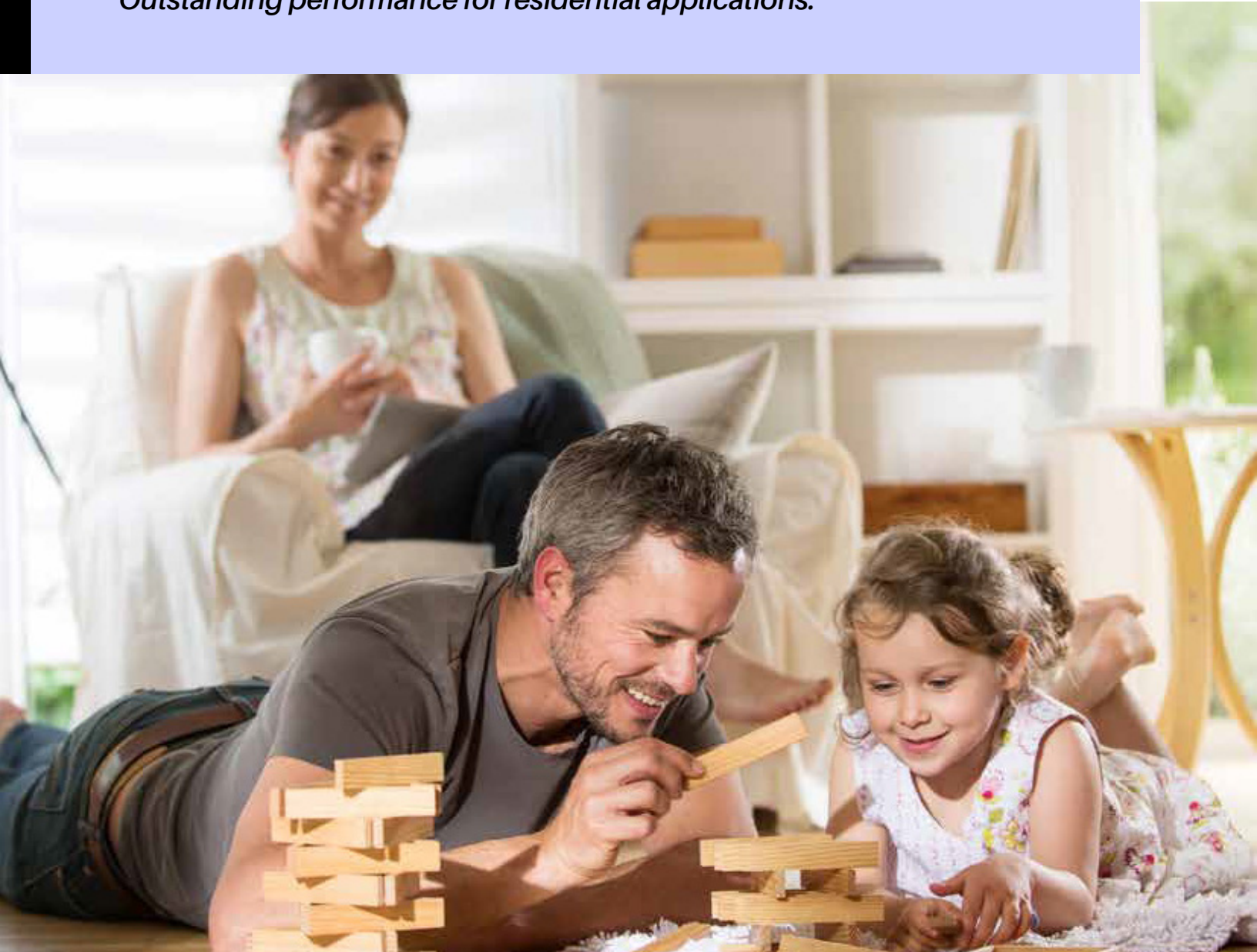


# Variable speed solutions

*Outstanding performance for residential applications.*

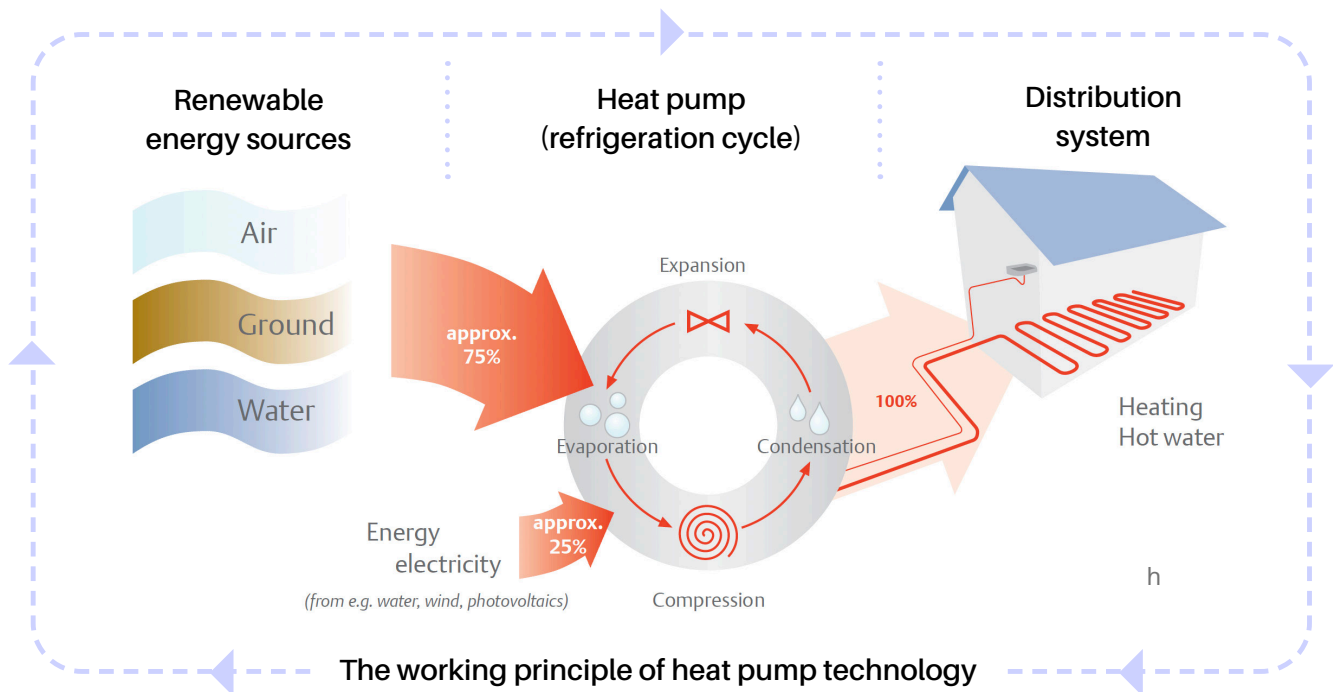


## Heat pumps - an efficient technology using renewable energy

Environmental impact, reduction of carbon footprint and energy consumption are at the centre of every discussion. New legislation such as the Energy Performance of Buildings (EPBD) directive, the Renewable Energy Sources (RES) directive and Ecodesign have been implemented to improve the use of primary energy and promote energy efficiency in heating and cooling applications.

Although the RES directive acknowledges air, water and ground as renewable energy sources, most water heaters on the market today still use fossil fuels or direct electricity.

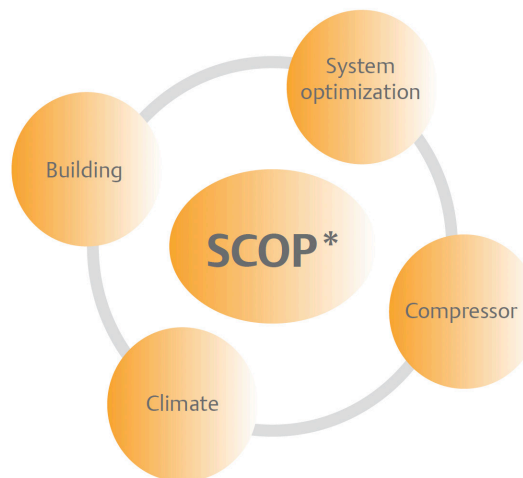
Heat pumps are recognized as the technology of choice to make renewable energy usable.



### Solutions for heat pumps

Copeland provides solutions that not only reduce development time and cost, but also increase system reliability and performance, by combining know-how both in compressor technology and refrigerant flow control.

Its advanced key components for heat pump systems, such as the new Variable Speed compressor range, prove once more that Copeland drives technology and helps prevent global warming by reducing CO<sub>2</sub> emissions and primary energy consumption.



\***SCOP** - Seasonal coefficient of performance

**System optimization** - Key factors for an improved efficiency. Copeland provides solutions for two key elements: compressor and system design

## Your choice for an efficient heating solution

Copeland offers a wide selection of products from single components that can be implemented into heating and reversible systems, over a combination of compressors and controls, to the option of integrating its technologies into one highly efficient refrigerant module – tailored to application needs. The more integrated the solution, the more advantageous are time to market, investment and resources while reliability and efficiency will increase.

RELIABILITY AND EFFICIENCY +

TIME TO MARKET, INVESTMENT, RESOURCES -

### The compressor solution

Copeland variable speed scroll and inverter drive



-  Modulation
-  Reliability
-  Efficiency




#### Key benefits:

- Superheat envelope controller, electronic expansion valves and sensors
- Simplicity of adoption
- Integrated solution

### The combined solution

Copeland variable speed scroll and inverter drive with superheat envelope controller



-  Diagnostics
-  Low life cycle cost
-  Efficiency




#### Key benefits:

- Superheat envelope controller, electronic expansion valves and sensors
- Simplicity of adoption
- Integrated solution

### The integrated solution

Refrigerant module heating



-  Efficiency
-  Reliability
-  Diagnostics

#### Key benefits:

- Modular concept – reduced complexity
- Best reliability
- Short time to market

## Variable speed scroll compressor and inverter drive

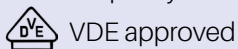
Outstanding performances and reliability based on a brushless permanent magnet motor matched with a highly efficient drive



ZHW Copeland scroll variable speed compressor and inverter drive

### Key features:

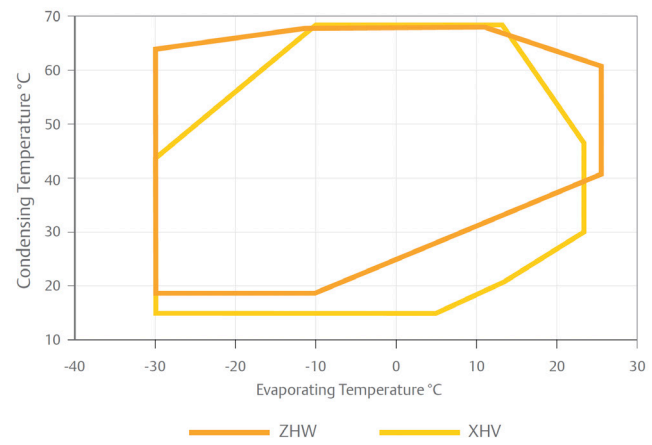
- Designed for R410A
- Variable speed solution for best in class seasonal efficiency (SCOP and ESEER)
- Extended envelope of models without enhanced vapor injection
- Variable volume ratio (VVR - ZHW only) and high volumetric efficiency valve (HVE) to boost both cooling and heating efficiency
- Wider modulation range with speed variation from 15 to 120Hz
- Compressor envelope, speed and safety information via driver serial communication (RS485 - Modbus)
- Drive with embedded compressor safety algorithms for superior reliability
- Enhanced vapor injection (ZHW only):
  - + 15% COP
  - + 25% Capacity



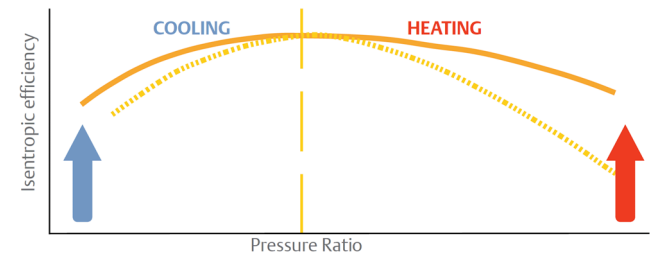
## Copeland introduces two variable speed compressor models:

- ZHW – Dedicated to heating applications, with Enhanced Vapor Injection
- XHV – Reversible cooling and heating applications, without enhanced vapor injection

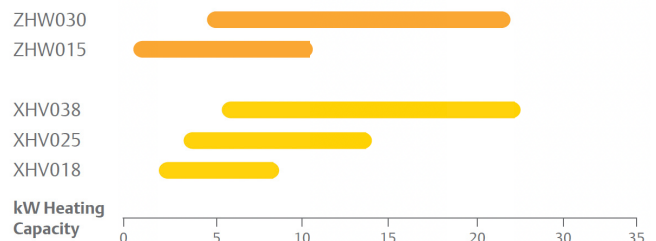
### ZHW/XHV operating envelope



### ZHW/XHV operating envelope



### ZHW/XHV operating envelope

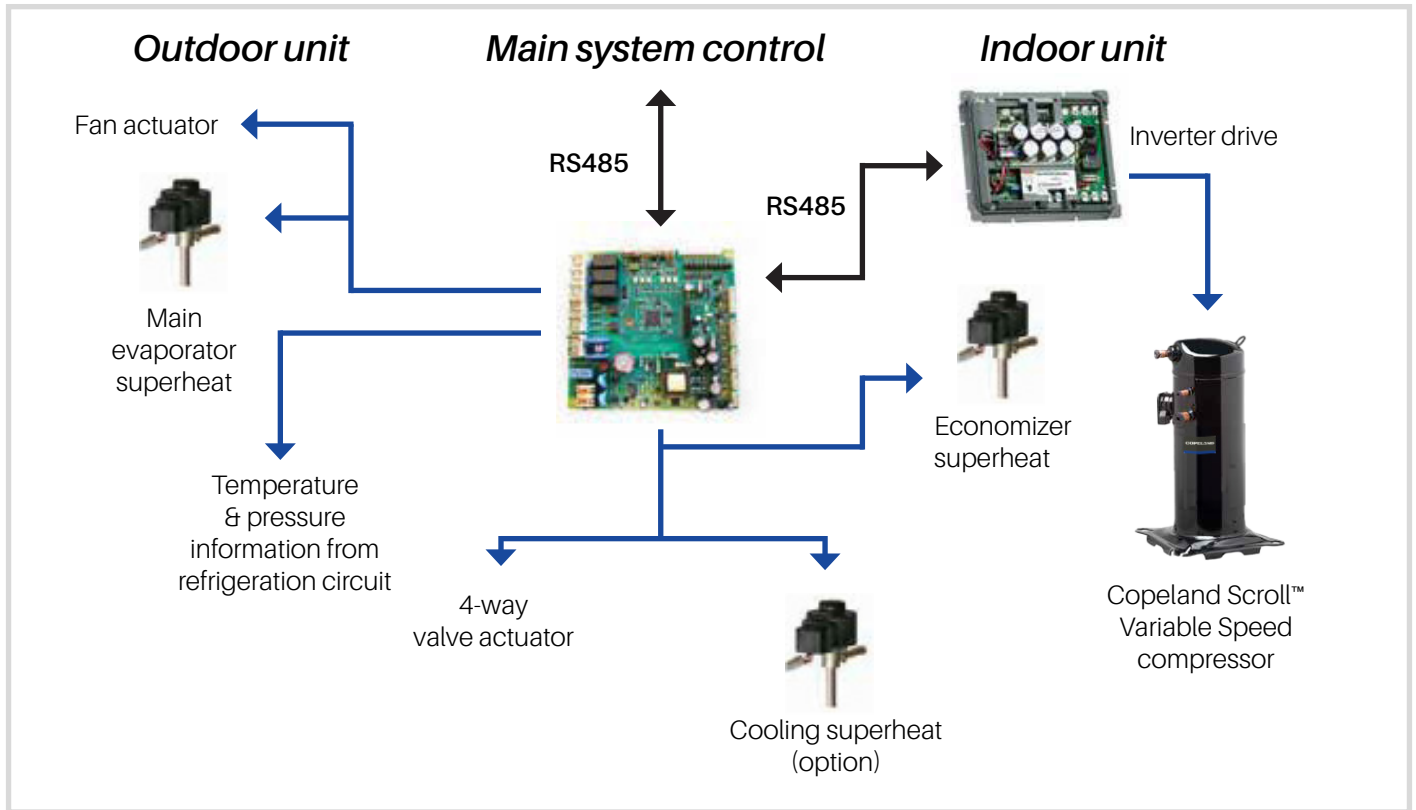


Conditions: Heating kW evaporating -7°C, condensing 50°C, 4K subcooling, 5K superheat

# Superheat Envelope Controller (SEC)

All parameters under control.

*Integrated solution for superior reliability and efficiency*



## Key features:

- Compressor operating map management
- Compressor speed management
- Superheat control
- Enhanced Vapor Injection / Wet Vapor Injection control
- Compressor speed management during defrost
- Actuation of evaporator fan
- Smart crankcase heater control
- Oil recovery
- Energy meter
- Frequency management to avoid resonances
- Information available via serial communication (RS485 - Modbus)

## Available for different system configurations

Configuration	Monobloc	Split
Air-to-water	EVI* / non EVI	EVI / non EVI
Ground source	EVI / non EVI	

\*Enhanced Vapor Injection

# XHV variable speed compressors

Optimized for average and warm climates.



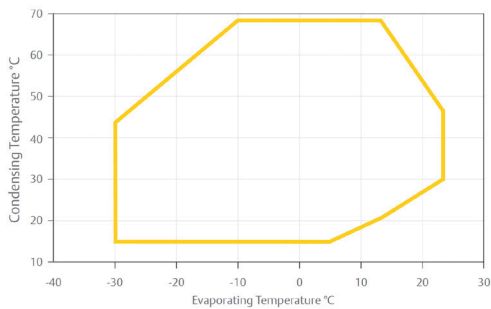
### Key benefits:

- Wide operating envelope
- Increased efficiency at low ambient temperature conditions
- Variable speed and low superheat capability
- Enables highest A++/A+++ efficiency class possible<sup>h</sup>
- Speed variation between 15 to 120Hz

A+++

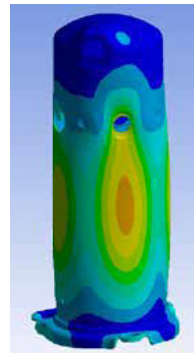
A++

### XHV operating envelope



- Designed for low water temperature
- Allows high water temperature for average climate
- Wet suction capability for improved system efficiency
- Axial and radial compliance for superior reliability

### Simplicity of adoption



- Deep understanding of compressor interaction with the system embedded into the design process
- Supply fully qualified EMC compliant components
- Acoustic, vibration and numerical simulation capability
- Provide additional expertise on modal analysis, virtual prototyping, stress and sound evaluation

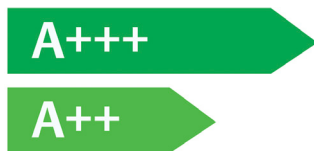
# Refrigerant module heating

The core of next generation heat pumps.



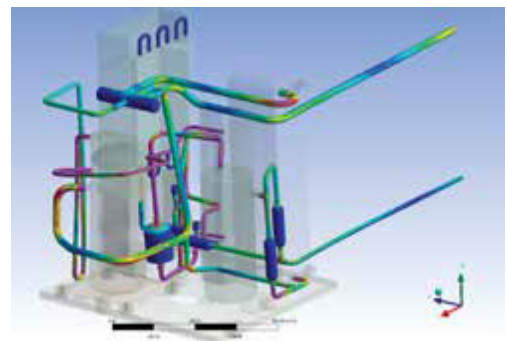
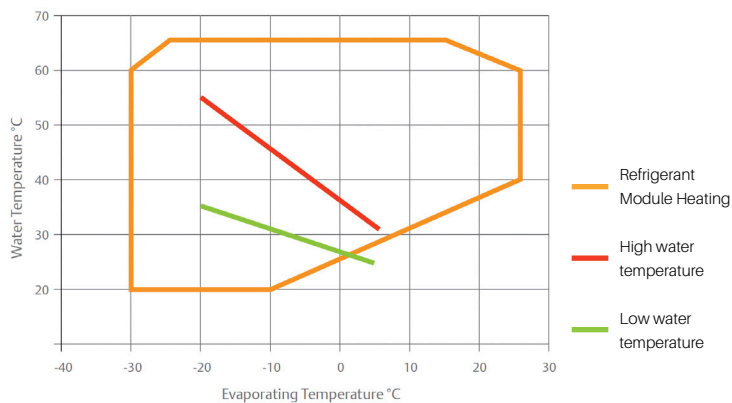
### Key benefits:

- Best SCOP
- Best reliability
- Reduced complexity
- Enables highest A++/A+++ efficiency class possible\*
- Fully compliant with EMI/EMC normative and VDE certified



\* Final efficiency class depending on final heat pump design

## Refrigerant module heating operating envelope



### Module components

- Copeland variable speed compressor and inverter drive
- Copeland electronic expansion valves
- Pressure temperature sensors
- 4-way reversing valve
- Plate heat exchanger(s)
- Liquid receiver
- Piping
- Copeland refrigerant circuit controller

### Advanced functionalities

- Optimized evaporator fan speed control
- Defrost management
- Monitoring
- All SEC controller features
- Piping stress analysis
- Modal analysis to avoid resonance frequencies

## Primary energy ratio simulation

Tech	High temperature (55°C) single		2017 required primary energy ratio
	Class	Ratio	
Gas	C	72%	86%
Gas cond.	B	88%	
Best gas cond.	A	97%	
ZP	B	83%	110%
ZH	A+	99%	
ZHI	A+	113%	
XHV	A++	132%	
ZHW	A++	148%	

According to EN14825

**This simulation is based on air-to-water heat pumps**, both at high (55°C) water temperature featuring different compressor technologies:

- **ZP:** Fixed speed air conditioning optimized scroll
- **ZH:** Fixed speed heating optimized scroll
- **ZHI:** Fixed speed heating optimized scroll with enhanced vapor injection
- **XHV:** Variable speed scroll optimized for average and warm climates
- **ZHV:** Variable speed heating optimized scroll with enhanced vapor injection



Energy label example

### Minimum primary energy ratio ( $\eta$ ) requirements by equipment type\* :

	2015 Tier 1	2017 Tier 2
Boilers	>86%	>86%
Low temperature (35°C) heat pump	>115%	>125%
High temperature (55°C) heat pump	>100%	>110%

\* Label mandatory <70kW, limits apply to all water heater generators <400 kW

**For more details, see [copeland.com/en-gb](http://copeland.com/en-gb)**