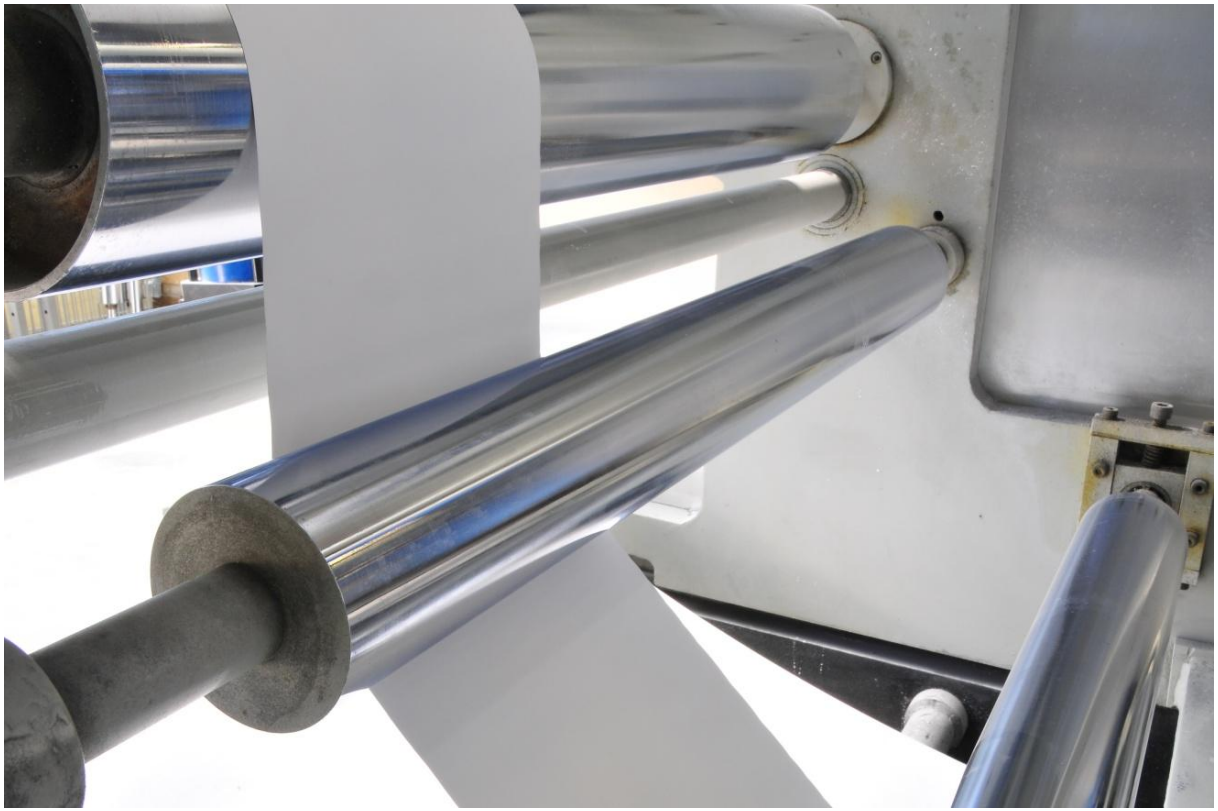
Sorption technology in energy recovery in AHU´s



Enventus Company Profile

- Manufacturer of
  Rotating heat exchangers, heat wheels

- Turnover 11 Mio Euro (2009)
- 60 employees

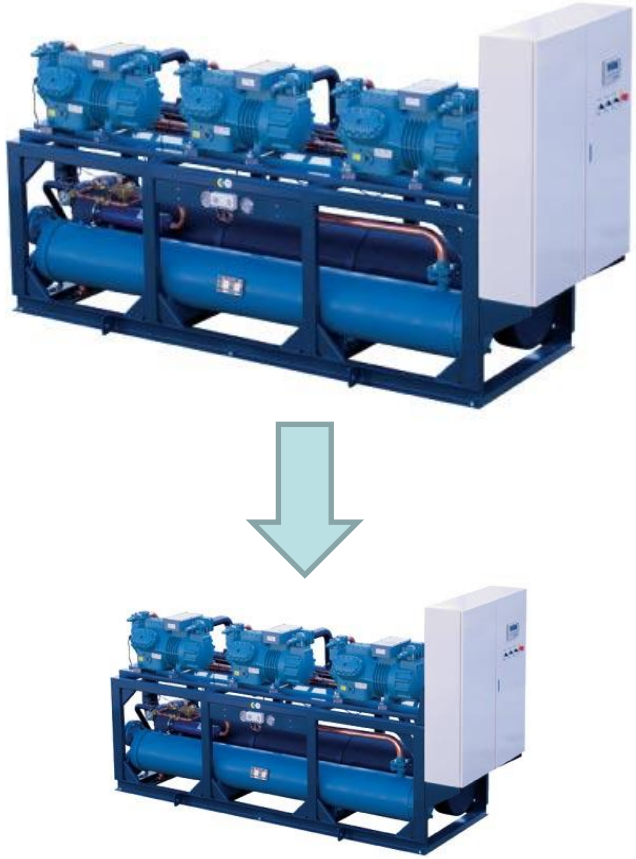
- Annual production over 20’000 rotors
- Delivered approx 250’000 rotors over the years

- 3000 m2 production area in Sweden
- 1000 m2 assembly plant in Kunshan, Shanghai, China

- Market position: Leading Scandinavian supplier
  Number 2 in Europe

Advantages of sorption technology

- **20-40% lower cooling capacity need for AHU´s**
- **Energy saving in the summer time**
- **Energy and capacity saving when humidification is needed**
- **Better air quality (higher humidity) in winter time**



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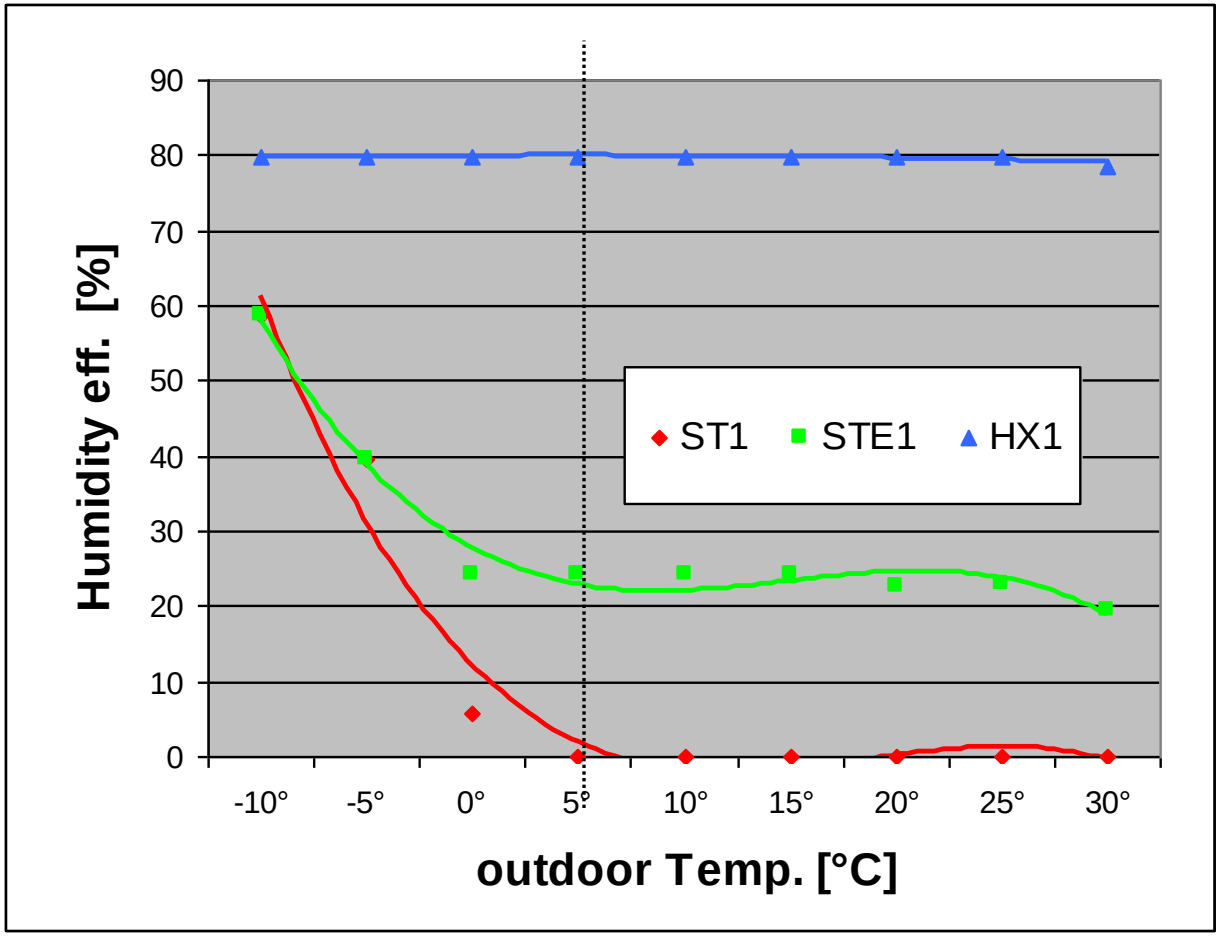
Definitions according Eurovent certification program

1. Condensation rotors, non hydroscopic — no designed humidity transfer properties
2. Enthalpy / Hydroscopic rotors, — low to medium humidity transfer efficiency
3. Sorption rotors, — high humidity transfer efficiency

EUROVENT RATING STANDARD
for the
CERTIFICATION
of
ROTARY HEAT EXCHANGERS

The class “sorption rotor” has to fulfil specific additional requirements on the latent efficiency: Under all tested conditions with nominal airflow rate the latent efficiency has to be at least 60% of the sensible efficiency. Rotors which have lower latent efficiency only can be certified in the class “enthalpy rotor / hygroscopic rotor”.

Humidity efficiency of different types



ST1 = Condensation

STE1 = Hydroscopic

HX1 = Sorption

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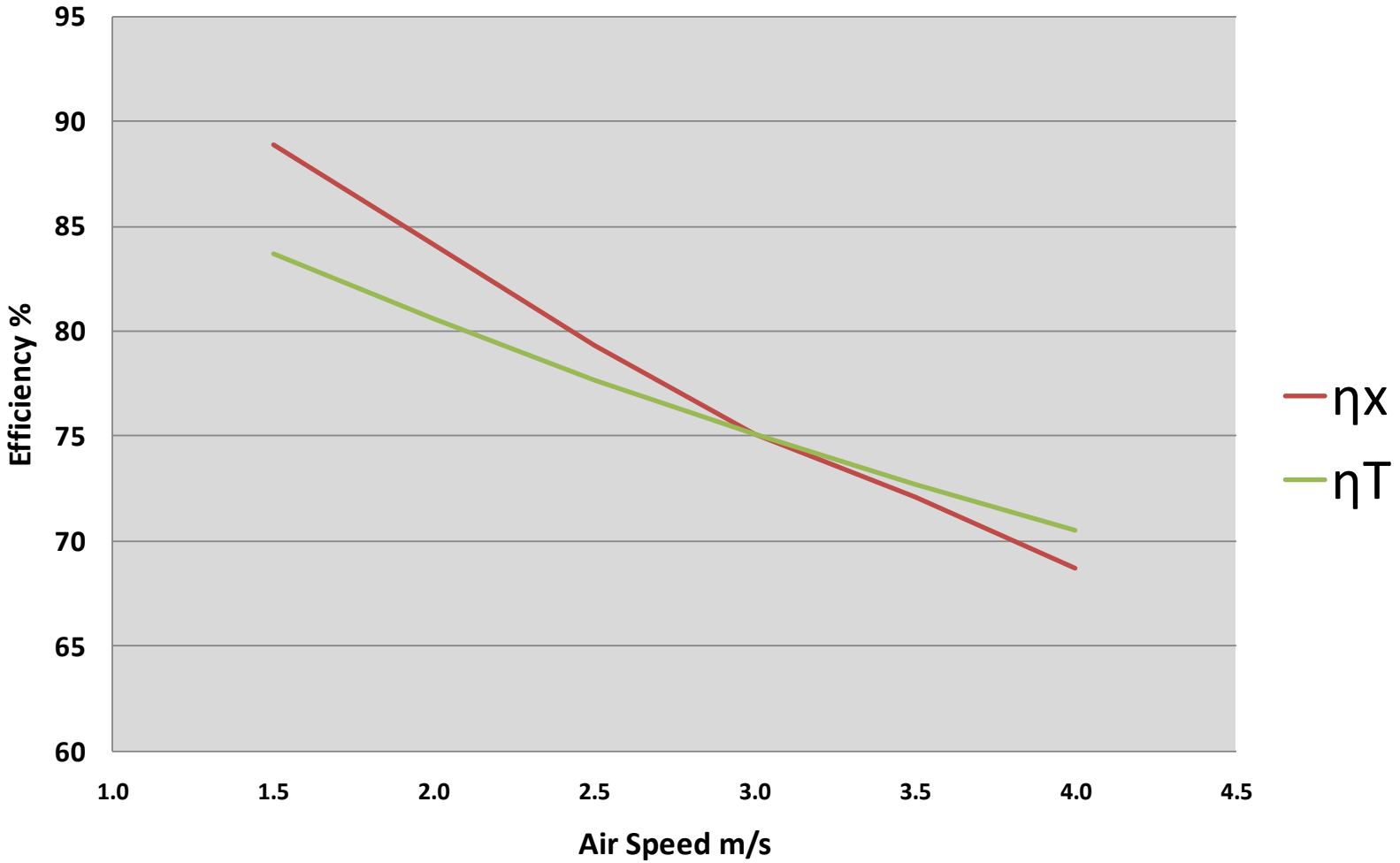
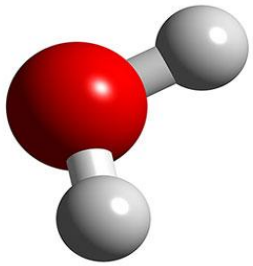
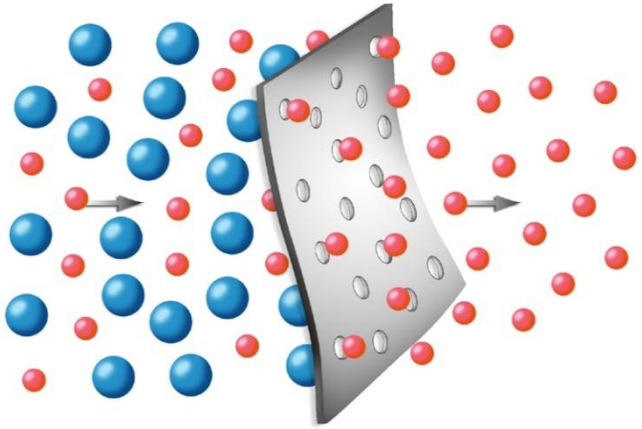
Performance of HX1 Sorption Rotor

with 1.7 mm well height (24C/50%, 30C/50%)



Sorption Rotors (HX1 and HM1)

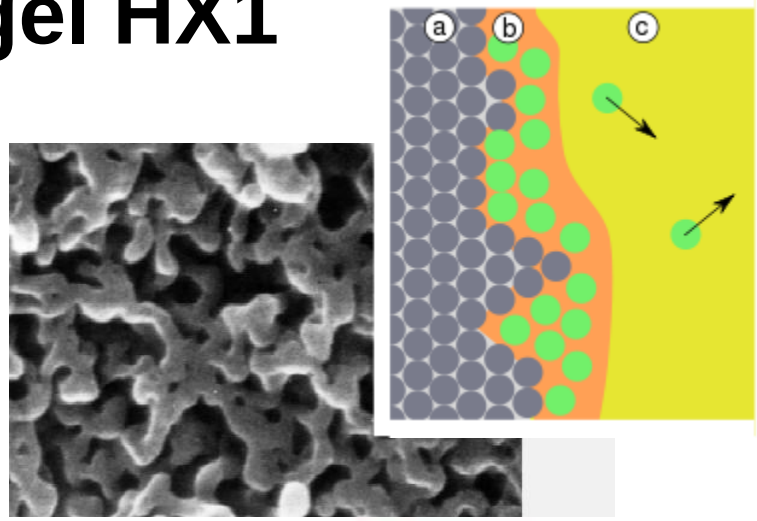


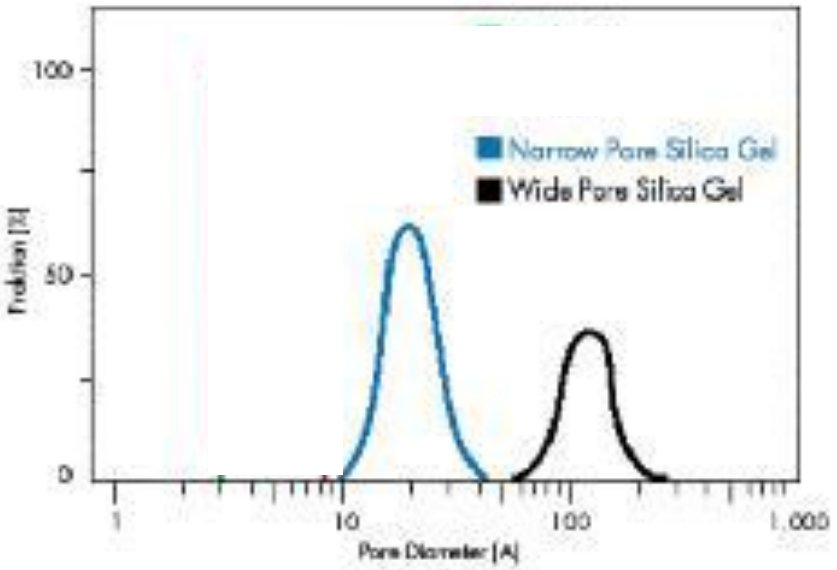


- Active coating on the sorption foil for sensible and high humidity recovery
- The humidity transfer of the sorption rotors is a physisorption process on a very high active surface.
- There is no chemical process, the catch of molecules is based on Molecule size and weak atomic forces

Sorption material , Silicagel HX1

- Commonly used material in packing and drying applications, SiO_2
- 1g adsorbent equal to approx. 700 m^2, We use silica gel 15 g/m^2 aluminum 1m^2 surface = 1.5 football fields
- Extreme high humidity efficiency, especially at high RH level
- Wide distribution of pore sizes
- Is not selective on what it adsorbs

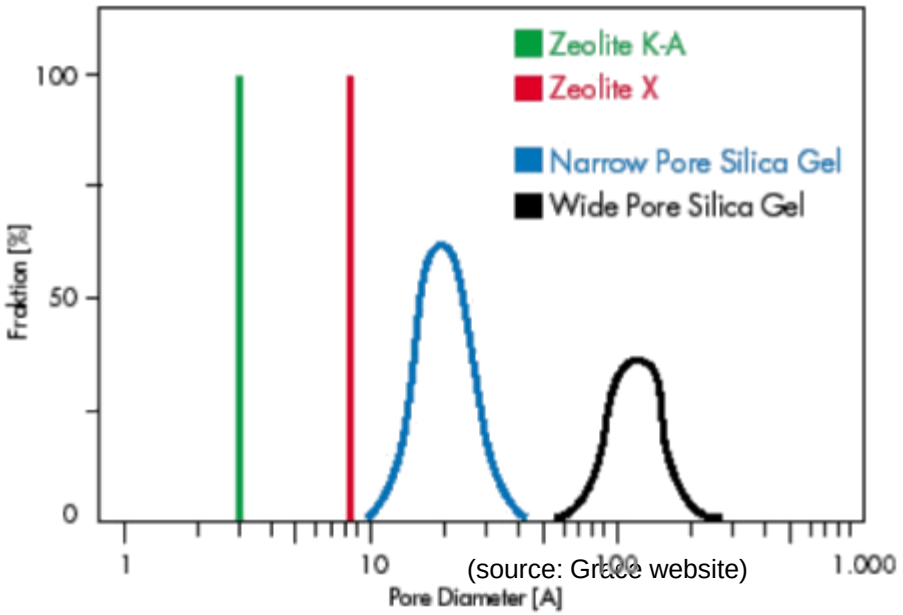




Sorption material, Molecular sieve HM1

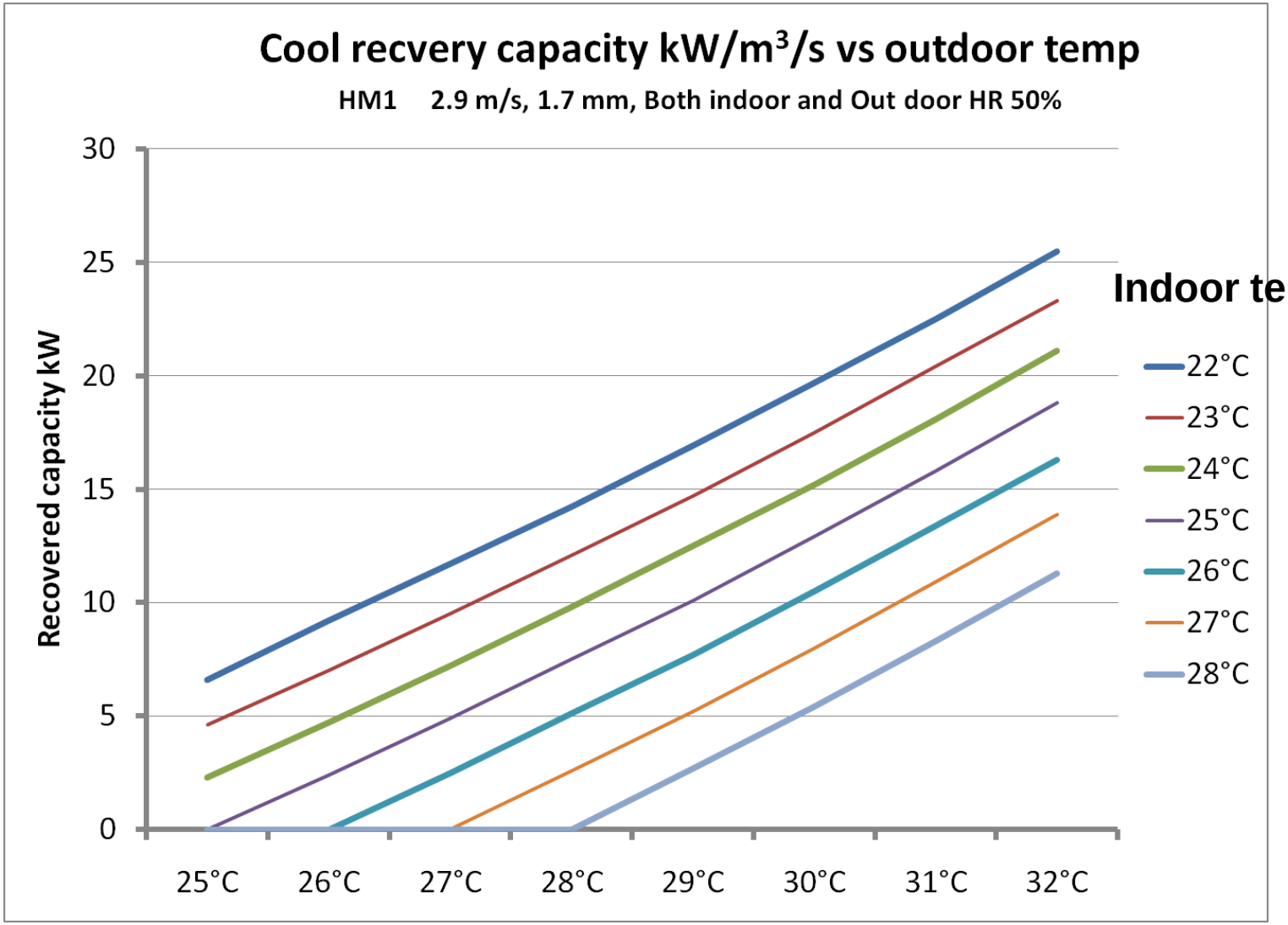
- Functional group of materials
- Widely used adsorbent in chemical industry.
- Engineered structures to specific function, pore size defined
- In HVAC applications use 3-10Å pore sizes for water (2.7Å)
- We use (AlO_4) and (SiO_4), 3Å
- High humidity efficiency
- Very selective to adsorb only water molecules

tetrahedras of
(AlO4) and (SiO4)
(source: Grace website)



(source: Grace website)

Pore Size Distribution of Zeolites and Silica Gels



Outdoor air temperature °C, RH 50%

Case 25°C/50%, 33°C/50%

air flow 36000 m^3/h, Rotor 2950 mm, 1.7 mm , 3.0 m/s

Explanantion	Condensing rotor	Sorption rotor	Difference
Temp efficiency	75.0%	75.0%	0 %
Humidity efficieny	0%	72,7%	72.7%
Pressure drop	156 Pa	204 Pa	48 Pa
∆ Entalphy	6.2 kJ/kg	17.3 kJ/kg	11.1 kJ/kg
Capacity / m3/s air	7.4 kW/ m^3/s	**20,8 kW/ m^3/s air**	**13.4 kW/ m^3/s air**
Humidity transfer	0	3,6 g/s / m^3/s air	4.4 g/s / m^3 air

Cooling capacity saving 13.4kW / m^3/s air. (20.8 if condensing rotor not used in Summer)

Increase of power consumption due to pressure drop increase 0.2 kW/m^3/s air

Pay back time

The investment cost of additional cooling capacity is about 100-200 Euro/kW

>>> The capacity savings due Sorption's rotor was 13 kW/ m^3/s
giving investment savings of **1300-2600 Euro/m^3/s**

Additional investment for Sorption treatment is **400-800 Euro/ m^3/s**

With 400-800 Euro investment 1300-2600 Euro savings
=
0 days pay back time

There is no additional investment from the system perspective.
To compensate the energy cost of the pressure drop increase we need 3-5% cooling full capacity utilization or total utilization time of AHU or 5- 10 years of AHU without any use of cooling capacity.

Where to use sorption technology

- ✓ **Installations where cooling is required**
- ✓ **Regions where peak load management is a topic**
  (capacity shortage of installed power from utilities)
- ✓ **Chilled beam, chilled ceiling , dry cooling fan coils applications**
- ✓ **Whenever humidification of supply air is required**
- ✓ **Existing installation where chillers capacity is limited and causing problems in summer time**

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…more info and downloads:

www.enventus.com

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Thank you for your interest!

Questions?


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