Carrier

United Technologies

DESIGNING INNOVATIVE SOLUTIONS

HEATING, VENTILATION & AIR CONDITIONING SOLUTIONS

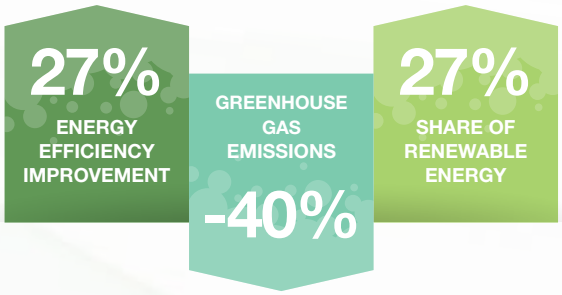
ECO DESIGN READY

CARRIER, NATURAL LEADER IN ENVIRONMENTAL RESPONSIBILITY

The impact of European Ecodesign regulations on heat pumps and chillers

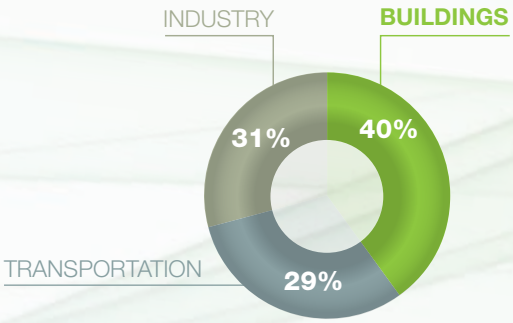
Carrier committed to **environmental responsibility**

Carrier is committed to limiting the environmental impact of its products and solutions and reducing energy consumption.
This commitment is in line with the targets of the European climate and energy package for 2030:

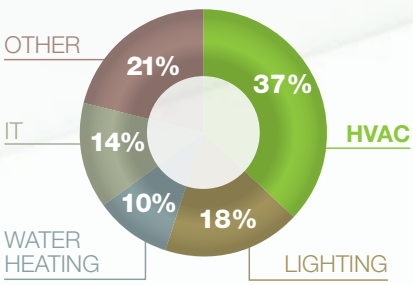


The energy efficiency improvement target strongly influences the heating, ventilation and air conditioning (HVAC) market.

Indeed buildings are the largest consumers of energy today and, of that consumption, HVAC systems account for considerably more than other equipment. Providing its customers with energy efficient solutions is therefore now a key sustainable development opportunity for the HVAC industry.



Total energy consumption



Building energy consumption

Source: World Business Council for Sustainable Development Report

In order to achieve these objectives, the European Union has developed a regulation to reduce energy consumption in equipment in buildings, including lighting, IT, water heating and HVAC:

Ecodesign

Ecodesign **regulations**

The latest European regulations apply to chillers in comfort and industrial process cooling applications, and to heat pumps.

Regulation 2016/2281

sets new energy efficiency requirements for chillers of up to 2000 kW used in air conditioning applications for comfort cooling. It comes into force in January 2018. This regulation also sets new energy efficiency requirements for **industrial process cooling chillers of up to 2000 kW with a positive leaving water temperature**.

Regulation 2015/1095

introduces increased energy efficiency requirements for **industrial process cooling chillers with negative leaving water temperatures** and is applicable from July 2018.

Under regulation 813/2013

air- and water-to-water heat pumps up to 400 kW must comply with higher energy efficiency requirements as from September 2017. **Heat pumps up to 70 kW must also carry Energy Labelling** in line with regulation 811/2013 from September 2015 onwards.

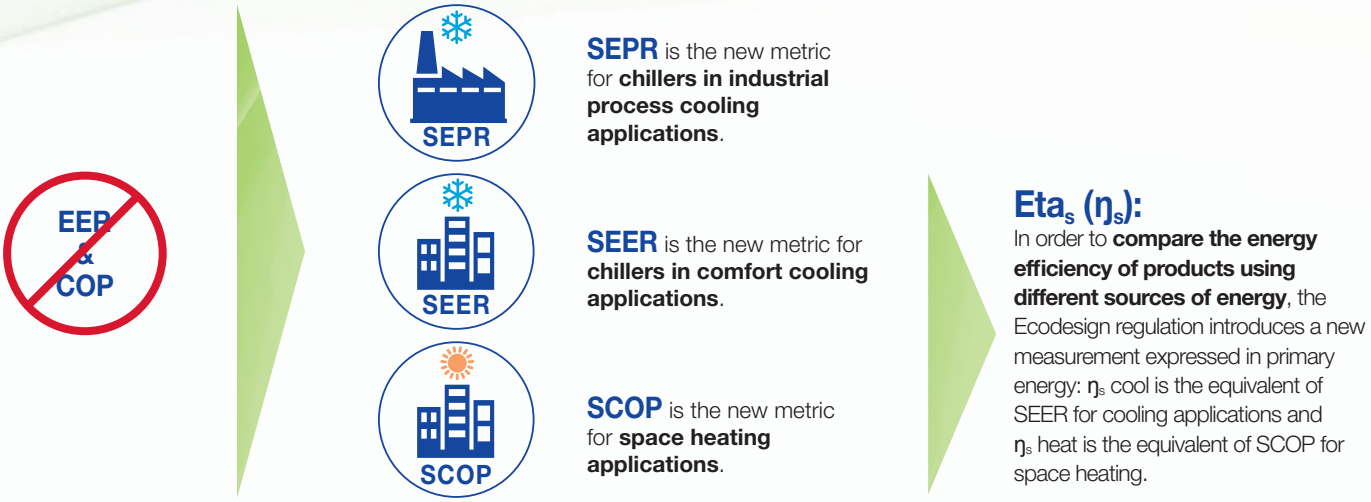
The new regulations also require manufacturers and all companies involved in the supply chain to provide specific technical information. For example, all advertising, sales or technical material must include information on the product's energy efficiency class.

New metrics because seasonal efficiency matters

With all new buildings expected to be close to zero energy by January 2021, calculations of the energy efficiency of buildings require accurate indicators of the efficiency of their equipment. These indicators must be representative of actual operations throughout the year, measuring the performance of equipment on a seasonal basis.

EER & COP belong to the past. Now, and in the future, the focus is on seasonal efficiency. With a broad new products range, Carrier is fully engaged to take up the challenge of energy efficiency.

Compliance with the new Ecodesign regulations therefore involves the use of new, more meaningful seasonal efficiency metrics. The Seasonal Energy Efficiency Ratio (**SEER**), Seasonal Energy Performance Ratio (**SEPR**) and Seasonal Coefficient of Performance (**SCOP**) all ensure precise evaluation of the energy actually consumed by chillers and heat pumps, by including seasonal variations in their measurements. Previous metrics (EER & COP) measured operations only at a single point, at full thermal load, and were therefore less representative of consumption over entire heating and cooling seasons.



SEPR is the new metric for **chillers in industrial process cooling applications**.

SEER is the new metric for **chillers in comfort cooling applications**.

SCOP is the new metric for **space heating applications**.

Eta$_s$ (η_s):

In order to **compare the energy efficiency of products using different sources of energy**, the Ecodesign regulation introduces a new measurement expressed in primary energy: η_s cool is the equivalent of SEER for cooling applications and η_s heat is the equivalent of SCOP for space heating.

These new seasonal performance metrics are now the key indicator used for all product ranges, in all applications. They are calculated according to technical standard EN 14825 and compliance is mandatory for a product to obtain CE marking.

Comfort **cooling**

Ecodesign regulation 2016/2281 sets minimum efficiency levels for chillers rated up to 2000 kW with a leaving water temperature equal to or greater than 2°C. It covers units used in air conditioning applications to ensure temperature comfort in buildings used by humans. These are divided into two sub-categories based on chilled water temperature:

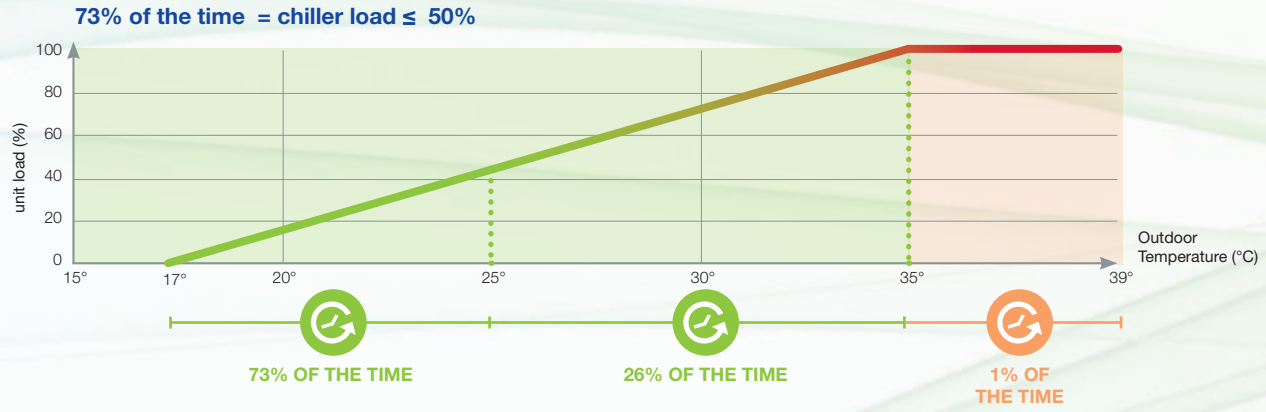
Low temperature chillers
supplying chilled water to fan coil or air handling units (efficiency calculated at 12/7°C entering/leaving temperature).

Medium temperature chillers
supplying chilled water, for instance to cooling floors or chilled beams (efficiency calculated at 23/18°C entering/leaving temperature).

SEER - Seasonal Energy Efficiency Ratio

SEER measures the seasonal energy efficiency of chillers by calculating the ratio between annual cooling demand and annual energy input. It takes into account the energy efficiency achieved for each outdoor temperature weighted by the number of hours observed for each of these temperatures, using actual climate data.

For low temperature applications the indicator is $SEER_{12/7°}$, calculated at 12/7° chilled water entering/leaving temperature, while **for medium temperature applications $SEER_{23/18°}$ is calculated at 23/18°** conditions. It is important to note that $SEER_{23/18°}$ can be up to 20% higher than $SEER_{12/7°}$ so it is crucial to check the chilled water conditions used to determine the SEER when comparing the seasonal energy efficiency of chillers.



SEER is a new way of measuring the true energy efficiency of chillers for comfort cooling over an entire year.
This new indicator gives a more realistic indication of the real energy efficiency and environmental impact of a cooling system.

Efficiency requirements

Regulation 2016/2281 sets seasonal energy efficiency in Eta_s cool (η_s cool). This expresses SEER in terms of primary energy and so makes it possible to compare the energy efficiency of units using different energy sources.

There is no cooling efficiency requirement for heat pumps concerned by regulation 813/2011 or for medium temperature industrial process chillers concerned by regulation 2015/1095.

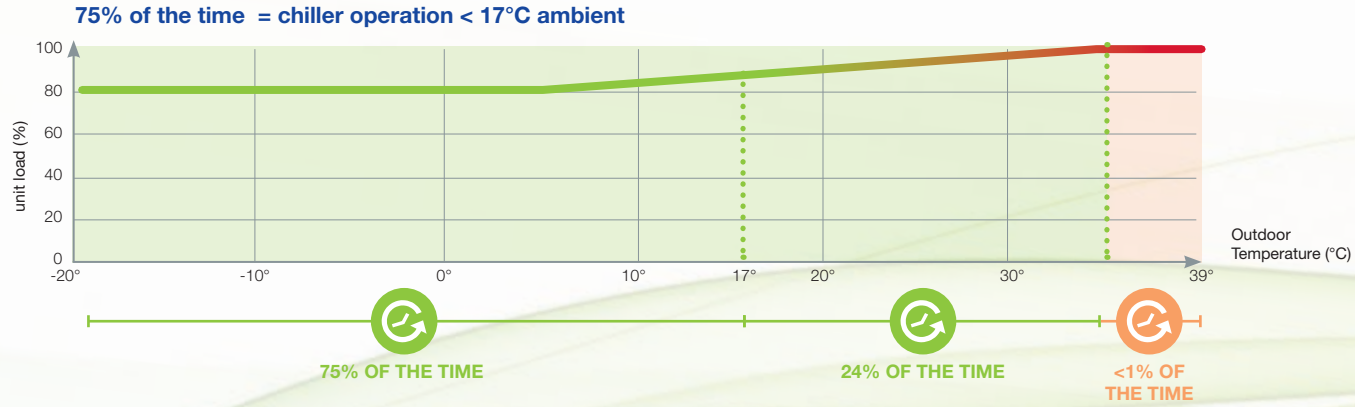
COMFORT CHILLERS	From 01/2018		From 01/2021	
	η_s cool %	SEER 12/7° or 23/18°	η_s cool %	SEER 12/7° or 23/18°
Air cooled < 400 kW	149	3,80	161	4,10
Air cooled 400 to 2000 kW	161	4,10	179	4,55
Water cooled < 400 kW	196	4,98	200	5,08
Water cooled 400 to 1500 kW	227	5,75	252	6,38
Water cooled 1500 to 2000 kW	245	6,20	272	6,88

Industrial process **cooling**

Two Ecodesign regulations set efficiency requirements for industrial process cooling applications such as data centers, agrifood or pharmaceuticals.

SEPR - Seasonal Energy Performance Ratio

SEPR measures the seasonal energy efficiency of process chillers by calculating the ratio between annual cooling demand and annual energy input. It takes into account the energy efficiency achieved at each outdoor temperature of an average climate weighted by the number of hours observed for each of these temperatures.



SEPR is a new way of measuring the true energy efficiency of chillers for process cooling over an entire year.
This new indicator gives a more realistic indication of the real energy efficiency and environmental impact of the cooling system.

Efficiency requirements for high temperature process chillers

Regulation 2016/2281 sets minimum efficiency levels for positive leaving water temperature chillers (high temperature chillers) rated up to 2000 kW used in industrial process cooling applications. High temperature chillers are capable of delivering leaving water temperatures of between 2°C and 12°C.

There is no High Temperature SEPR requirement for heat pumps concerned by regulation 813/2011 or medium temperature industrial process chillers concerned by regulation 2015/1095.

HIGH TEMPERATURE PROCESS CHILLERS	From 01/2018	From 01/2021
	SEPR 12/7°	SEPR 12/7°
Air cooled < 400 kW	4,50	5,00
Air cooled 400 to 2000 kW	5,00	5,50
Water cooled < 400 kW	6,50	7,00
Water cooled 400 to 1500 kW	7,50	8,00
Water cooled 1500 to 2000 kW	8,00	8,50

Efficiency requirements for medium temperature process chillers

Regulation 2015/1095 sets minimum efficiency levels for chillers with negative leaving water temperature used in industrial process cooling applications. Medium temperature process chillers are defined as units capable of operating at -8°C leaving temperature.
Chillers coverered by this regulation are not subject to efficiency requirements from regulation 2016/2281.

MEDIUM TEMPERATURE PROCESS CHILLERS	From 07/2018
	SEPR -2/-8°
Air cooled < 300 kW	2,58
Air cooled > 300 kW	3,22
Water cooled < 300 kW	3,29
Water cooled > 300 kW	4,37

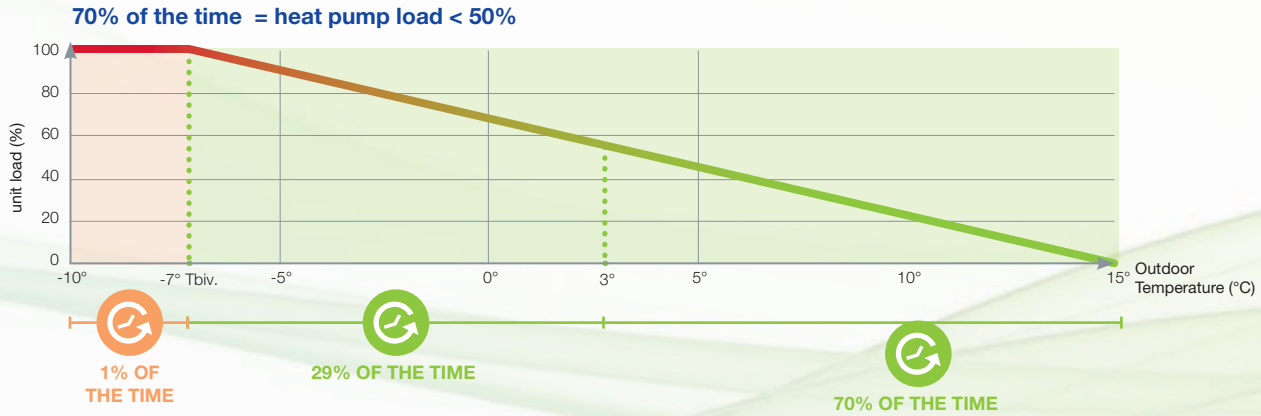
Note: for medium temperature process chillers intended to be charged with a refrigerant fluid with a GWP<150, SEPR values can be lowered by a maximum of 10%.

Space heating

Ecodesign regulation 813/2013 sets minimum energy efficiency levels for air- and water-to-water heat pumps rated up to 400 kW. It relates to units used for space heating only and to combination heaters that also supply hot water, and covers two sub-categories based on leaving water temperature: medium temperature and low temperature.

SCOP – Seasonal Coefficient of Performance

SCOP measures the seasonal energy efficiency of heat pumps by calculating the ratio between annual heating demand and annual energy input. It takes into account the energy efficiency achieved at each outdoor temperature of an average climate weighted by the number of hours observed for each of these temperatures.



SCOP is a **new way of measuring the true energy efficiency** of heat pumps **over an entire year**. **This new indicator** gives a more realistic indication **of the real energy efficiency and environmental impact of the heating system**.

Efficiency requirements

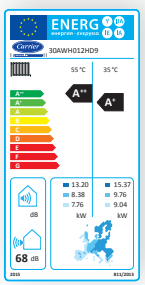
Regulation 813/2013 sets seasonal energy efficiency in Eta$_s$ heat (ηs heat). This expresses SCOP in terms of primary energy and so makes it possible to compare the energy efficiency of units using different energy sources.

There is no cooling efficiency requirement for heat pumps concerned by regulation 813/2011.

HEAT PUMPS (space & hot water heating 47/55°)	From 09/2017	
	η_s heat %	SCOP 47/55°
Air to water < 400 kW	110	2,83
Water to water < 400 kW	110	2,95
LOW TEMPERATURE HEAT PUMPS (space heating 30/35°)	**From 09/2017**	
	η_s heat %	SCOP 30/35°
Air to water < 400 kW	125	3,20
Water to water < 400 kW	125	3,33

Energy Labelling

In addition, **European Energy Labelling regulation 811/2013 classifies heat pumps up to 70 kW from G to A++, according to their energy efficiency**. This enhanced consumer information drives the market towards more energy-efficient products. From September 2019, the E, F and G classes will no longer exist. A new A+++ class will identify the most energy efficient products.



Carrier solutions
already compliant

Carrier's chillers and heat pumps are already in line with the European Ecodesign regulation requirements on energy efficiency.

Ultra modern laboratories

Carrier's Research & Development teams and its laboratories, among the largest such facilities dedicated to HVAC in Europe, are an important part of what makes the company a natural leader. Carrier benefits from unique facilities, both in terms of cooling coverage, air treatment capacities and measurement accuracy.

Cooling:

- 15 individual test rooms
- ambient control from -25°C to 55°C
- total test capacity of 6 MW

Ventilation:

- acoustics, aeraulics, characterisation of heat recovery systems
- wall panels insulation, casing air leakage and strength, filter bypass leakage
- air flow testing on heat recovery units from -10°C to +90°C
- individual unit test capacity up to 35 000 m^3/h, humidity from 30 % to 90 %

Eurovent Certification:

Although products and performances are assessed in Carrier's laboratories under their application conditions Carrier also supports and participates at the stringent independent Eurovent Certification Programmes for refrigeration, air conditioning, air handling and heating products including tests in accordance with relevant European standards (EN 1886 and EN 13053).

Carrier
a natural leader

Introduced in 2010, the Carrier CO_2NSERVATION Meter calculates avoided greenhouse gas emissions as a result of the installation of high-efficiency Carrier air conditioning, heating and refrigeration systems by customers around the world since 2000. In 2017, the Carrier CO_2NSERVATION Meter reached **213 million metric tonnes** of greenhouse gases saved, the equivalent of:

Approximately 39 000 000 vehicles removed from the road for one year*

The electricity consumed by **approximately 25 000 000 homes** during one year*

* According to the United States Environmental Protection Agency Green Power Equivalency Calculator
The model compares the projected GHG emissions from select Carrier products to emissions from comparable baseline products, with the difference representing the avoided emissions.
The meter also incorporates energy savings as measured from energy service contracts. Learn more on http://naturalleader.com/

Carrier Service

To ensure an air conditioning system has minimum environmental impact, it must be run and maintained at optimum capability levels.

For Carrier, that means ensuring its products are environmentally responsible for their entire life on site and that's why Carrier undertakes all refurbishment activities on machines that have already been installed.

To bring peace of mind to its customers, Carrier provides service offerings tailored to their specific requirements, including:

- Comprehensive and efficient preventive maintenance programs
- Advanced service offer based on secure connectivity, allowing real-time monitoring of equipment and transfer of information from Carrier experts
- Continuous internal training
- On-site inspection
- Control solutions for low energy and high-performance systems

Presence in more than **60** countries

24/7 availability

More than **110** years of experience

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