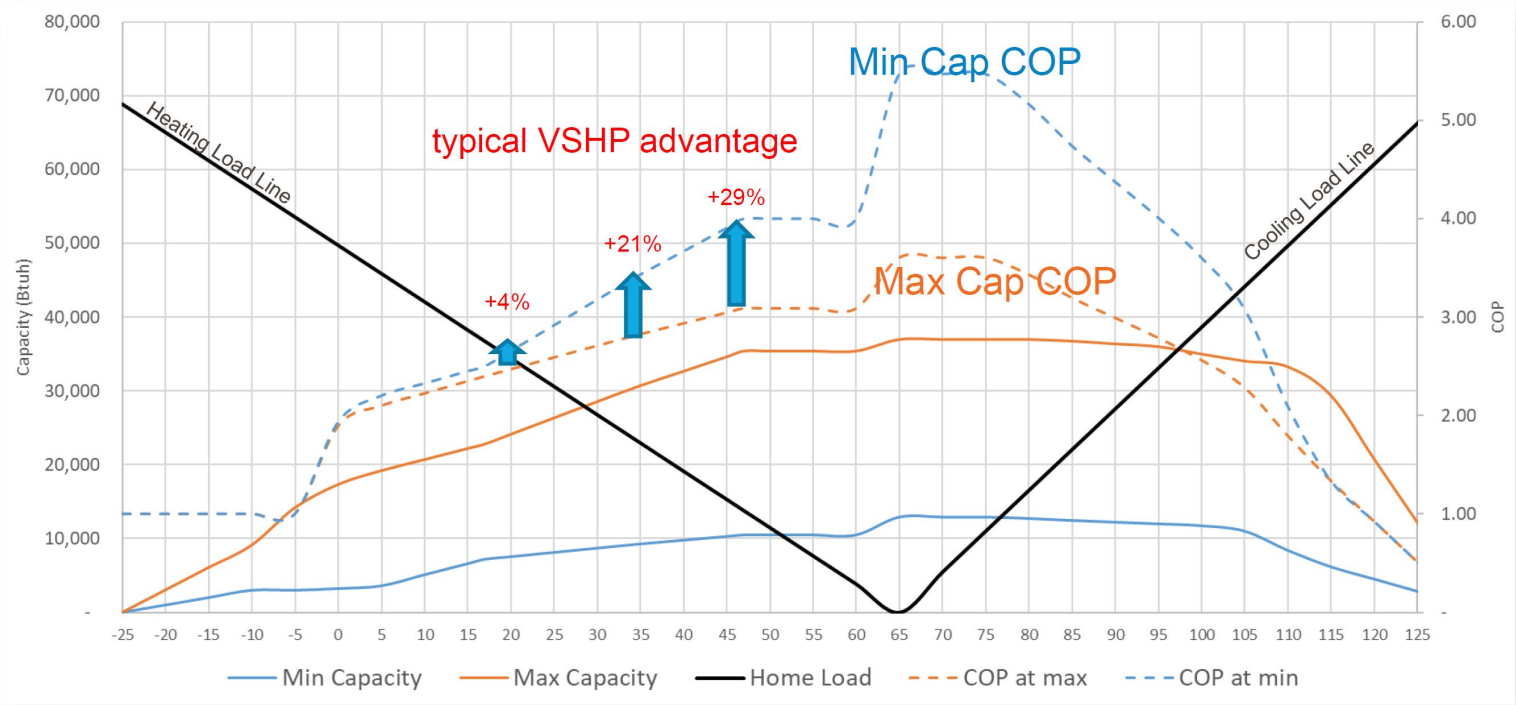
Minimum Capacity COP



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MN CEE Analysis

- Low-Load efficiency is important to seasonal performance **in all climates**
- Minimum Capacity COP@47°F appears to be the best indicator

25% improved MinCap COP@47°F
(Modeled Results)

City	Additional Savings
Portland	16%
New York City	17%
Bozeman	11%
Minneapolis	8%

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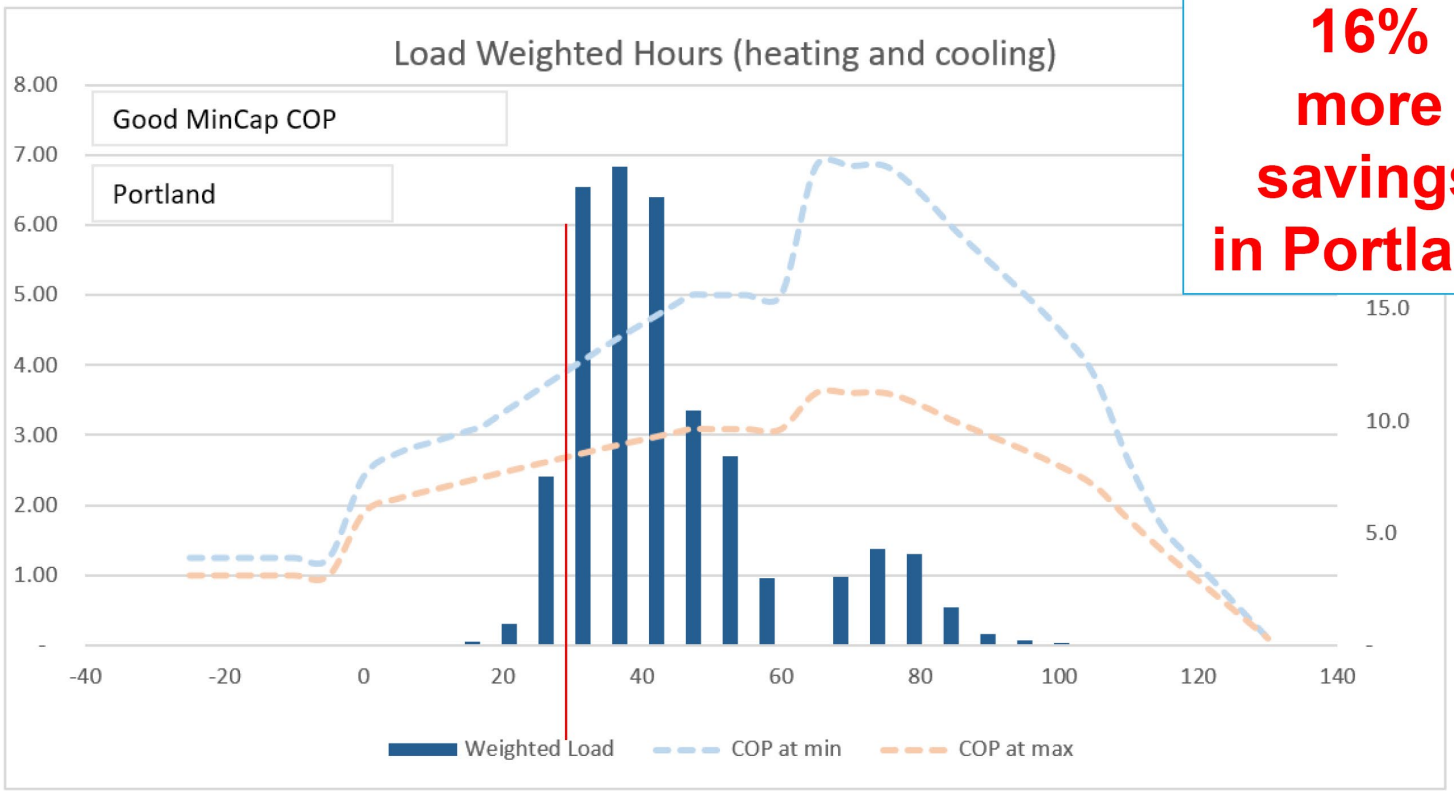
Annual Heating vs COP

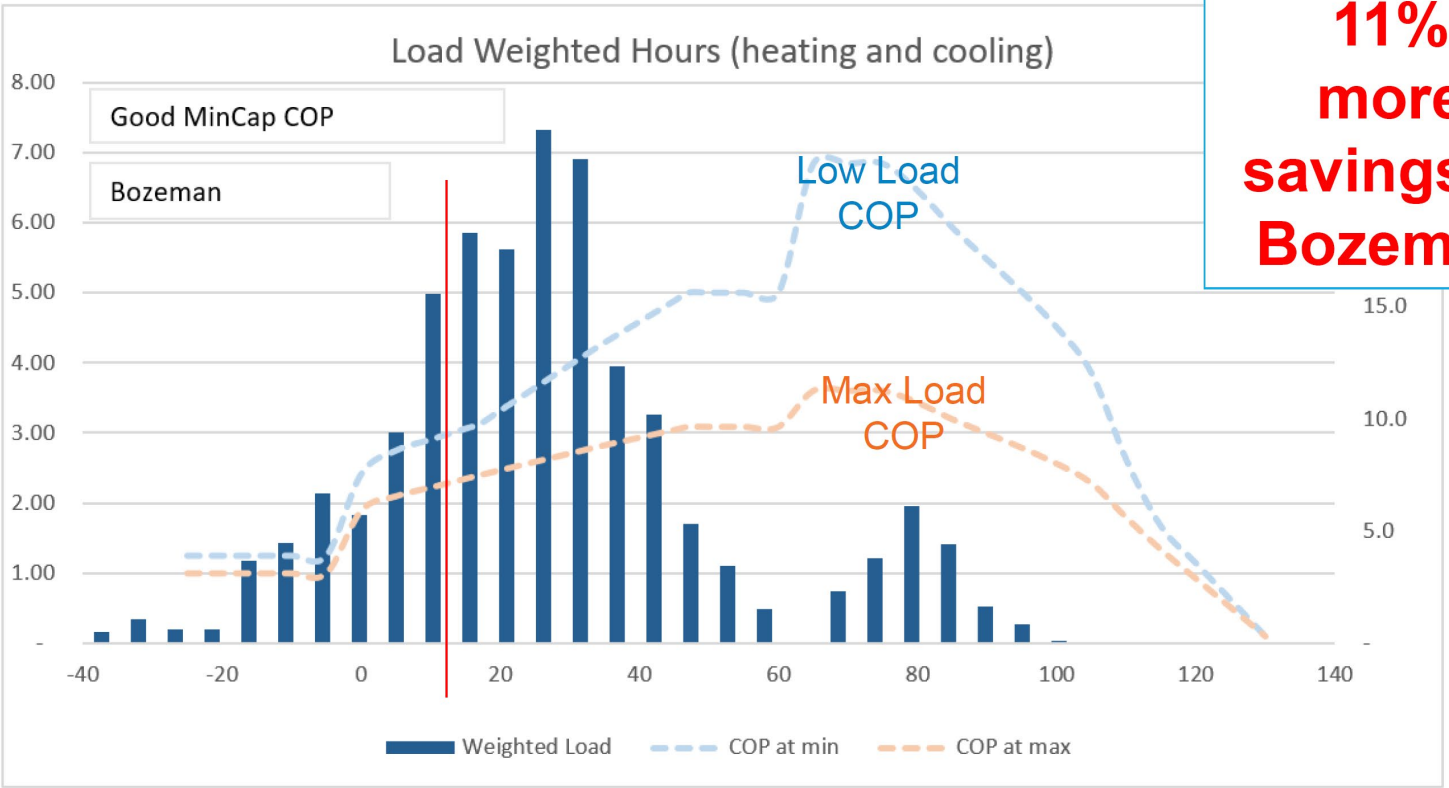
Portland, OR



16% more savings in Portland

Annual Heating vs COP

Bozeman, MT



11% more savings in Bozeman

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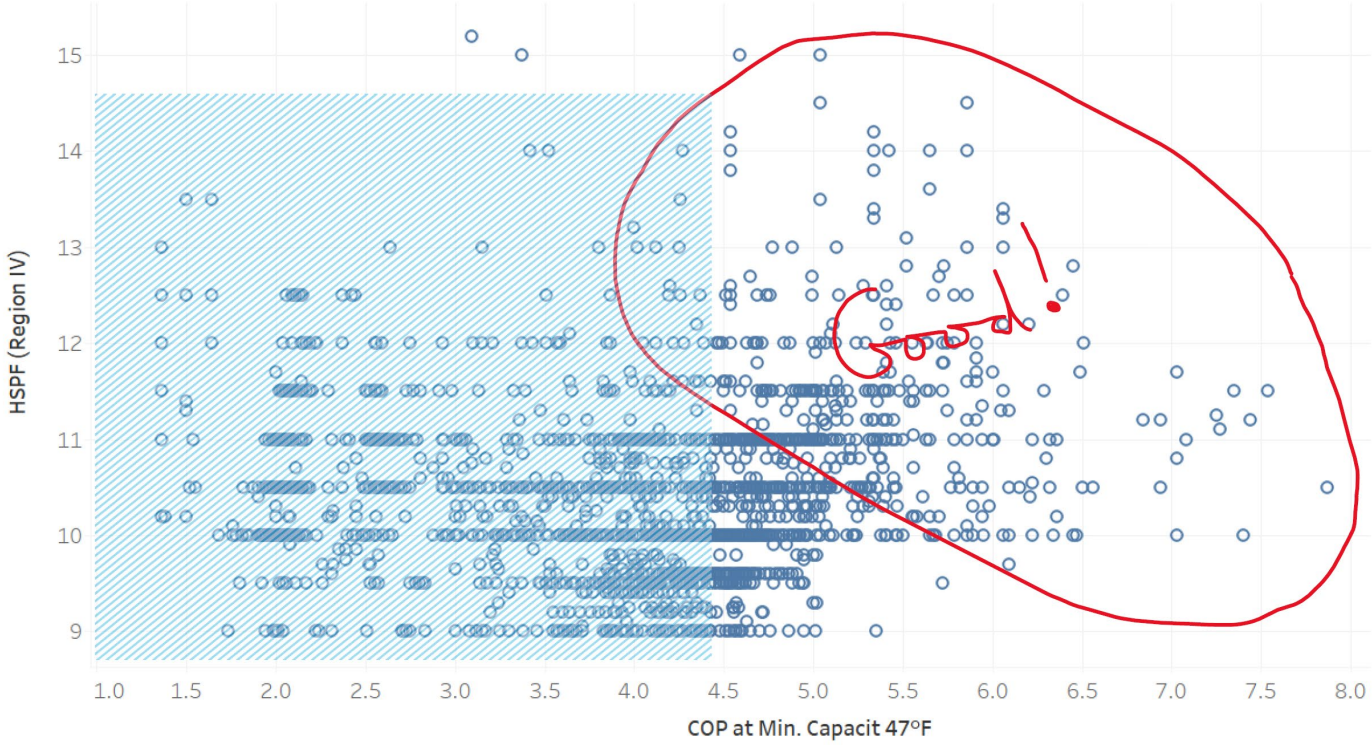
MinCap COP47 vs HSPF

(NEEP heat pump database)



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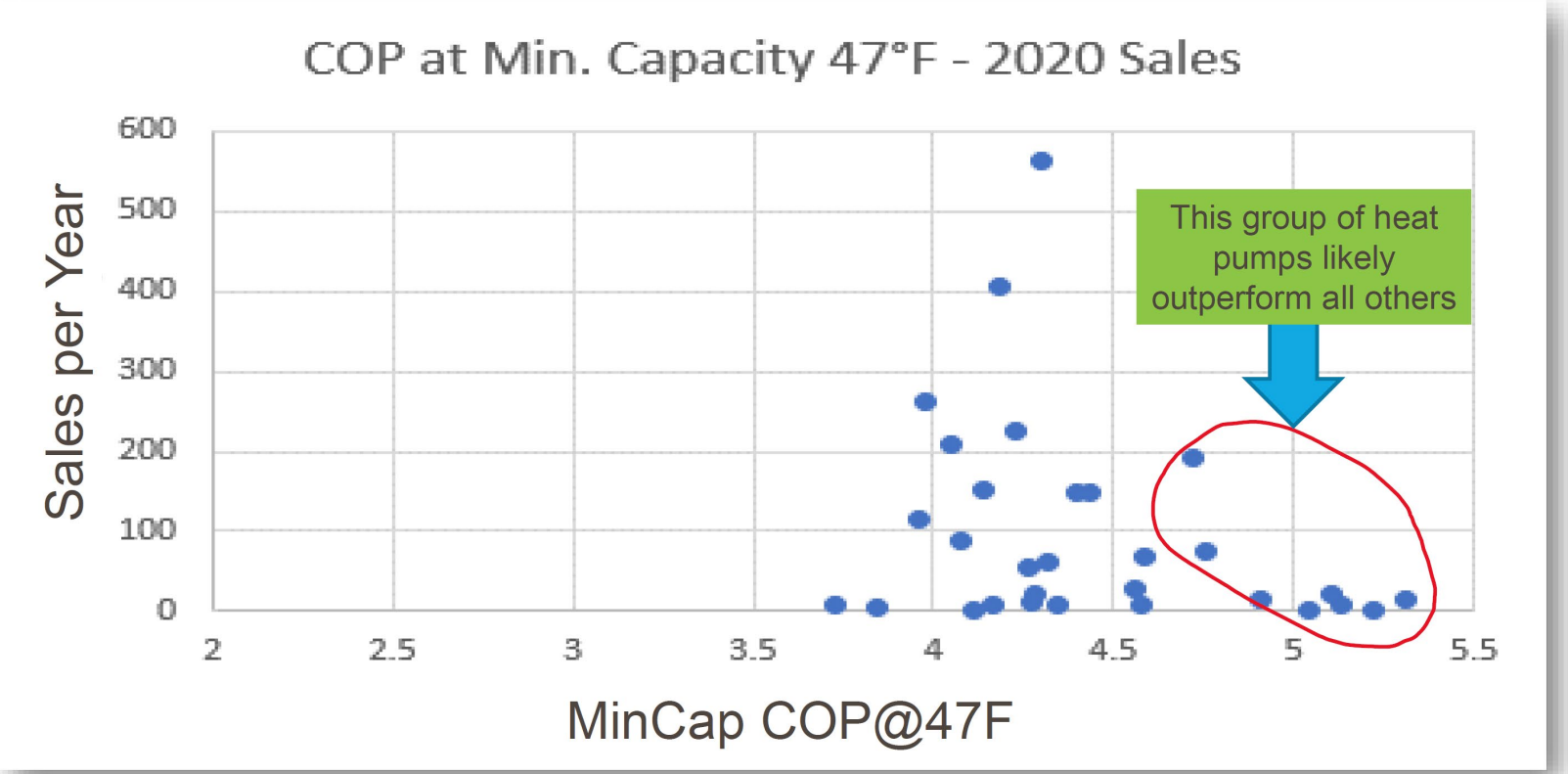
BPA – Market Data Analysis



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Low Load Efficiency

Definition	Savings	Identification
MinCap COP@47 > 5.0	Energy Savings • 7-17% Improvement Peak Savings • negligible Carbon Savings • Local grid dependent	NEEP Heat Pump Database

City	Savings
Portland	16%
New York City	17%
Bozeman	11%
Minneapolis	8%

Red indicates work is needed

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Low Fan Speed Increases Losses

- Variable Speed HPs may be a bad idea if ducts are inadequate

Bad Ducts
+ VSHP

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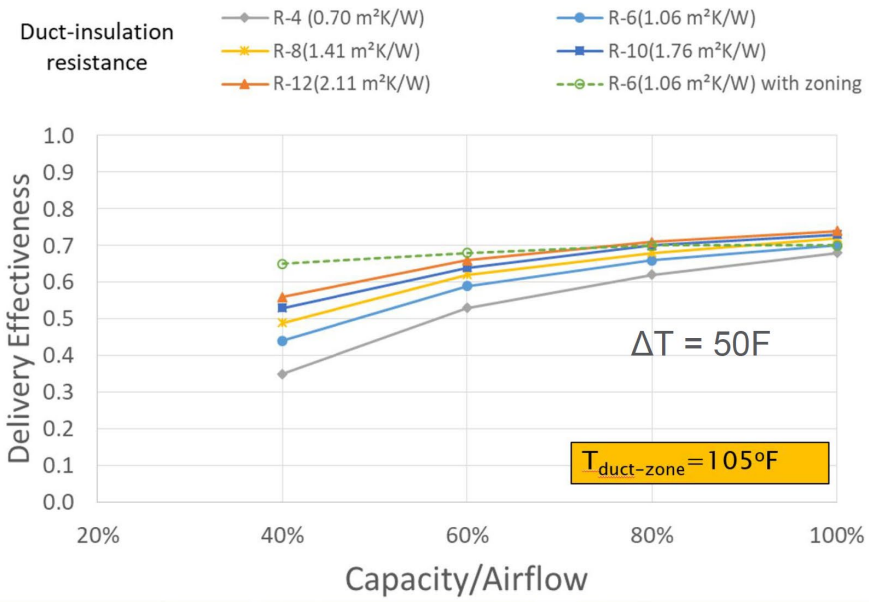

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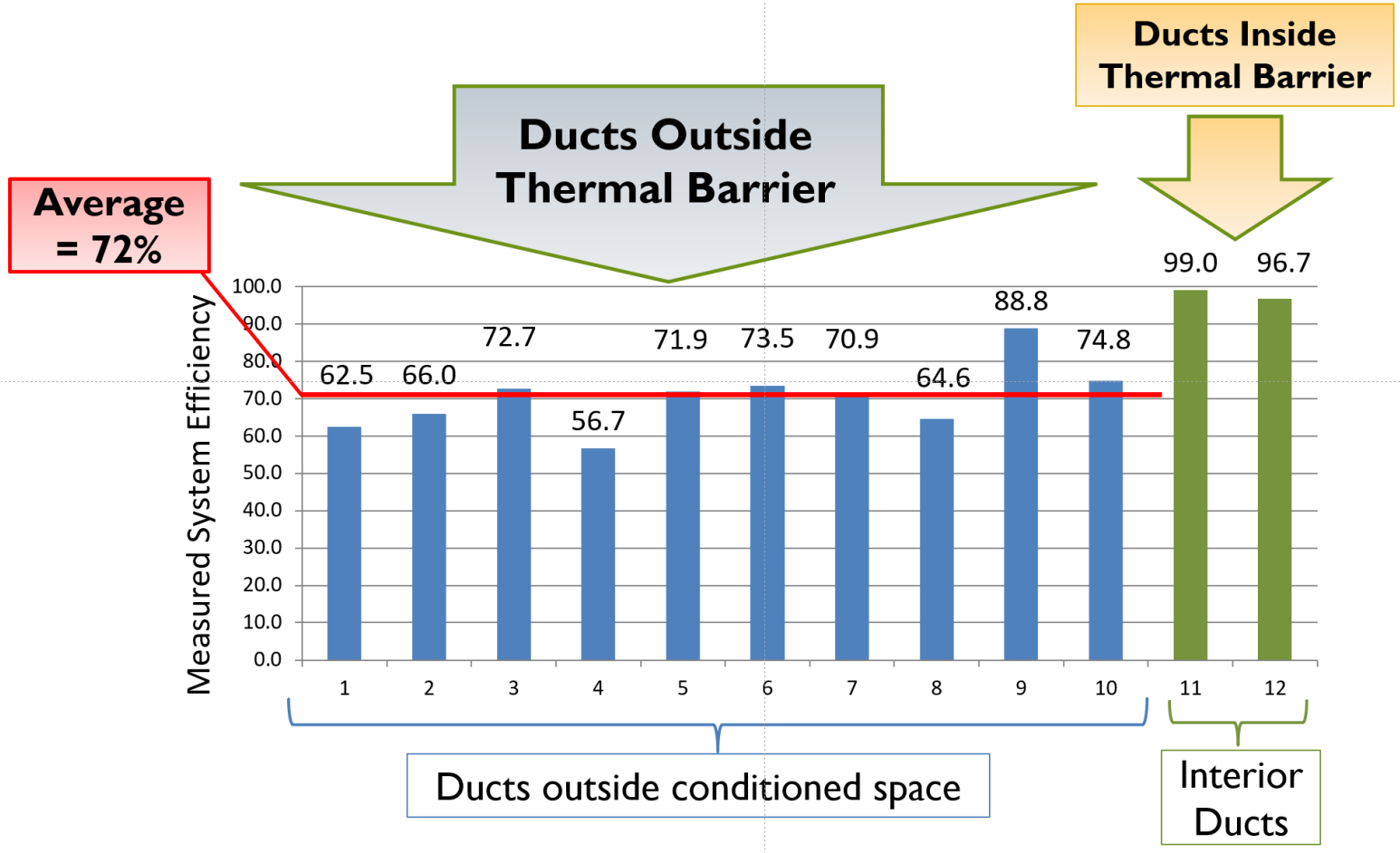
Outside vs. Inside Energy Savings



Data from Ecotope Inc.

Getting the most out of your HVAC diagnostic tools

Installation Best Practices

- [x] Improved product selection
- [x] Ensuring adequate ductwork
- [ ] Improved installation practices

Commonly used HVAC diagnostic tools

Basic roles of standard HVAC diagnostic tools:

Check for leaks

Confirm electrical measurements are in spec

Verify proper amount of refrigerant

Bluetooth-enabled tools

Bluetooth functionality increasingly common across mainstream HVAC diagnostic product lines

T·E·C

Supco

iManifold®

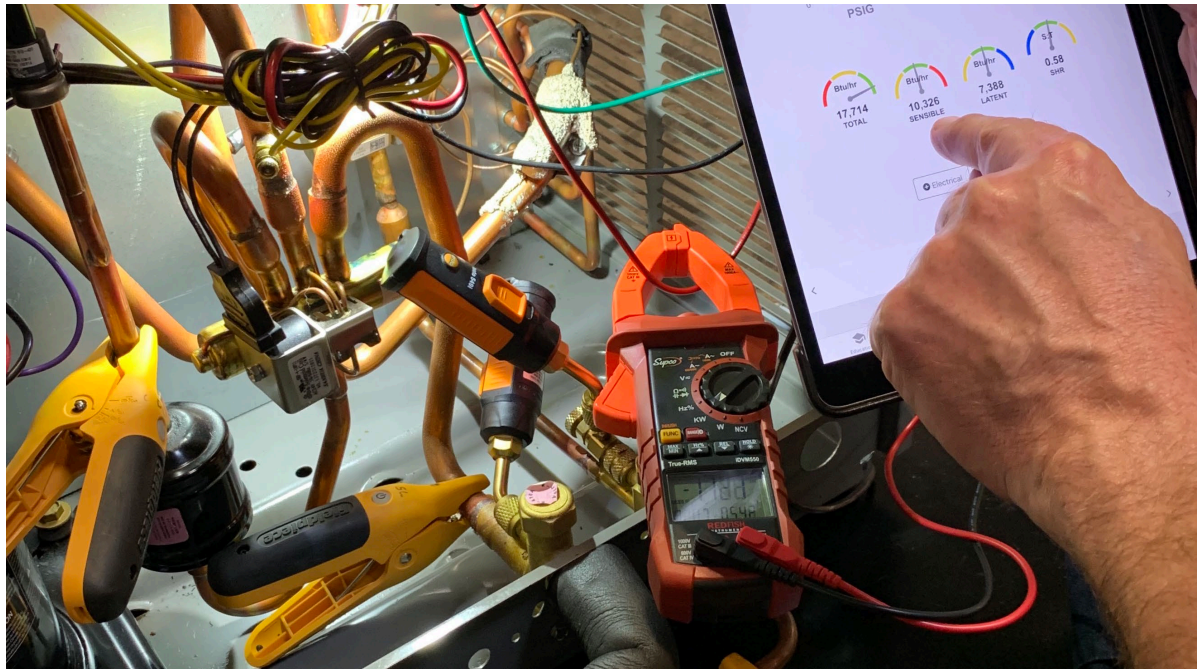
testo

ACCUTOOLS®

Fieldpiece

Realizing full potential of Bluetooth-enabled tools

measureQuick



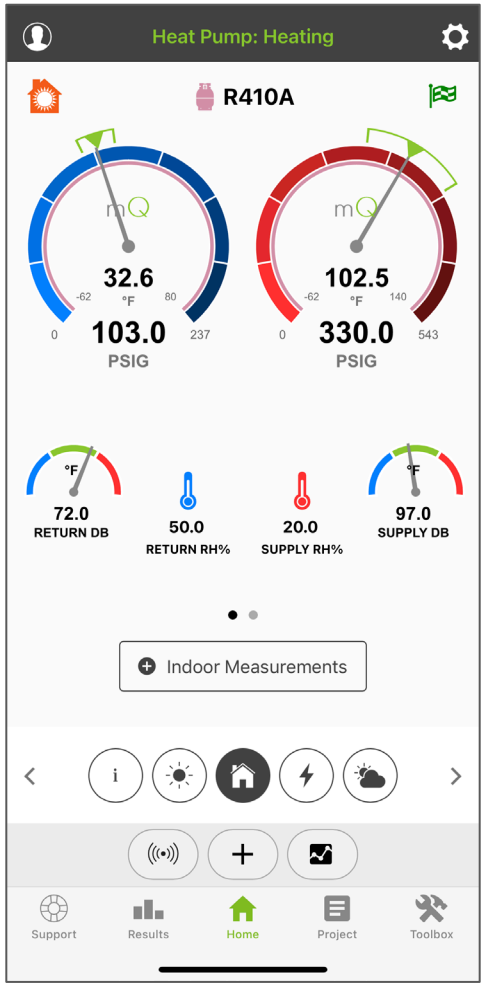
measureQuick benefits

- Central hub receiving and interpreting real-time data collected by Bluetooth-enabled diagnostic tools
  - Supports mix-match of brands (ex. Fieldpiece/Testo/etc.)
- Diagnoses issues with system performance during installation and tune-up
- Provides customer-facing reports, supporting sales process
- Supports technician training and troubleshooting, allowing veteran installers to review system diagnostics from remote location in real-time
- Benchmarking systems, increasing value for maintaining service agreements with installer

measureQuick

measureQuick Benefits

- mQ application supports diagnostic reporting for heat pumps, gas furnaces and central AC
- Can be accessed via smart phone, tablet and laptop

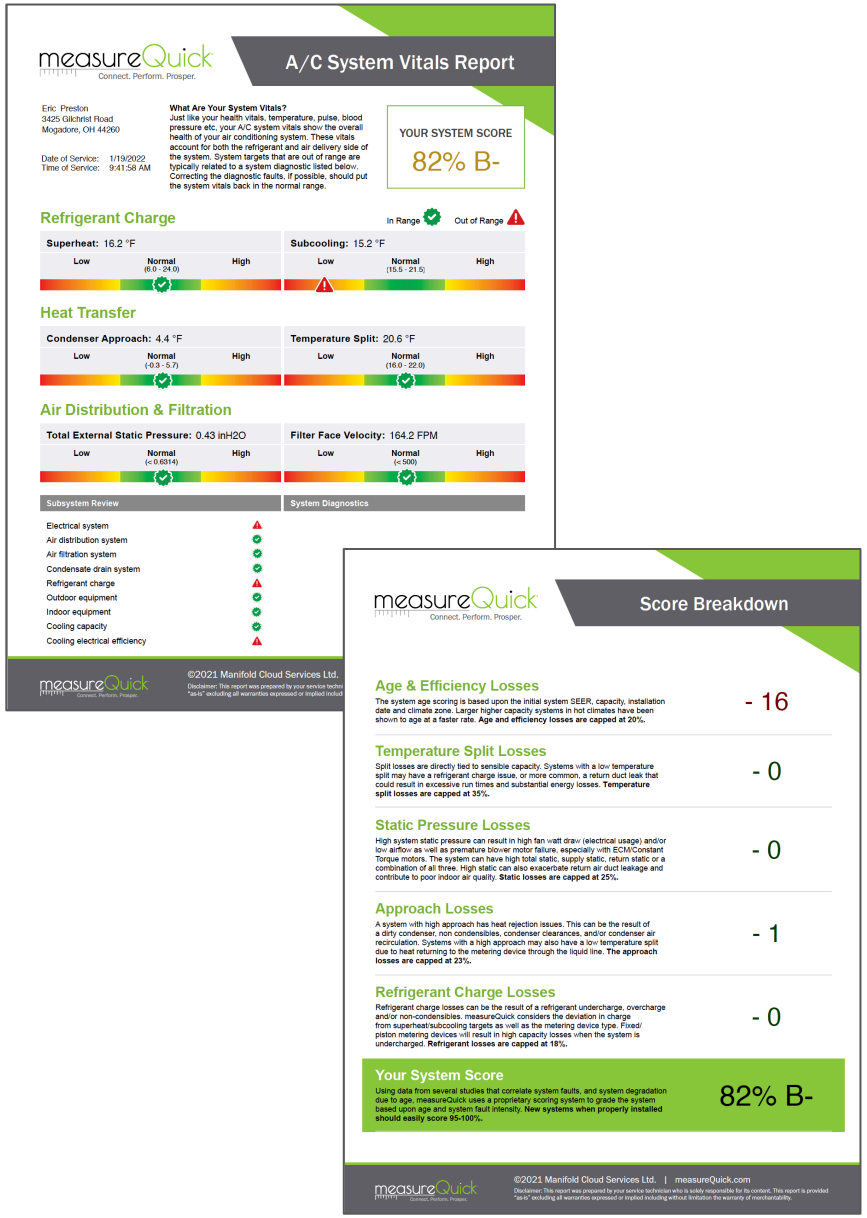


Heat pumps

measureQuick

measureQuick Reporting System

- Measurements and calculations
- Pass/Fails for subsystems
- Corrective actions
- Photo documentation
- Geo location



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A/C System Vitals Report

Eric Preston
3425 Gilchrist Road
Mogadore, OH 44260

Date of Service: 1/19/2022
Time of Service: 9:41:58 AM

What Are Your System Vitals?
Just like your health vitals, temperature, pulse, blood pressure etc, your A/C system vitals show the overall health of your air conditioning system. These vitals account for both the refrigerant and air delivery side of the system. System targets that are out of range are typically related to a system diagnostic listed below. Correcting the diagnostic faults, if possible, should put the system vitals back in the normal range.

YOUR SYSTEM SCORE
82% B-

Refrigerant Charge — In Range / Out of Range

	Low	Normal	High
Superheat: 16.2 °F		(6.0 - 24.0)	
Subcooling: 15.2 °F		(15.5 - 21.5)	

Heat Transfer

	Low	Normal	High
Condenser Approach: 4.4 °F		(-0.3 - 5.7)	
Temperature Split: 20.6 °F		(16.0 - 22.0)	

Air Distribution & Filtration

	Low	Normal	High
Total External Static Pressure: 0.43 inH2O		(< 0.6314)	
Filter Face Velocity: 164.2 FPM		(< 500)	

Subsystem Review	System Diagnostics
Electrical system	
Air distribution system	
Air filtration system	
Condensate drain system	
Refrigerant charge	
Outdoor equipment	
Indoor equipment	
Cooling capacity	
Cooling electrical efficiency	

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Score Breakdown

Age & Efficiency Losses — - 16
The system age scoring is based upon the initial system SEER, capacity, installation date and climate zone. Larger higher capacity systems in hot climates have been shown to age at a faster rate. **Age and efficiency losses are capped at 20%.**

Temperature Split Losses — - 0
Split losses are directly tied to sensible capacity. Systems with a low temperature split may have a refrigerant charge issue, or more common, a return duct leak that could result in excessive run times and substantial energy losses. **Temperature split losses are capped at 35%.**

Static Pressure Losses — - 0
High system static pressure can result in high fan watt draw (electrical usage) and/or low airflow as well as premature blower motor failure, especially with ECM/Constant Torque motors. The system can have high total static, supply static, return static or a combination of all three. High static can also exacerbate return air duct leakage and contribute to poor indoor air quality. **Static losses are capped at 25%.**

Approach Losses — - 1
A system with high approach has heat rejection issues. This can be the result of a dirty condenser, non condensibles, condenser clearances, and/or condenser air recirculation. Systems with a high approach may also have a low temperature split due to heat returning to the metering device through the liquid line. **The approach losses are capped at 23%.**

Refrigerant Charge Losses — - 0
Refrigerant charge losses can be the result of a refrigerant undercharge, overcharge and/or non-condensibles. measureQuick considers the deviation in charge from superheat/subcooling targets as well as the metering device type. Fixed/piston metering devices will result in high capacity losses when the system is undercharged. **Refrigerant losses are capped at 18%.**

Your System Score — 82% B-
Using data from several studies that correlate system faults, and system degradation due to age, measureQuick uses a proprietary scoring system to grade the system based upon age and system fault intensity. **New systems when properly installed should easily score 95-100%.**

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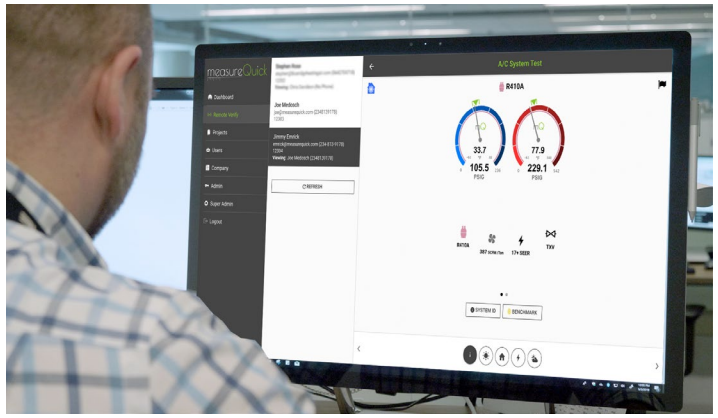
measureQuick

measureQuick QC & Support System

- Remote viewing of:
  - Data from the field
  - Diagnostics and cleared faults
  - All performance calculations
- Ability to prepopulate projects
- Generate past reports



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measureQuick Workforce Development

mQ features supporting workforce development:

- Real-time remote view of system diagnostics, allowing for feedback from experienced staff while in other locations
- Prescriptive workflow – application presents step-by-step installation/tune-up process
- Instant feedback – mQ application flags testing results outside of normal range and provides list of possible causes

measureQuick

Future of connected tools within Residential program

Energy Trust of Oregon recognizes the value of enhanced data collection and real-time diagnostics.

While measureQuick is the highlighted tool in today's presentation, Energy Trust is monitoring the market for similar tools coming into the market, including sensors built into new HVAC equipment

Thank you

Mark Jerome
Sr. Technical Energy Manager

EnergyTrust of Oregon