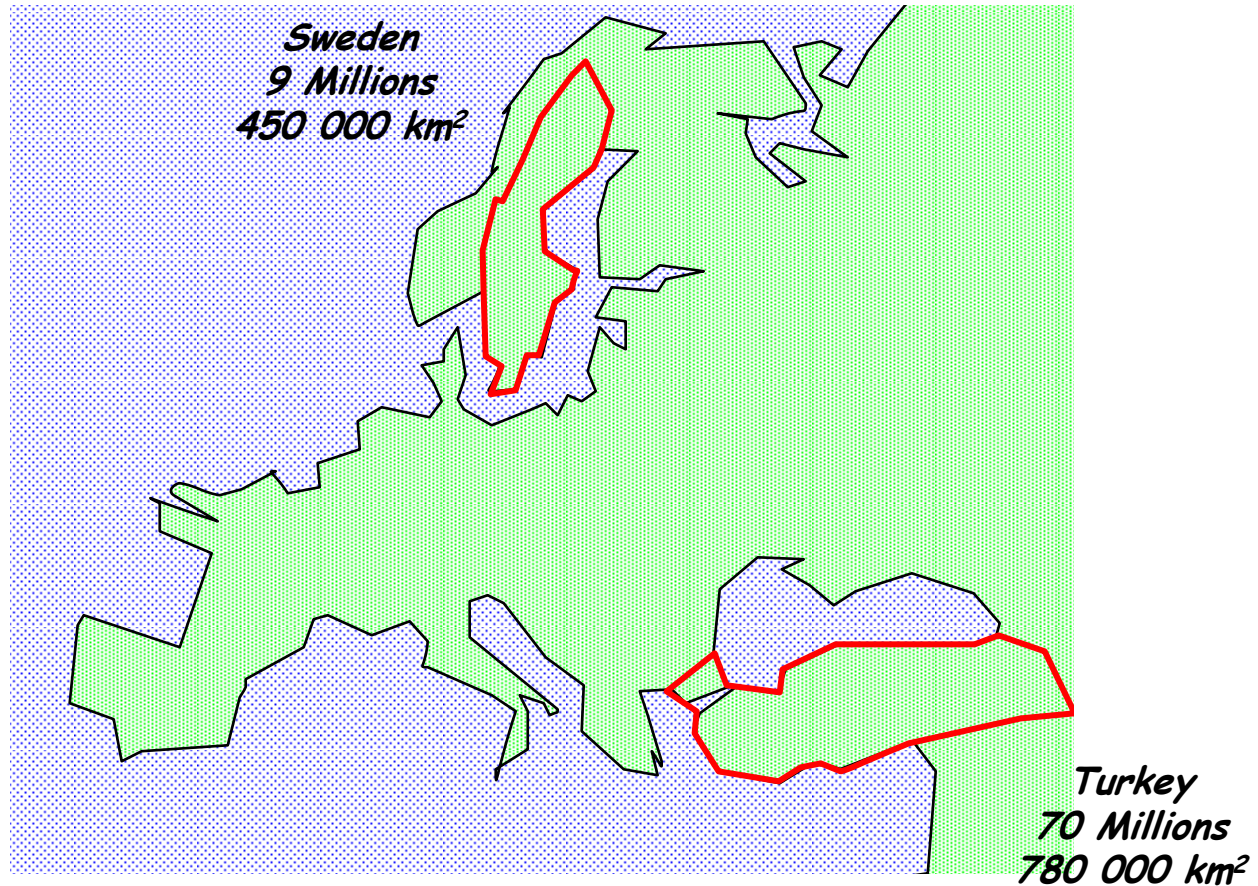


Professor Enno Abel
Chalmers University of Technology
Gothenburg, Sweden

enno.abel@cit.chalmers.se

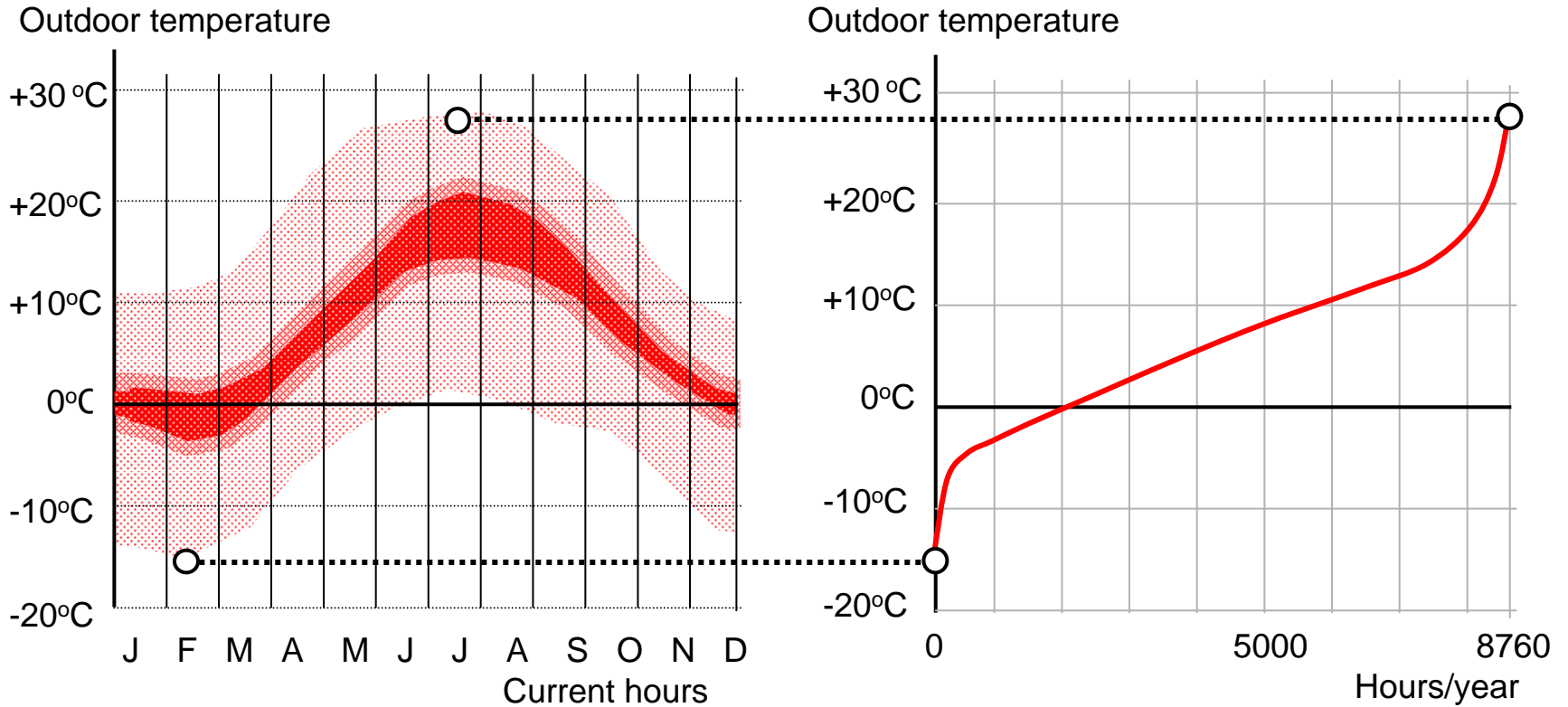
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Turkey - Sweden

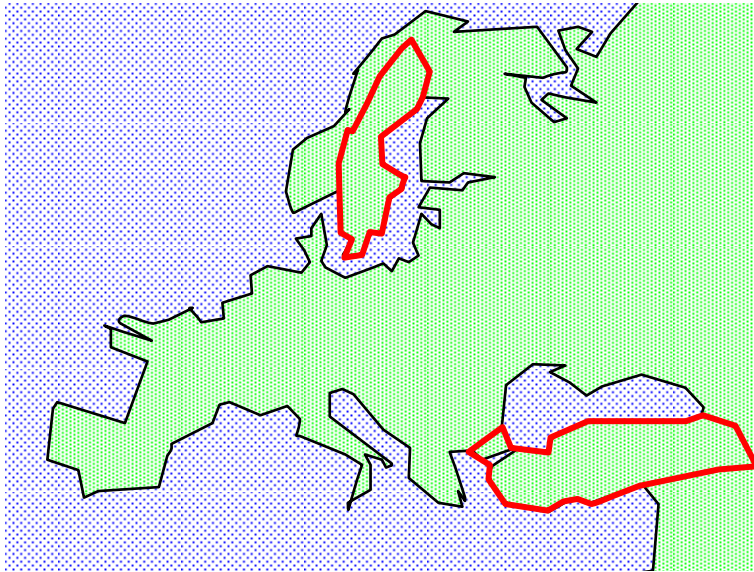


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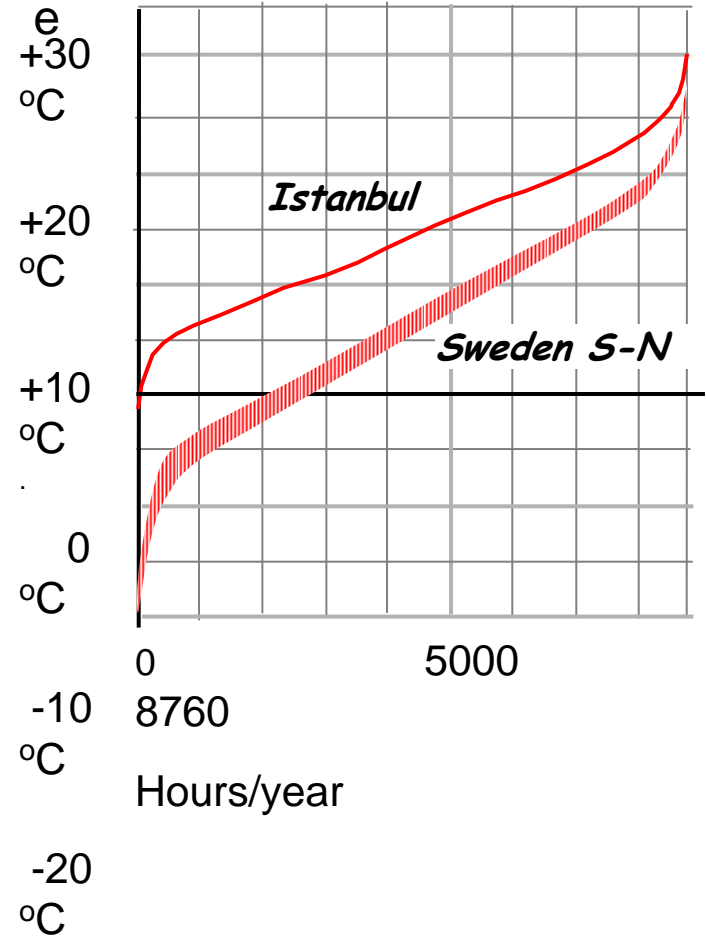
The Duration diagram



Turkey - Sweden



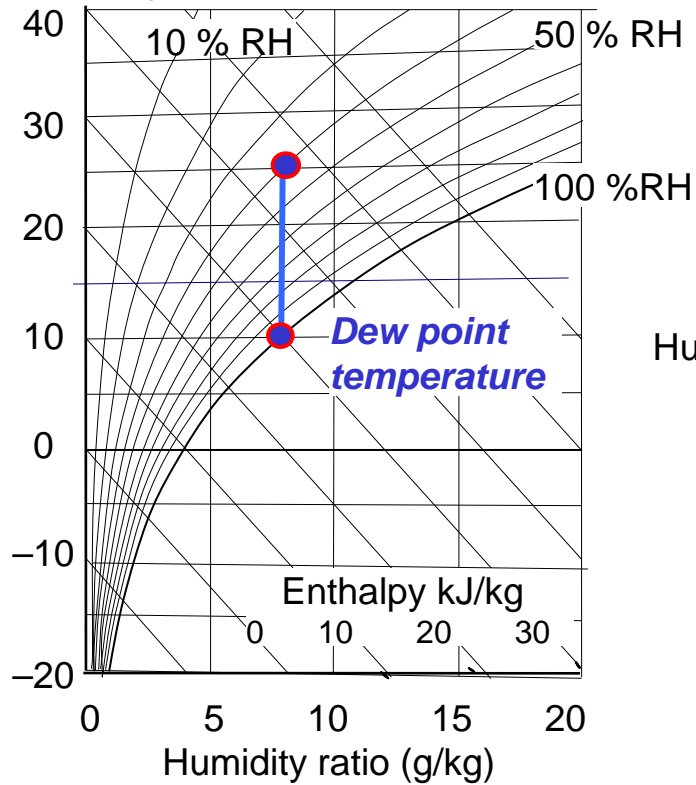
Outdoor
temperatur



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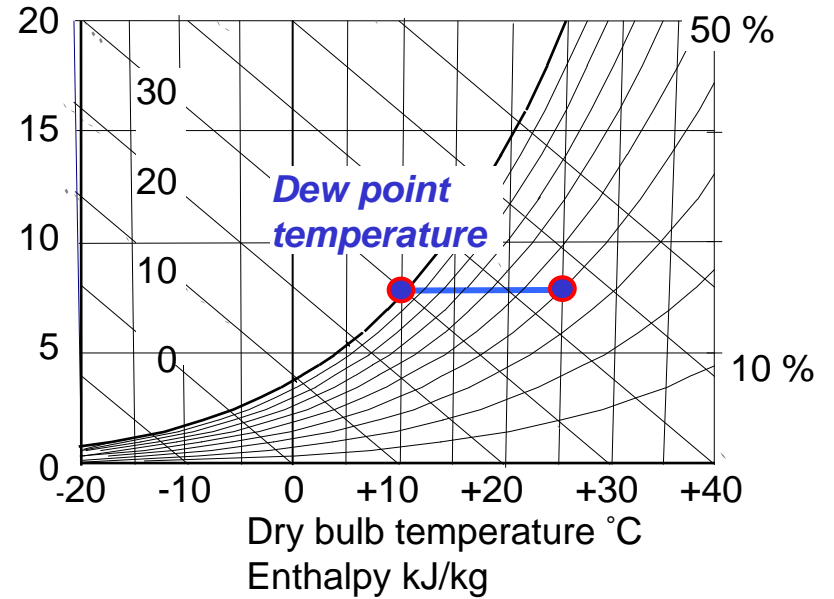
Dry bulb temperature °C

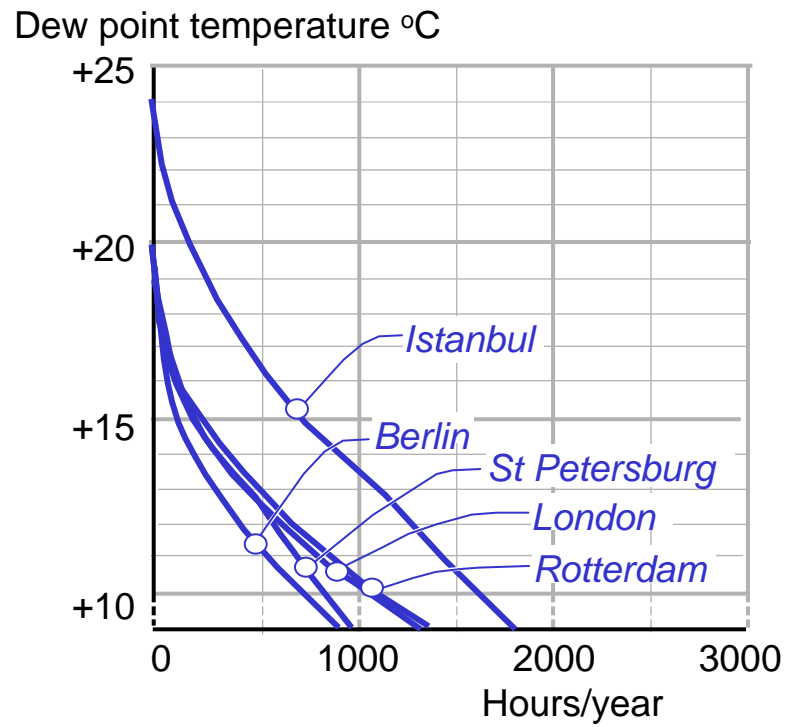
Enthalpy kJ/kg



Humidity ratio (g/kg)

100 % RH





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System boundaries

the Room Air

Requirements on:

Thermal climate

Air Quality

The interplay

Building - Activity

Outdoor climate

results in

Heat deficit

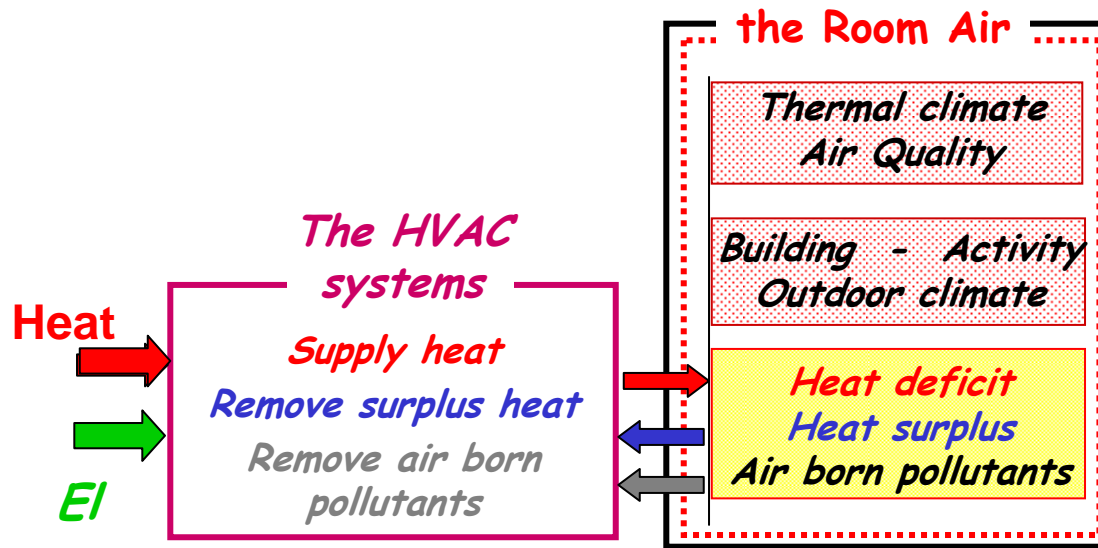
Heat surplus

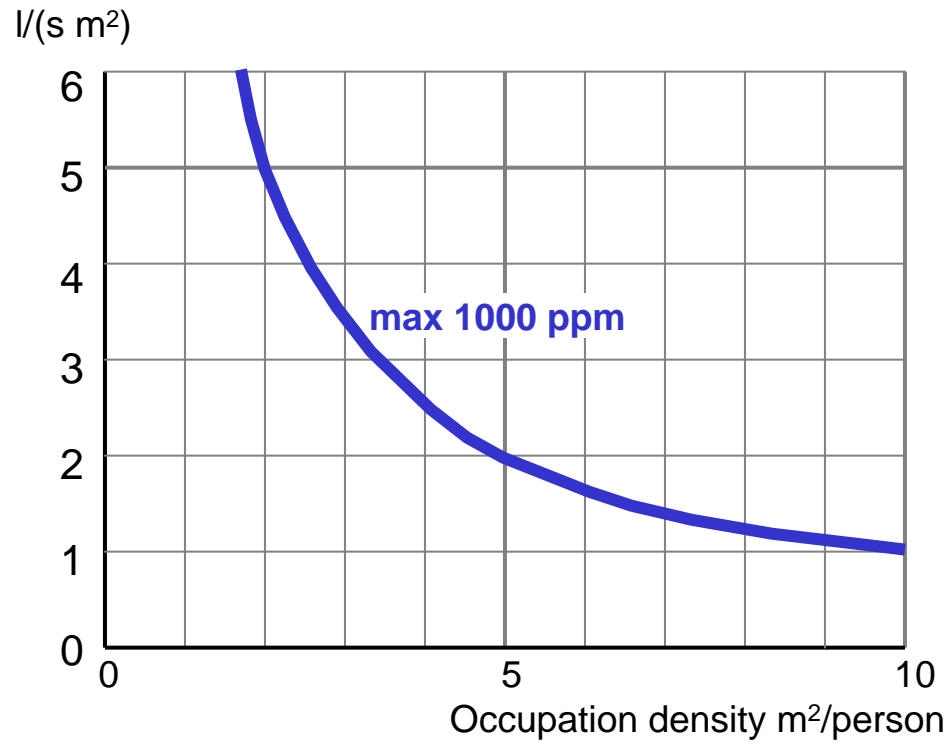
Air born pollutants

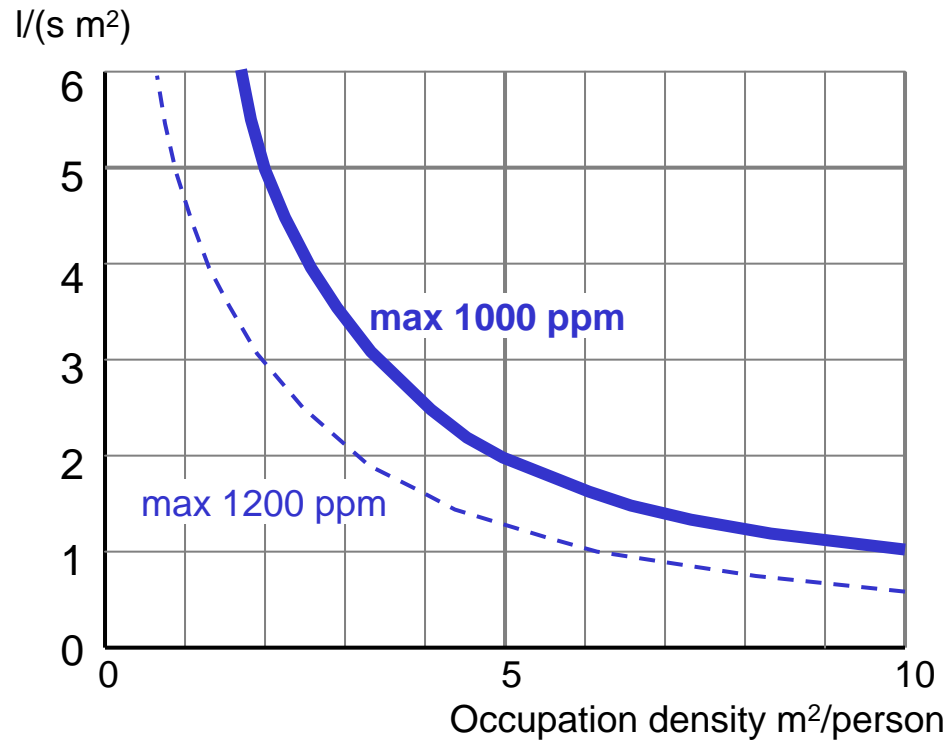
The need of HVAC is primarily decided by the building design, the activities in the building, the demands set upon the indoor climate and the and the accompanying heat deficiencies, heat surpluses and pollution surpluses

The task of the HVAC system is to ensure the heat supply, the removal of surplus heat and removal of air pollutants is ensured

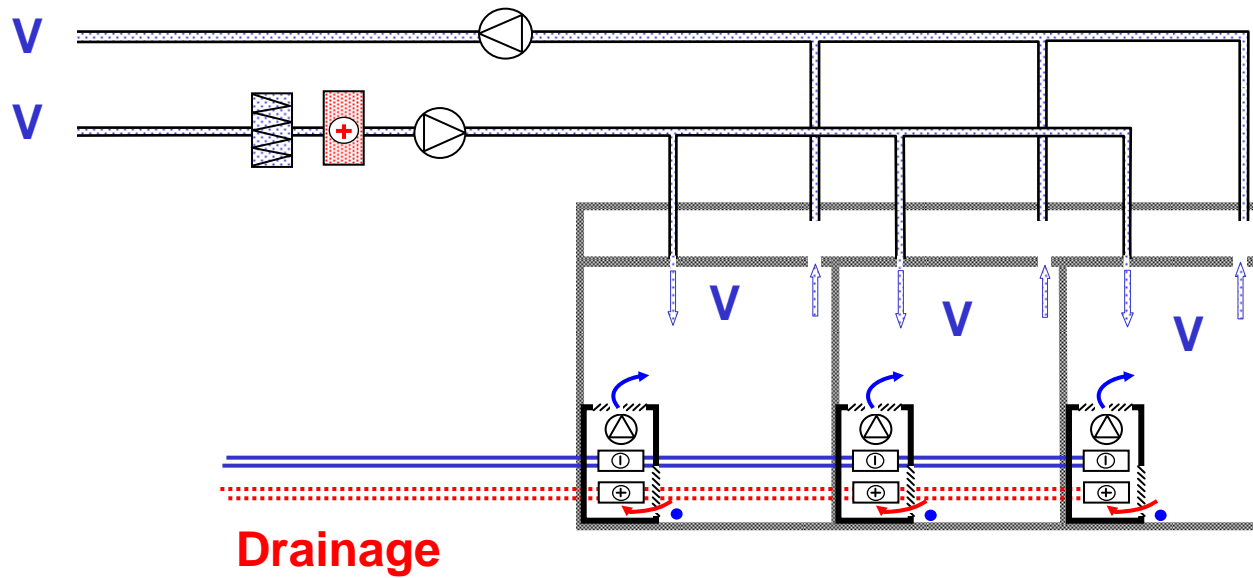
System boundaries





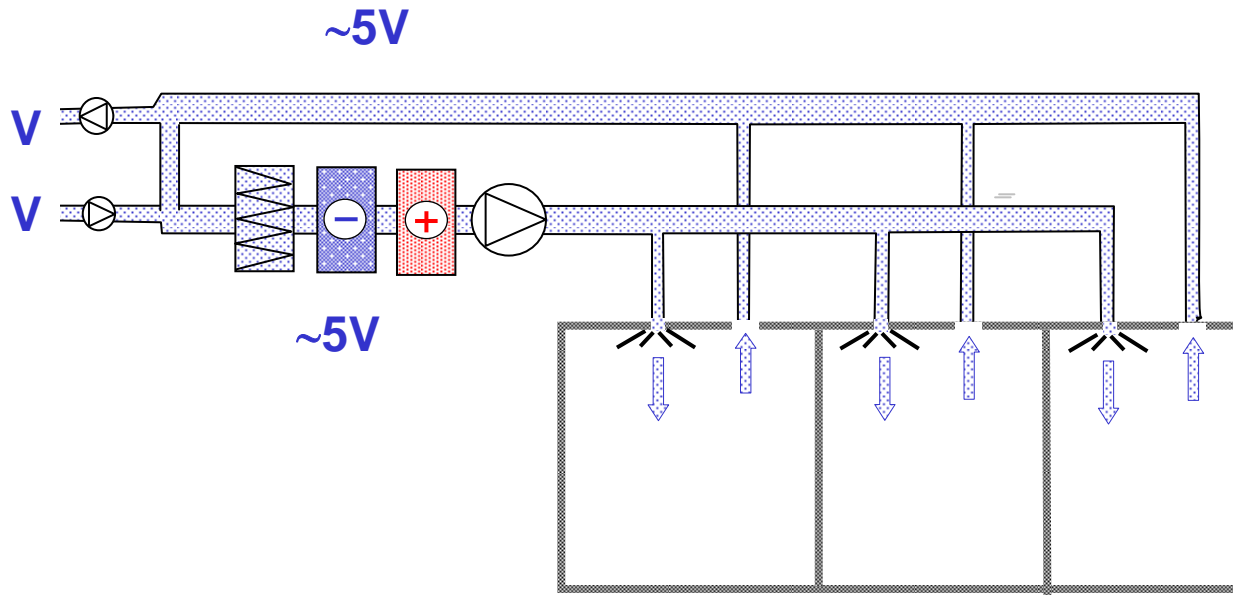


Fan Coil System



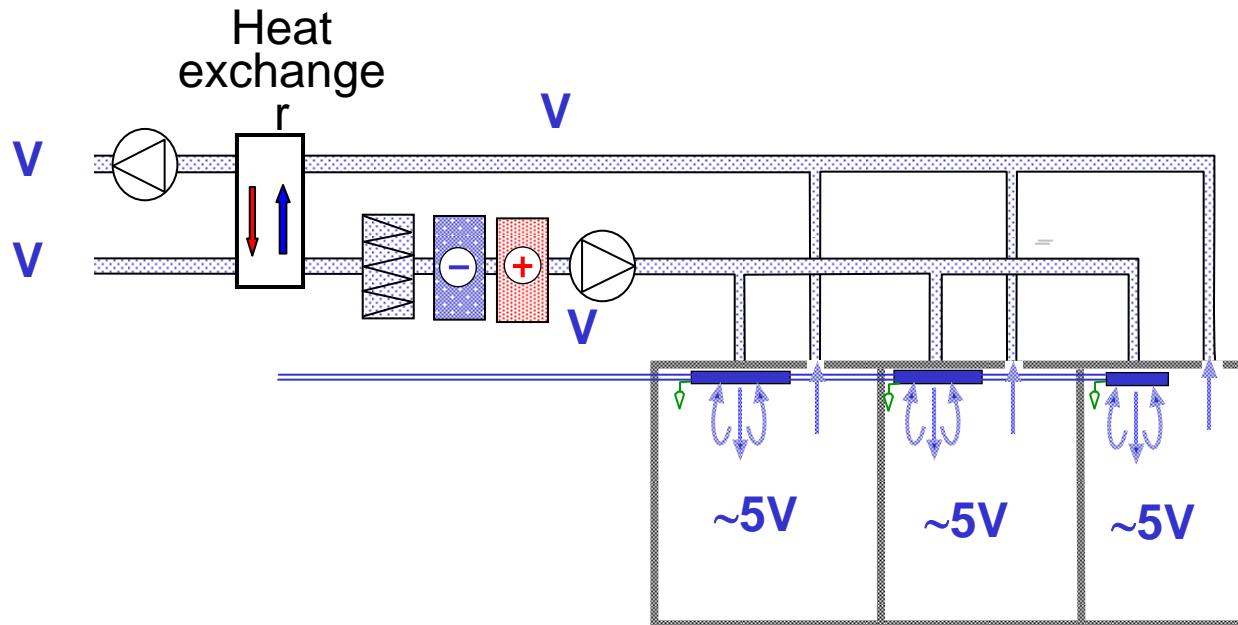
Air System

CAV (Constant Air Volume flow)
Recirculation

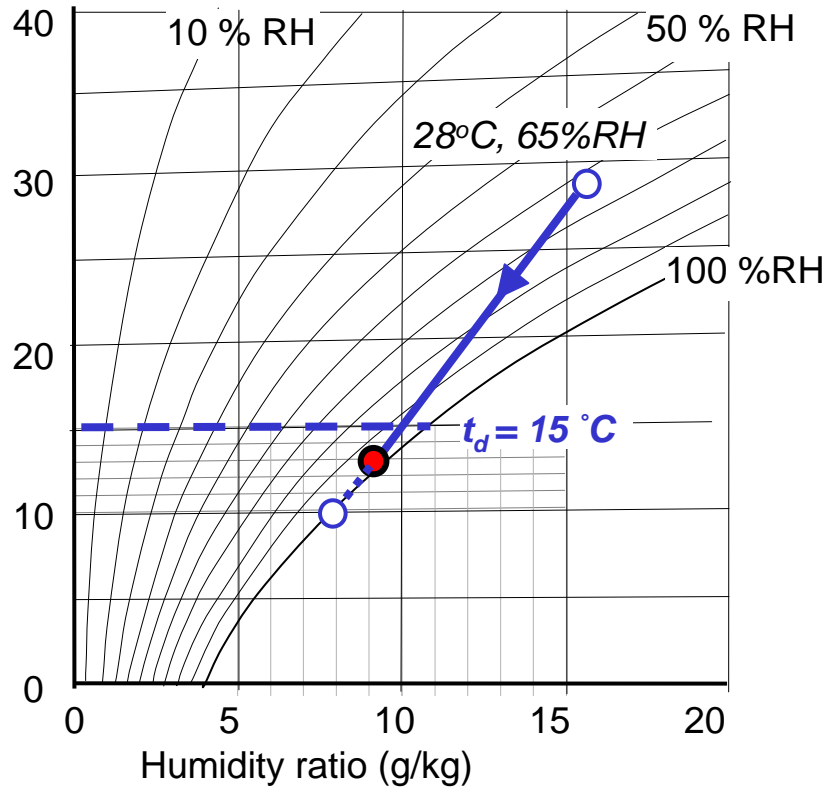


Chilled water and air system

Heat recovery by Heat Exchange



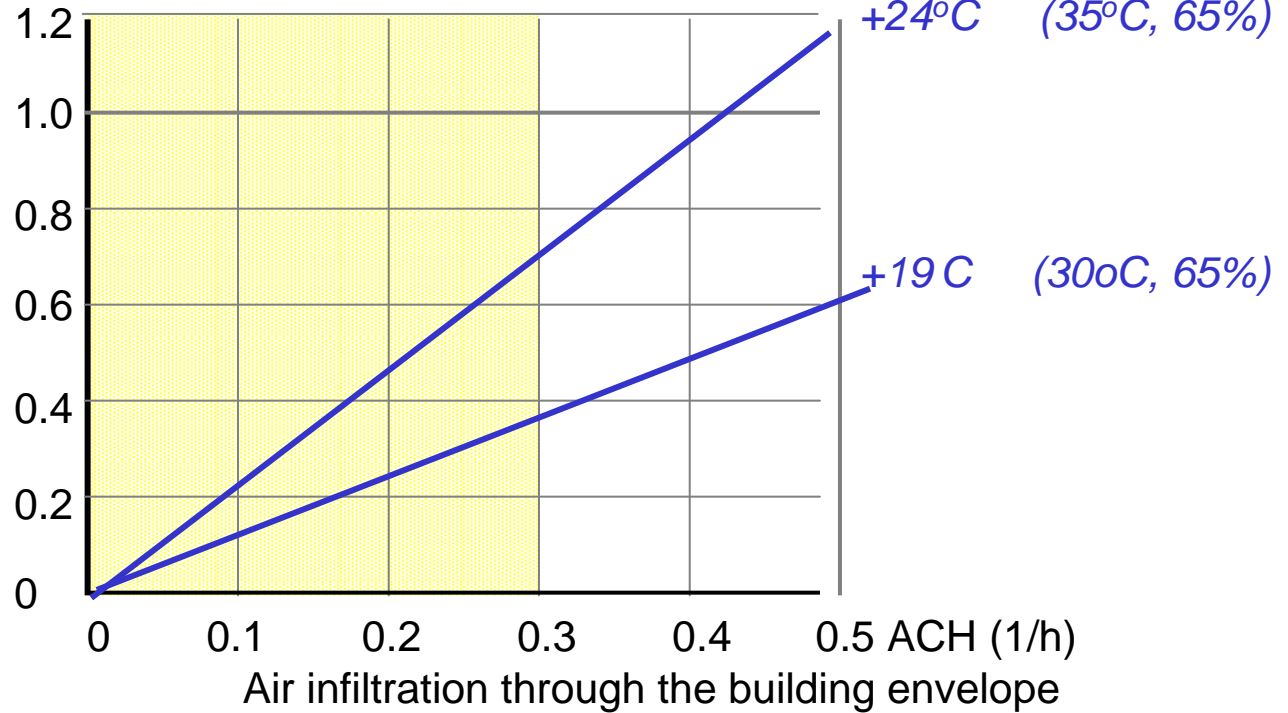
Dry bulb temperature °C



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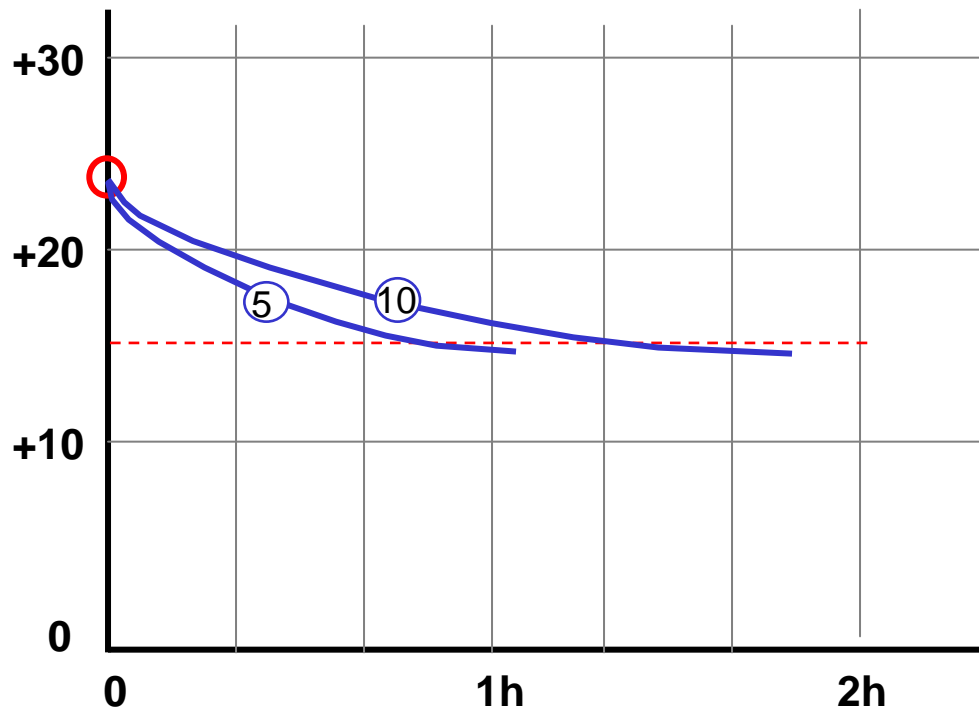
Dew point temperature
rise due to infiltration °C

*Outdoor air dewpoint
temperature*

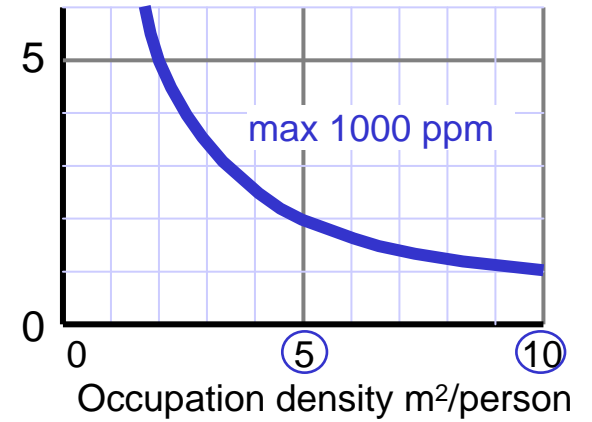


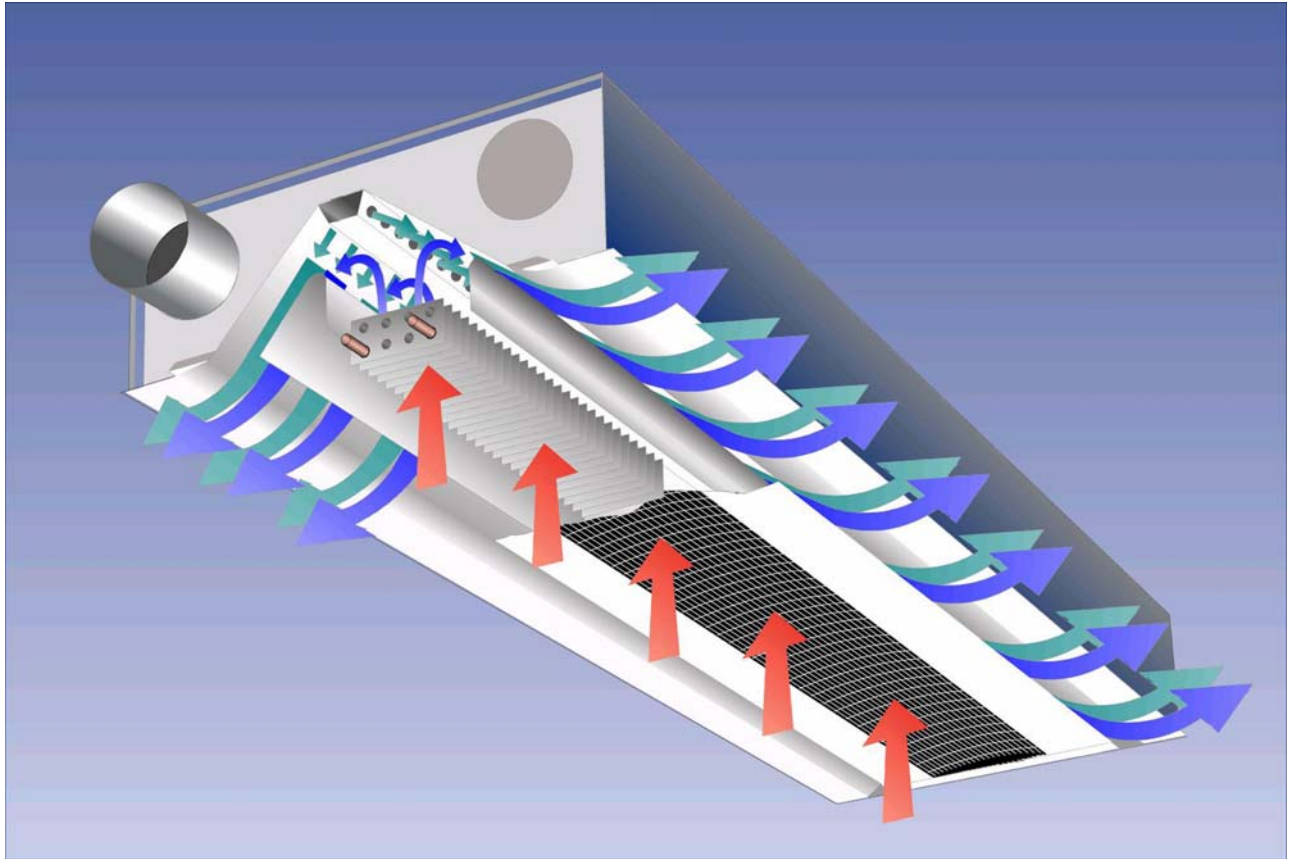
*Example:
Outdoor air dewpoint temperature +24°C*

Dewpoint °C



$I/(s\ m^2)$

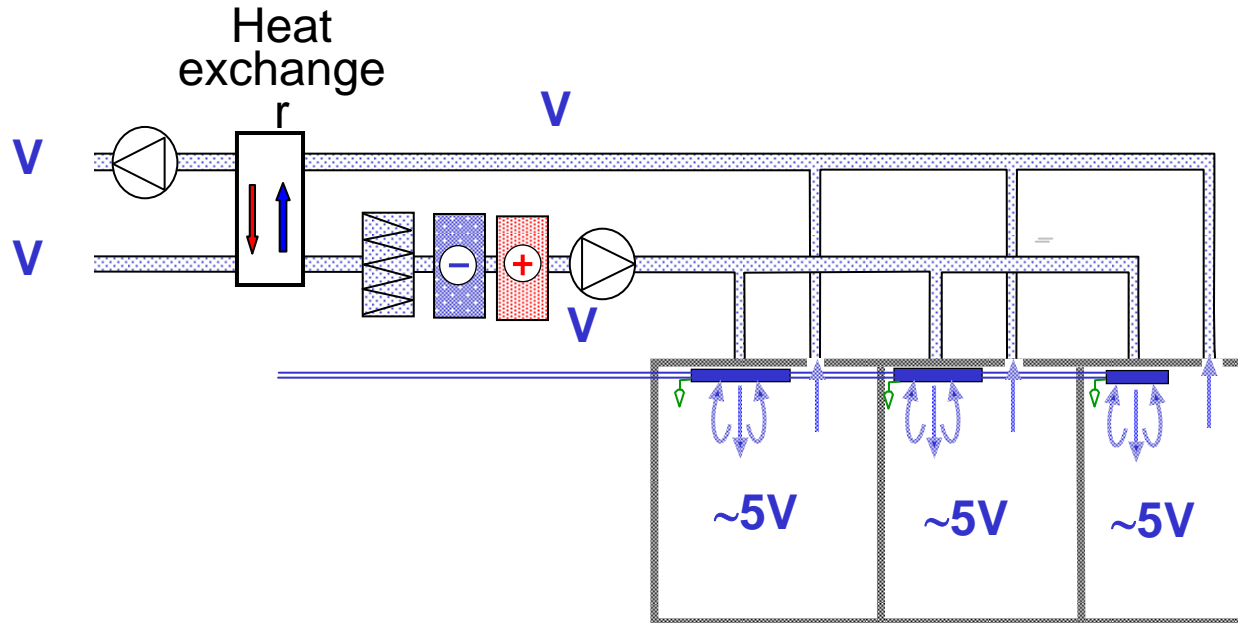




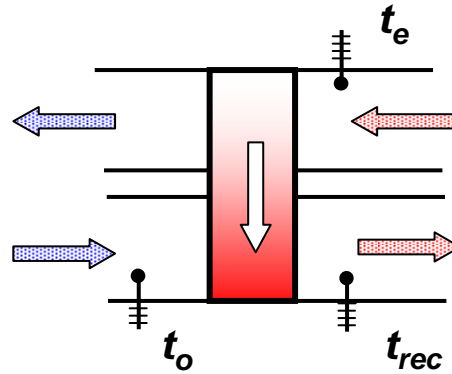
*Istanbul 2008-05-12
Enno Abel*

Chilled water and air system

Heat recovery by Heat Exchange



Temperature Efficiency - Recovery Efficiency



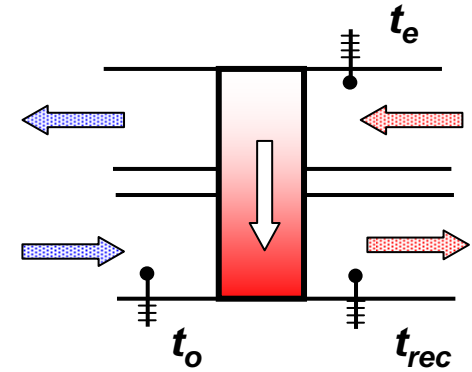
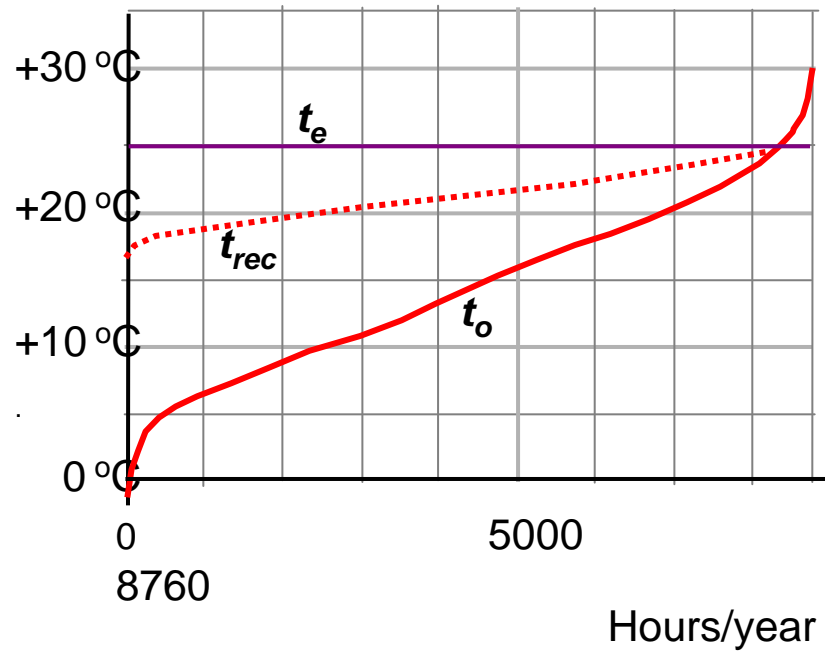
Temperature Efficiency η_T

$$\eta_T = \frac{t_{rec} - t_o}{t_e - t_o}$$

Heat recovery

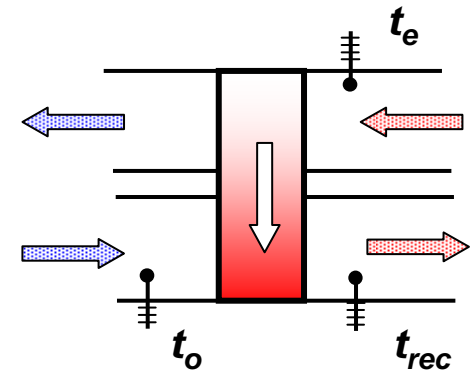
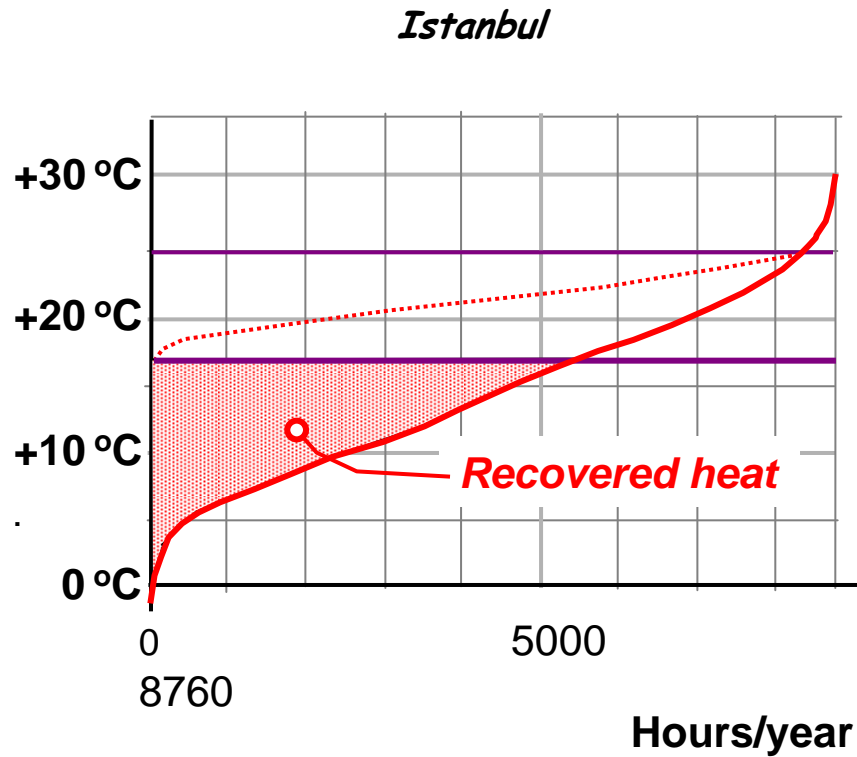
Outdoor temperature

Istanbul



$$t_{rec} = t_o + \eta_T (t_e - t_o)$$

Heat recovery



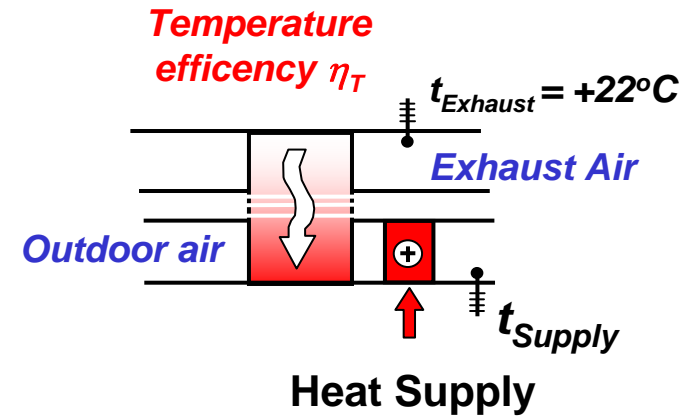
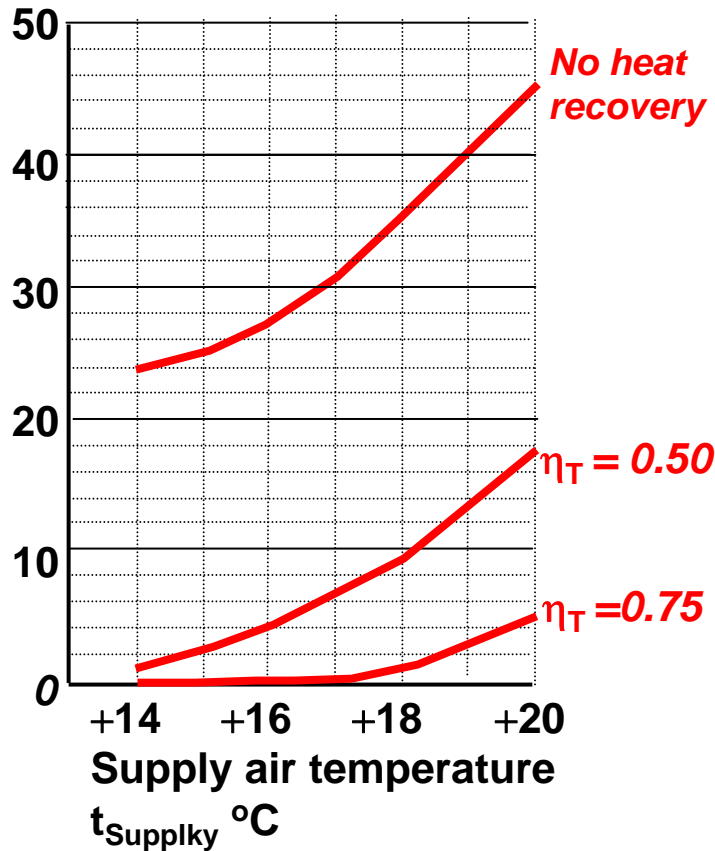
Heat recovery

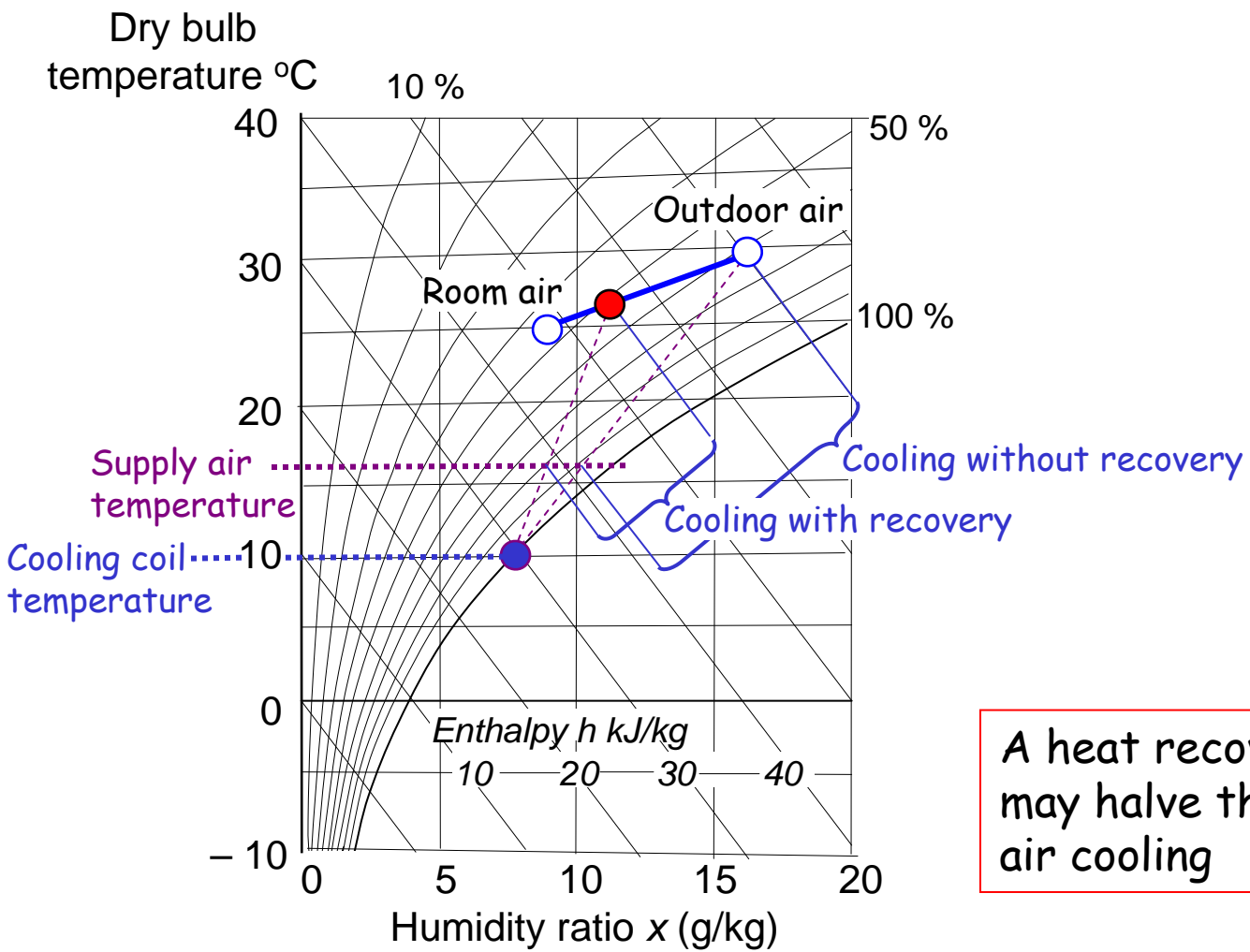
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Operation: 7am – 6pm, 5 days a week

4 m²/person → 2,5 l/(m²s)

Heat supply needed
kWh/(m²·year)





A heat recovery system may halve the need of air cooling

The climate system is normally in operation during working hours only

The dewpoint of the room air must be lowered before the cooling starts

I.e. the air system has to start before the chilled water system

Chilled surfaces for indoor climate control are a good option even in areas with humid climate

Initial cost

Space

presupposed the system is designed and operated in a proper way.

In combination with a proper air handling it becomes very efficient from both initial cost and operation point view.