



# NY - GEO 2024

APRIL 8-9 | ALBANY NY



# Heat Pump Design Innovations to Make Domestic Hot Water

**Moderator:** • Jens Ponikau / [Buffalo Geothermal](#)

**Panel:** • Alberto Ferradas / [Ecoforest](#)  
• Mike Hammond / [ClimateMaster](#)  
• Justin Jobe / [Enertech Global](#)

BUILDING ELECTRIFICATION - 11:00 AM

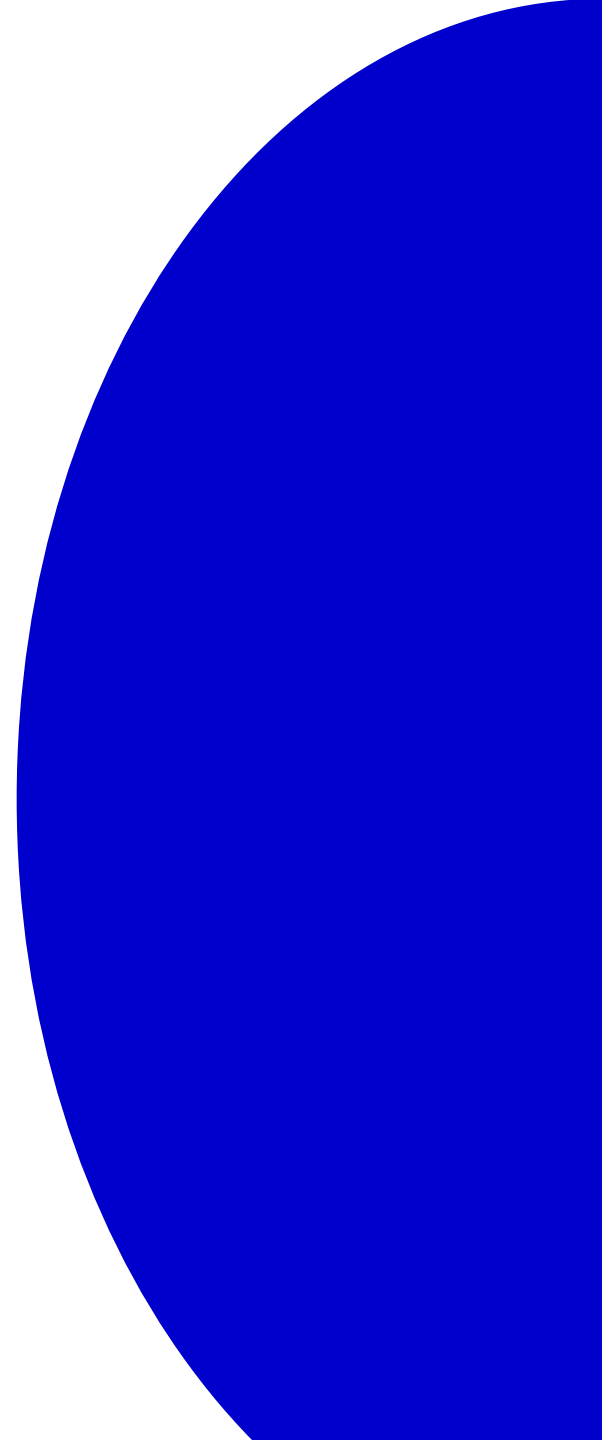


# **NY – GEO 2024**

## **ALBANY**

**DHW PRODUCTION  
TECHNOLOGIES WITH HEAT  
PUMPS**

**WELCOME!**





# ALBERTO FERRADÁS

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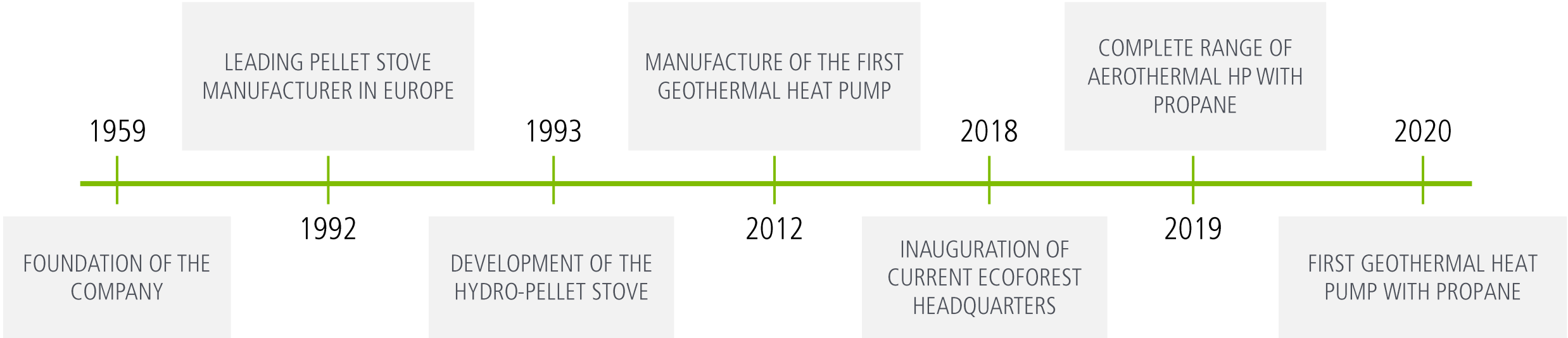
Tel. +34 986 26 21 84 Ext. 711

Ecoforest, who we are



# Ecoforest Milestones

# ECOFORREST & NETZERO – NY GEO 2024

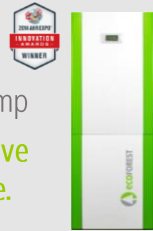


# Ecoforest Milestones

# ECOFORREST & NETZERO – NY GEO 2024

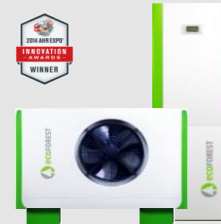
## 2012

**1<sup>st</sup>** Ground source heat pump with **Inverter Technology** and **active cooling** for **by reversing the cycle**.



## 2013

**1<sup>st</sup>** Heat pump with **hybrid systems control** integrated (ground, air, water...)



## 2014

**1<sup>st</sup>** Water-water heat pump **high power range** with **inverter technology** and **active cooling** by reversing the cycle



## 2015

Cascade management with **maximum efficiency** (exclusive).



## 2016

**2<sup>nd</sup>** Generation of Ecoforest Inverter heat pumps.



## 2018

**ecoSMART** energy managers, patented technology for **hybridization** of our heat pumps range with **PV installations**.



## 2018

**3<sup>rd</sup>** Generation of Ecoforest Inverter heat pumps.



## 2018

**1<sup>st</sup>** Generation of **Netzero** heat pumps for **North American market**



## 2019

**1<sup>st</sup>** Air source heat pump **Scroll + Inverter + EVI** whit **FLASH TANK** technology.



# Ecoforest Milestones

# ECOFORREST & NETZERO – NY GEO 2024

## 2020

Release of the **ECOFORREST PRO**, with R290, natural refrigerant.  
**1<sup>st</sup> Water-water heat pump with no restrictions installed indoor.**



## 2021

**ALL** our pumps integrate the **ecoSMART e-manager** making it possible to manage with photovoltaic excess



## 2021

**2<sup>nd</sup> Generation** of ecoAIR air-to-water heat pump ecoAIR+



## 2021

We obtain for our Netzero heat pumps, **all Certifications for North America**



## 2023

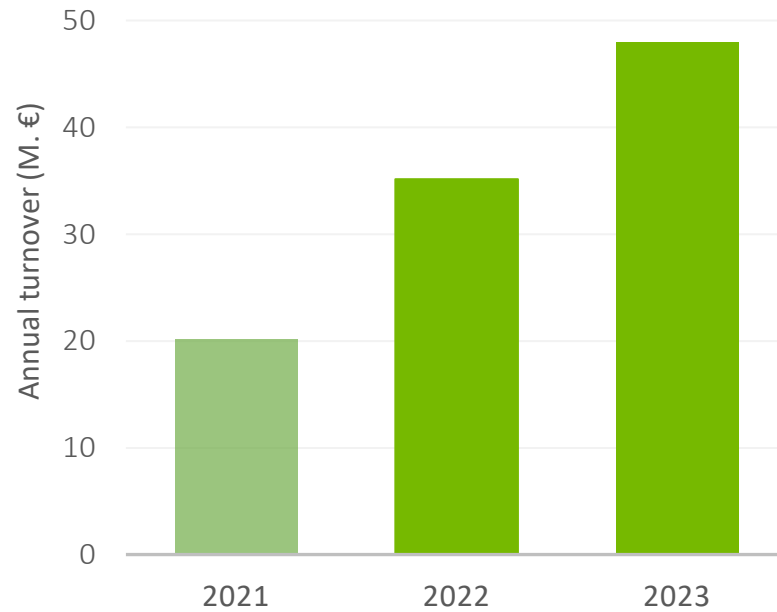
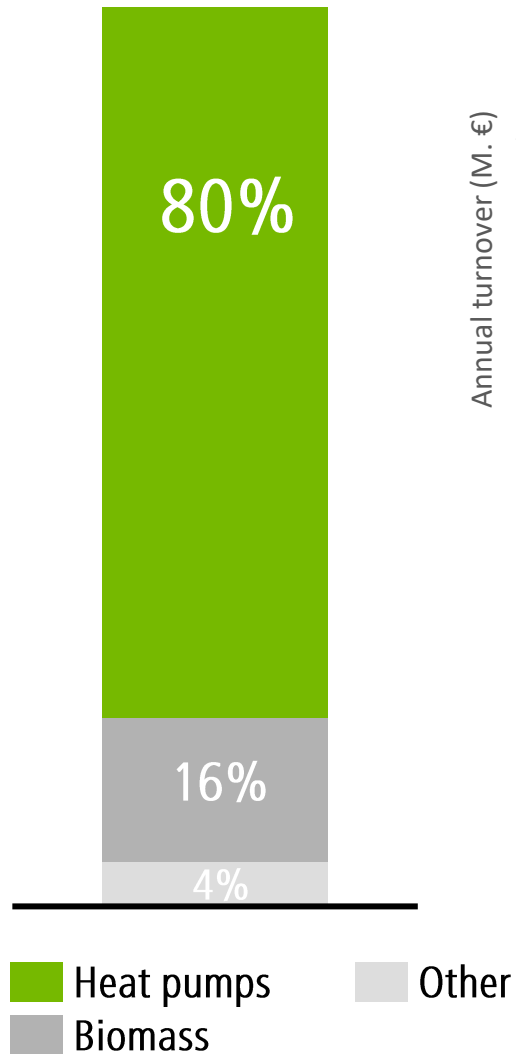
**2<sup>nd</sup> Generation** of Netzero heat pumps and listed in **2023 Most Efficient Energy Star** heat pumps



## 2023

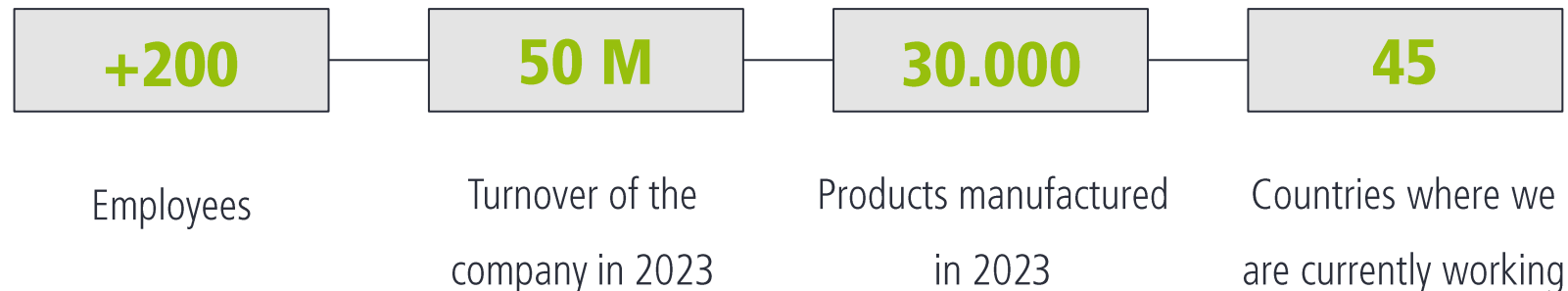
Listed in **2024 Most Efficient Energy Star** heat pumps and winners of several prestigious awards for best heat pumps in Europe





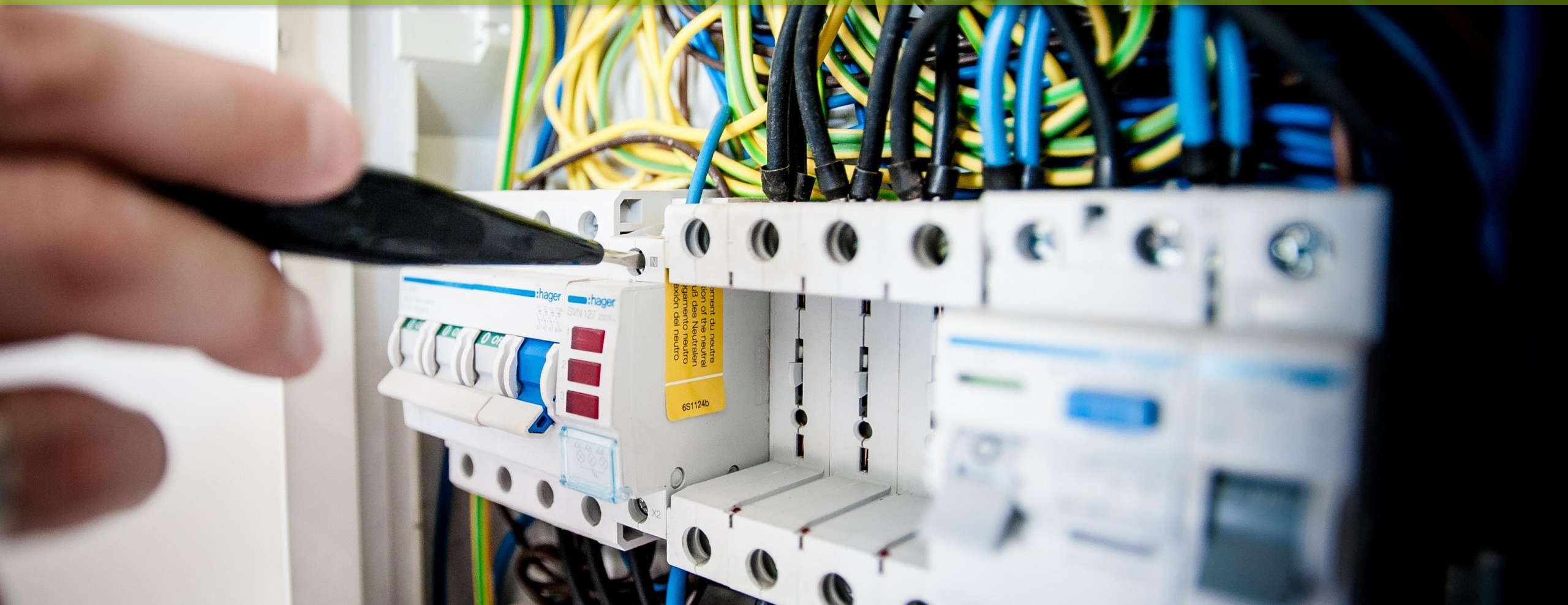
2021: 25%  
2022: 82%  
2023: 37%

ECOFOREST is the fastest growing heat pumps manufacturer in Europe in the last 5 years

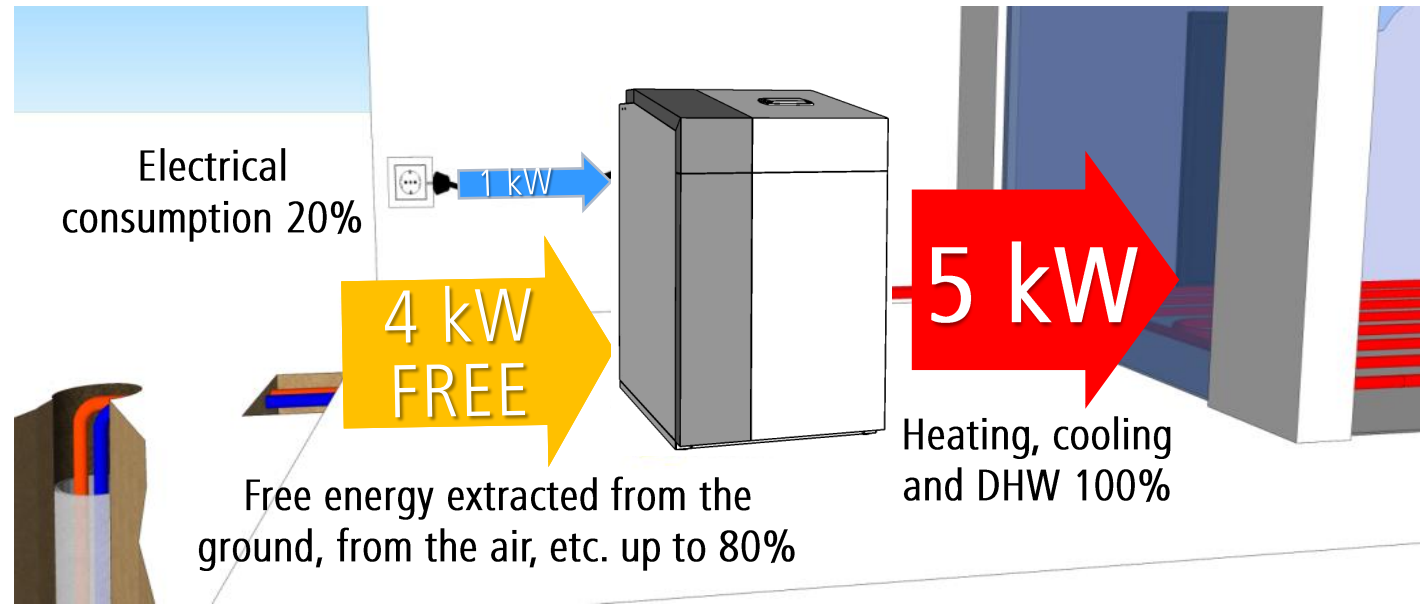




# Technologies to improve DHW production with heat pumps



# All in one & the most efficient technology

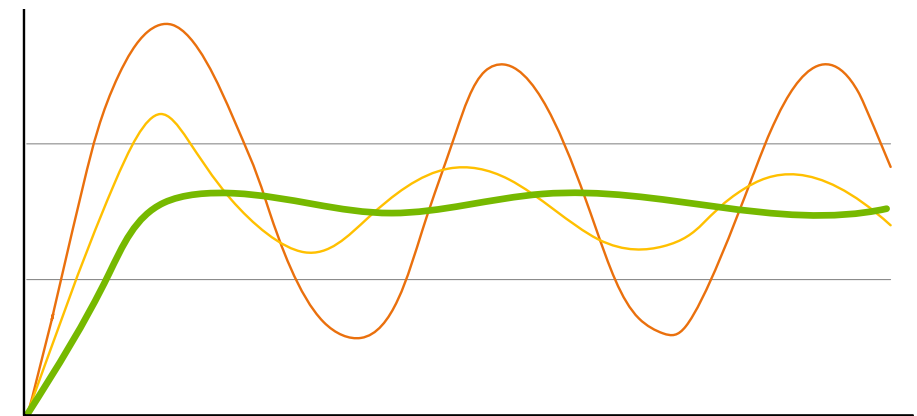


$$\text{EFICIENCY} = \text{Useful power} / \text{Electrical consumption} = 5/1 = 5$$

Heat pumps can be more than 5 times more efficient than traditional systems.

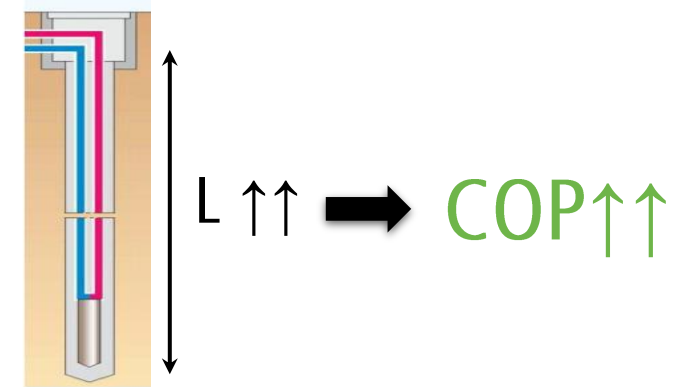
- ✓ Capability to vary the compressor power and adapt it to the characteristics of each installation. Very important as **this way it is possible to reach higher temperatures in the DHW tanks**, getting more out of the compressor operation map.
- ✓ **The Seasonal Performance Factor (SPF) increases considerably** as the heat pump adapts its power to changes in demand and can maintain milder outlet temperatures.

Adaptation of the heat pump to the installation



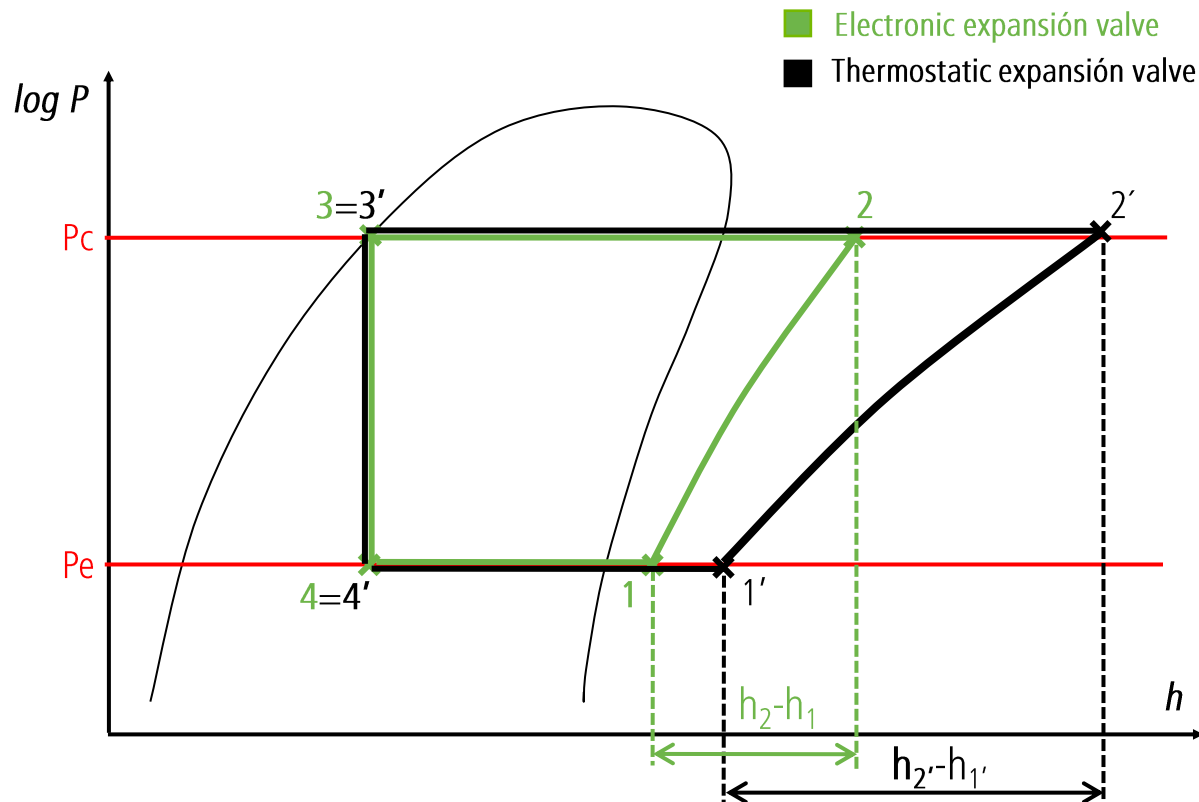
- Ecoforest inverter technology
- Traditional inverter technology
- On/Off compressors

- ✓ The source systems are dimensioned for the maximum thermal power that the installation needs.
- ✓ However, because the installations operate most of the time at partial loads and because our heat pumps have the ability to modulate and adapt their power to the one required by the installation, **most of the time the source systems are oversized.**
- ✓ Result → Increased fluid temperature in the source circuit and consequently increased performance.



# Electronic expansion valves

- Much better control of the refrigerant flow
- Therefore, lower overheating degrees → lower electrical consumption for the compression and better COP



$$h_{2'} - h_{1'} > h_2 - h_1$$

↓

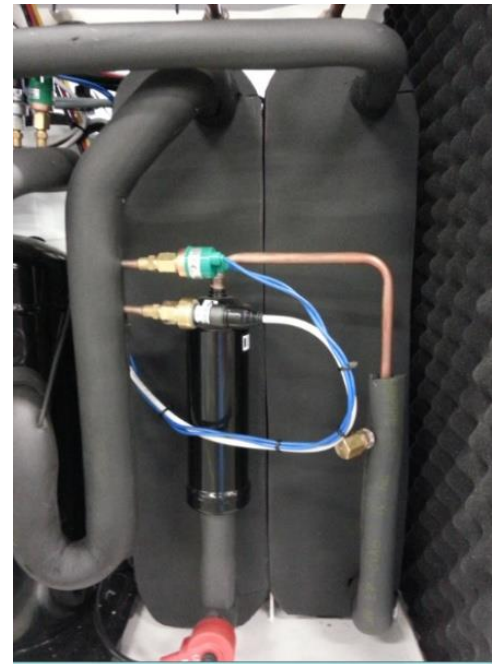
$$W_{\text{comp}'} > W_{\text{comp}}$$

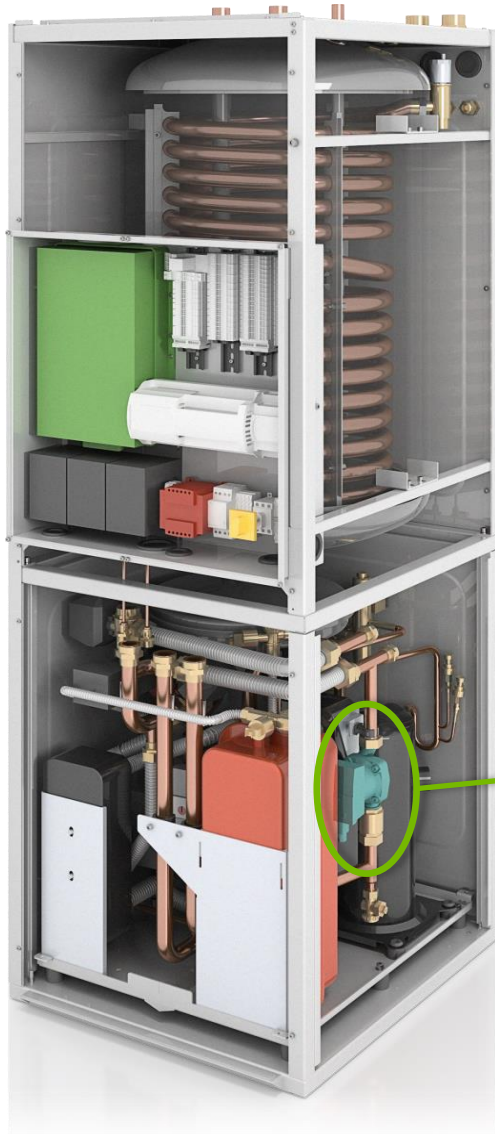
↓

$COP' < COP$

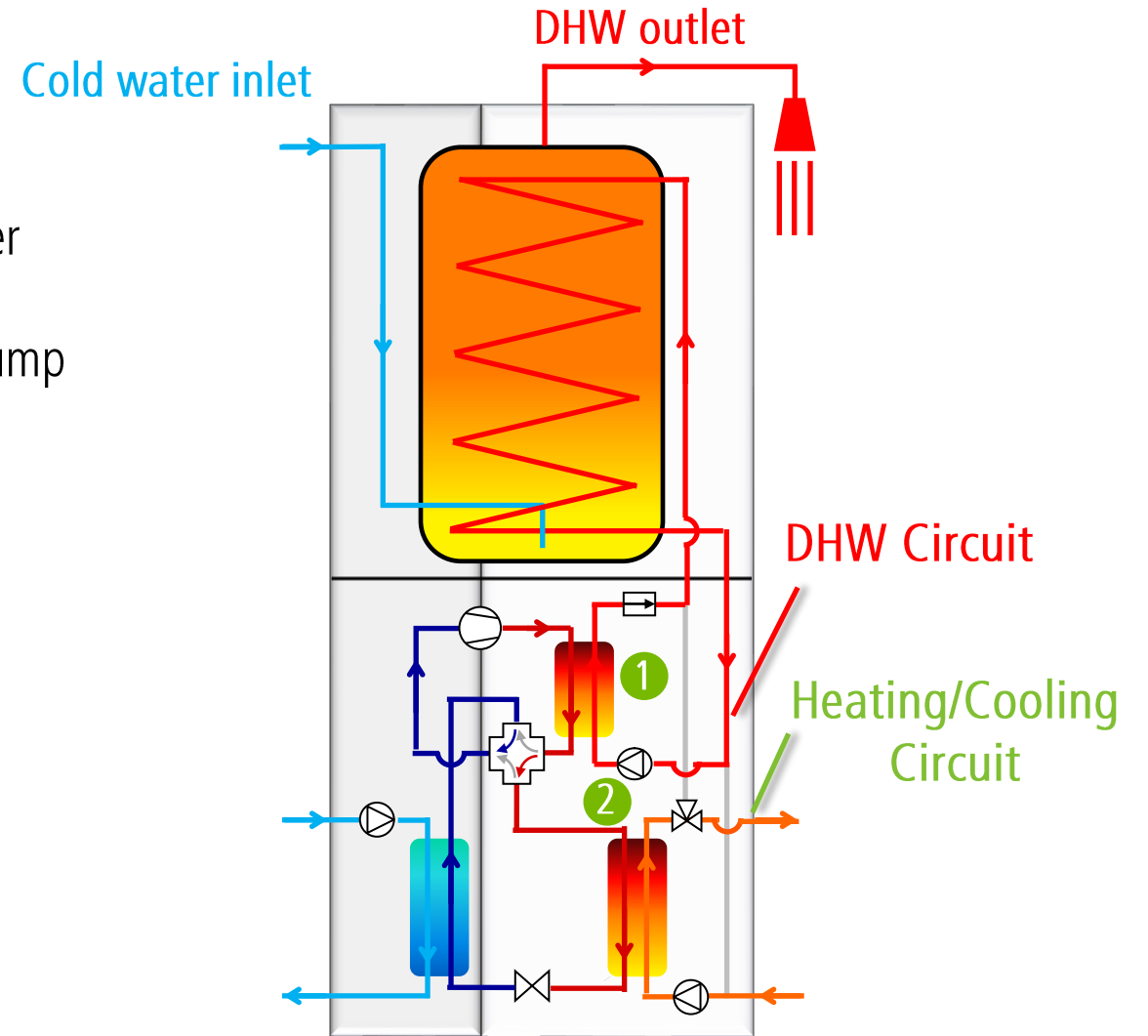
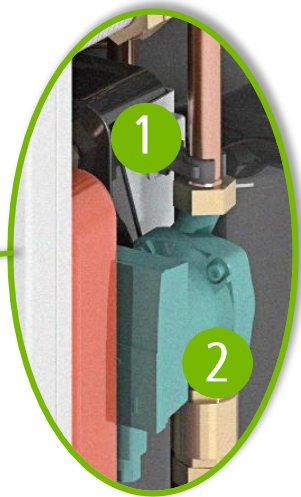
# Plate heat exchangers

- Condenser, asymmetric plates channels
- Evaporator, "Equalancer" distribution system
- Much better efficiency than coaxial heat exchangers

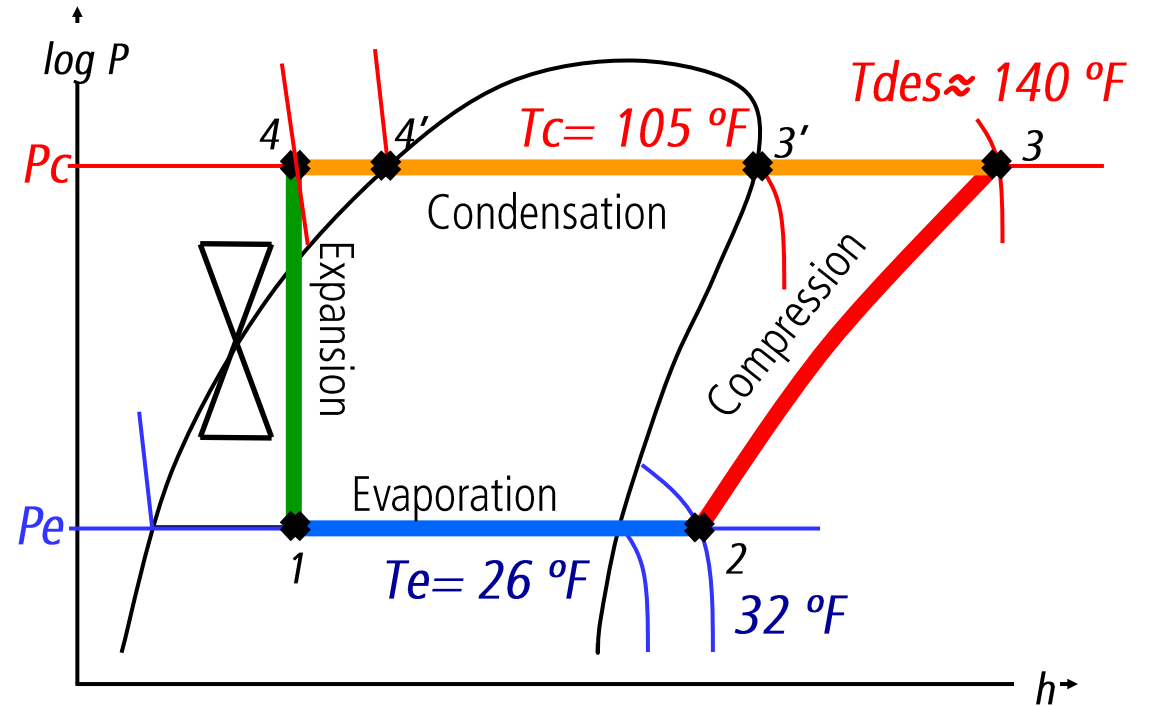
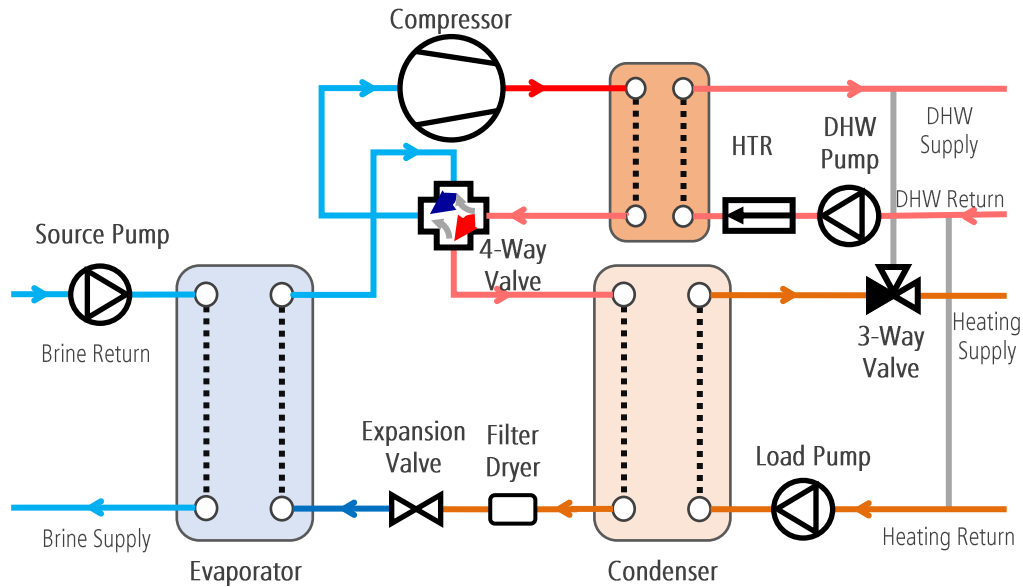




- 1 Additional desuperheater
- 2 Additional circulation pump



## Simultaneous production of DHW & Heating

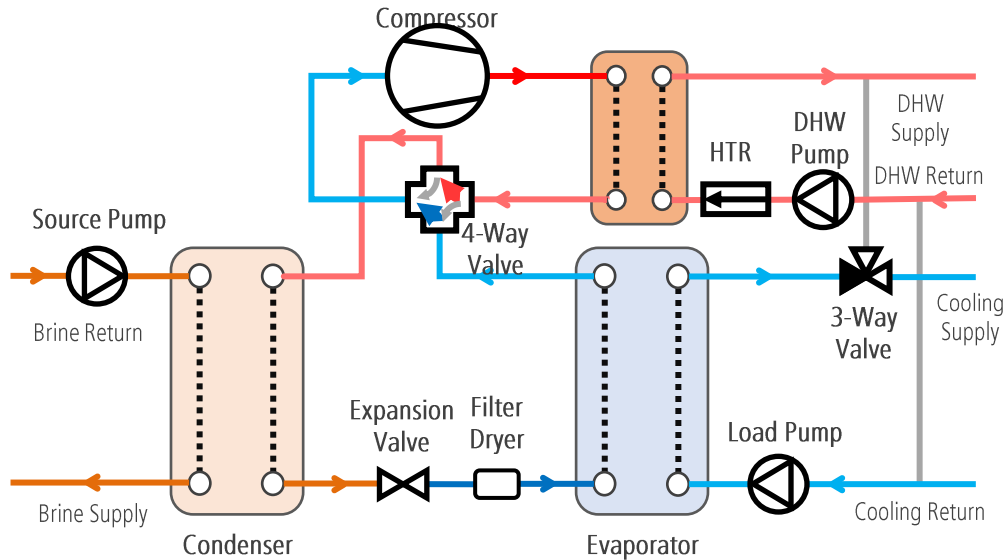


Operation Example

- ✓ DHW production up to 160 °F!
- ✓ DHW production efficiency = Heating production efficiency → up to 200% increase in efficiency!

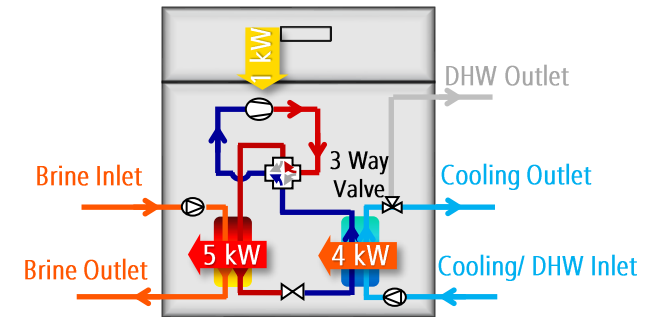


## Simultaneous production of DHW & Cooling



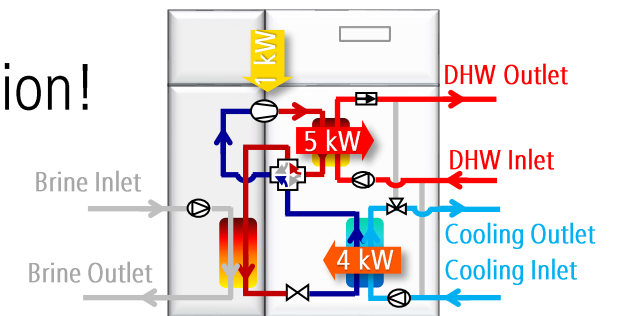
- ✓ The highest efficiency possible in heat pumps → Free DHW production!
- ✓ DHW production up to 160 °F!
- ✓ Great reduction of the number of cycle reversions → greater comfort and useful life

### TRADITIONAL TECHNOLOGY



$$\text{Efficiency} = 4/1 = 4$$

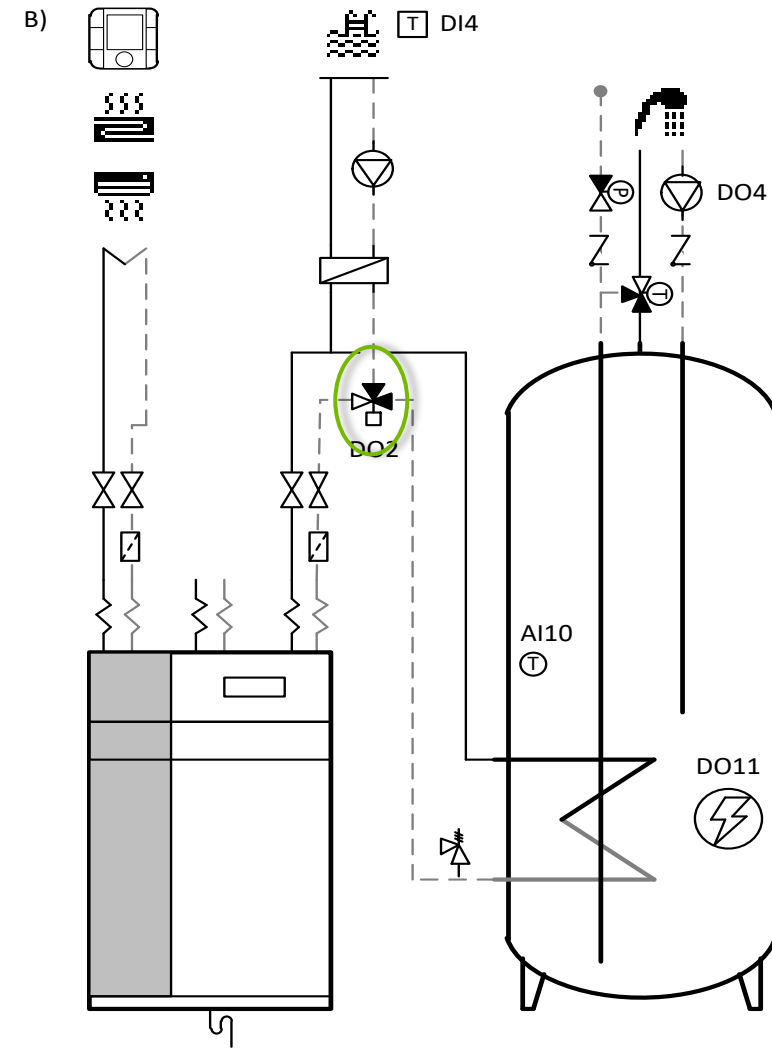
### HTR TECHNOLOGY

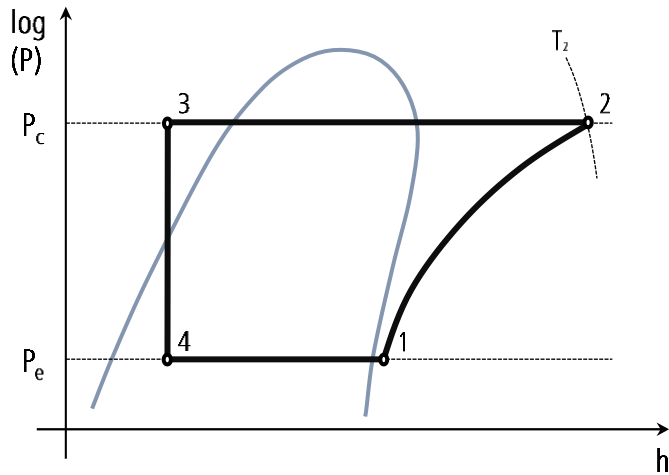
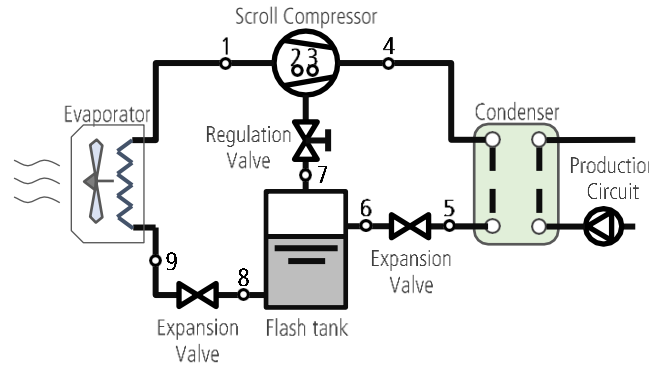
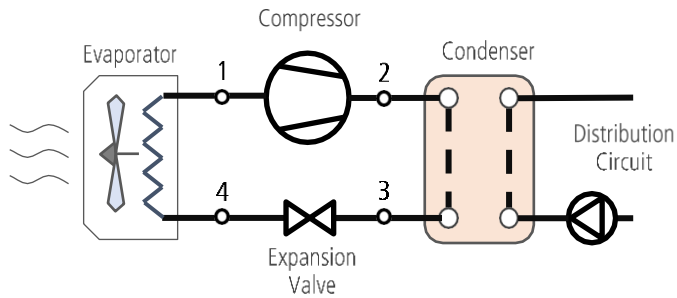


$$\text{Efficiency} = (4+5)/1 = 9$$

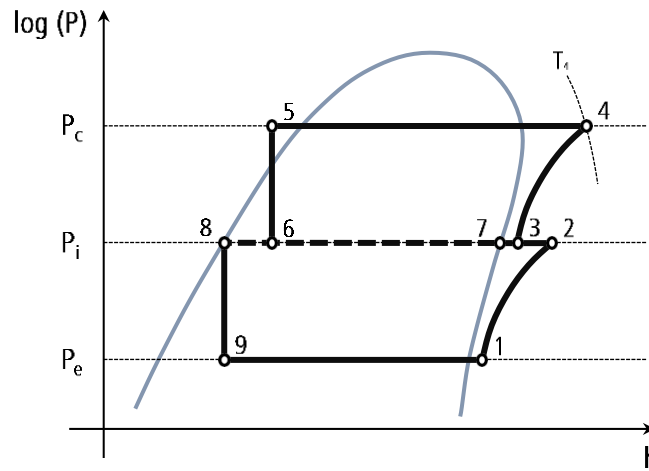
## HTR Technology for pool heating

By simply installing a 3-way valve commanded by the heat pump itself, it is possible to use the HTR technology to simultaneously meet the demands of cooling and pool, heating it completely **for free** and reducing our energy bills considerably.

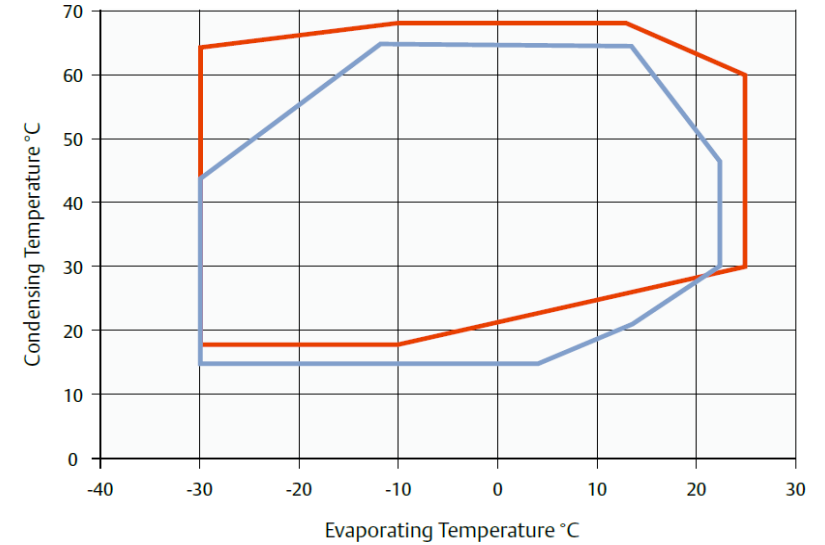




Traditional technology



EVI technology

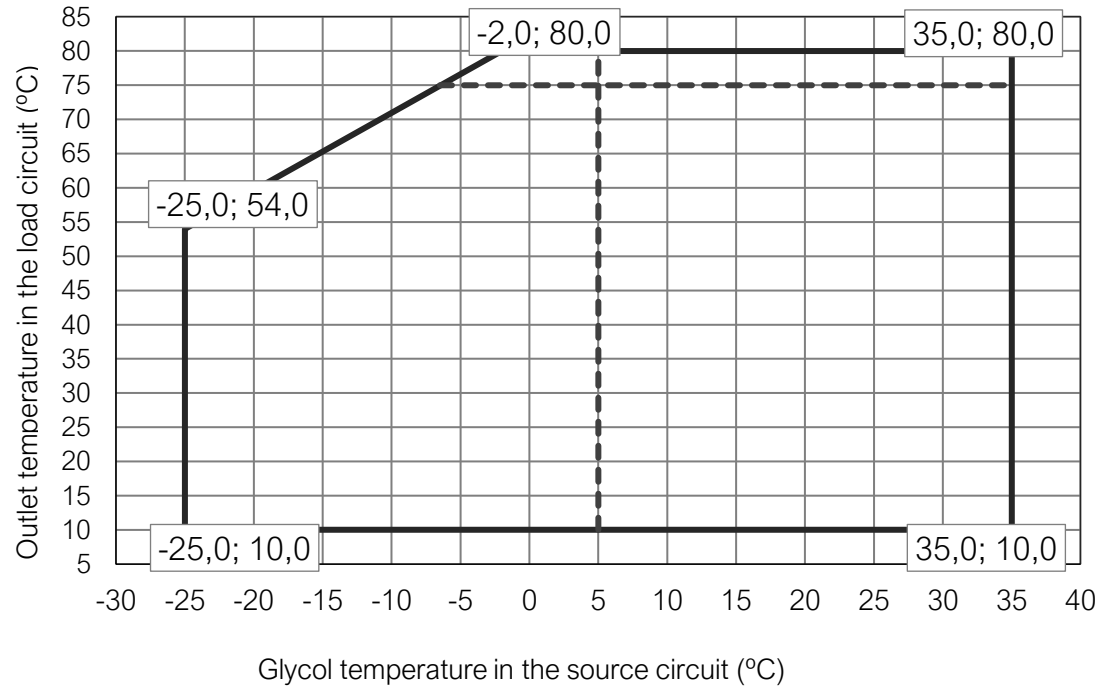


R410A with scroll compressor

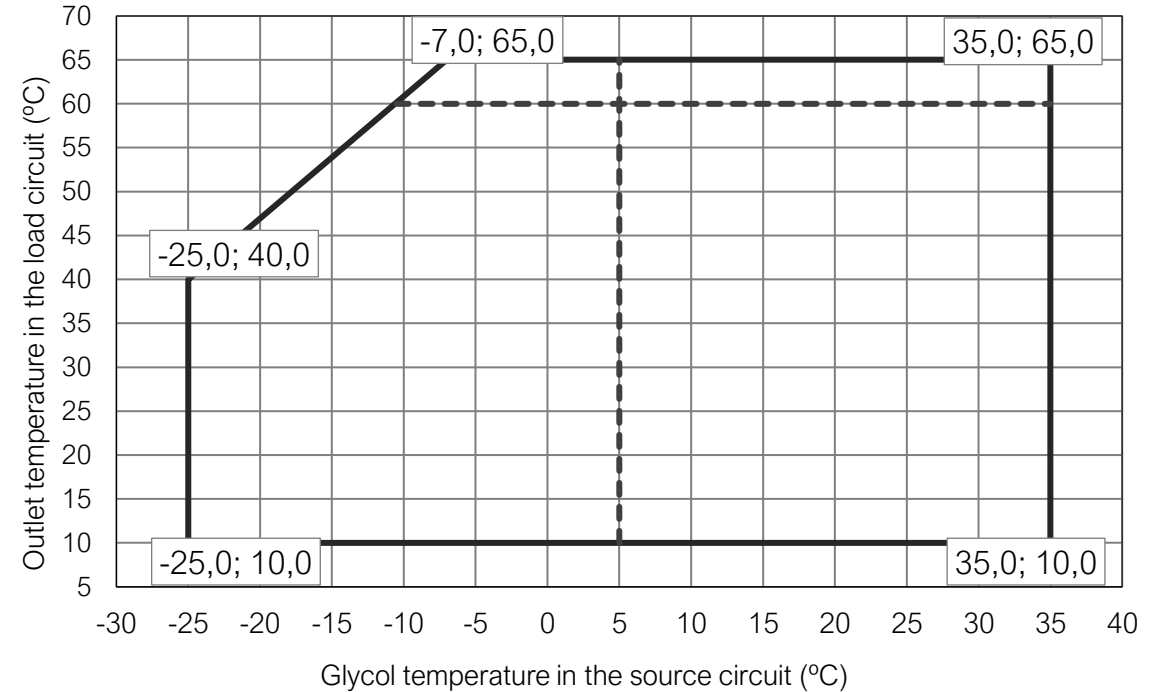
R410A with scroll compressor and EVI technology

**Larger operation map:** Possibility of reaching higher DHW temperatures in unfavorable operating conditions

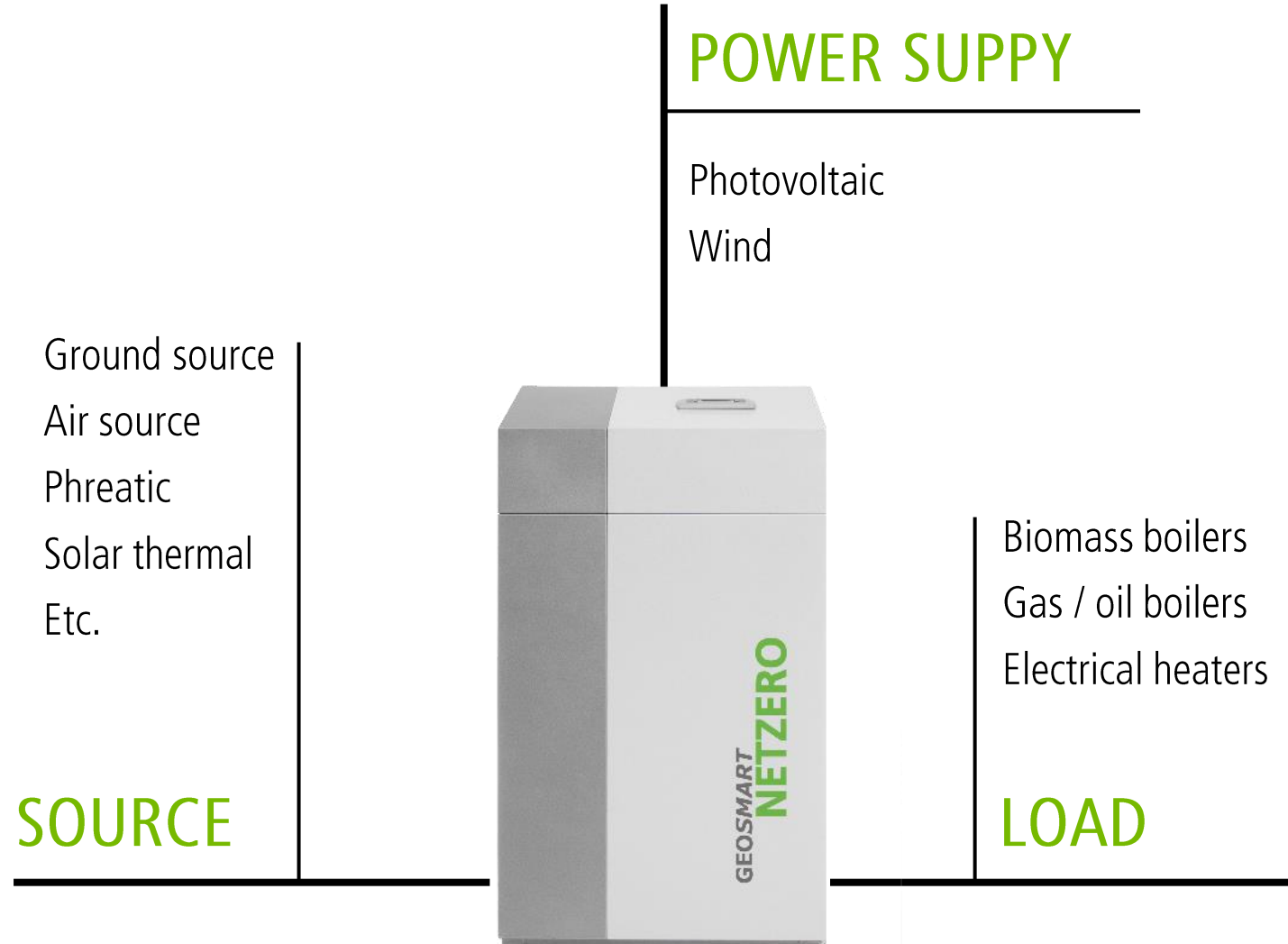
## R290



## 410A



- ✓ Maximum DHW temperature with 410A  $\approx 140$  °F
- ✓ Maximum DHW temperature with R290  $\approx 165$  °F



## HYBRID SOURCE

Why choose between ground source and air source when you can get the best of both?

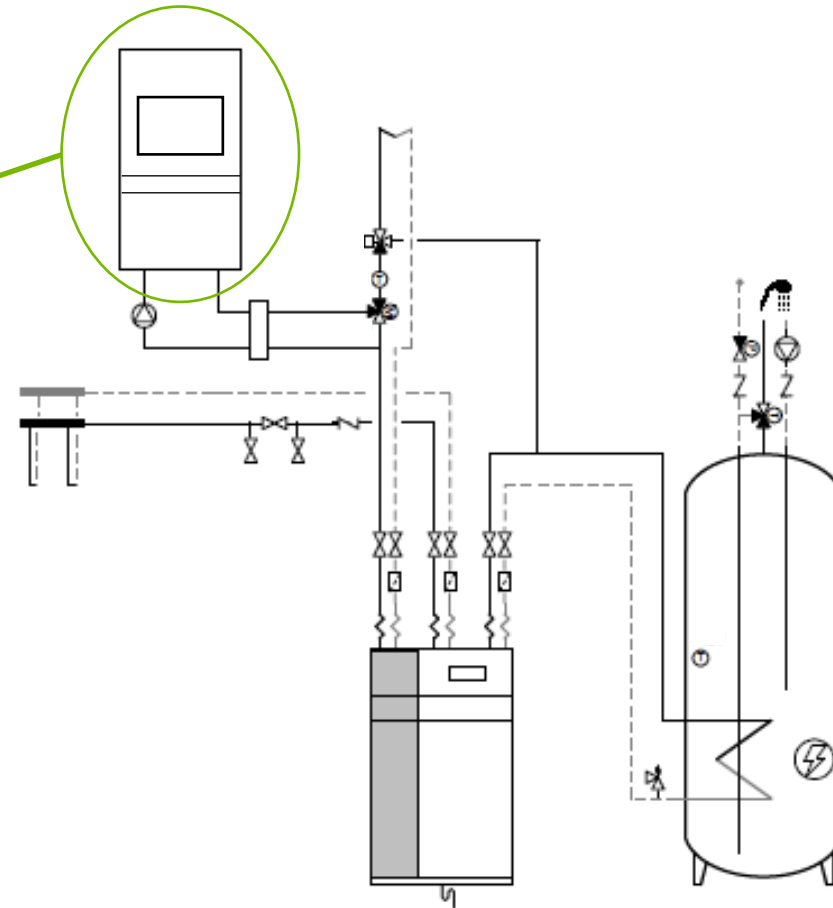
- Possibility of using different source systems in the same installation with a heat pump → possibility of hybridizing traditional geothermal drillings with Air Units (AU).
- Unique installations with the advantages of both systems, choosing the heat pump at all times the most efficient source or combination of sources.



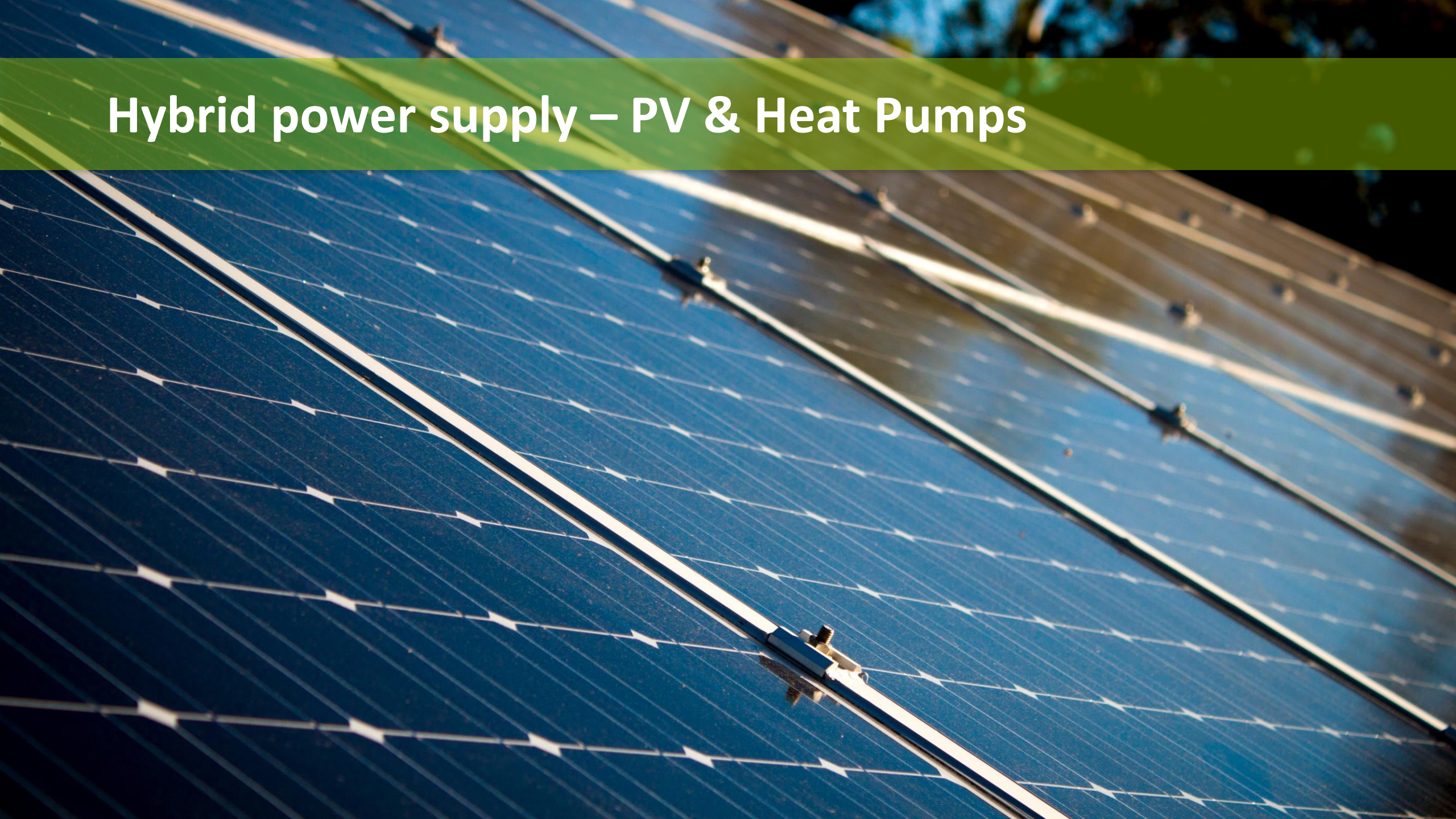
## HYBRID LOAD

### Auxiliary / emergency boiler

- ✓ Heating
- ✓ DHW
- ✓ Heating and DHW



# Hybrid power supply – PV & Heat Pumps



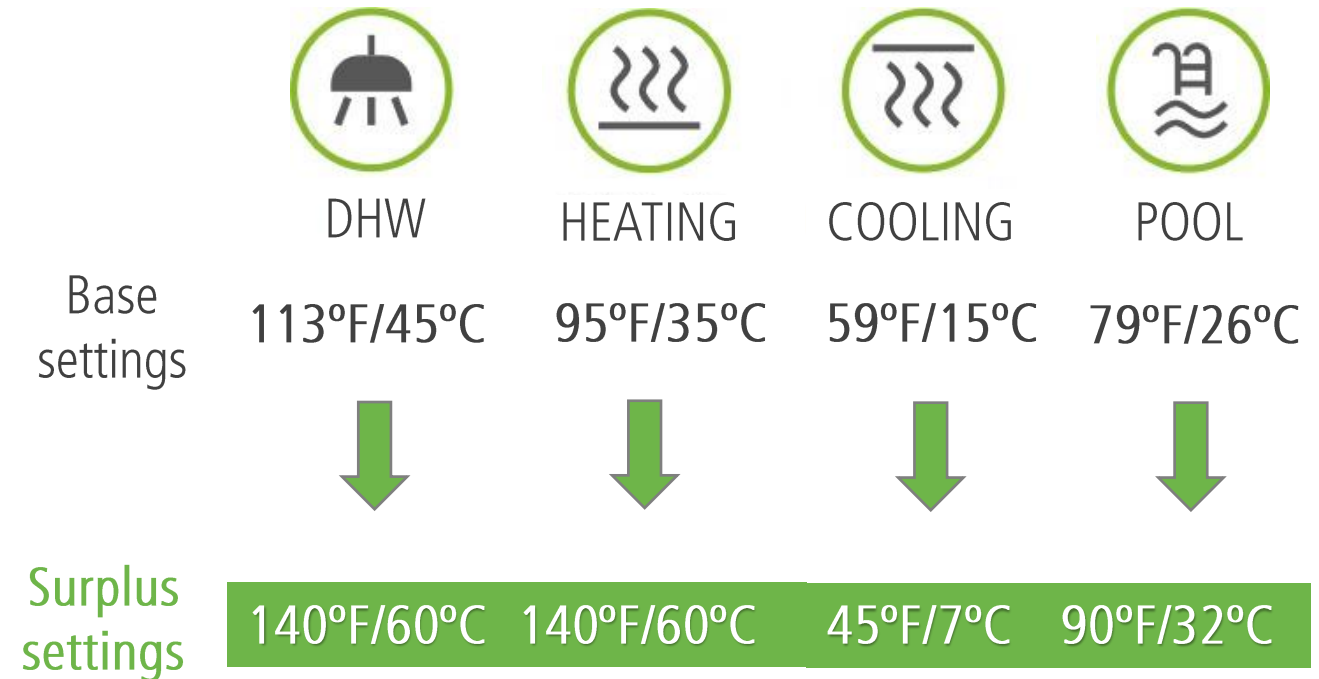


## PV & Heat Pumps

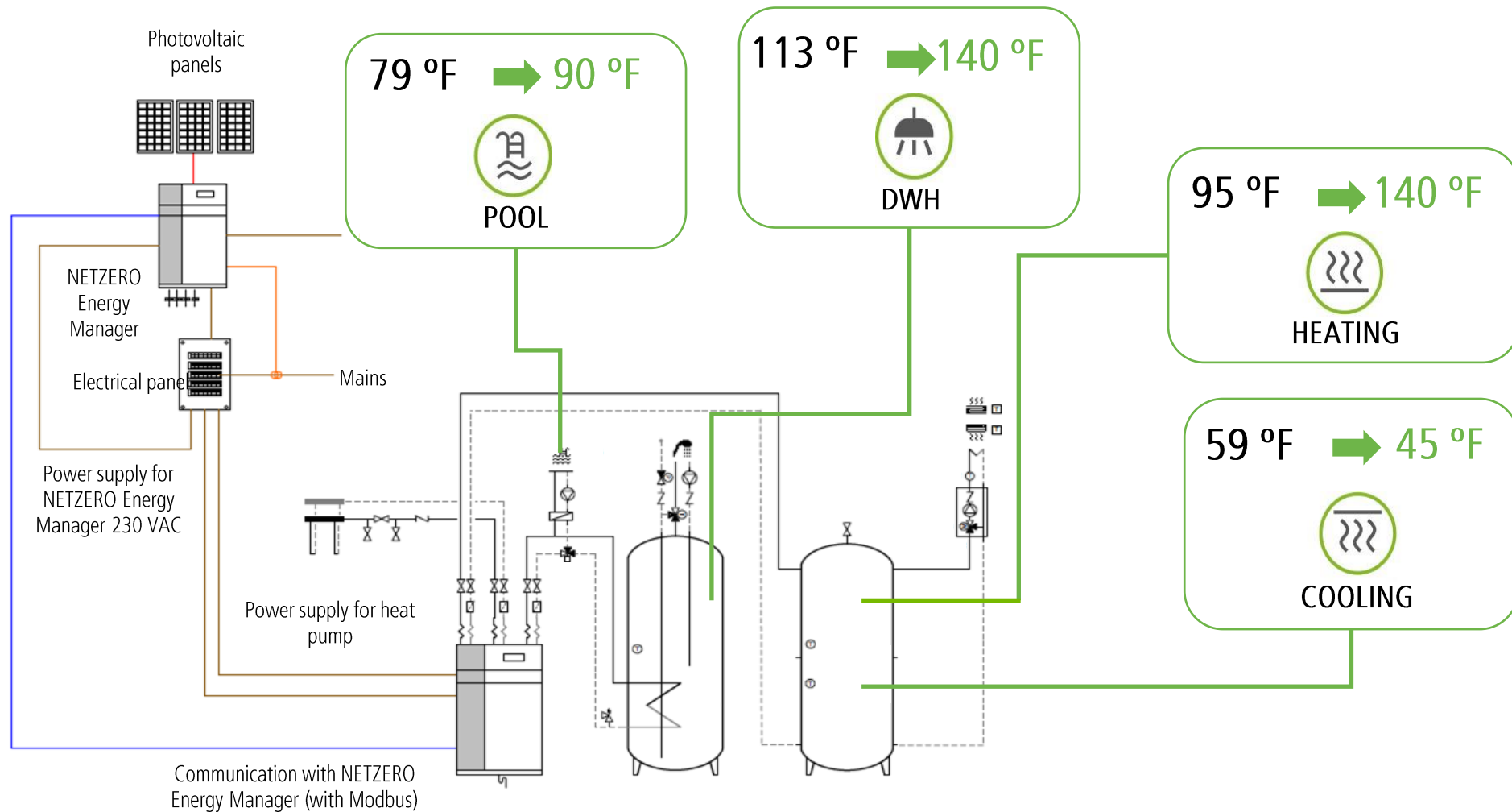
### Surplus control Net Zero Balance

During periods of high PV production, the heat pump detects that there is surplus energy.

Via bus communication, the heat pump modifies the setpoint temperatures and adjusts the consumption to the available surplus power (with the aim of achieving an overall balance between surplus and consumption).



## PV & Heat Pumps





# NY – GEO 2024

## ALBANY

DWH PRODUCTION  
TECHNOLOGIES WITH HEAT  
PUMPS

THANK YOU!



7300


  
**CLIMATEMASTER**

  
**CLIMATEMASTER**

EMPLOYMENT  
OFFICE →

**iGate2.0**



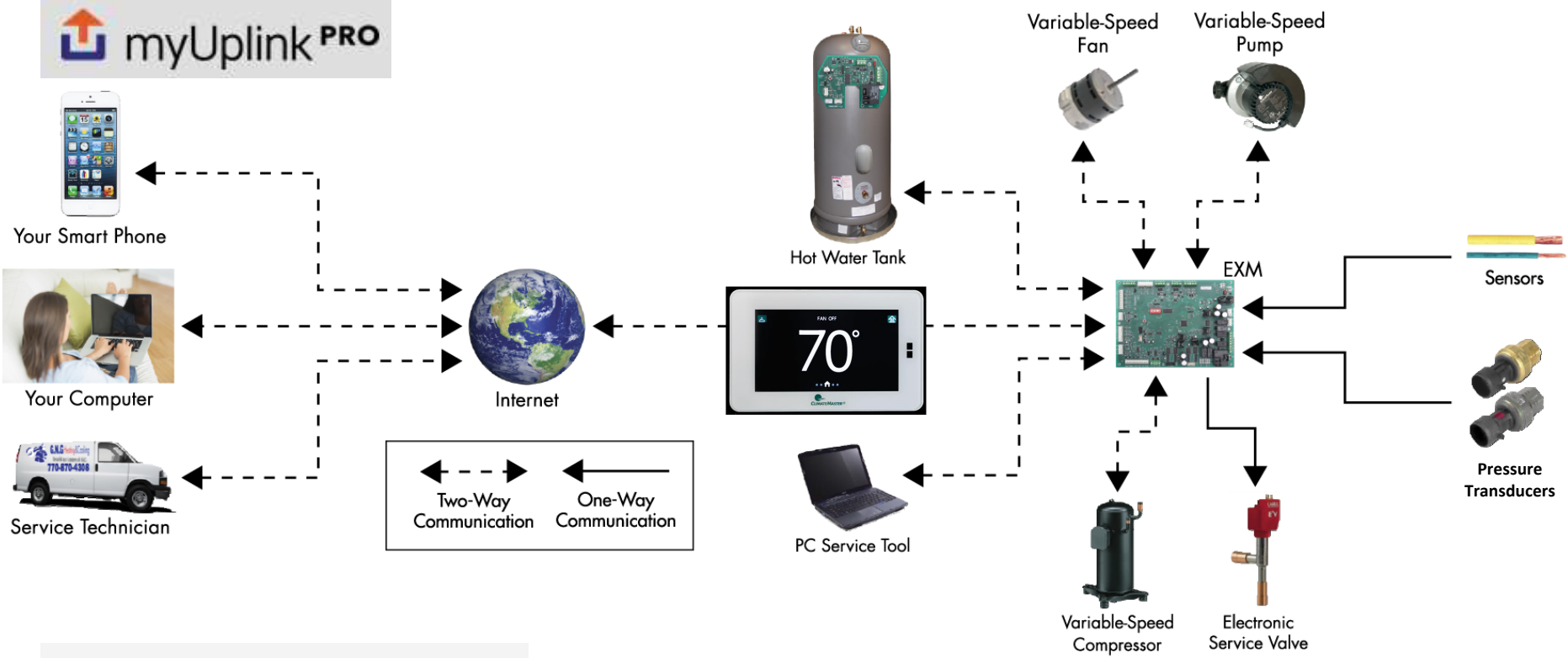
 myUplink PRO

**CLIMATEMASTER**  
TRILOGY® Variable Capacity Q-Mode™ Water Heating



 **iGate™ Smart Tank**











Download the app and keep track of your system wherever you are.

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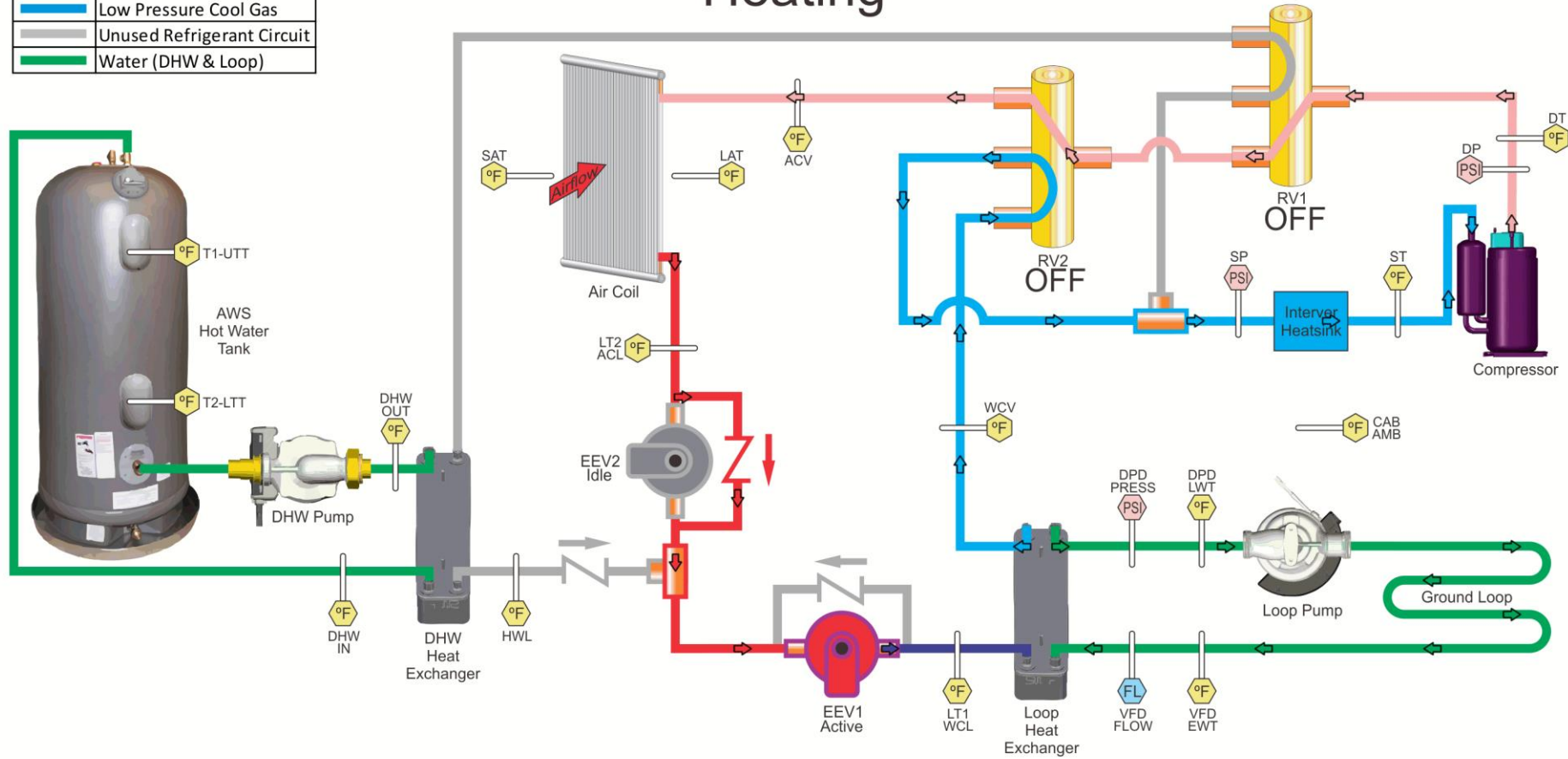
# Q -Mode

- Variable capacity forced air cooling
- Simultaneous cooling and hot water
- Variable capacity forced air heating
- Stand alone hot water production



Circuit Legend	
	High Pressure Hot Gas
	High Pressure Hot Liquid
	Low Pressure Cool Liquid
	Low Pressure Cool Gas
	Unused Refrigerant Circuit
	Water (DHW & Loop)

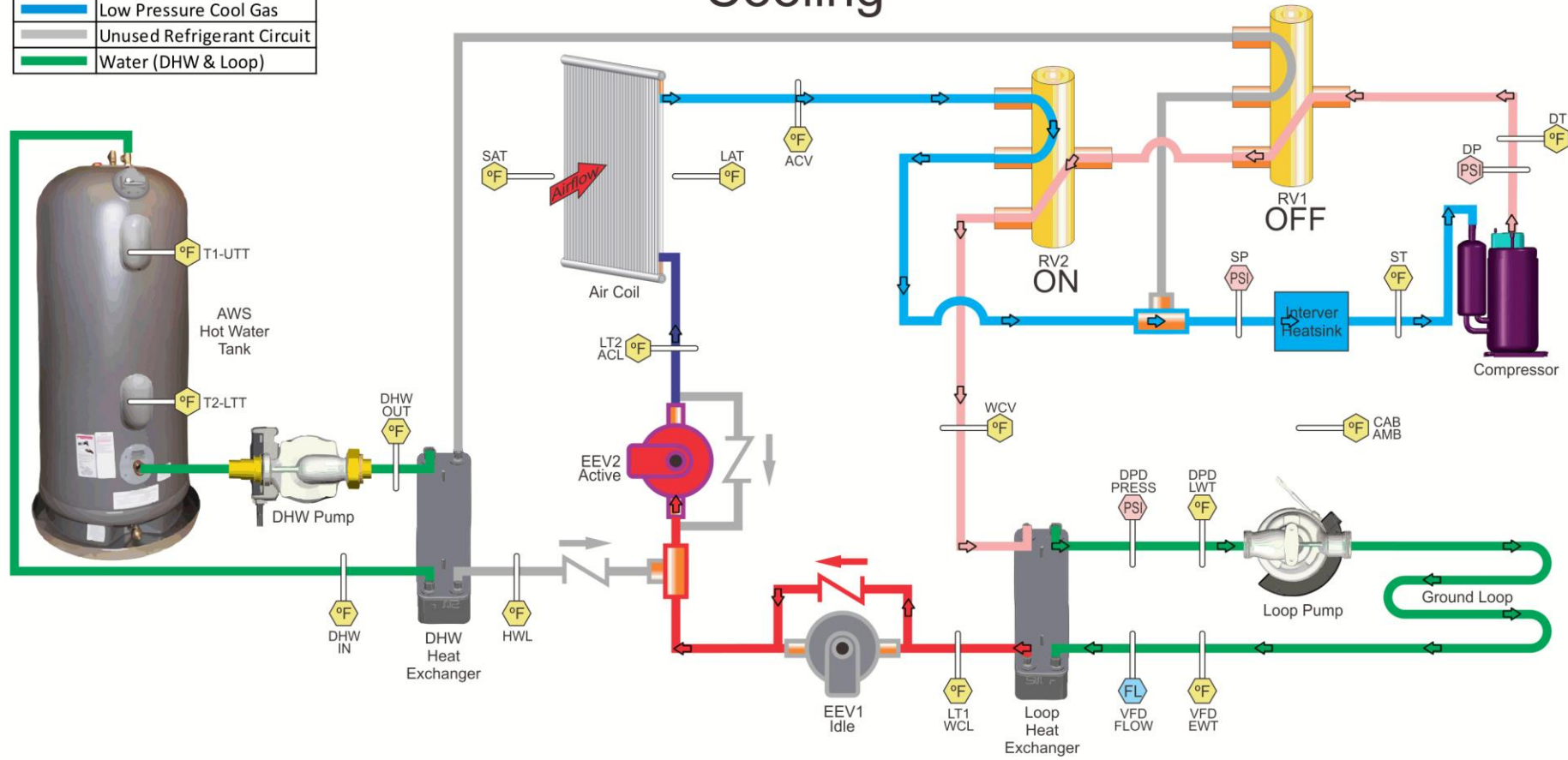
# Trilogy Variable GSHP Heating





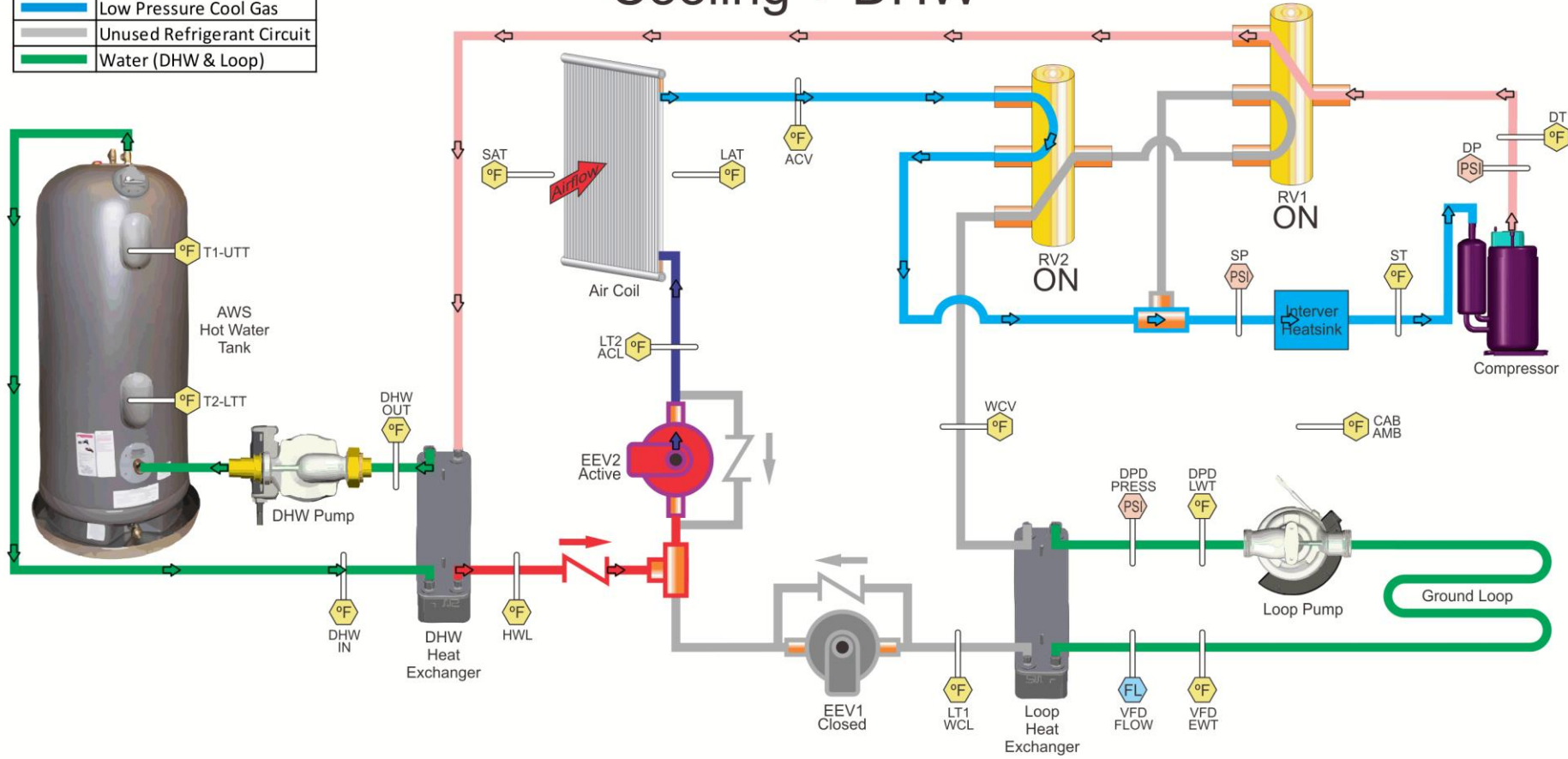
Circuit Legend	
	High Pressure Hot Gas
	High Pressure Hot Liquid
	Low Pressure Cool Liquid
	Low Pressure Cool Gas
	Unused Refrigerant Circuit
	Water (DHW & Loop)

# Trilogy Variable GSHP Cooling



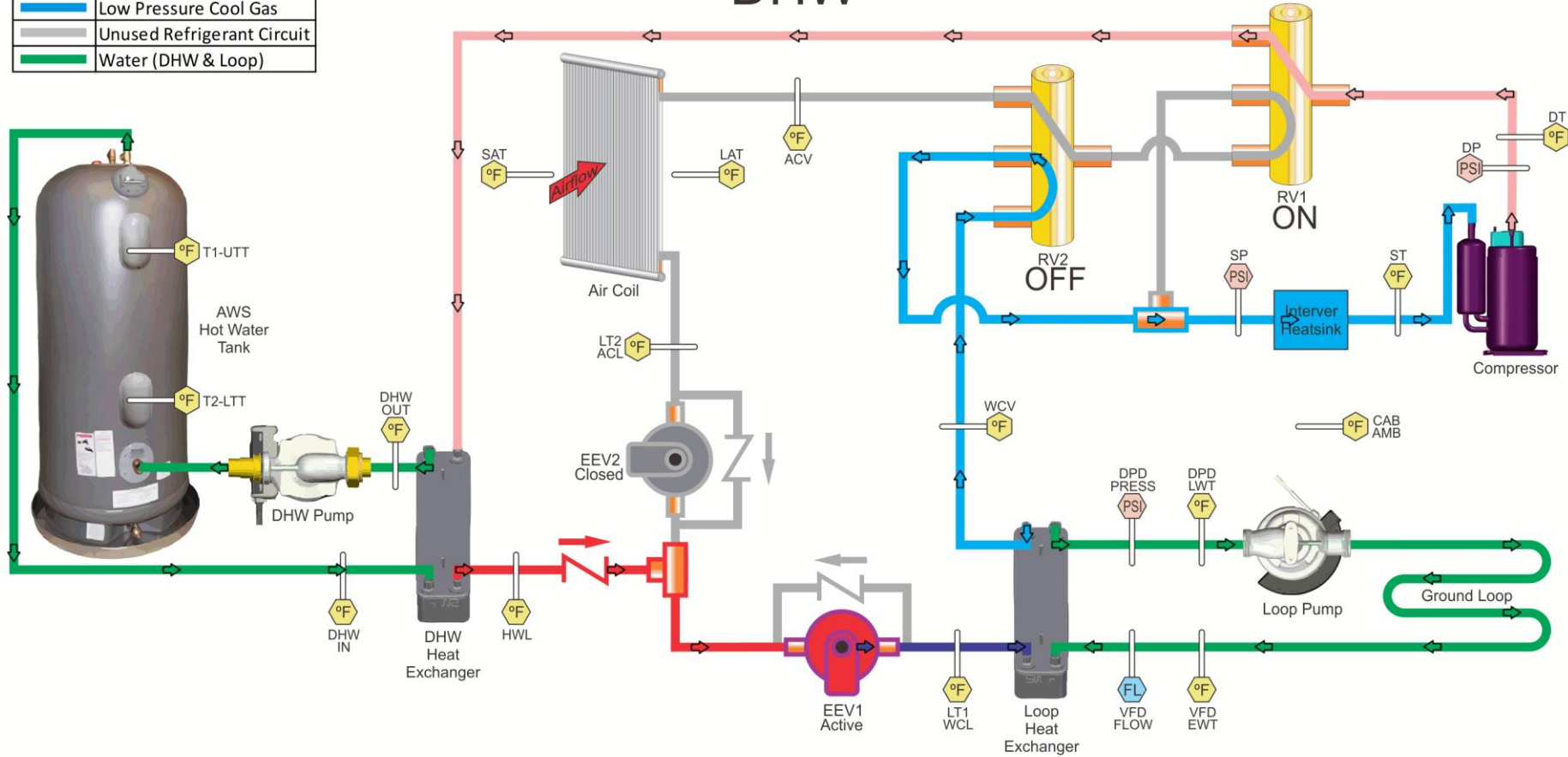
Circuit Legend	
	High Pressure Hot Gas
	High Pressure Hot Liquid
	Low Pressure Cool Liquid
	Low Pressure Cool Gas
	Unused Refrigerant Circuit
	Water (DHW & Loop)

# Trilogy Variable GSHP Cooling + DHW

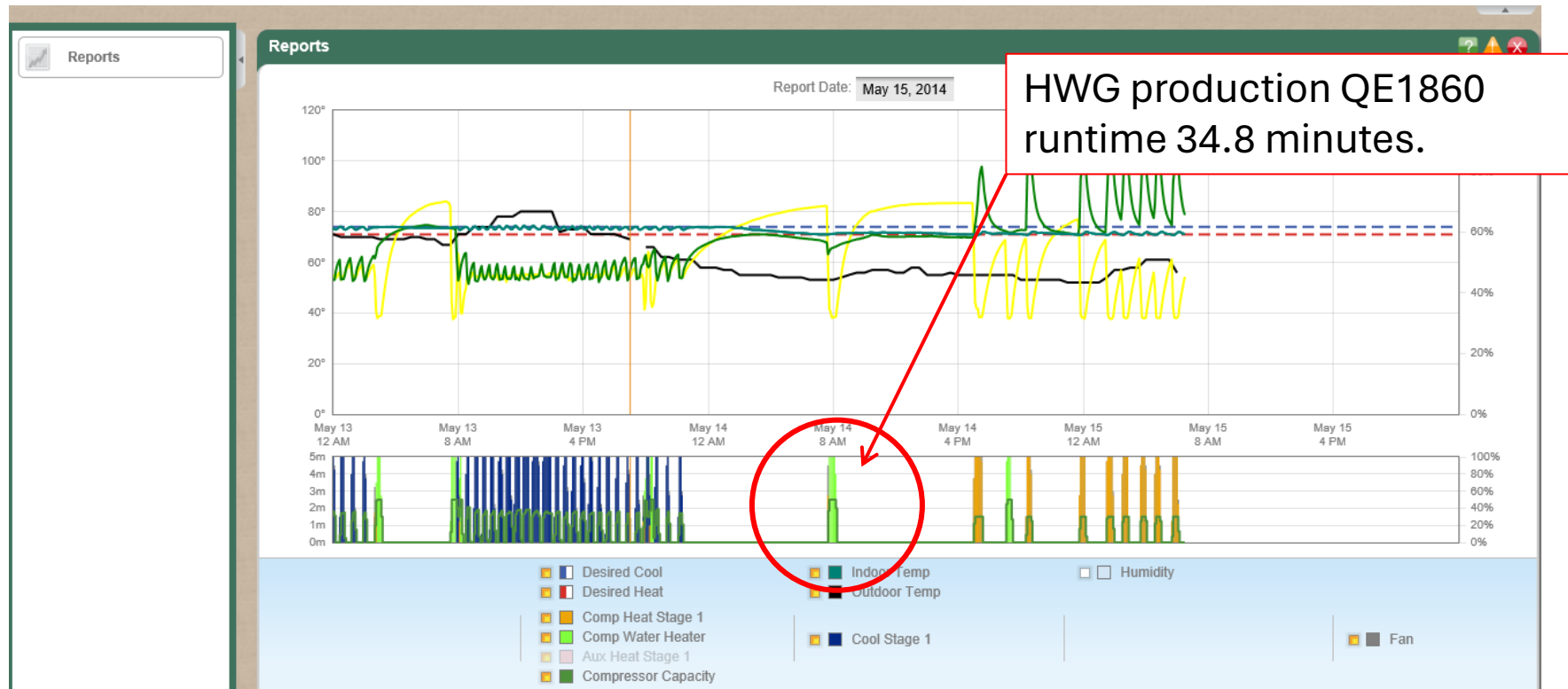


Circuit Legend	
	High Pressure Hot Gas
	High Pressure Hot Liquid
	Low Pressure Cool Liquid
	Low Pressure Cool Gas
	Unused Refrigerant Circuit
	Water (DHW & Loop)

# Trilogy Variable GSHP DHW



# Recovery without any Space Temp interruptions.



# 1860 Heat Pump verses 4500 Watt Element

36 Minutes

Recovery Rate Calculation W-W HP with Storage Tank			
H =	0.58	hours	= output
Q =	30,450	btu/h	= input
G =	85	gallons	
Ti =	100	°F	
Ts =	125	°F	
Where			
H = recovery rate (hours)			
Q = Water-to-Water heat pump capacity at given conditions (in btu/h)			
G = gallons of storage			
Ti = initial water temperature of storage tank			
Ts = setpoint temperature (desired water temperature of storage tank)			

1 hour 9 minutes

Recovery Rate Calculation W-W HP with Storage Tank			
H =	1.15	hours	= output
Q =	15,354	btu/h	= input
G =	85	gallons	
Ti =	100	°F	
Ts =	125	°F	
Where			
H = recovery rate (hours)			
Q = Water-to-Water heat pump capacity at given conditions (in btu/h)			
G = gallons of storage			
Ti = initial water temperature of storage tank			
Ts = setpoint temperature (desired water temperature of storage tank)			

QE1860 normal low HWG capacity  
using 85 gallon tank

# Gas Water Heater

## ENERGY STAR® Program

Sponsored by the U. S. Environmental Protection Agency and the Department of Energy, the ENERGY STAR® program promotes environmentally conscious products, which often can translate into savings for homeowners. We are pleased to announce that the following A. O. Smith high efficiency models have been recognized as ENERGY STAR® water heaters. These are ideal hot water solutions for the homeowner looking to go green and save green.

\*Effective as of September 1, 2010.

[2013-2014 Manufacturer's Certification Statement](#)

## Residential

40,000 @ .70 EF is 28,000 net water heating

## High Efficiency Models

Model Number	Series	Gallon Capacity	Energy Factor	Recovery Rise 90oF GPH	Vent Connection (Inches)	Input BTU/HR	Height*	Diameter	First Hour Rating Gallons
<b>6-Year Tank and Parts Warranty</b>									
GAHH-40	102	40	0.70	43	3 or 4	40,000	61 3/4	20	70
GAHH-50	100	50	0.70	43	3 or 4	40,000	60 5/8	22	81

# Case Study 1 - Overview

- Original development were installed in two new construction homes located in Oak Ridge, TN as part of the ZEBRAAlliance Project.
  - 3-story
  - 3,700 ft<sup>2</sup>
  - High performance envelope
- Non-occupied research homes with simulated water and internal loads used to validate building and appliance simulation models.
- Final report: CRADA NFE-07-01000



# Case Study 1 - Overview

- A 2,600 ft<sup>2</sup> model home was then used to simulate system performance across 5 U.S. locations:
  - Atlanta
  - Houston
  - Phoenix
  - San Francisco
  - Chicago
- 2-ton HVAC and 50-gallon water heating systems
  - Baseline
    - 13 SEER ASHP with 0.9 EF electric tank.
  - 2-Stage GSHP
    - 27 EER with desuperheater and 0.9 EF electric tank.
  - Variable GSHP
    - Integrated water heating and smart tank.



# Case Study 1 - Results

Red = Resistance  
Heat

Operational Mode	ASHP	2-Stage GSHP		Variable GSHP	
	Energy Use (kWh)	Energy Use (kWh)	Savings (%)	Energy Use (kWh)	Savings (%)
Atlanta					
Heating	2388 (93)	1660 (5)	30.5	1155 (6)	51.6
Cooling	1608	1177	26.8	754	53.1
WH	3293	2672 (2524)	18.8	848 (3)	74.3
Total	7479	5699	23.8	2946	60.6
Phoenix					
Heating	762	542	28.9	306	59.9
Cooling	3450	2756	20.1	1921	44.3
WH	2470	1731 (1575)	29.9	510	79.4
Total	6871	5218	24.1	2926	57.4
Chicago					
Heating	6448 (1268)	4052 (95)	37.2	3139 (41)	51.3
Cooling	651	333	48.8	251	61.5
WH	4140	3309 (3108)	20.1	1309 (101)	68.4
Total	11429	7884	31.0	4888	57.2

# Case Study 1 - Results

Operational Mode	2-Stage GSHP		Variable GSHP	
	Energy Savings (%)	(%) Total Energy Savings	Energy Savings (%)	(%) Total Energy Savings
Atlanta				
Heating	30.5	40.9	51.6	27.2
Cooling	26.8	24.2	53.1	18.8
WH	18.8	34.9	74.3	53.9
Phoenix				
Heating	28.9	13.3	59.9	11.6
Cooling	20.1	42.0	44.3	38.8
WH	29.9	44.7	79.4	49.7
Chicago				
Heating	37.2	67.6	51.3	50.6
Cooling	48.8	0.9	61.5	6.1
WH	20.1	23.4	68.4	43.3

# Case Study 1 – Summary

- Moving to a GSHP showed overall site energy reductions of 25-30% when compared to the baseline system.
- A fully variable GSHP with integrated water heating increased to 50-60%.
  - 45-55% through hot water production.
- Site reduction of resistance heat is crucial for savings.

Justin Jobe  
Sales & Field Applications Engineer

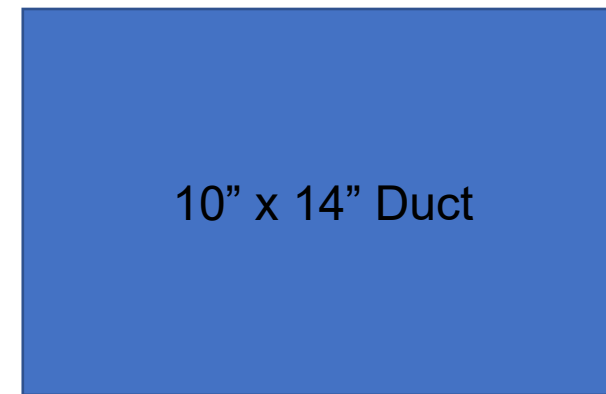


# Variable Speed Water to Water & Air to Water Heat Pumps



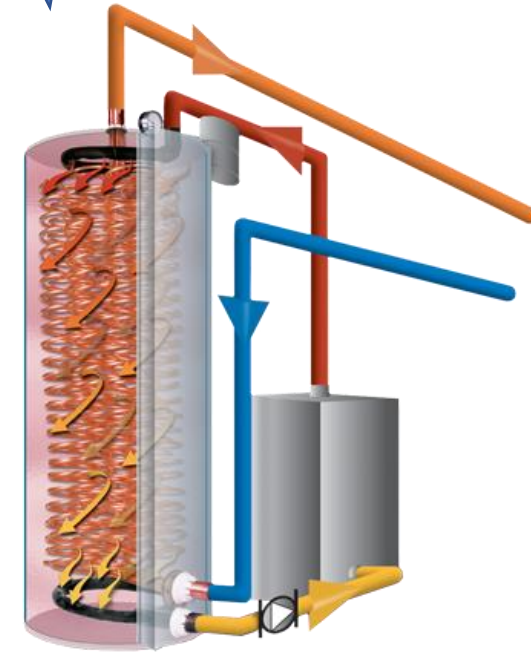
# Benefits of Water to Water/ Air to Water HP's

- Hydronic heating/cooling is more efficient than forced air heating/cooling
  - 1" diameter pipe can carry as much heat as a 10" x 14" duct
- Added bonus of 100% DHW
- Great boiler replacement
- Heating/Cooling/DHW
- No More Buffer Tanks!

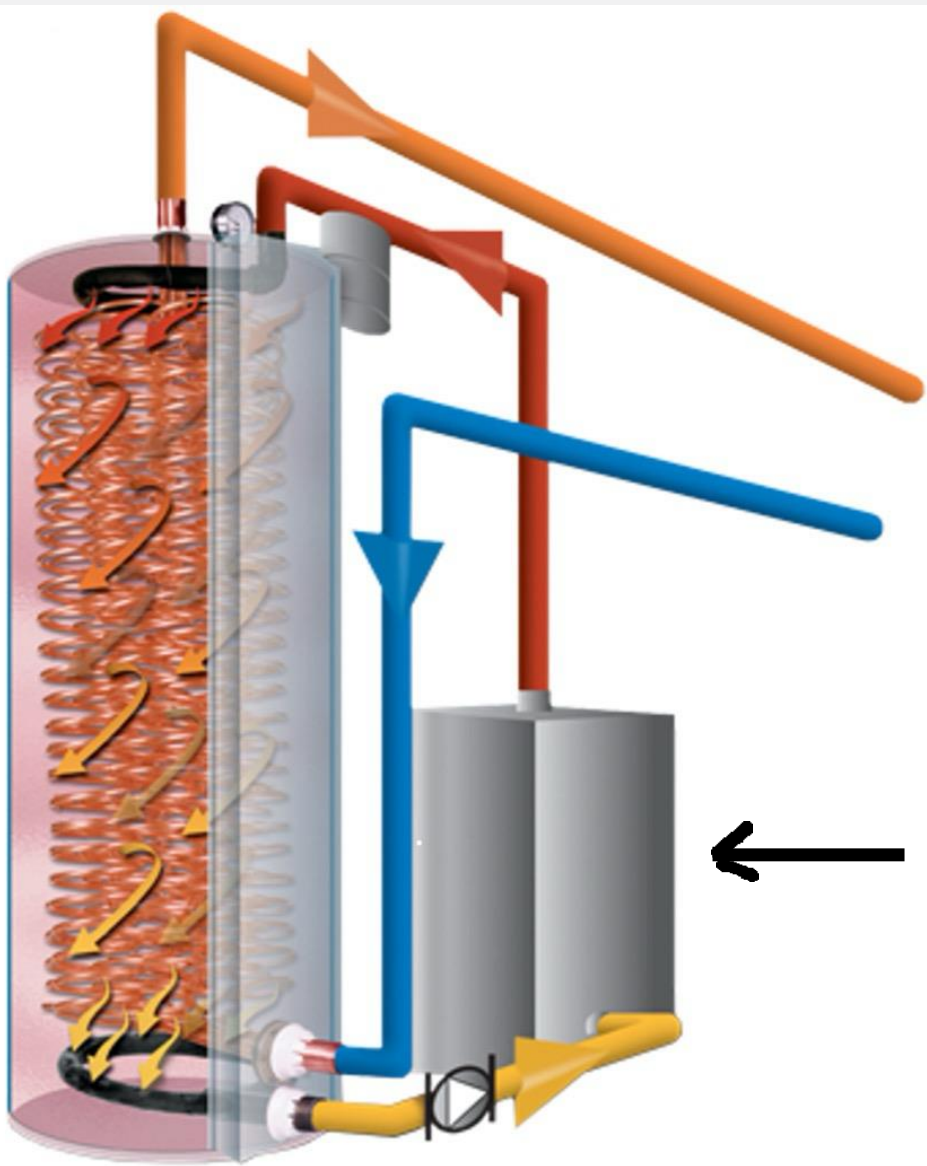
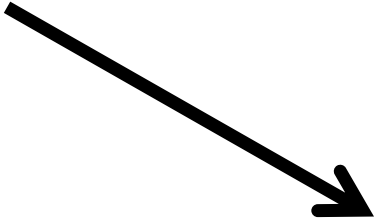


# Variable Speed Hydronics Offer

- Radiant floor
- Fan coil forced air heating and/or cooling
- Decorative low mass wall/baseboard radiation
- Domestic hot water generation



**DHW Tank**



**Heat Pump**





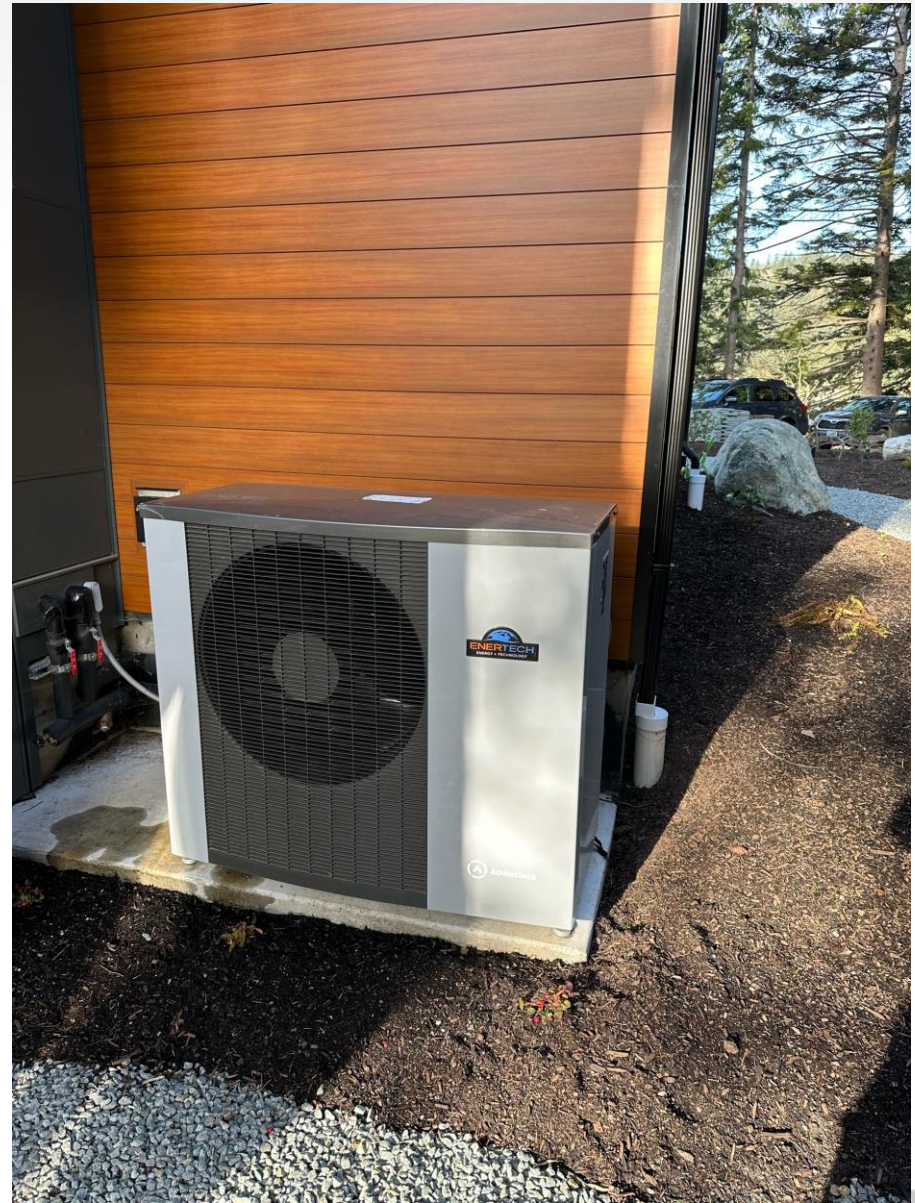


# Poestenkill, NY





# Anacortes Washington







Questions???





# NY - GEO 2024

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# Heat Pump Design Innovations to Make Domestic Hot Water

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**Panel:** • Alberto Ferradas / [Ecoforest](#)  
• Mike Hammond / [ClimateMaster](#)  
• Justin Jobe / [Enertech Global](#)

BUILDING ELECTRIFICATION - 11:00 AM