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CHILLVENTA
2022

INDOOR AIR QUALITY

SUSTAINABILITY

ENERGY PERFORMANCE OF
REFRIGERATION SYSTEMS

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**CAREL Group** companies

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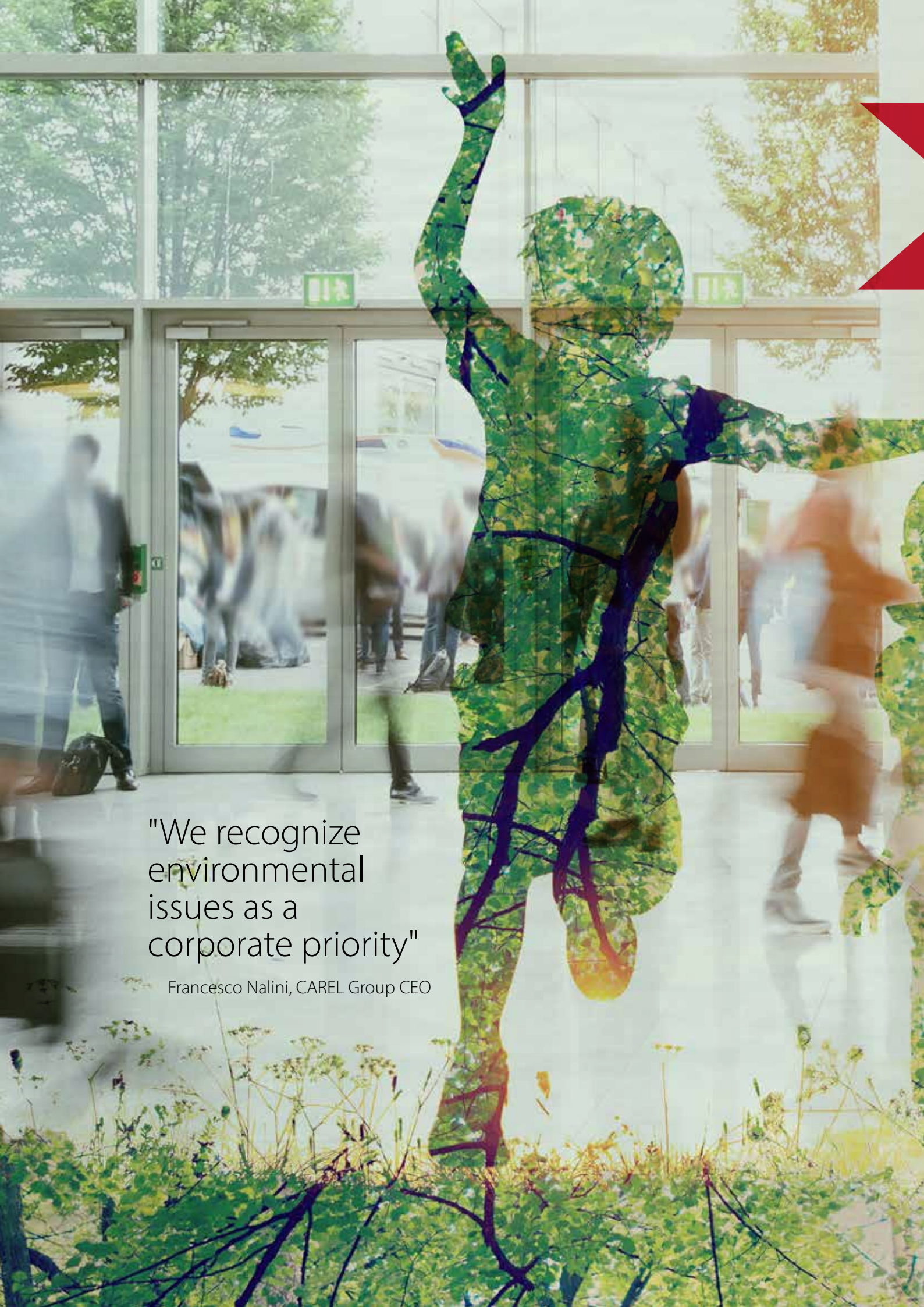


"We recognize environmental issues as a corporate priority"

Francesco Nalini, CAREL Group CEO

# DRIVEN BY THE FUTURE

## Sustainability in action

**The company's claim, "Driven by the future", perfectly sums up the CAREL model, representing the starting point and the final goal that together encompass the process of designing, manufacturing and marketing our products and systems.**

Indeed, CAREL's products are born from the hope that a better future for the planet and its people is possible. It is with this awareness that CAREL intends to follow a path to achieve, day after day, **concrete and measurable sustainability objectives**, for the present and future generations.
As innovative consulting and technological partner, CAREL anticipates market demands, proposing energy-efficient solutions with guaranteed high performance.

**Continuous improvement is our modus operandi**, the method that allows us to create a standard without being constrained by it and then gradually succeeding in surpassing it to define an even higher-level standard. **Research, innovation and technology are the keys to our success:** for almost fifty years, the customer's needs have been at the centre of the elements we develop to ensure **functional and aesthetic differentiation, all with a sustainable approach**. Our Group's strength lies in the integration between the different areas; our overall vision, experience and transversal competencies mean we can exceed the boundaries of individual products and represent a single partner that can identify integrated application solutions.

# INDOOR AIR QUALITY

## for healthy and sustainable environments

**Optimal indoor air quality, along with correct temperature and relative humidity conditions, are key to ensuring health, well-being, and performance** during the time people spend inside buildings. And to ensure fresh and clean air, ventilation with outside air plays a crucial role: **both the removal of pathogens from indoor spaces and the transmissibility of airborne diseases depend greatly on the humidity level**. Indeed, viruses and bacteria spread more easily in dry air, and this can only be overcome by **controlling the relative humidity, which should be set between 40 and 60%.**

The control systems of air handling units - the heart of ventilation systems - are essential components for controlling and guaranteeing the best indoor air conditions with the lowest energy consumption.

# ENERGY PERFORMANCE
## of refrigeration systems

The events that have shaped the last two years have brought about changes in many aspects of our daily life, directly and indirectly accelerating the trend that sees greater awareness of the key role that food quality, cost saving, environmental impact and the value of time have in people's lives. **In refrigeration systems, more aware technological choices can have a significant impact on energy consumption and food storage**, and therefore become a positive factor for change in this crucial sector.

In order to support the drive to reduce energy consumption, guaranteeing complete management of refrigeration systems with the focus on energy efficiency and performance optimisation, CAREL has developed **solutions capable of ensuring both the highest quality food preservation and ease of use, from installation through to everyday operation of the systems by the user**.

# SUSTAINABILITY
## starts with natural and low-GWP refrigerants

**Control solutions for systems that use natural and low-GWP refrigerants are the focus of CAREL's offering at Chillventa**, where sustainability is one of the most interesting and widely-discussed topics. It is now clear that tackling climate change is essential for all economic sectors, as well as an opportunity to build a new economic model that everyone can contribute to.

With extensive experience in the design and production of solutions aimed at saving energy and involving the use of alternative refrigerants, CAREL is ready to face the current challenges for industry as a whole, and the process industry sector.

# INDOOR AIR QUALITY

## Humidity control for your health

With the Covid-19 pandemic, a well-known physical phenomenon has been brought into the public eye, namely, that pathogens emitted by a sick person by sneezing, talking, or breathing remain suspended in the air of the environments they are in.
Less well known, however, was the fact that **the ability of airborne diseases to be transmitted is strongly influenced by humidity**. In fact, many times have we felt dry eyes, skin or throat, or felt the presence of dust more because of the dryness of the environment's air. This is all because the **comfort zone for humans lies between 40 and 60% relative humidity (rH)**. Between these two values, the person feels comfortable, is efficient and remains healthy. At the same time, viruses and bacteria are slowed down in their spread and their ability to survive is reduced.
Keeping humidity stable in this comfort zone is not always easy and can only be **reliably guaranteed by controlled humidification of indoor air**.
**Ultrasonic humidifiers combine the energy efficiency of the adiabatic process with effectiveness against viruses and bacterial contamination**.
CAREL **humiSonic direct** is **efficient**, as ultrasonic humidifiers guarantee energy savings of 90% when compared to ordinary steam generators; **reliable**, as humiSonic is guaranteed for 10,000 operating hours when running on demineralised water and **versatile**, thanks to the size of the droplets produced (average diameter of 5 µm) that guarantees very fast absorption of the atomised water in the room or duct, avoiding possible condensation.
The integration of a system for water treatment as the **HygroMatik WaterLine RO** helps to be more effective against contamination in air humidification and cooling systems as viruses and bacteria present in the water are filtered out by the process of reverse osmosis before they reach the air humidification systems.
In hygienically sensitive application areas, HygroMatik together with CAREL offers FlexLine, a modern generation of steam humidifiers which consists of a basic model that can be expanded to create individual humidification solutions suitable for all requirements.

HYGROMATIK
WE HUMIDIFY THE AIR

## Better control for better air

Optimal indoor air quality, along with proper temperature and relative humidity conditions are key to ensuring health, well-being, and performance when spending time in confined spaces. **The air handling unit (AHU) is the heart of the ventilation system in residential and commercial buildings and is designed to achieve these goals**. AHUs remove polluted air from indoor spaces – either actually-polluted or air that is simply uncomfortably warm or cold – and replace it with clean, fresh air at the right temperature and relative humidity and ventilation with outside air plays a crucial role in eliminating pathogens from indoor environments.
The control system is a crucial component to achieving the correct control of the system components in order to ensure the required indoor air conditions with the lowest energy consumption.
More broadly, the control solution also needs to ensure effective communication with other control systems, such as the BMS to optimise energy consumption across the building, and it should monitor and log the operation of all the devices in order to understand in advance the reduction in performance that occurred during the unit's lifetime.
Finally, the control system needs to ensure safe operation and use of the equipment, as well as cybersecurity of the IT network. The latter involves compliance of the controllers with IT security protocols in accordance with relevant ISO and EU standards.

**µAria is CAREL's new solution for the complete management of ventilation and heat recovery units in residential applications**. µAria provides software features designed and optimised for the most common types of units on the market. Compatibility with different types of probes and sensors (temperature, humidity, CO2, VOC, etc.) guarantee the possibility to measure the desired values and use them for the optimal control.
The distinctive feature of µAria is a **new level of usability**. Thanks to NFC and Bluetooth® connectivity, users can interact with the controller via the CAREL mobile app, allowing quick and easy access to all unit parameters for quick and easy start-up.

**k.Air, on the other hand, is CAREL's fully configurable pre-programmed solution, designed for the management of different types of air handling and ventilation units, from high efficiency heat recovery units to modular units for commercial**

# Humidifier life cycle management

In order to guarantee room air quality and the economic investment for purchasing the systems, it is essential to preserve the product's efficiency during its entire life cycle.
As a matter of fact, **life cycle analyses indicate that proper start-up, combined with periodic maintenance and expert management of system configurations, will in the medium term produce a lower economic impact than the costs resulting from non-optimal performance, prolonged downtime, occasional repairs or, in the worst case scenario, the need to replace the product with a new one in advance.** Through expert technical support and digital remote control services, the units' performance remains constant over time and unexpected costs, whether direct or indirect, are limited and managed as far as possible.

**The CAREL group offers a complete package of services for the entire range of its humidifiers.** The aim is to maintain the operating performance of the unit over time and increase its lifespan, both in the case of in-system activities and through digital services for remote assistance.

Thanks to CAREL's experience and the expertise of its technicians, the analysis of any malfunctions will quickly result in a solution to restore the unit in the shortest possible time. **The CAREL group offers a complete service that supports customers in analysing the anomaly, organising the intervention and, if necessary, supplying any spare parts.** Spare parts play a fundamental role during the product life cycle as the preservation/wear of the components also determines the product's operating life.

**or process applications.**
It is a ready-to-use solution that doesn't require any software programming experience. Thanks to the availability of the native Ethernet™ port on all models, a web interface is available from first start-up, offering an high-end user interface to simplify access to settings for all types of users. In addition, BACnet™ and Modbus® communication protocols are available as standard for communication with other devices in the same network, including third-party systems.


FIND IT IN CPQ

The new **CPQ module** is also available with k.Air. This new tool allows users to select, quote and finally configure k.air and all the necessary accessories for a complete installation. The k.AIR CPQ module is a powerful companion for designers, OEMs and installers to complete their tasks quickly and easily, from design to start-up.


# Green industries for the planet

It is now clear that tackling climate change and pursuing environmental sustainability across all economic sectors is today's greatest challenge. It is also an opportunity to build a new economic model that everyone can contribute to.

It is evident that **industrial processes and their systems can greatly benefit from highly-efficient technologies**, which will be increasingly used by markets to achieve many social, economic and environmental objectives in the short, medium and long term.

With extensive experience in the use of natural refrigerants and the proposal of energy saving solutions, **CAREL is ready to face the current challenges and opportunities that arise in industry, in particular in the process industry sector, proposing µChiller Process for small and medium-sized process chiller market**, plus advanced programmable controllers for larger process chillers.

Specifically, µChiller Process is the only parametric controller with innovative connectivity features that can manage all the typical functions required for process chillers to ensure ample usability, including hot gas bypass and tank management, control of two user pumps, and the possibility to manage two auxiliary loops in addition to control of the main refrigerant circuit.

µChiller Process meets the main requirements of this sector, such as compatibility with the current F-gas regulations, and is ready to operate with natural and low-GWP refrigerant gases, such as $CO_2$, R290, R32, R452B, R454B, R513A and many others. In addition, end users can make use of advanced local and remote connectivity functions for simple, fast, and intuitive system management, including through dedicated apps for smartphones and tablets (Applica).

The µChiller Process family portfolio, together with electronic expansion valves, drivers, compressors, sensors and many other accessories, are part of the range of CAREL solutions classified as A2L ready and A3 ready and therefore meet the certification requirements for use with flammable gases; µChiller Process can therefore be easily integrated into bundle solutions, ready to be used by unit manufacturers to achieve the required objectives in terms of high efficiency, safety and electrical compliance.

# Reduced emissions without compromises

The regulatory framework is unquestionably pushing the commercial refrigeration market, especially the European one, towards a reduction of $CO_2$ emissions. This involves on the one hand **reducing the GWP of installations (reduction of direct emissions), and on the other hand seeking greater efficiency (reduction of indirect emissions).**

**Heosbox $CO_2$** is a solution that meets both requirements. It is a **moto-condensing unit for waterloop installations, equipped with high efficiency Heos technology, designed to operate with $CO_2$ refrigerant in subcritical conditions**.

The reduction of direct emissions, due to a lower installed refrigerant charge and much lower risk of leaks and reduction of indirect emissions through timely and optimised regulation of individual utilities, leads to better overall efficiency.

In fact, as each evaporator works independently of the others, **the unit operates under ideal evaporation conditions**, without having to make the compromises typical of a centralised system and its installation is easy and flexible thanks as it is a semi-plug in unit.

**Heos technology allows to maximise efficiency through continuous modulation of the cooling load** synchronising the actions of the BLDC compressor, electronic valve and system control, enabling improved reliability and reduced maintenance costs, with the possibility of predictive actions. Thanks to precise and stable adjustment of the temperature and moisture of the counter it grants Improved food preservation.

Heosbox $CO_2$ aims to offer a **natural and sustainable alternative to propane in waterloop applications**: the use of $CO_2$ allows the charge limits to be exceeded as it is a non-flammable refrigerant and by operating under subcritical conditions, synergies can be created with systems in which a cold water loop is already provided (e.g. air conditioning systems).

Subcritical operation also makes it possible to exploit the extraordinary properties of $CO_2$ under such operating conditions

# SUSTAINABILITY

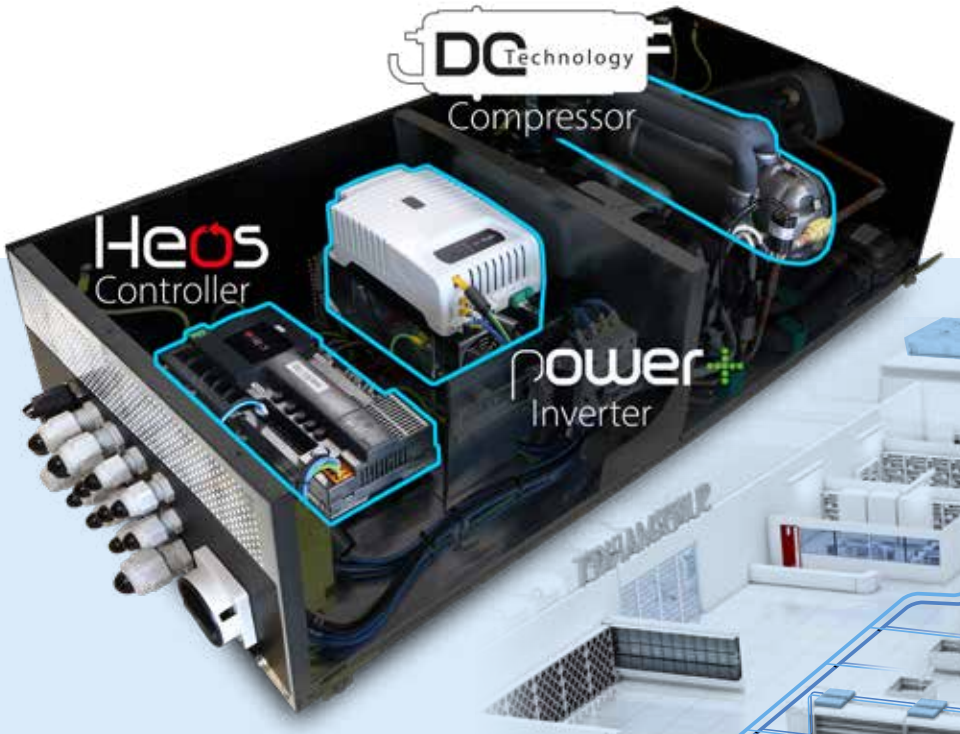
## Suitable compressors for a Greener Planet

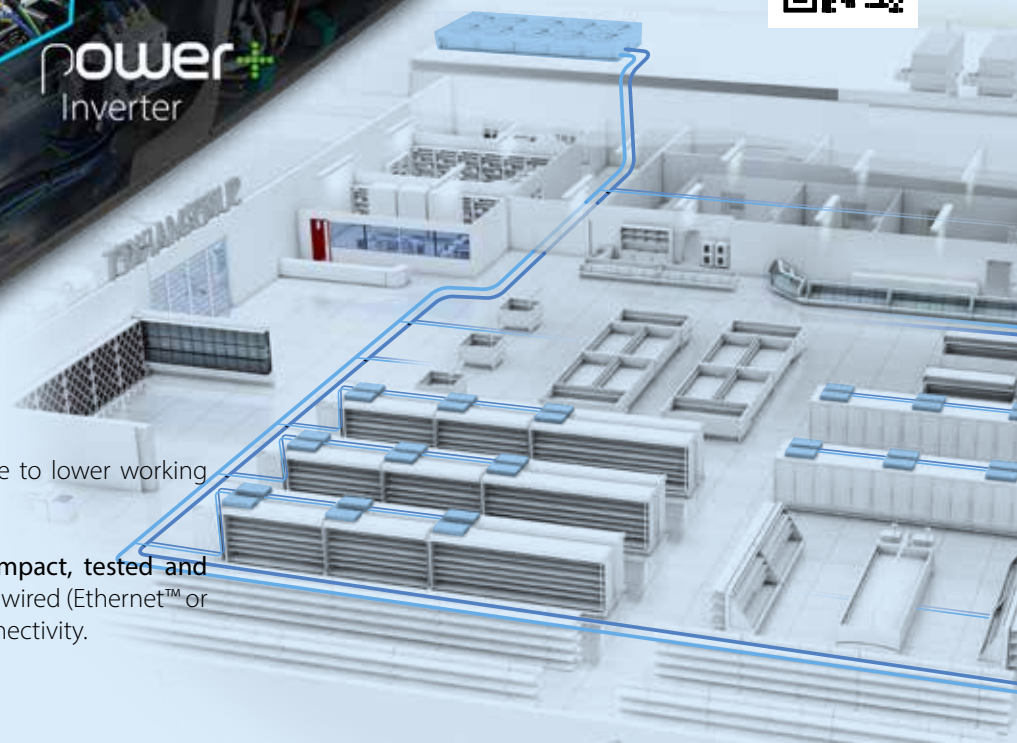
Widespread awareness campaigns and increasingly stringent regulations encourage virtuous acts of sustainability. In EU countries, the reference standard on environmental sustainability for equipment that makes direct or indirect use of energy is the **Ecodesign Directive**. **Particularly in the HVAC/R sector, the requirement is not only dictated by regulatory references but also by the market's own demands**.

Conscious compliance with these requirements implies **optimising the performance efficiency of equipment, thus reducing operating costs**. The areas of application vary, from heat pumps, to process chillers and refrigeration in general, etc. And for each specific use, it is a question of finding the most sustainable, reliable and affordable solution.

CAREL brings to life virtuous sustainability and finds its most "natural" expression in identifying and proposing the most suitable solutions for each application area and market.

This study and **years of experience in control systems and continuous experimentation have led to the choice of the range of scroll and rotary compressors available today in the CAREL product range**. Alongside the more traditional ranges for the use of synthetic refrigerants (R-410A, R-32, R-448A, R-449A, etc.) are those designed for natural refrigerants, also focused on environmental sustainability as they have low or zero GWP. These include carbon dioxide (R-744, CO2) and propane (R-290). They range **from fixed-speed compressors to variable-speed compressors, which use BLDC technology with a DC inverter**. Depending on the application, the variability of the load and the working conditions in general, the two solutions may be used as alternatives or in synergy. But it goes without saying that the most common situations, and therefore worthy of greater attention, involve the **variability of load and working conditions**. It is precisely for these that CAREL has developed particularly efficient products and solutions. In fact, **inverter BLDC technology with a DC inverter combined with the adoption of the electronic expansion valve allow for large, precise and always energy-efficient capacity modulation.**



while keeping technology costs down, due to lower working pressures.

Heosbox $CO_2$ offers all this through a **compact, tested and easy-to-install solution** featuring advanced wired (Ethernet™ or serial) or wireless (Bluetooth® and NFC) connectivity.

# ENERGY PERFORMANCE OF REFRIGERATION SYSTEMS

## Increase efficiency… with in-field commissioning

From a refrigeration installer's point of view, one of the critical aspects when working in the field is **time**. But it is also a matter of **urgency**, and if lasting too long can have a major impact on the quality of stored food and a matter of **organisation**, as emergency call-outs have a disruptive effect on the installer's day-to-day schedule.

Faults can be minimised by correct installation and proper maintenance, nonetheless, service in the field is often required… so it's better to make it fast!

CAREL intends to help installers, making in-field configuration extremely easy and much faster than before and exploiting a powerful tool always have available: the smartphone.

Discover the power of **CAREL APPLICA** - just one single app that can interact with and configure different CAREL controllers for different applications - and try it out on the brand-new **iJW refrigeration controller**, making its European debut at Chillventa, for your first experience of smarter field commissioning.

## Advanced connectivity for refrigeration plants

There are numerous challenges behind the design and construction of a refrigeration machine, and every OEM knows them very well: sizing, component selection, welding, assembly. However, there is another fundamental phase that challenges installers and technicians: the machine's commissioning and start-up.

Having simple set-up and adjustment procedures can make all the difference, and can even prevent setting errors at source by making machine interfacing as intuitive as possible.

It was with these objectives in view that the **new µRack** was developed, **the control for condensing units and small refrigeration plants**. It encapsulates everything you need in terms of software functionality and hardware connections to control the unit in the best possible way. With **dedicated energy-saving functions**, it can modulate compressors of various types and condenser fans to balance the energy consumed, while at the same time safeguarding the reliability of the system with logic designed to protect compressors and service continuity.

Connected via Bluetooth® or NFC µRack allows builders, installers and users to **interface and adjust the unit quickly and intuitively via smartphone apps**.

## The cutting edge in refrigeration controller performance

**The events that have defined the last two years in our society have directly or indirectly boosted the trend that sees greater awareness of the key role that food quality, cost savings, environmental impact and the value of time have in people's lives.** More aware technological choices can therefore have a direct impact on energy consumption, and at the same time significantly improve environmental impact and the quality of food preservation, thus becoming a positive factor for change in a crucial sector. **The MPX and Heos ranges represent the solutions for the complete management of supermarket refrigeration units**, guaranteeing: food preservation quality, energy efficiency, lower environmental impact, easy use.

At Chillventa, CAREL previews the evolution of the Heos control: **HeosPRO, a solution in continuity with the MPX range from a usability and connectivity point of view for a common family feeling** between the different products, both functionally and aesthetically, using the latest-generation user interfaces with touchscreen displays and a modern design. **Limiting the energy consumption** of the various refrigeration system components is just one of the ways to achieve environmental sustainability. Together with this, **reducing direct $CO_2$ emissions plays an important role in commercial refrigeration**. This can be done by using environmentally-friendly refrigerants, with a low GWP. CAREL offers refrigerant neutral solutions: all versions of the MPXzero, MPXone and HeosPRO can be used with any type of refrigerant, even highly flammable gases (A3) such as propane (R290).


Further evolution of the HeosPRO is the new **Heos Powerboard** a top performing controller able to directly control power supply and to protect, via embedded fuses, different types of loads, substituting or simplifying electrical panel constructions and saving space and costs.

# DC Technology for high efficiency solutions


Energy efficiency has been a consolidated requirement for years now, especially in commercial refrigeration.
The main driver is the normative context (in Europe through the Eco design requirements).
Not only have increasingly strict requirements been introduced, yet the need to display the energy consumption of refrigeration units (Eco labelling) allows direct, transparent comparison between the various solutions that end users can find on the market.
The second driver is the increases in the cost of electricity, as a consequence of the current geopolitical context in Europe and beyond.
What does CAREL propose to improve efficiency in commercial refrigeration applications?
For more than 10 years now, CAREL has been proposing to achieve energy efficiency through the concept of continuous modulation of performance.
Continuous modulation can be achieved through the synchronised action of a variable-speed compressor with BLDC technology, combined with an inverter and electronic valve.
This makes it possible to optimally meet the load requirements of the specific refrigeration unit, adapting to the daily and seasonal variability in refrigeration load.

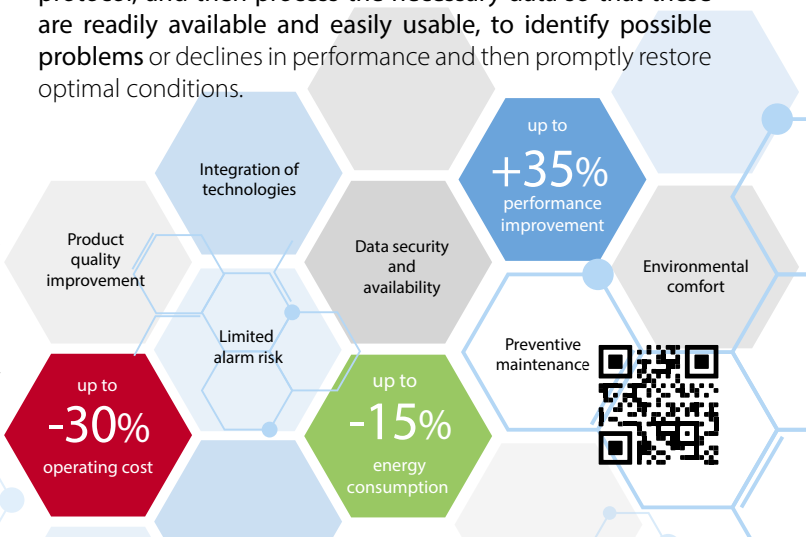
# Maximum performance and reliability for scientific applications

**Pharmaceuticals and healthcare services have continued to attract a high level of interest in recent years, with a big boost due to Covid19.** Attention has also grown in product storage solutions for scientific and medical purposes due to the high economical and strategic value of the products themselves.
CAREL with the **new born of the family, IJS for scientific applications**, offers solutions aimed to ensuring the conservation stability of the products thanks to specific algorithms, combined with hardware options able to drive modulating loads, also improving energy performance of the refrigerated units. The technology for the direct management of variable speed compressors (VCC) allows the rapid adoption of modulating solutions togheter with the ability to adapt the workload to the real ambient conditions, minimizing compressor's startups and maintaining the products' temperature as stable as possible.

IJS

# Monitoring services for performance optimisation

A fundamental role in ensuring **control and optimisation of energy consumption** remains sustainable over time is played by the **digital systems** used to support both occupants and maintenance technicians in the optimal management of buildings. **On-site monitoring systems, and the modern data mining and machine learning techniques used by centralised web portals, can be used to aggregate the data collected and consequently provide effective analysis of system performance.** This makes it possible to highlight any deviations from optimal performance and focus the attention on the cases that are actually critical.
Lighting, air conditioning and heating systems, refrigerant circuits, compressor racks, electrical panels, energy meters and so on, made by different manufacturers, located in sites all around the world, and installed by different technicians with multiple procedures, habits and experience, create extremely heterogeneous systems in terms of configurations and performance that are not easily comparable with each other. **Local supervisors connected to the RED optimise portal can centralise the information, irrespective of the technology or protocol, and then process the necessary data so that these are readily available and easily usable, to identify possible problems** or declines in performance and then promptly restore optimal conditions.



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DRIVEN BY THE FUTURE

Sustainability in action

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# Our speeches @ Chillventa Specialist Forum 2022

| Time | Title | Language | When | Where | Session Number |
|---|---|---|---|---|---|
| 11:20<br>11:40 | CAREL iJW: your refrigeration controller, for new installations and on-field replacement | ENG | Tuesday 11/10/2022 | Hall 7A-616, Ref. | #024 |
| 11:40<br>12:00 | Benefits of a hygienic, efficient and smart solution for ventilation systems in the era of the "New Normal" | ENG | Tuesday 11/10/2022 | Hall 4A-401, AC WP V | #044 |
| 12:20<br>12:40 | The evolution of refrigeration controlling solutions for scientific and medical applications | ENG | Tuesday 11/10/2022 | Hall 9-550, Appl. Educ. Reg. | #008 |
| 10:00<br>10:20 | An innovative $CO_2$ system goes offshore: fully modulating racks for ships and boats | ENG | Wednsday 12/10/2022 | Hall 7A-616, Ref. | #077 |
| 15:40<br>16:00 | New uRack, the latest controller for compact compressor racks, ready for the digital era | ENG | Wednsday 12/10/2022 | Hall 7A-616, Ref. | #093 |
| 10:20<br>10:40 | Heosbox $CO_2$: high efficiency solution, alternative to propane, for self-contained units | ENG | Thursday 13/10/2022 | Hall 7A-616, Ref. | #130 |

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