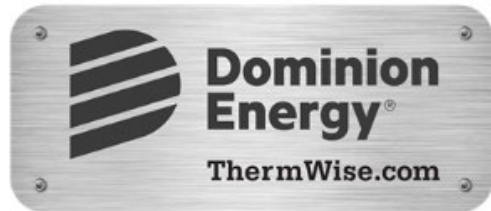


The Utah Energy Code Webinar will begin at 10am

Enter your questions in the chat window

If you are requesting DOPL credit you must have a webcam turned on and be visible to the instructor for the entire webinar



THIS WEBINAR IS BEING RECORDED

Utah Energy Code Training

COLD CLIMATE HEAT PUMPS

CHRIS COX, PE - NEXANT

JOHN COUNSELL – FIELD TECHNICAL CONSULTANT FOR LENNOX INDUSTRIES

Learning Objectives

What is a heat pump

How does code apply to heat pumps

Field installation training (John Counsell)

Benefits of heat pump systems

What is a heat pump

Similar to residential air conditioners

Can provide heating and cooling

Use basic refrigeration cycle with a reversing valve for heating

Most use air-to-air heat transfer but can be water source systems

A back-up heat source is recommended in cold climates

Cold weather operation requires intermittent defrost cycle

Can even heat water!



What is a heat pump

Ducted forced air systems – similar to residential central AC

Ductless systems are popular

Packaged equipment exists



What is a heat pump

Gas absorption Heat Pump (GAHP)

Gas-fired

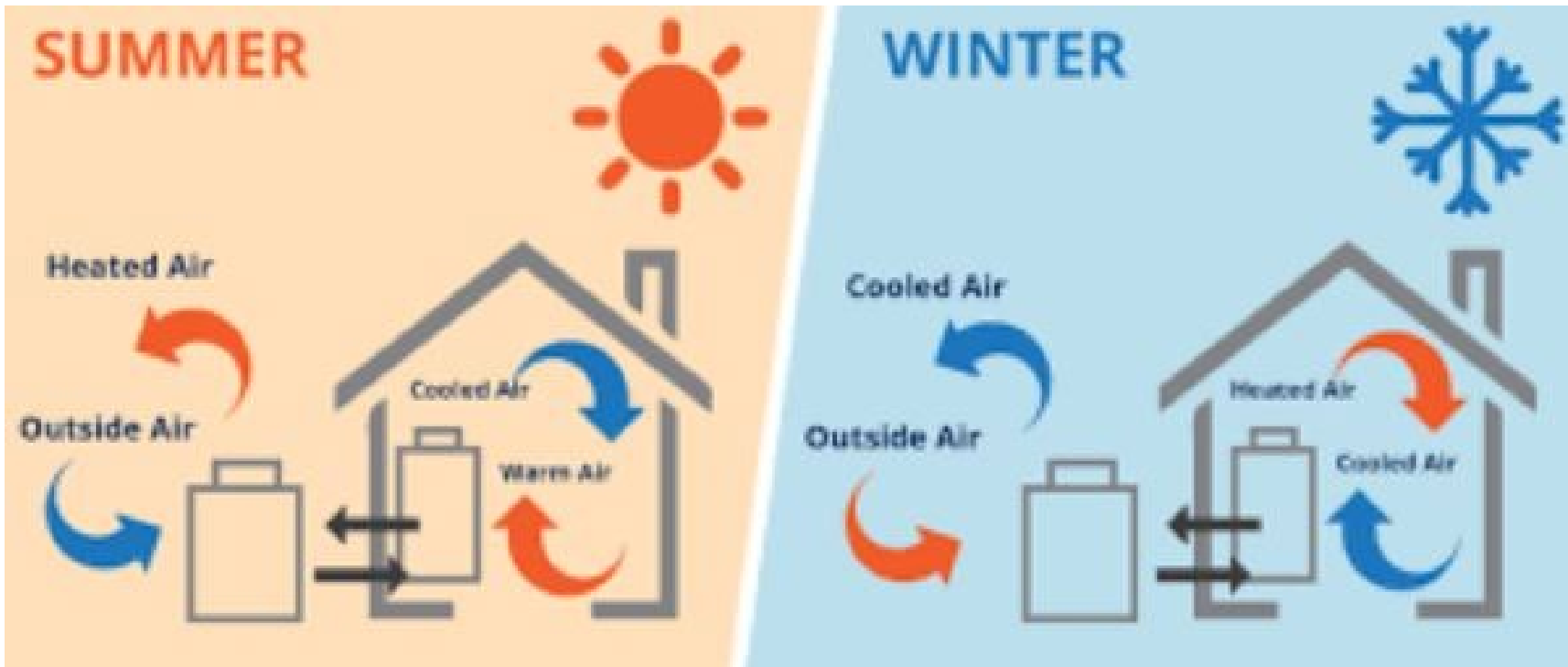
Use an ammonia-water absorption cycle

These are uncommon but an example of adaptability



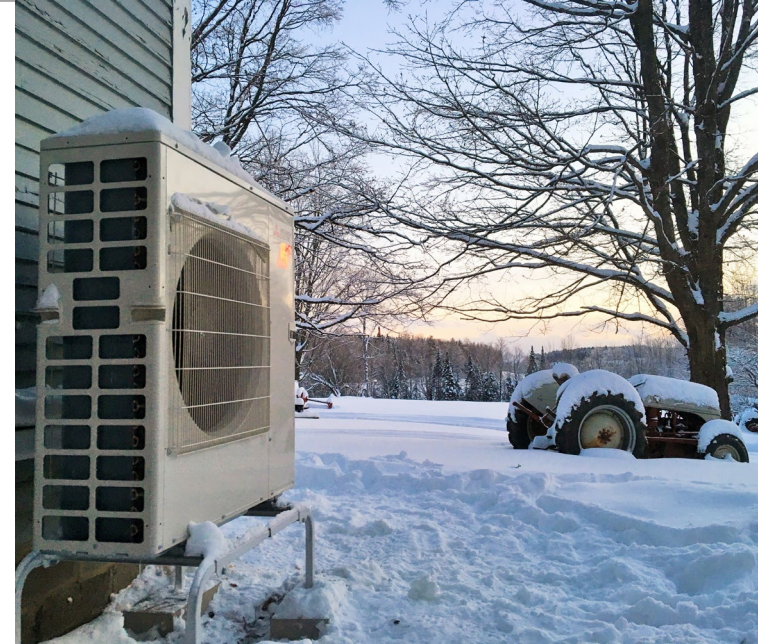
What is a heat pump

Central-ducted split-systems will be the focus of this presentation



Cold Climate Heat Pumps

- Cold Climate Air Source Heat Pump (ccASHP)
- Designed to operate at low outdoor air temperatures (CZ 4 or higher)
- Variable capacity compressors (for example, inverter-driven)
- Northeast Energy Efficiency Partnership (NEEP) provides ccASHP product listings
 - For Non-Ducted systems: HSPF >10
 - For Ducted systems: HSPF >9
 - COP @5°F >1.75 (at maximum capacity operation)
 - SEER > 15



Energy Code – Federal Requirements

Residential products subject to CFR 430.32.c(3)

- Central air conditioners and central air conditioning heat pumps manufactured on or after January 1, 2015, and before January 1, 2023 must have a Seasonal Energy Efficiency Ratio and Heating Seasonal Performance Factor not less than:

Split-system heat pumps 14 SEER 8.2 HSPF

Single-package heat pumps 14 SEER 8.0 HSPF

Through-the-wall heat pumps 12 SEER 7.4 HSPF

The Energy Policy and Conservation Act (EPCA) of 1975 prescribes energy conservation standards for many consumer products and requires DOE to periodically revise as appropriate

Energy Code – Federal Requirements

Residential products subject to CFR 430.32.c(3)

- Central air conditioners and central air conditioning heat pumps manufactured on or after January 1, 2023, shall have a Seasonal Energy Efficiency Ratio and Heating Seasonal Performance Factor not less than:

Split-system heat pumps **15 SEER 8.8 HSPF**

Single-package heat pumps 14 SEER 8.0 HSPF – no change

Through-the-wall heat pumps 12 SEER 7.4 HSPF

Nothing too exciting happening in next iteration

Energy Code – Federal Fan Efficiency

[10 CFR 430.2](#) Manufacturers are required to comply with the U.S. Department of Energy (DOE) energy conservation standards for residential furnace fans starting July 3, 2019

Non-Weatherized, Non-Condensing Gas Furnace Fan (NWG-NC)	$FER = 0.044 \times Q_{Max} + 182$
Non-Weatherized, Condensing Gas Furnace Fan (NWG-C)	$FER = 0.044 \times Q_{Max} + 195$
Non-Weatherized Electric Furnace/Modular Blower Fan (NWEF/NWMB)	$FER = 0.044 \times Q_{Max} + 165$

FER (Watts/1000 cfm)**

Most Manufacturers are using EC motors to meet this requirement


Better Than Code Guidance

Needing some efficiency guidance?

ENERGY STAR certified heat pumps have higher ratings for seasonal energy efficiency ratio (SEER), energy efficiency ratio (EER), and heating seasonal performance factor (HSPF) and use about 5% percent less energy than conventional new models.

energystar.gov/products/heating_cooling/heat_pumps_air_source

ABOUT ENERGY STAR PARTNER RESOURCES SEARCH

 The simple choice for energy efficiency.

ENERGY EFFICIENT products ENERGY SAVINGS at home ENERGY EFFICIENT new homes ENERGY STRATEGIES FOR buildings & plants

Home » Energy Efficient Products » Heating & Cooling » Heat Pumps, Air Source

Energy Efficient Products

Products that earn the ENERGY STAR are independently certified to save energy, save money and protect the climate.

All Certified Products Appliances Lighting Office Equipment Electronics Product Specifications Search

AIR-SOURCE HEAT PUMPS For Partners


OVERVIEW SPECIFICATION BUYING GUIDANCE

Have you heard of ENERGY STAR certified Ductless Heating & Cooling?

Earning the ENERGY STAR means products meet strict energy efficiency guidelines set by the U.S. Environmental Protection Agency. By choosing ENERGY STAR certified heating and cooling equipment and taking steps to optimize its performance, you can enhance the comfort of your home while saving energy. Saving energy helps you save money on utility bills and protect our climate by helping prevent harmful carbon pollution and reducing other greenhouse gases.

Electric air-source heat pumps, often used in moderate climates, use the difference between outdoor air temperatures and indoor air temperatures to cool and heat your home.

ENERGY STAR certified heat pumps have higher ratings for seasonal energy efficiency ratio (SEER), energy efficiency ratio (EER), and heating seasonal performance factor (HSPF) and use about 5% percent less energy than conventional new models.



ENERGY STAR Certified Central Air Conditioning and Air Source Heat Pumps can be found in the CEE-AHRI database [CEE-AHRI database](#)

REBATE FINDER

Enter a zip code below to find deals near you!

SUBMIT

UT Energy Code – Residential

International Energy Conservation Code 2015 (IECC 2015) - Amended

R403.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

R403.7 Equipment sizing and efficiency rating (Mandatory). Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies. New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.

UT Energy Code – Commercial

Commercial installations subject to IECC 2018

C403.4.1.1 Heat pump supplementary heat (Mandatory). Heat pumps having supplementary electric resistance heat shall have controls that, except during defrost, prevent supplementary heat operation where the heat pump can provide the heating load.

C403.1.1 Calculation of heating and cooling loads. Design loads associated with heating, ventilating and air conditioning of the building shall be determined in accordance with ANSI/ASHRAE/ACCA Standard 183 or by an approved equivalent method

C403.3 Heating and cooling equipment efficiencies (Mandatory). Heating and cooling equipment installed in mechanical systems shall be sized in accordance with Section C403.3.1 and shall be not less efficient in the use of energy than as specified in Section C403.3.2.

UT Energy Code – Commercial

TABLE C403.3.2(2) MINIMUM EFFICIENCY REQUIREMENTS: ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY
Air cooled (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER 12.0 IEER
		All other	Split System and Single Package	10.8 EER 11.8 IEER
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.6 EER 11.6 IEER
		All other	Split System and Single Package	10.4 EER 11.4 IEER
	< 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.5 EER 10.6 IEER
		All other	Split System and Single Package	9.3 EER 9.4 IEER
Air cooled (heating mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	-	47°F db/43°F wb outdoor air	3.3 COP
		-	17°F db/15°F wb outdoor air	2.25 CO
	≥ 135,000 Btu/h and	-	47°F db/43°F wb outdoor air	3.2 COP
		-	17°F db/15°F wb outdoor air	2.05 COP

UT Energy Code – Commercial

ASHRAE 90.1-2016 Table 6.8.1-10 Variable Refrigerant Flow and Applied Heat Pumps

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY
	< 65,000 Btu/h	Electric Resistance (or None)	VRF multisplit system	13.0 SEER
VRF air cooled (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h		VRF multisplit system	11.0 EER 14.6 IEER
			VRF multisplit system with heat recovery	10.8 EER 14.4 IEER
	≥ 135,000 Btu/h and < 240,000 Btu/h		VRF multisplit system	10.6 EER 13.9 IEER
	≥ 135,000 Btu/h and < 240,000 Btu/h		VRF multisplit system with heat recovery	10.4 EER 13.7 IEER
			< 240,000 Btu/h	VRF multisplit system
	< 240,000 Btu/h		VRF multisplit system	9.3 EER 12.5 IEER
VRF air cooled (heating mode)	< 65,000 Btu/h	-	VRF multisplit system	7.7 HSPF
	≥ 65,000 Btu/h and < 135,000 Btu/h	-	47°F db/43°F wb outdoor air	3.3 COP
		-	17°F db/15°F wb outdoor air	2.25 CO
	≥ 135,000 Btu/h and < 240,000 Btu/h	-	47°F db/43°F wb outdoor air	3.2 COP
		-	17°F db/15°F wb outdoor air	2.05 COP

Cold Climate Heat Pump Field Guide

PRESENTED BY JOHN COUNSEL, LENNOX INDUSTRIES



Heat Pump Benefits

PRESENTED BY CHRIS COX, PE - NEXANT

Heat Pump Benefits

Home owners have varying motivations

- Equipment and installation costs
- Long term operational cost savings
- Environmental impacts
- Resiliency
- Incentives



Utility Cost Savings

Typical existing 1,900 sq ft home in Utah.

10 SEER AC and non-condensing furnace

9,577 kWh/yr and 823 Therm/yr - \$1,892/yr

Code minimum AC replacement 13 SEER AC

8,971 kWh/yr and 823 Therm/yr - \$1,826/yr

Savings of around \$66/yr!

Code minimum heat pump @ 14 SEER and 8.2 HSPF and backup furnace

9,577 kWh/yr and 592 Therm/yr - \$1,695/yr

Savings of around \$200/yr!



Environmental Benefits

Reduced source energy input and CO2 emissions

Typical existing 1,900 sq ft home in Utah @10 SEER AC 80% furnace

Source Energy Intensity – 102 kbtu/sq ft/yr

CO2 Emissions (Tons/yr) – 14.0 tons/yr

Code minimum AC replacement 13 SEER AC

Source Energy Intensity – 99 kbtu/sq ft/yr

CO2 Emissions (Tons/yr) – 13.2 tons/yr

Code minimum heat pump @ 14 SEER and 8.2 HSPF and backup furnace

Source Energy Intensity – 92 kbtu/sq ft/yr

CO2 Emissions (Tons/yr) – 12.7 tons/yr



Resiliency

Dual fuel systems include gas backup or electric resistance heating.

Should outdoor heat pump component fail, furnace will provide all heating

Should gas heat exchanger components fail, heat pump can provide some level of heat even at low ambient conditions.



Control of Energy Prices

Rocky Mountain Power Time of Use Rate

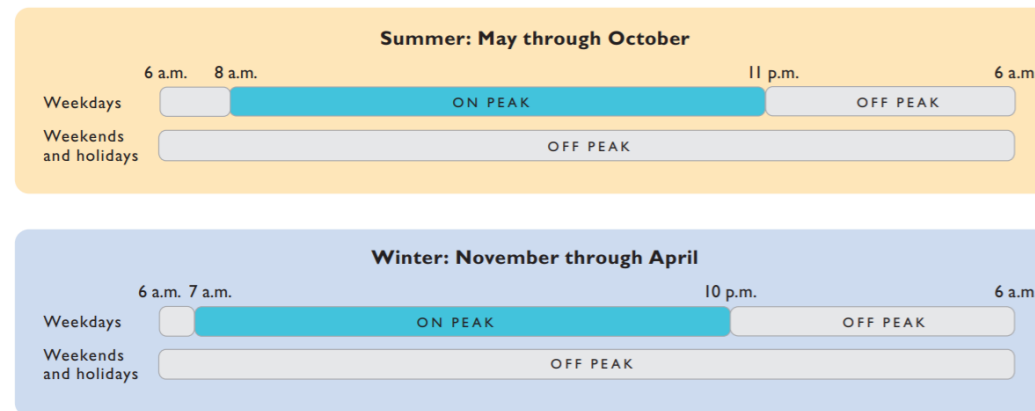
All kWh (May-October)

- Off Peak \$0.049571
- On-Peak \$0.14.5265

All kWh (May-October)

- Off Peak \$0.045369
- On-Peak \$0.124087

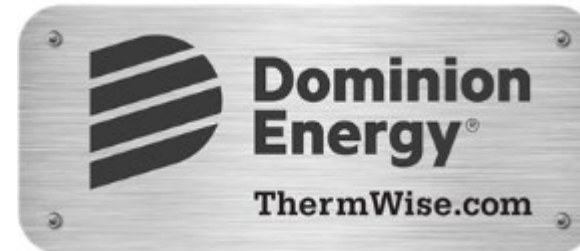
Here is a summary of “On” versus “Off” peak hours:



- **In the summer** – May through October – on-peak hours are 8 a.m. to 11 p.m. Monday through Friday, excluding holidays.
- **In the winter** – November through April – on-peak hours are 7 a.m. to 10 p.m. Monday through Friday, excluding holidays.
- Off-peak hours are all other hours.

A dual-fuel gas furnace backup system can be used to avoid on-peak charges and leverage low-cost electric heat pump energy during the off peak hours

Utility Incentives



Utility Incentives



Existing single family homes - Gas, oil, wood heating, pellet stoves, and propane systems conversions do not qualify. Only electrically heated homes qualify currently

Equipment purchases and services	Customer incentive
Single-head ductless heat pump (9.5 HSPF, 16 SEER)	\$1,300
Multi-head ductless heat pump (9.5 HSPF, 16 SEER)	\$1,700
Supplemental ductless heat pump (9.5 HSPF, 16 SEER)	\$600



Gas heated homes qualify, only on supplemental ductless heat pump systems.

Utility Incentives



Existing single family homes - Gas, oil, wood heating, pellet stoves, and propane systems conversions do not qualify. Only electrically heated homes qualify currently

Equipment purchases and services	Customer incentive
Heat pump upgrade tier 1 (9.0 HSPF, 15 SEER)	\$200
Heat pump upgrade tier 2 (9.5 HSPF, 16 SEER)	\$400
Heat pump conversion tier 1 (9.0 HSPF, 15 SEER)	\$650
Heat pump conversion tier 2 (9.5 HSPF, 16 SEER)	\$750



Utility Incentives



Existing single family homes - Gas, oil, wood heating, pellet stoves, and propane systems conversions do not qualify. Only electrically heated homes qualify currently

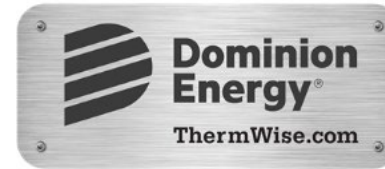
Equipment purchases and services	Customer incentive
Ground source heat pump conversion	\$2,500



Please visit Rocky Mountain Power's website to learn more about these programs!

<https://www.wattsmarthomes.com/>

Utility Incentives



Considering upgrading the furnace as part of the dual-fuel system upgrade. Dominion offers rebates for high efficiency space heating equipment.

Equipment Type	Efficiency Requirement	Customer Rebate
Gas Furnace	95% - 97.5%	\$300
Gas Furnace	97.5% or higher	\$350
Combined space and water heating system	Must be considered one unit by manufacturer and have AFUE of > 95%	\$750

Please visit Dominion Energy's website to learn more about these programs!

<http://thermwise.com/>



Thank you for attending!

