

# MENERGA ADCONAIR

One heat recovery system,  
various solutions



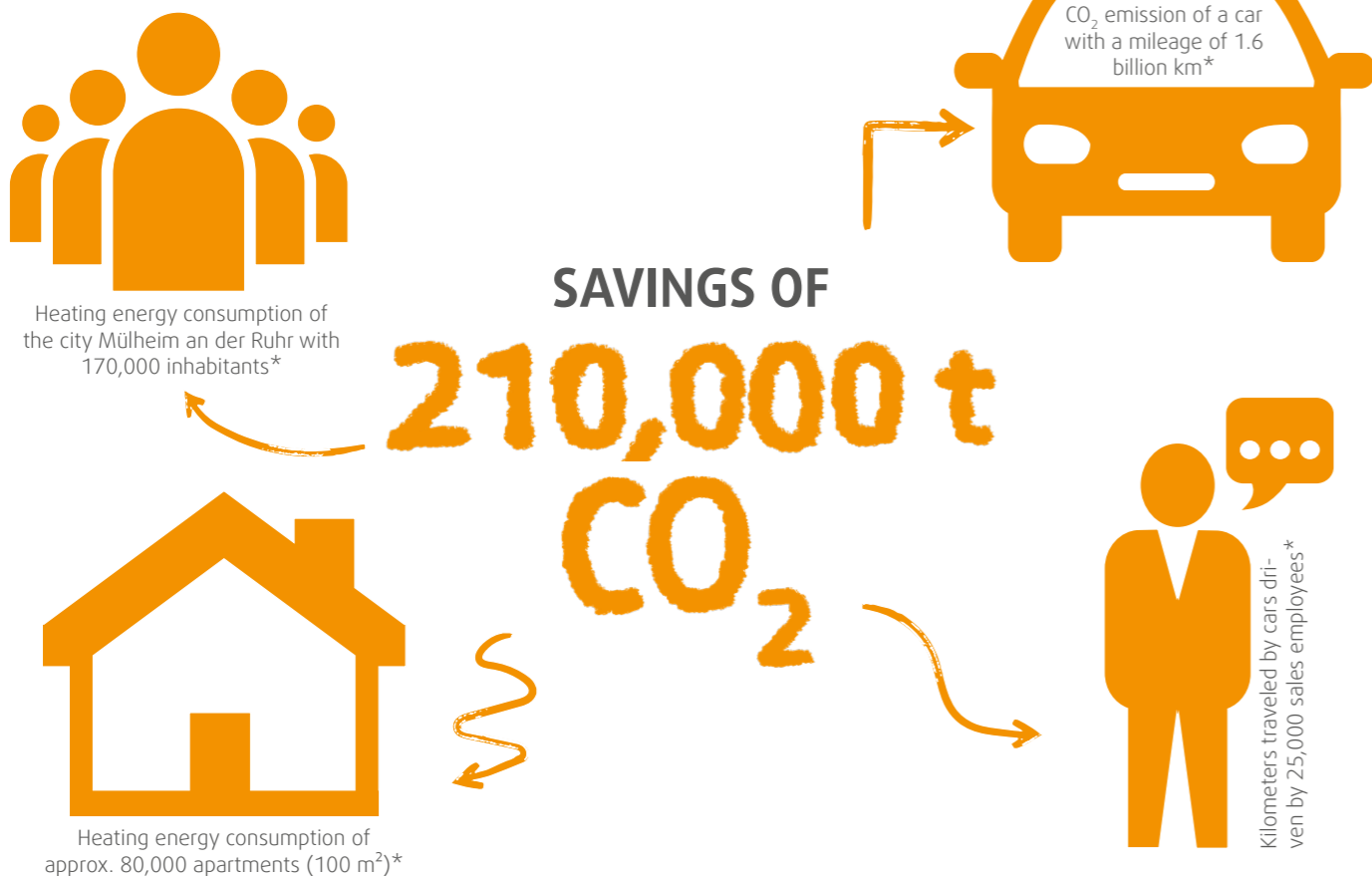
## MINIMAL ENERGY APPLICATION – MENERGA

Menerga has developed and produced innovative ventilation and air conditioning systems for extensive fields of application since 1980. We can safely claim that our technology is the leader throughout these areas, and that we set the benchmark for efficiency and effectiveness. Our philosophy – “Creating a good indoor climate – through **Minimal ENERGY Application**” – is our guideline, in which we have succeeded every single day since the company was founded. We are proud that Menerga from its very beginning was one of the first companies to focus on energy efficiency.

### POSSIBLE APPLICATION AREAS



### OUR CONTRIBUTION



\*Average savings by Menerga solutions in the period 2011 until 2016.



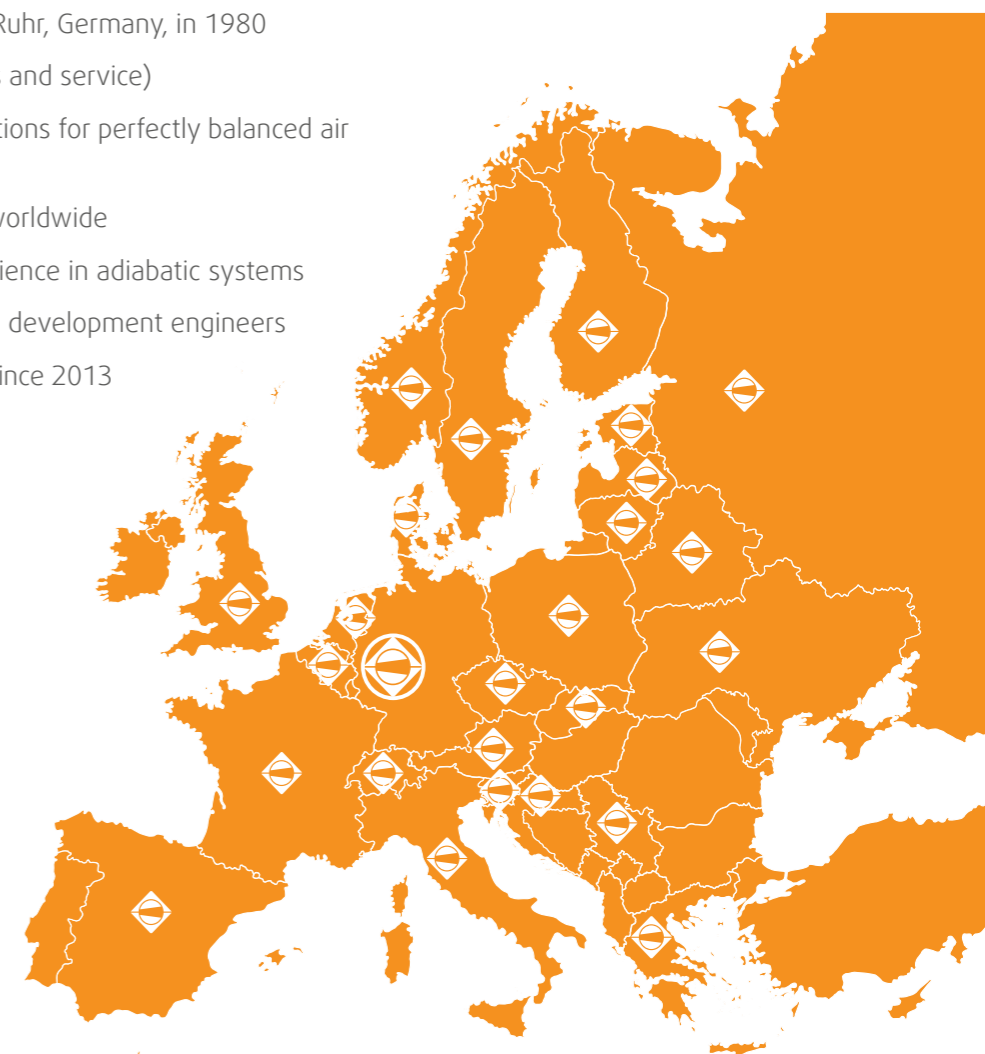
## THE MENERGA APP

This brochure contains an Augmented Reality element. Download our „ARdiabatic by Menerga“ app from the Apple or the Google Play Store, scan the QR code and experience digital and interactive elements. Simply move your tablet or smartphone over the heat exchanger with the QR code below.



## EUROPE-WIDE SALES AND SERVICE NETWORK

- Founded in Mülheim an der Ruhr, Germany, in 1980
- Europe-wide presence (sales and service)
- Customized air handling solutions for perfectly balanced air conditioning
- Over 40,000 installed units worldwide
- More than 25 years of experience in adiabatic systems
- Groupwide > 230 research & development engineers
- Part of the Systemair Group since 2013



## FULL COUNTERFLOW HEAT RECOVERY

Adconair heat recovery technology sets highest standards with its counterflow plate heat exchanger. The true counterflow section of the heat exchanger exceeds 80 % of its length, higher than any other, and at only 115 Pa pressure drop. At the same time, its performance places it in top energy efficiency classes and assures compliance with the second step of the Ecodesign Directive 1253/2014 without any difficulties. Menerga solutions with Adconair heat recovery are highly versatile and can be used in a great number and variety of applications. Thanks to its unique design, it is currently one of the best plate heat exchangers available on the market. In addition, the polypropylene material used allows pure water to be used without the addition of additives, such as cleaning or wetting agents, and therefore does not pollute the sewerage.

### THE ADCONAIR HEAT RECOVERY SYSTEM IS AVAILABLE IN VARIOUS MODELS:

- Adiabatic - integrated evaporative cooling
- Adiabatic<sup>zeroGWP</sup> - hybrid evaporative cooling
- Electrically driven AdiabaticDX<sup>carbonfree</sup> - with a turbo compressor which uses R718 as refrigerant
- Thermally driven AdiabaticDX<sup>carbonfree</sup> - integrated adsorption process on the basis of R718

### AVAILABLE WITH AIR VOLUME FLOWS UP TO 50,000 m<sup>3</sup>/h

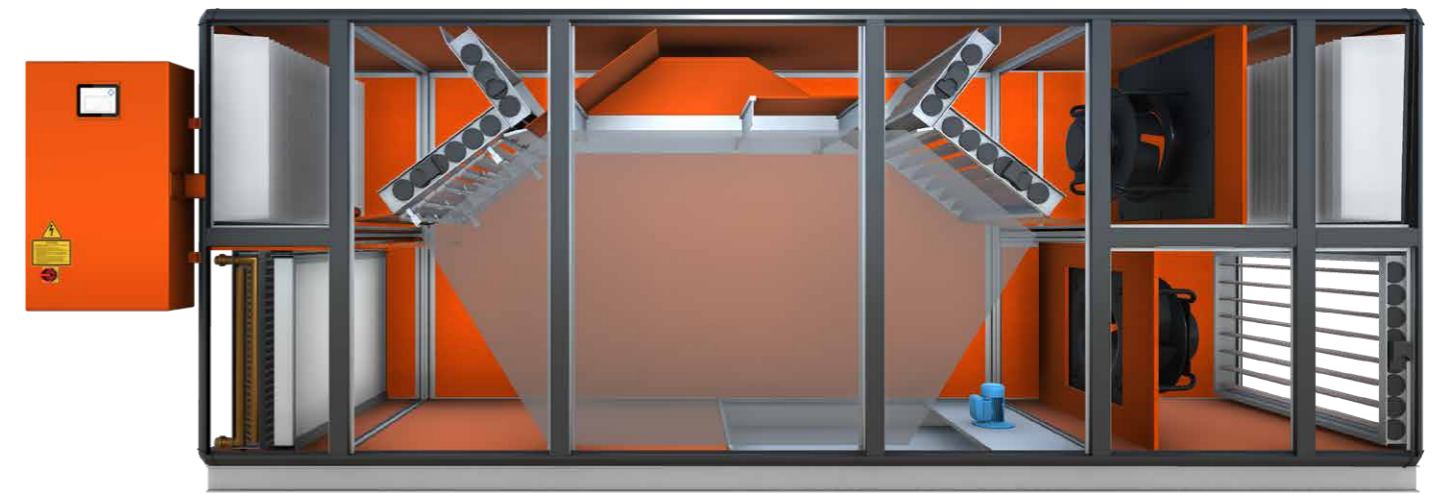
All variants at a glance	Supply air temperature	Outdoor air dehumidification	Extract of sensitive loads (heat)	Extract of latent loads (humidity)
Adiabatic	20 °C	-	+	+
Adiabatic <sup>zeroGWP</sup>	18 °C	-	++	++
AdiabaticDX <sup>carbonfree</sup>	< 18 °C	up to 4 g/kg	+++	+++

### HEAT RECOVERY

- Maximum efficiency with minimal air-side pressure drop thanks to optimized recuperator design
- Use of polypropylene, which is microbiologically harmless and non-corroding with highest durability towards solvents, grease, alkaline solutions and inorganic acids
- Extremely long-lasting thanks to use of nonaging, robust and flame resistant material
- Pressure stability for pressure differences up to 10,000 Pa between the two air flows
- Independently validated performance data of the heat exchanger measured in actual installation situation and in accordance with EN308
- 60 % better CO<sub>2</sub>-balance than in the production of aluminum systems
- Can be used in almost all areas, from industry with polluted exhaust air to hospital applications
- In-house production of all heat-exchange systems made in Germany
- Over 25 years of experience in producing heat recovery systems made of polypropylene
- The versatile recuperator design allows for 4 air entry positions with 2 exits

### CONTROLS

- Individual proportional servo control of the motor-driven dampers
- Monitoring of the availability and efficiency of the system
- Individual control of heat recovery system
- Remote maintenance via 256-bit encrypted cloud, with Menerga vicomo
- Integrated data logger with trend display, directly at the device or via cloud
- Fully variable control of the integrated cooling system
- Individual customization of the control concept
- C-Bus system, with interference-immune shielding that is not dependent on cabling length
- Demand-driven defrost function



## Adconair Adiabatic



### OPERATIONAL MODE - SUMMER



### COOLING SYSTEM

- Adiabatic cooling efficiency  $\Phi_{Adi} > 90 \%$
- No additional air-side pressure drop resulting from components installed in the air path, e.g. humidifiers
- Minimal water consumption of 2.2 l/person & day during summertime
- Low water consumption with circulating water system
- Reduction of the required DX cooling duty by up to 70%
- Minimal power consumption during operation
- No surface treatment of the recuperator required
- Resistance to corrosion
- Hygienically harmless due to use of reverse osmosis system

### DX COOLING (OPTIONAL)

- Performance increase of the integrated DX cooling system by up to 10 % by means of refrigerant sub-coolers
- Low refrigerant amount and minimal air-side pressure drop due to microchannel condensers
- EER values of up to 12 possible by combining the adiabatic cooling system and DX cooling\*
- Low mains power consumption
- High precision power control
- Various performance levels for optimally balanced systems
- Reversible design possible with heating function during wintertime for year-round usage of the installed components

\*dependent on sizes/air volumes



## ZERO GWP DUE TO HYBRID SUPPLY AIR COOLING

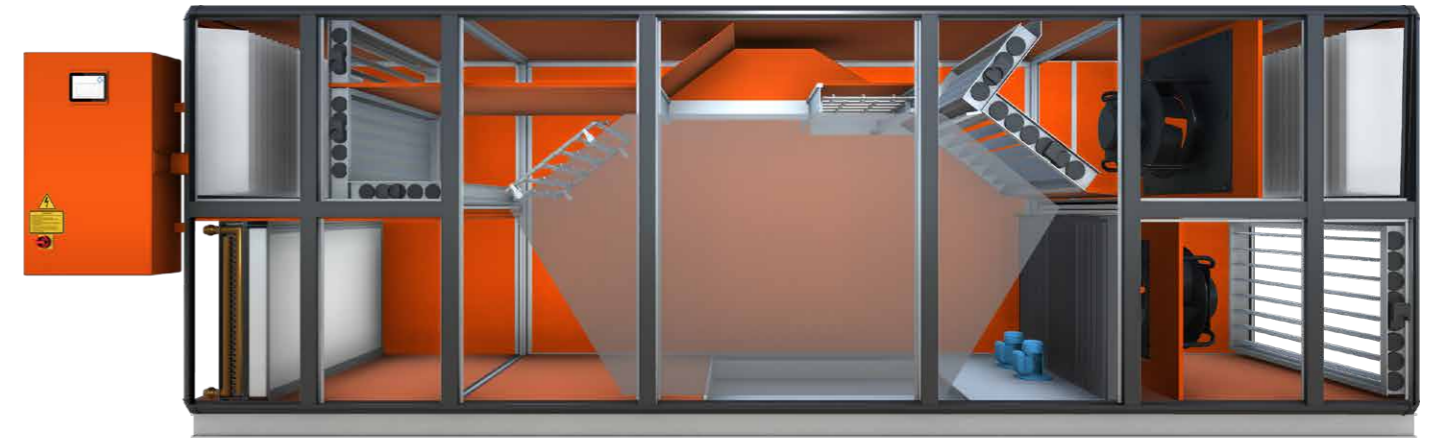
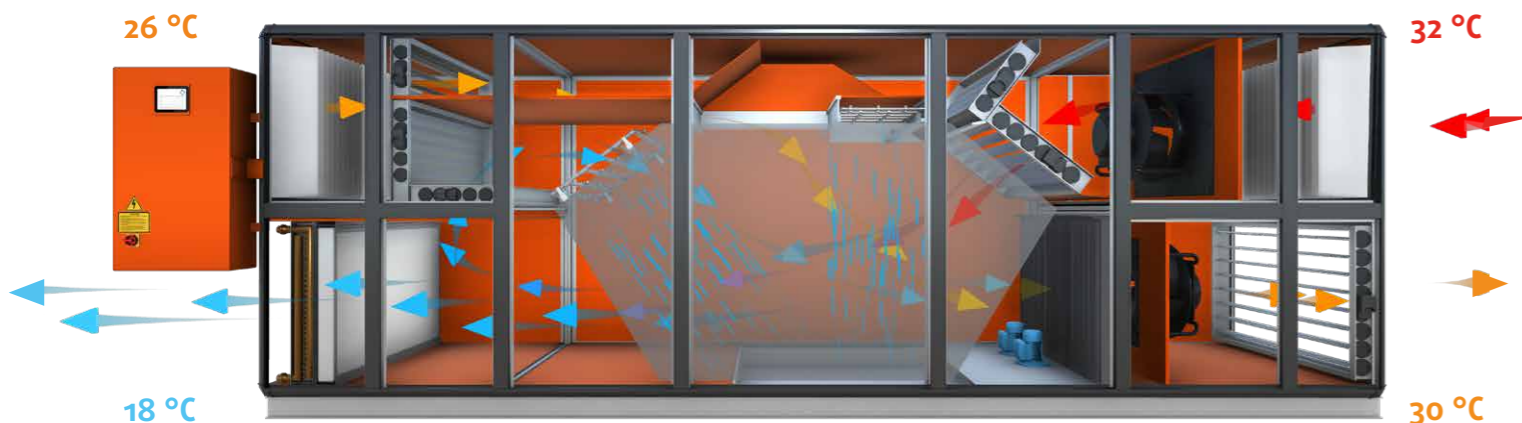
Menerga proves that it is possible to provide sufficient cooling without compression refrigeration systems that use FC: as proven by the new climate-neutral cooling technology offered by Adconair Adiabatic<sup>zeroGWP</sup>. This system cools warm outside air down to 18 °C using a hybrid evaporative cooling system, in a very effective and efficient manner. By combining the technologies of indirect adiabatic evaporative cooling with dewpoint cooling inside the proven Adconair heat recovery system, it is also possible to discharge high thermal loads from the rooms and to ensure constant low supply air temperatures. And all that without using any form of refrigerants. With a supply air temperature of 18 °C, this solution delivers 30 % more sensible cooling capacity than a standard adiabatic system. Just a minimal amount of 4.7 l/person and day of water or rainwater is sufficient to create a pleasant indoor climate during summer.

### FUNCTIONAL PRINCIPLE

Within the first-half of the heat exchanger, indirect, adiabatic evaporation cooling takes place, as familiar from Adconair Adiabatic systems. Outside air is therefore already extensively cooled down. In the second-half of the heat exchanger, so-called dew point cooling takes place. For this purpose, part of the already pre-cooled outdoor air is withdrawn after its exit from the heat exchanger as process air flow. Then it is directed back to the heat exchanger in accordance with the counterflow principle and again humidified. In this way, indirect evaporative cooling takes place again. Unlike conventional systems, the lowest possible temperature is no longer dependent on the wet-bulb temperature of the extracted air, but rather on the dew-point temperature of the pre-cooled outside air. The process air flow is up to 50 % of the nominal flow and is controlled continuously such that a constant supply air temperature is maintained. This has to be taken into account during the planning phase.



### OPERATIONAL MODE - SUMMER



## Adconair Adiabatic<sup>zeroGWP</sup>



### COOLING SYSTEM

- Adiabatic cooling efficiency > 115 % (based on the wet-bulb temperature of the extracted air)
- Low water consumption of 3.6 l/kWh
- Operation with rain water possible
- Minimal power consumption with a SEER of 36
- No surface treatment of the recuperator required
- Resistance to corrosion
- Great output, even with particularly high internal thermal loads
- Cooling of outdoor air by up to 20 K possible
- No need for a conventional refrigeration system
- Rising humidity of the extracted air does not result in notable power reduction

### AWARDED CONCEPT



In 2018, Menerga was awarded first place in the sixth edition of the German Refrigeration Prize in the award category "Energy-Efficient Cooling and Air-Handling Systems with Indirect Cooling" with the climate-neutral cooling technology Adconair Adiabatic<sup>zeroGWP</sup>.

The German Refrigeration Prize annually awards companies and people who develop and apply especially low-emission solutions in both refrigeration and HVAC technologies.

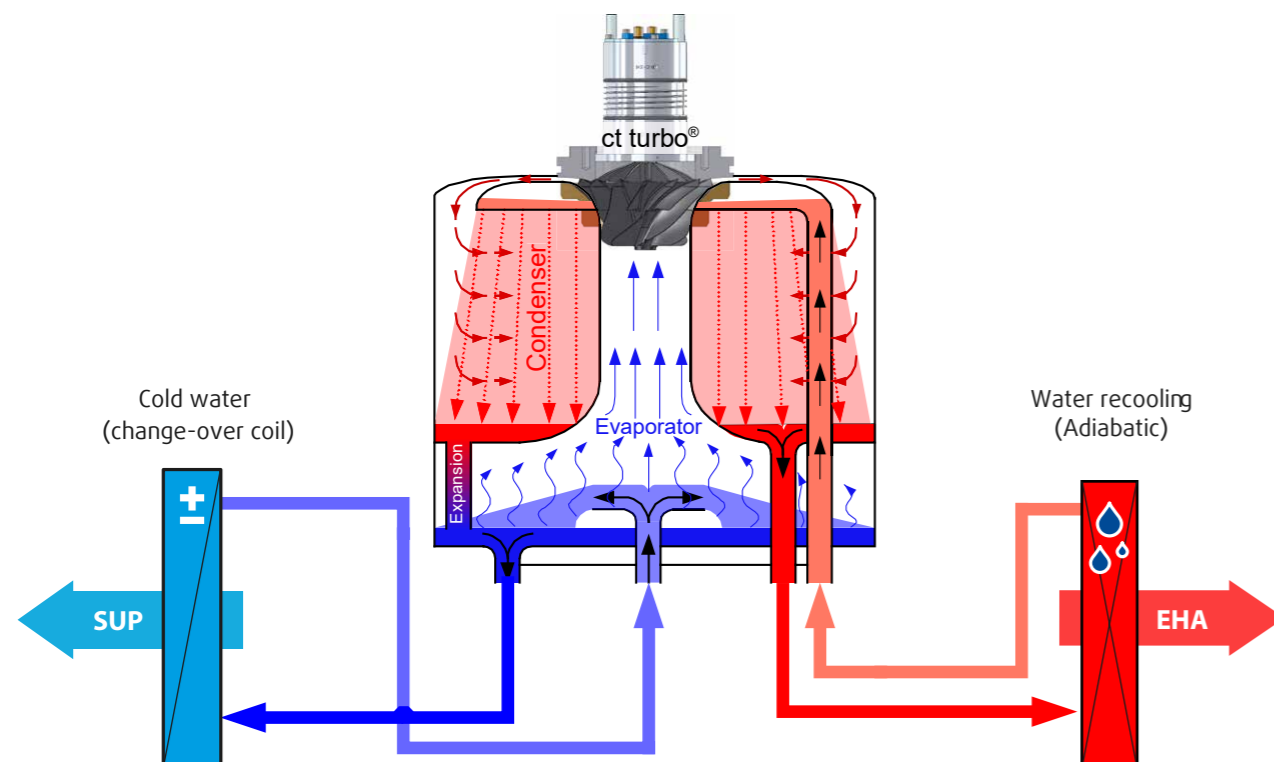
# WATER, THE MOST NATURAL REFRIGERANT

As a further extremely efficient alternative to the natural cooling processes, Menerga has developed the electrically driven AdiabaticDX<sup>carbonfree</sup> cooling technology. Together with a partner, we have developed a concept that can ideally be combined with our proven Adconair heat recovery system. This electrically driven variant is based on a turbo compressor with the refrigerant R718 (water). Compared to conventional refrigerants, water has ten times the evaporation energy and is therefore an extremely effective and natural refrigerant. No certified refrigeration engineers are required for the maintenance of the refrigeration system, and, last but not least, only very low pressures are required compared to over 70 bar for conventional CO<sub>2</sub> refrigeration systems. The indirect adiabatic evaporative cooling integrated in the air handling unit also ensures a greatly improved EER value. This means you are on the safest side possible with regard to the F-Gas regulation with the refrigerant used. Just like the system with the adsorption technology, this variant also makes use of the existing heat exchanger in the supply air. Thus, no unnecessary pressure loss on the air side is generated here either. This electrically driven solution is an ideal partner for a system with photovoltaic electric panels for environmentally friendly power. Equally but in contrast the thermally driven carbon-free unit would work with heat generated by thermal solar panels.

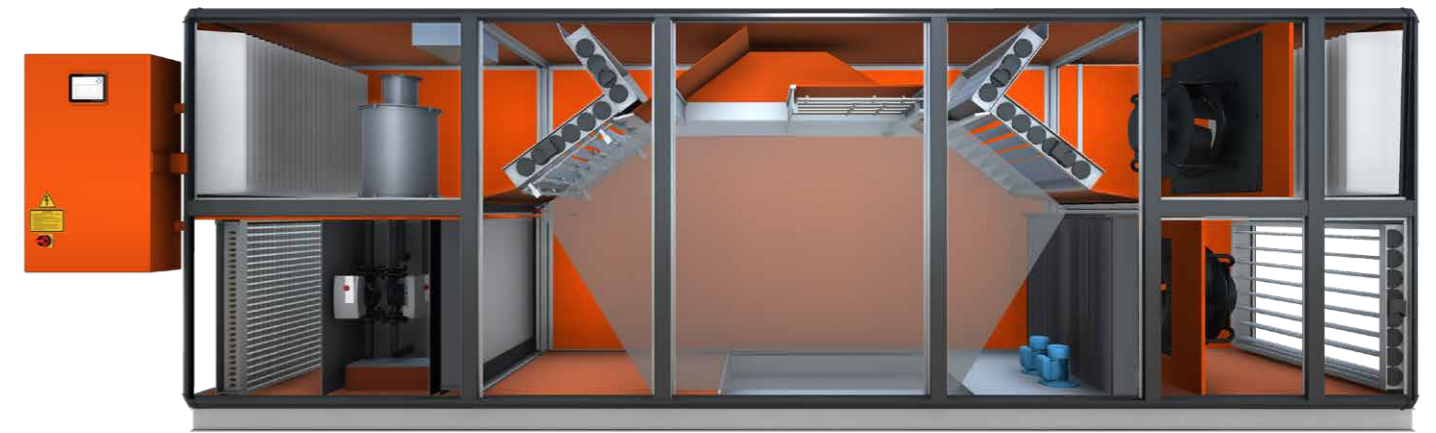
## FUNCTIONAL PRINCIPLE

The key components of this system are the turbo compressor and an integrated hydraulic module. The system makes it possible to use the natural refrigerant R718 (water), which evaporates and condenses at low pressures, similar to the principle of conventional DX cooling. This makes it possible to reliably achieve supply air temperatures of as low as 12 °C. The re-cooling of the system also takes directly within the air handling unit itself, so that no external peripherals are required.

## DESIGN AND FUNCTION OF THE TURBO COMPRESSOR



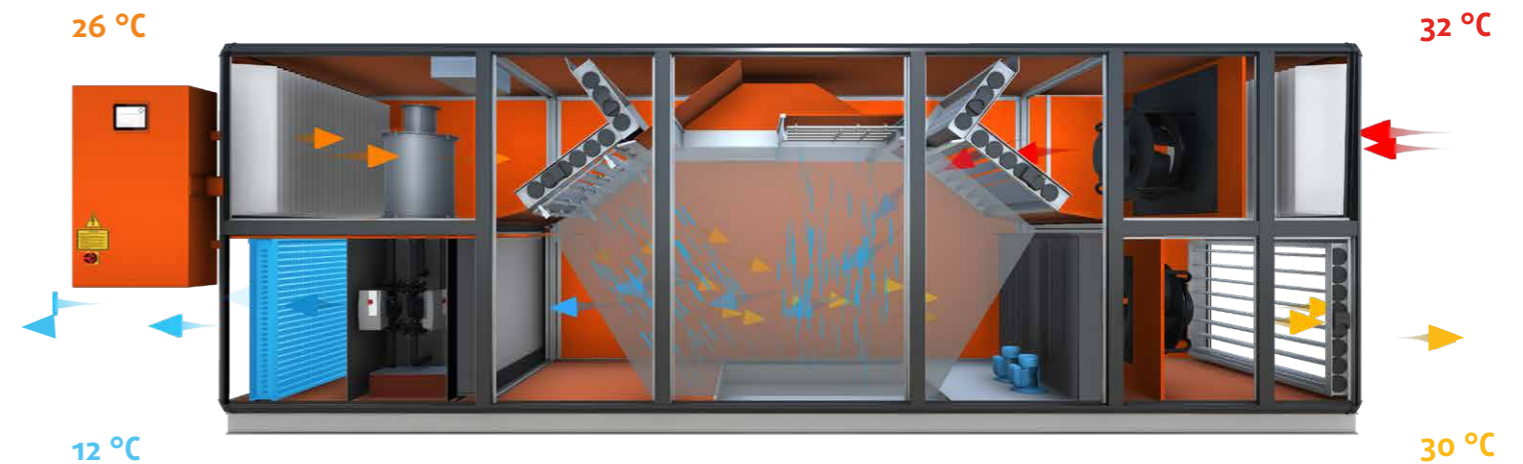
Picture: Efficient Energy GmbH



## Adconair AdiabaticDX<sup>carbonfree</sup> - electrically driven



### OPERATIONAL MODE - SUMMER



### FC-FREE SUPPLY AIR COOLING

- FC-free, due to the use of water (R718) as refrigerant with GWP = 0
- Output-regulated turbo compressor
- EER > 11 (total EER, includes indirect evaporative cooling)
- Re-cooling directly within the unit, i.e. no external re-cooling system
- Completely encapsulated hydraulics in the supply air
- Usage of the combined heating and cooling coil in the supply air for cooling in summer and heating in winter
- System is neither subject to the F-Gas Regulation nor to the pressure equipment directive
- Operation with rain water possible

### COOLING SYSTEM

- Adiabatic cooling efficiency  $\Phi_{Adi} > 90 \%$
- No additional air-side pressure drop resulting from components installed in the air path, e.g. humidifiers
- Low water consumption due to circulating water system
- Reduction of the required DX cooling duty by up to 70 %
- Minimal power consumption during operation
- No surface treatment of the recuperator required
- Resistance to corrosion



## WASTE HEAT USED REASONABLY

In addition to the electrically driven version of the AdiabaticDX<sup>carbonfree</sup>, Menerga have worked with a partner to develop a thermally driven cooling technology in order to avoid high energy consumption during the summer cooling season. The term „carbonfree“ describes the adiabatic evaporative cooling, which is supported by a refrigeration system operated with an F-Gas-free refrigerant. The cooling supply is provided by a closed adsorption cooling circuit integrated into the HVAC unit – which supplies the heating coil, used for supply air heating in winter, with cold water for cooling. In contrast to a compression refrigeration system, no electric power is needed for this operation, since heat starting at a temperature of 55 °C is employed, e.g. from solar heat, district heating or waste heat from combined heat and power plants. Even in midsummer, the integrated re-cooling by the adsorption refrigeration unit guarantees extremely low re-cooling temperatures and therefore allows high cooling energy efficiency ratios (EER). Furthermore the deployed refrigerant water (R718), which is integrated into the adsorption refrigeration unit has a Global Warming Potential (GWP) of zero. Unlike other natural refrigerants, it is neither flammable nor toxic.

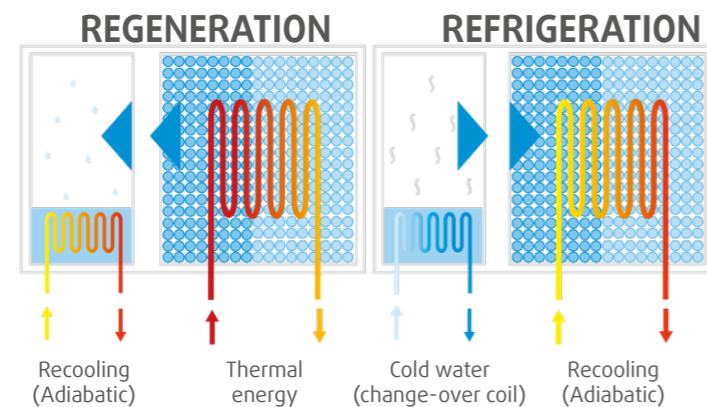
### FUNCTIONAL PRINCIPLE

The key components of this system consist of two modules, which are equipped with silica gel as an adsorption material. The physical process of adsorption produces cold water, which is used in a change-over coil to cool and dehumidify the supply air. The flow temperatures from the refrigeration circuit are low enough to cool the outside air from 32 down to around 16 °C, in combination with indirect, adiabatic evaporative cooling. While one module generates the cold water by this process, the second module is regenerated during the same process. For this purpose, hot water (from 55 °C) is applied, which leads to desorption of the saturated silica gel. The desorption is at least as fast as the adsorption, so that enough cooling energy is always available.

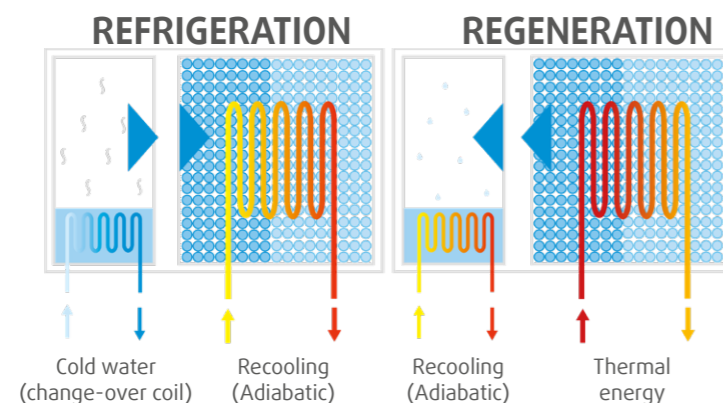
The following drawing demonstrates this process:

### DESIGN AND FUNCTION OF THE ADSORPTION PROCESS

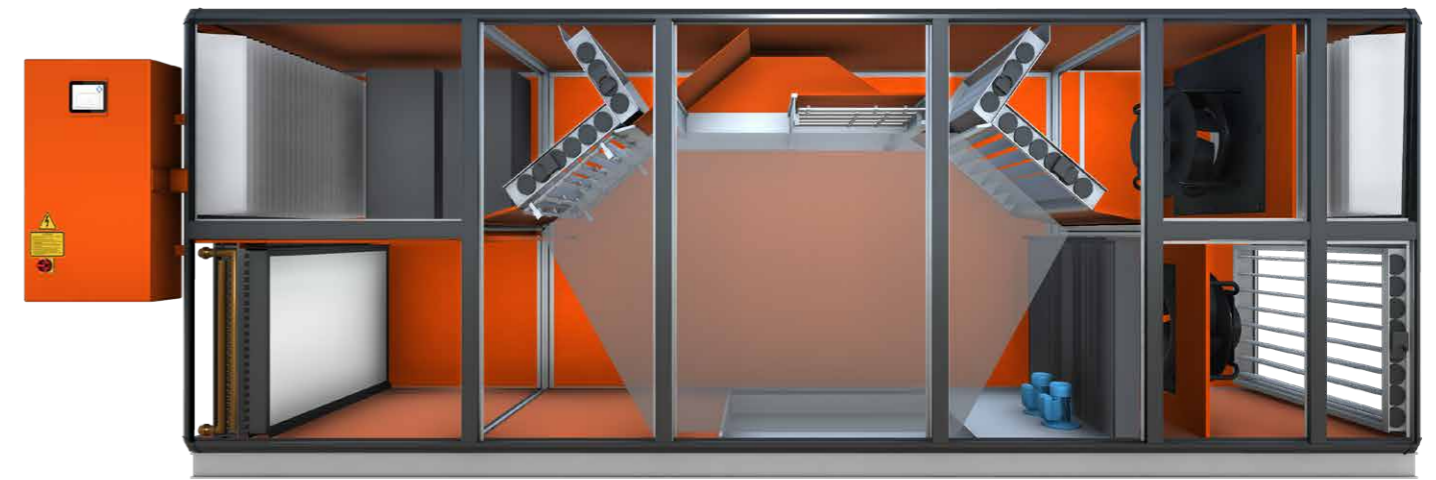
#### PHASE A



#### PHASE B



Picture: FAHRENHEIT GmbH



## Adconair AdiabaticDX<sup>carbonfree</sup> - thermally driven



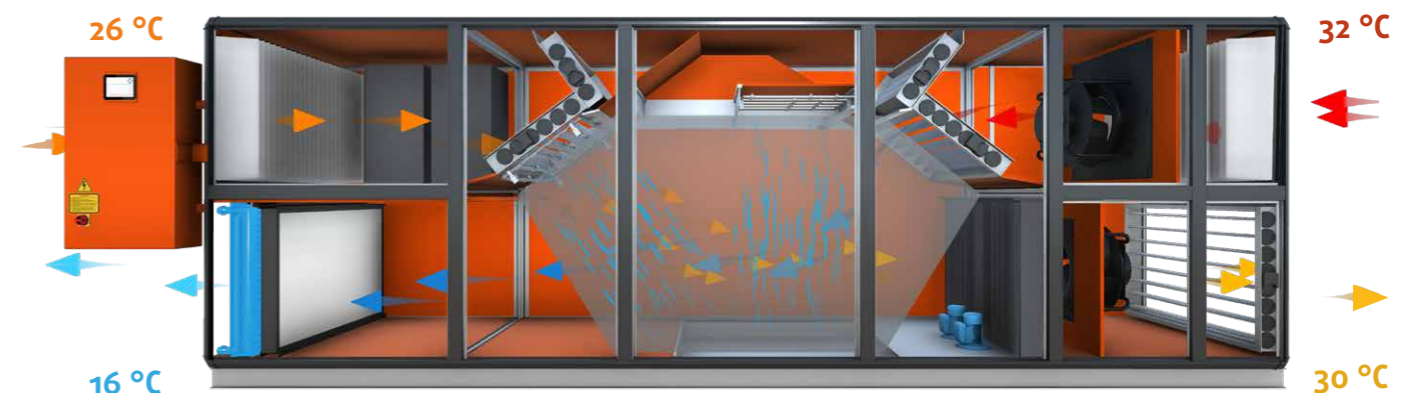
### FC-FREE SUPPLY AIR COOLING

- Carbon-free, since water is used as refrigerant GWP = 0 (R718)
- No additional energy consumption for supply air cooling and dehumidifying
- Operating heat for adsorption process from 55 °C
- Possible energy sources: solar heat, district heating, waste heat from combined heat and power plants, process heat, or the heating connection for the heating coil, required in any case for winter operation
- Integrated re-cooling, no external re-cooling plant required
- Hydraulically separated heat and cold supply, no mixing possible
- No certified refrigeration technicians for maintenance needed
- Is not subject to the F-Gas regulation or the pressure equipment directive

### COOLING SYSTEM

- Adiabatic cooling efficiency  $\Phi_{Adi} > 90 \%$
- No additional air-side pressure drop resulting from components installed in the air path, e.g. humidifiers
- Low water consumption due to circulating water system
- Coverage of the annual cooling demand > 90 %
- Minimal power consumption during operation
- No surface treatment of the recuperator required
- Resistance to corrosion

### OPERATIONAL MODE - SUMMER



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## OUR FIELDS OF APPLICATION:

