Hall 4A

Chillventa Specialist Forums 2022
Chillventa Fachforen 2022

CONNECTING EXPERTS.

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CAREL

Benefits of a hygienic, efficient and smart solution for ventilation systems in the era of the “New Normal”

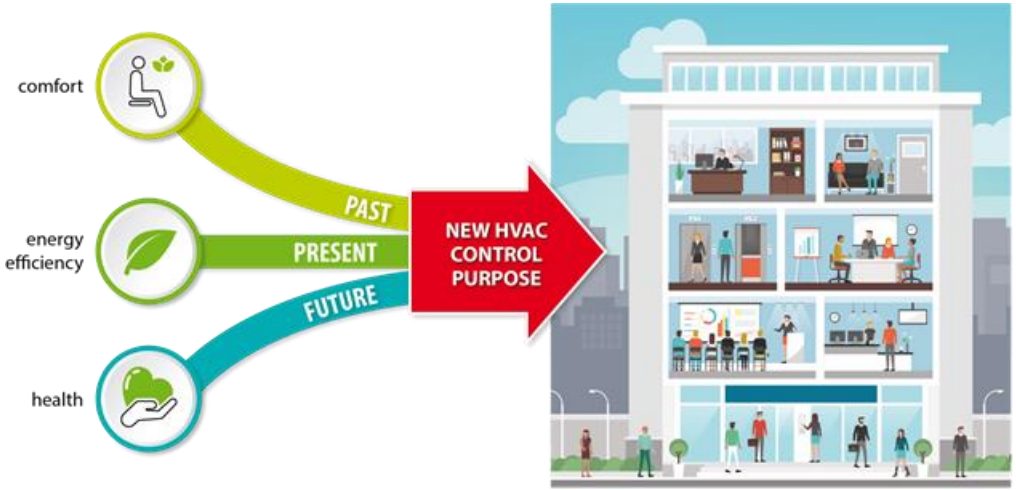
DRIVEN BY THE FUTURE

Sustainability in action

Andrea Pagan

Background and target

Ventilation has a fundamental role in ensuring health and wellbeing through the right **Indoor Air Quality**.



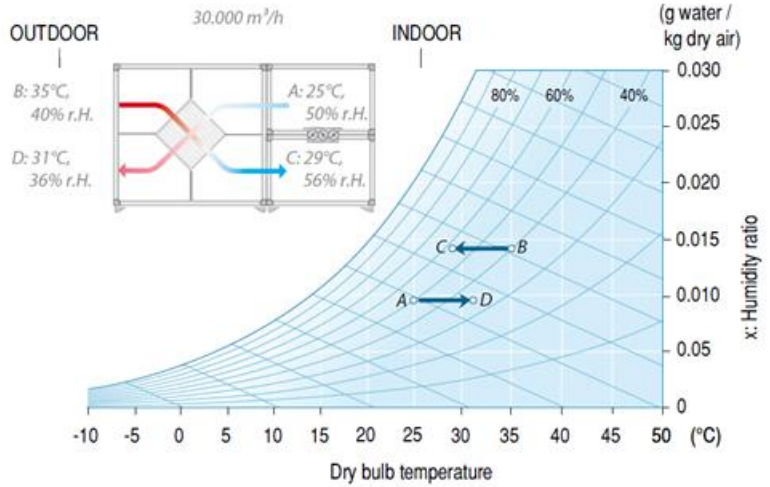
Can we found the right balance between Health and Efficiency?

A study to compare among different operating scenarios in order to explore benefits of new design criteria for a solution able to combine both health and energy efficiency.

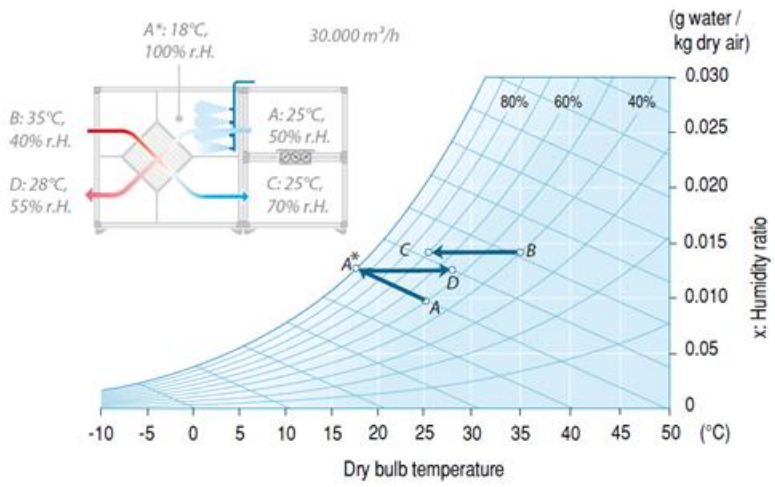
Ventilation and energy consumption

The **increase** amount of **fresh air** requires **energy consumption**.

Norms for non-residential ventilation units promote **energy efficiency**.



ErP 1253/2014 : Non-residential ventilation units (> 250 m³/h) mandatory requires heat-recovery systems with thermal efficiency > 73%

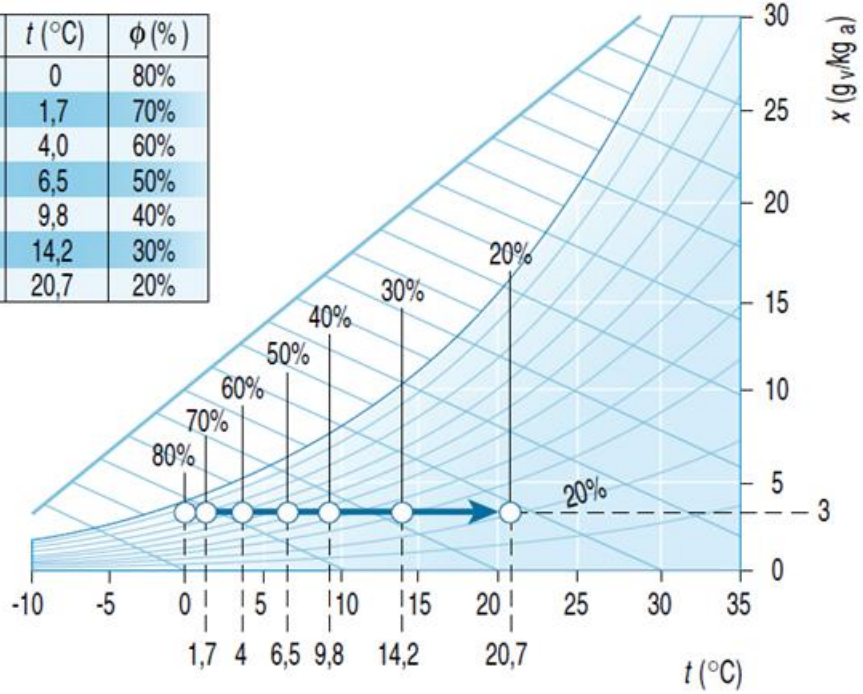


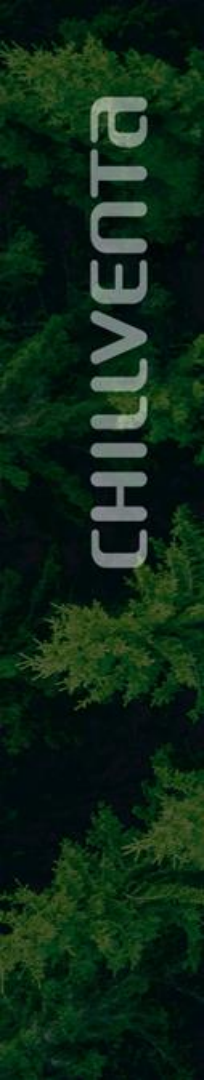
EN3803:2000, sect. 5.3.2, : "it is recommended to use indirect evaporative cooling (DIN EN 13053) in addition to heat recovery on the extract side."

Ventilation and humidity level

The **increase** of **fresh air** can affect **humidity levels** inside the rooms.

x (g_v/kg_a)	t (°C)	ϕ (%)
3	0	80%
3	1,7	70%
3	4,0	60%
3	6,5	50%
3	9,8	40%
3	14,2	30%
3	20,7	20%





Hygiene as a priority

Minimum target is that supply **air quality** has **not to be deteriorated** by the air-handling system.

VDI 6022-1 "Hygiene requirements for ventilation and air conditioning systems and units" is the most important reference for design , execution, operation and maintenance.

Heat recovery

Tightness and differential pressure resistance (EN 13779, Annex A.4), smooth surfaces and corrosion-resistant materials, easy cleanability

Humidification

Corrosion resistant materials (Stainless steel AISI 304 or aluminum alloy), automatic draining and washing cycles after each evaporation cycles, no use of recirculated water

Control and operation

limit sensors to control rH is not exceeding 90 %,automatic shutdown of humidification in case of AHU failure, forced ventilation to avoid wet areas downstream of humidifiers or coolers in case of stop for any reasons"

…and then comes pandemic

Guidelines basically recommends common operating conditions :

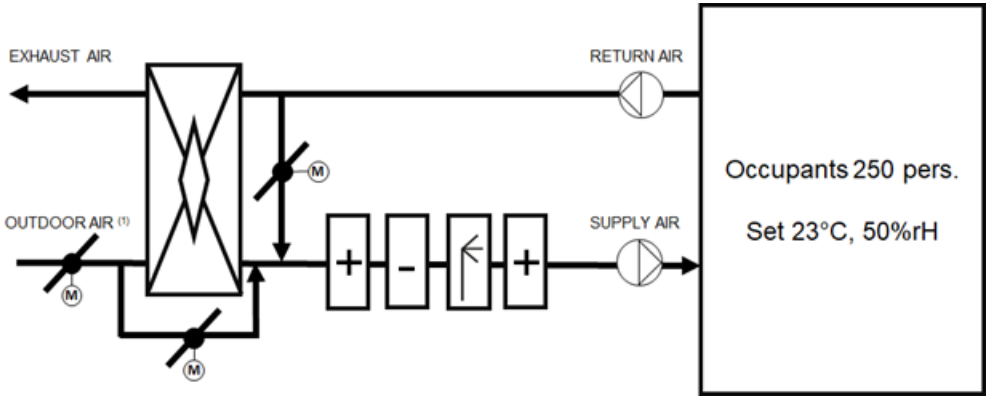
- Ensure ventilation with outside air as much as possible (100% OA , 24/7)
- Safe use of heat recovery systems
- Guarantee minimum humidity level

Required actions are very **demanding** in term of **energy consumptions** and cannot be considered **sustainable for the long term**.

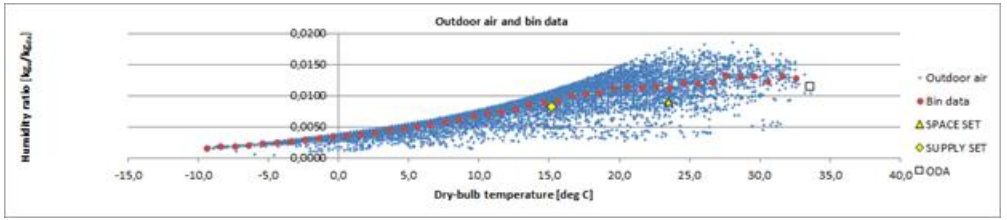
Simulation scenarios

Three different scenarios :

- Pre-pandemic
- Pandemic
- Post-pandemic (“New Normal”)

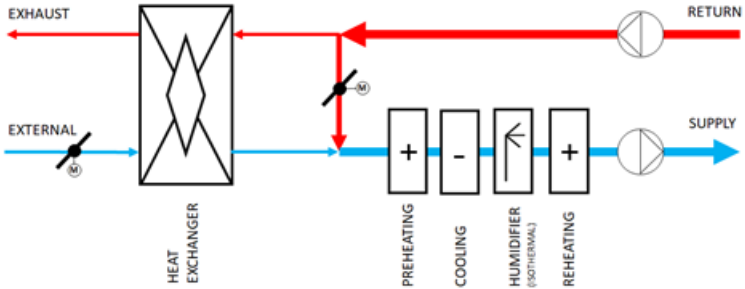


The algorithm modulates all devices (fans, exchanger by-pass,% of external air in mixing, coils, humidifiers) in order to minimize running costs and primary energy usage.

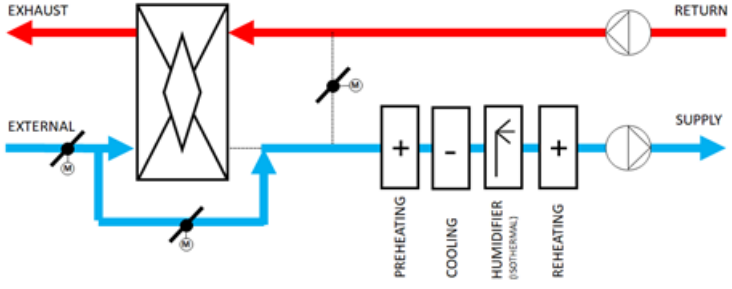


(1) *Climatic conditions for Milan and bin data rapresentation*

Scenario pre-pandemic VS pandemic



- Airflow Q= 31,600 m3/h
- **Heat recovery ζ= 73% sensitive, by-pass on/off**
- Isothermal humidification from electrical source
- **Percentage of Outside Air = 20%**
- Percentage of Recirculated Air = 80%
- Constant airflow management (CAV)
- **Operation 12 hours/day**

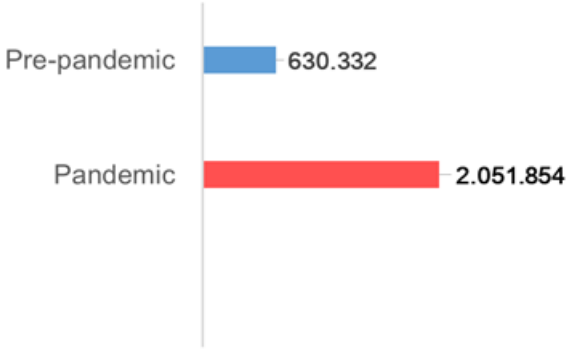


- Airflow Q= 31,600 m3/h
- **Heat recovery by-passed**

- Isothermal humidification from electric source
- **Percentage of Outside Air = 100%**
- Percentage of Recirculated Air = 0%
- Constant airflow management (CAV)
- **Operation 24 hours/day**

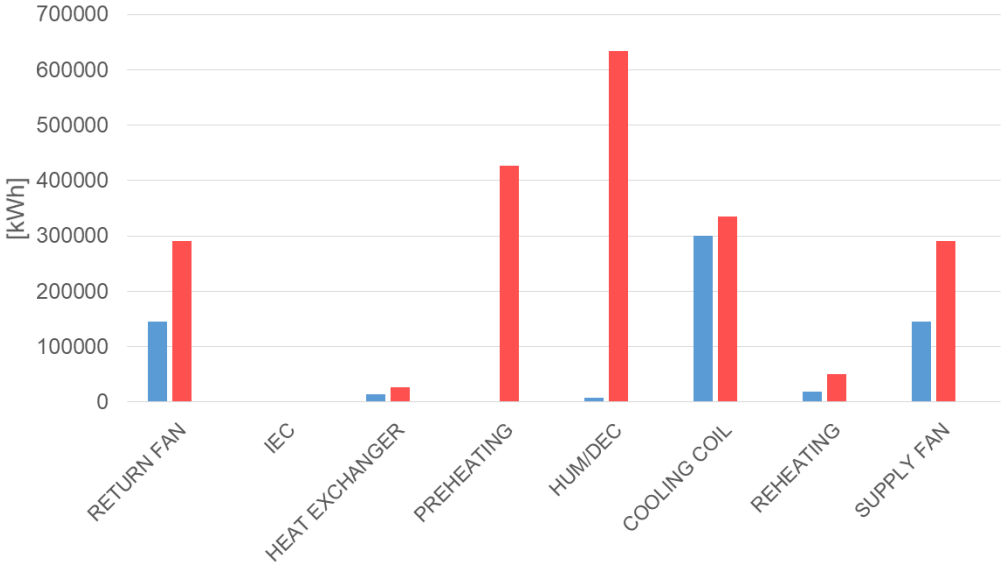
Results pre-pandemic VS pandemic

Total primary energy contributions [kWh]



Results based on climatic data of Milan

Device contributions [kWh]



Variation = +1.421.522 kWh/yr **(+226%)**

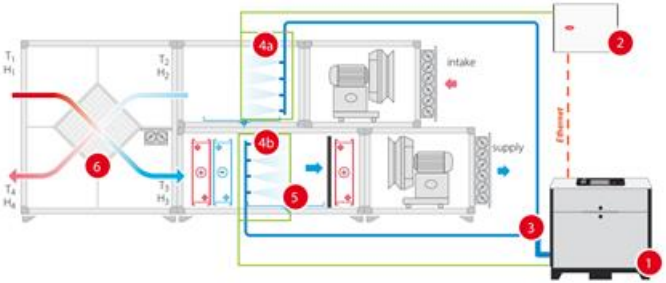
Description of “new normal” solution

RECUPERATOR
THE HEAT EXCHANGER

Plate heat exchanger B-BLUE

- **Near-zero** leakage
- Hygienic and corrosion resistant characteristics **certified** by **VDI 6022-1**
- Fins with a hydrophilic absorbent coating to support wetting during **IEC**

Description of “new normal” solution



High pressure water atomizer

- **IEC** and **DEC** with single pumping station
- Continuous capacity **modulation**
- **Low** energy consumption **(4 W/l** only**)**
- Hygienic certification **VDI 6022-1**

Description of “new normal” solution

µAria

Solution for ventilation system control

- smart control logics of all unit devices to achieve maximum **Indoor Air Quality**
- Operating sequence of devices according to **minimum energy consumption** in every condition
- **Control** programme in accordance with **VDI 6022-1**

K.air

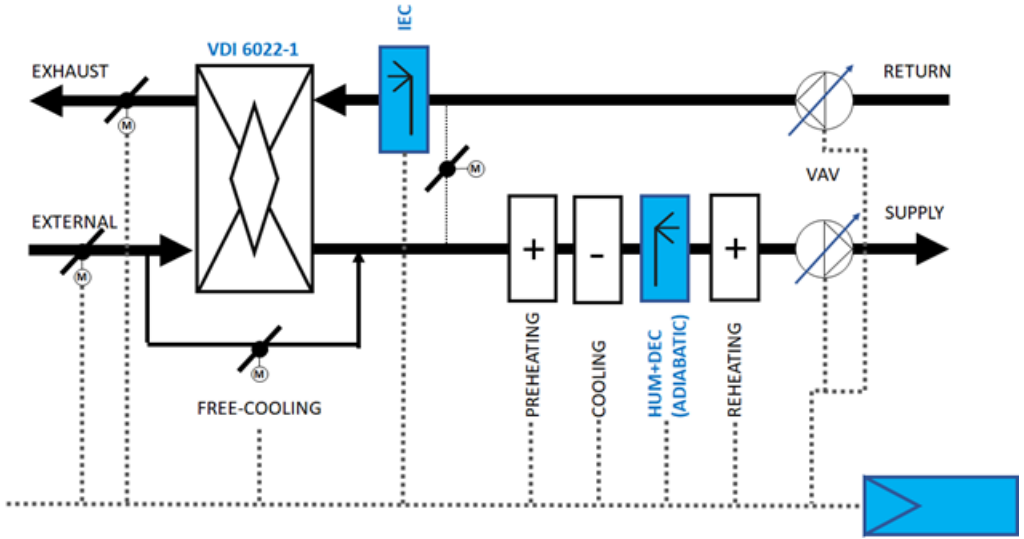
Description of “new normal” solution

RED optimise

Unit control and monitoring

- **Remote control** for “crisis” management
- **Acquiring information** about room conditions and system operation
- **Assessing performance** deterioration compared to design condition

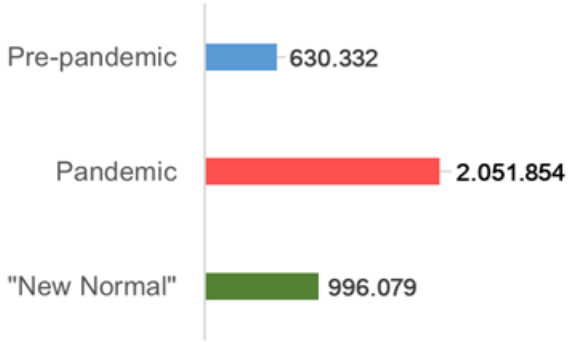
Post-pandemic -“new normal” scenario



- Airflow Q= 31,600 m3/h
- Heat recovery ζ= 73% sensitive, by-pass on/off
- **Adiabatic Humidification**
- Outside Air Percentage = **100%**
- **Indirect evaporative cooling** with recovery unit dampening
- Recirculated Air percentage= 0%
- Variable airflow management **(VAV)**
- Operation 24 hours/day

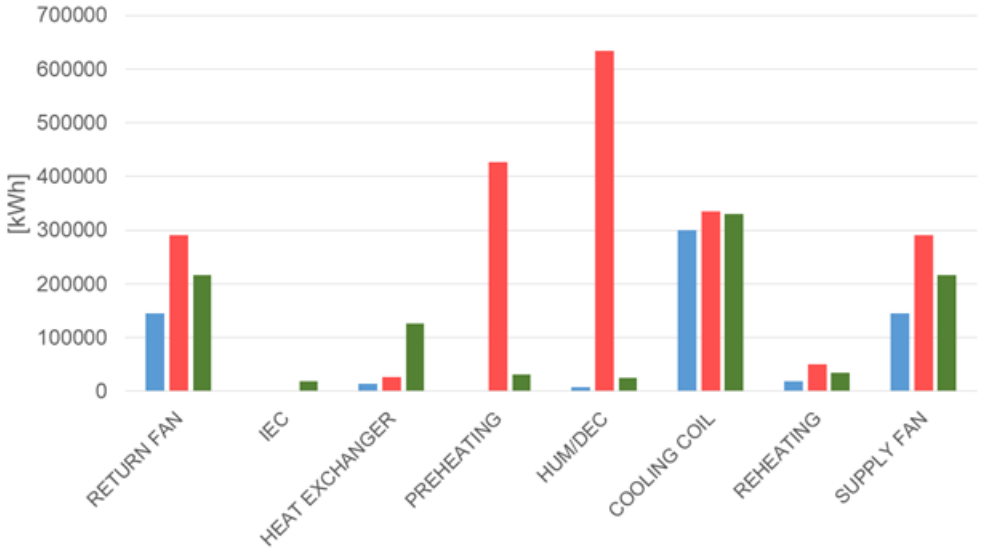
Post-pandemic -“new normal” scenario

Total primary energy contributions [kWh]



Results based on climatic data of Milan

Device contributions [kWh]

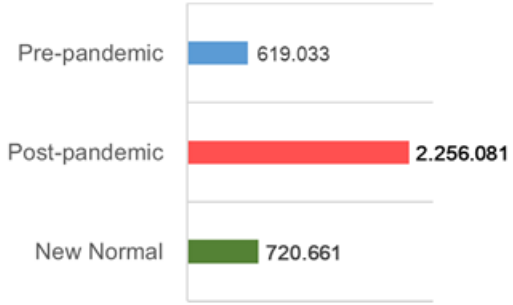


Variation (Pandemic - New normal) = - 1.055.775 kWh/yr **(-52%)**

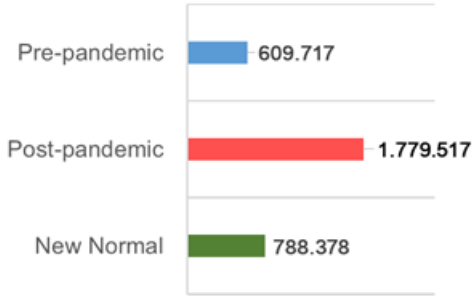
Comparison between different climatic conditions

Total Primary Energy Contributions [kWh]

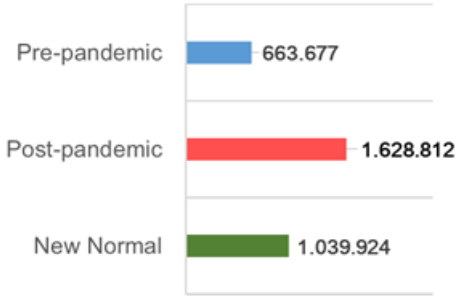
Berlin



Madrid



Athens



Variation (Post Pandemic-New normal)	- 1.535.420 kWh/yr **(-68%)**	
Variation (Post Pandemic-New normal)	- 991.139 kWh/yr **(-56%)**	
Variation (Post Pandemic-New normal)	- 588.888 kWh/yr **(-36%)**	

Conclusion

Ventilation is an essential strategy to ensure adequate **IAQ** for **health, wellbeing and safety** in confined spaces.

More stringent health requirements **increase the energy consumption**.
Condition not sustainable for long terms

New design approach : advanced technologies for **heat recovery, indirect evaporative cooling, humidification** and, more generally, the **control** and **supervision** of the air handling unit in line with the most advanced hygienic standards, can be a solution to bring primary energy consumption back to an "**sustainable" situation**, while still meeting stringent safety requirements.

Carel is an **innovative** and **reliable** partner to make **better** air handling unit.

Technology and expertise for **health** and **energy efficiency**.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