FUTUREHOME

LA FUTURA CASA

Innovative Technology, Zero Energy Solutions

"One day all systems will be made as We are doing today"

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Järvevana 7B/TOYOTA Office building

Järvevana 7B is an office building in the capital of Estonia, Tallinn, with a net floor area of 62,430 square feet (5,800 square meters). There is also located TOYOTA Baltics head office.

The goal was that it would be one of the most energy efficient office building in Scandinavia today at the same time reaching for highest indoor climate comfort. **The aim was to use thermally activated building systems (TABS), and ground is used as heat source**, Solar panels as a source of energy consumption.

Task was also to produce significant % of its water from the rainfall from the sky. To achive this efficient indoor climate, planning and calculating and designing inertial indoor climate systems had to be done. Also the aim was also to reduce heating plant and not to connect to district heating.

There is also **no need for dry coolers or cooling towers**. The roof is clear from noise generating units. On the roof there are penthouse type meeting rooms and saunas for relaxing, also a hudge terrace to enjoy view from one side to the nerby forrest and other side breathtaking Tallin city view.



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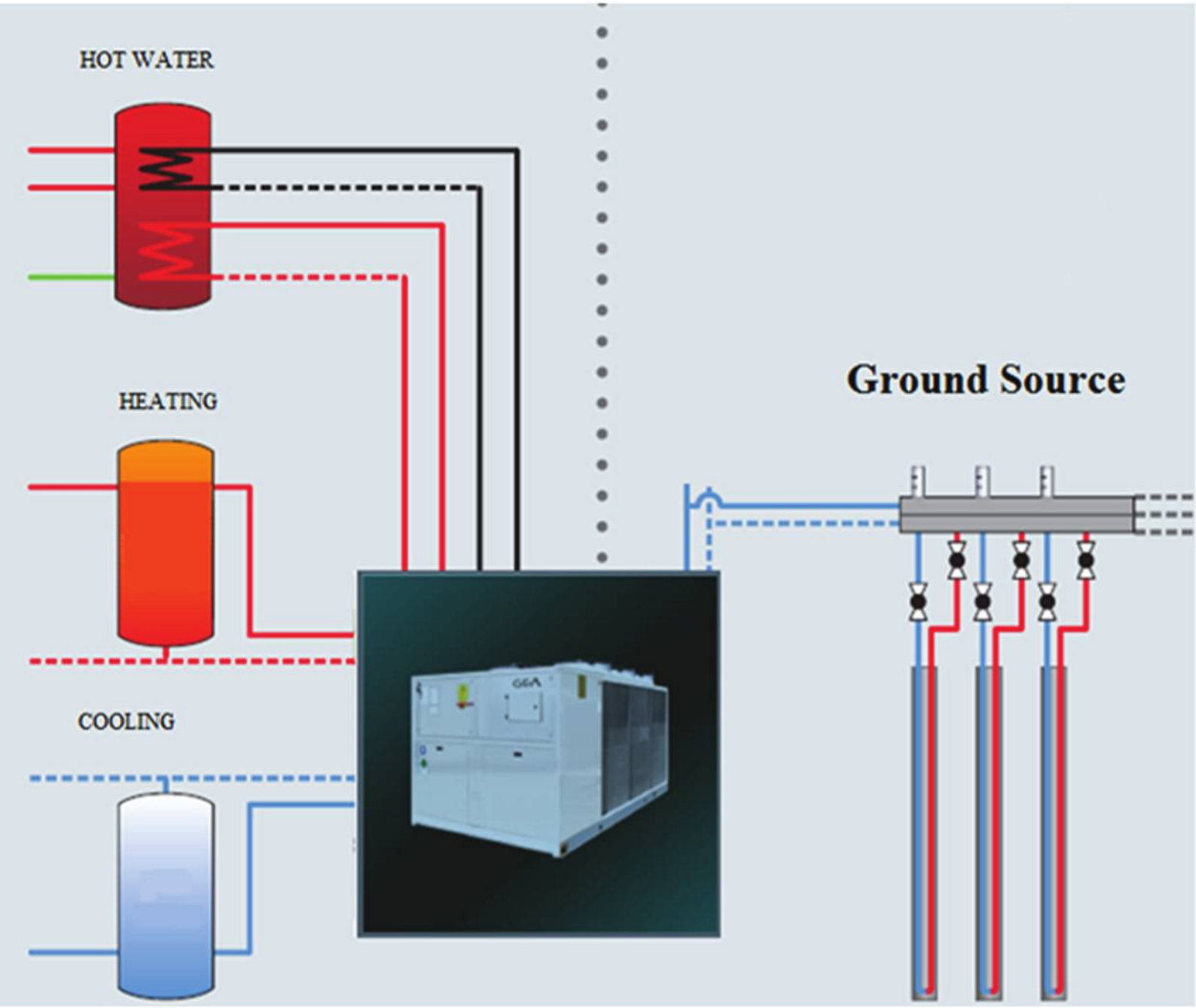
Heatpump / Chiller



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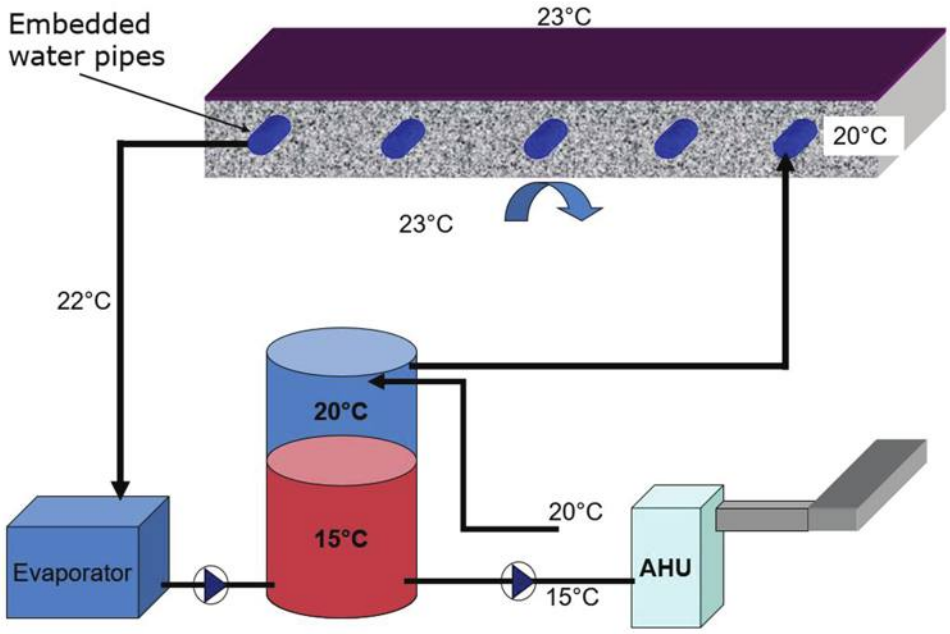
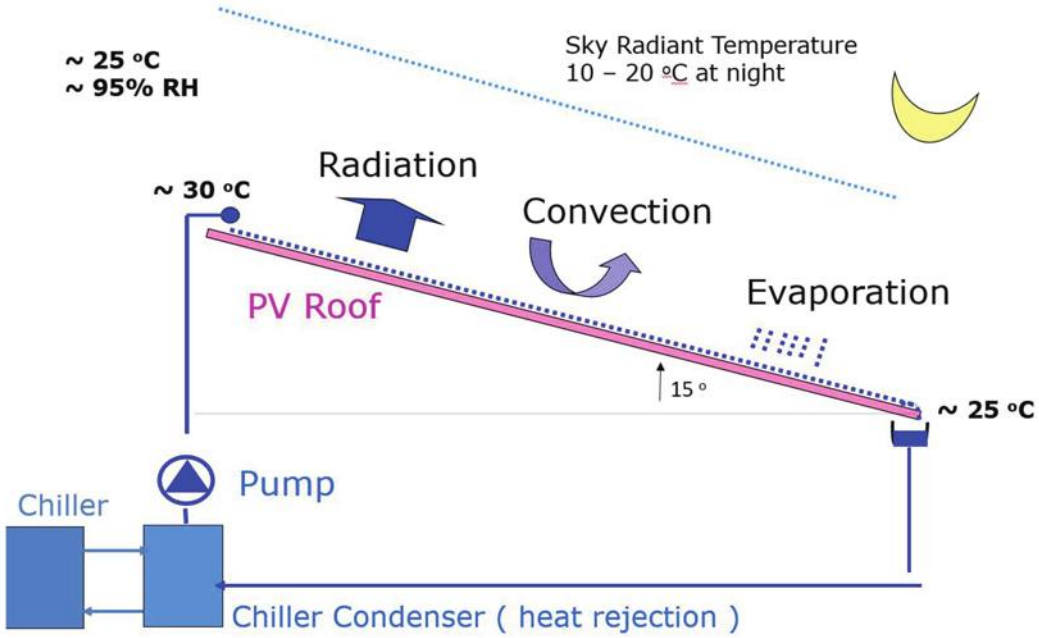
Heatpump / Chiller

- Off coil temperature of chiller in increased from 7 oC to 18 oC increased COP of Chiller.



* ceiling cooling + air handling unit solution

- Option was to use trickling Cool Roof



* usage of night roof cooling / trickling cool roof

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TABS - Thermally Activated Building Structures

+

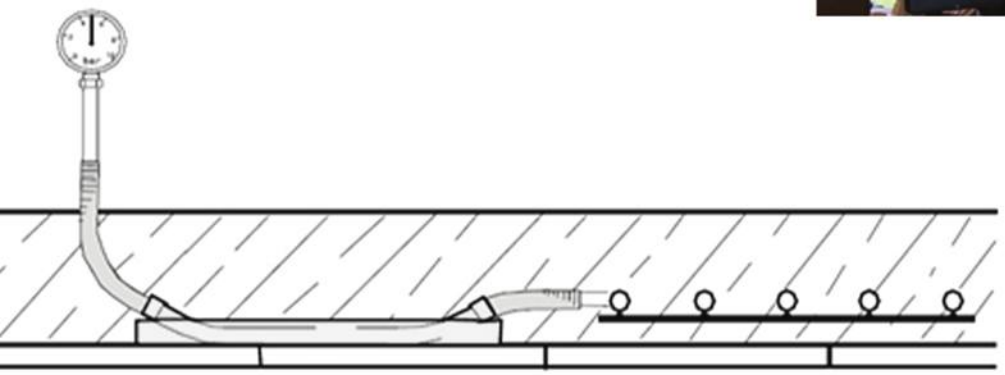
- Invisible cooling and heating
- Maintenace free system
- Noisless cooling and heating
- Better performance in operative indoor temperature, sensible cooling
- Higher temperatures of energy carrier medium for cooling
- Lower temeprature of energy carrier medium for heating
- Less risk for draught
- Reduction of freon ammount circlulating in the house
- Water based systems are more flexible to add different energy sources
- Reduction of energy station

–

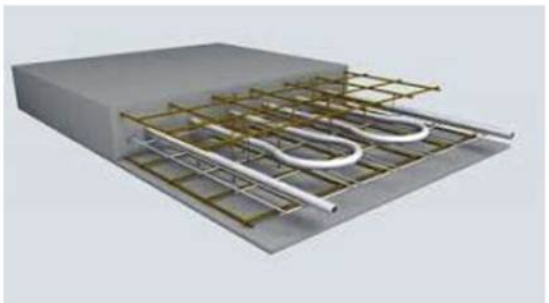
- Capacity restrictions
- Humidity control on the house in case of cooling

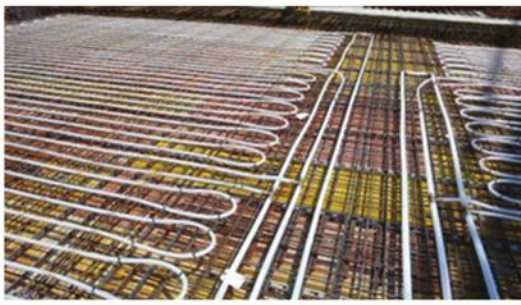


Office Järvena 7B interior









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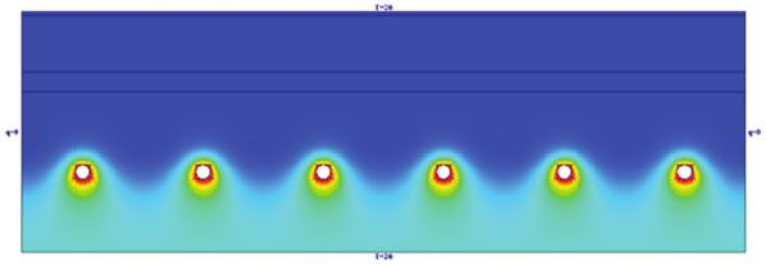
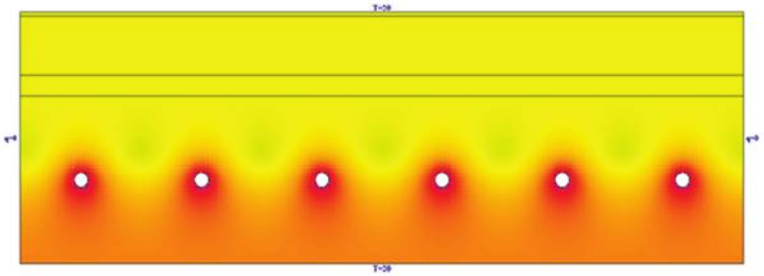
Cooling and heating

• Cooling case
Ceiling cooling output capacity 55 W / m2. This means: 7 W m2 up direction 48W/m2 for down direction



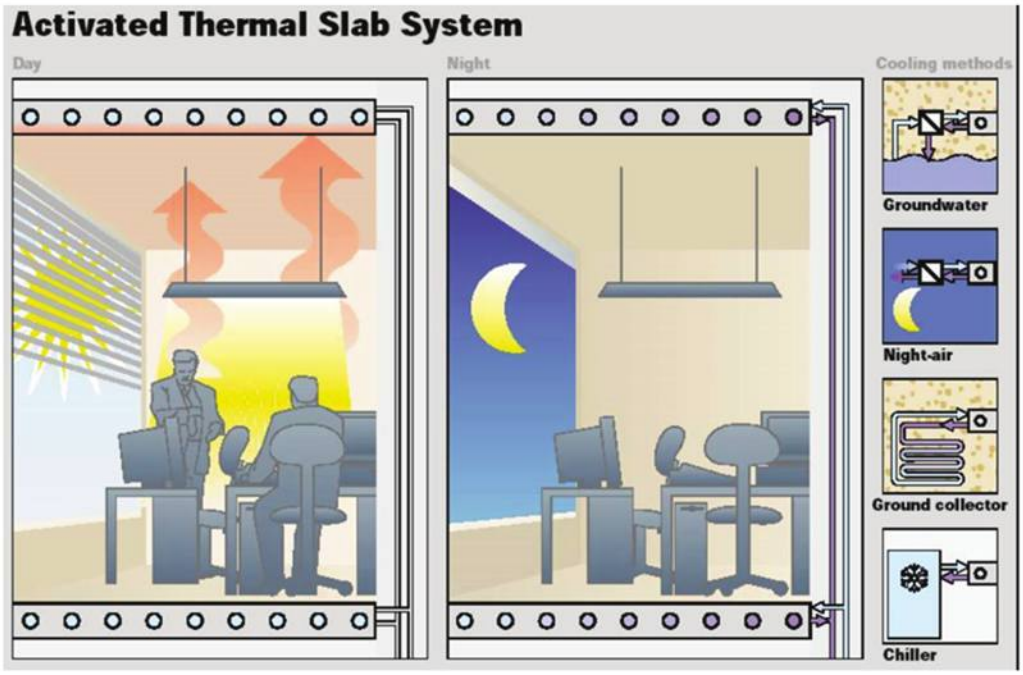
7 W/m²
48 W/m²
55 W/m²

• Heating case
Ceiling heating output capacity 28 W /m2. This means: 5 W/m2 up and 23 W /m2 down



5 W/m²
23 W/m²
28 W/m²

• Ideology
Passive cooling and shading. Passive cooling runs in night mode



Cooling and heating

• Cut the cooling station capacity

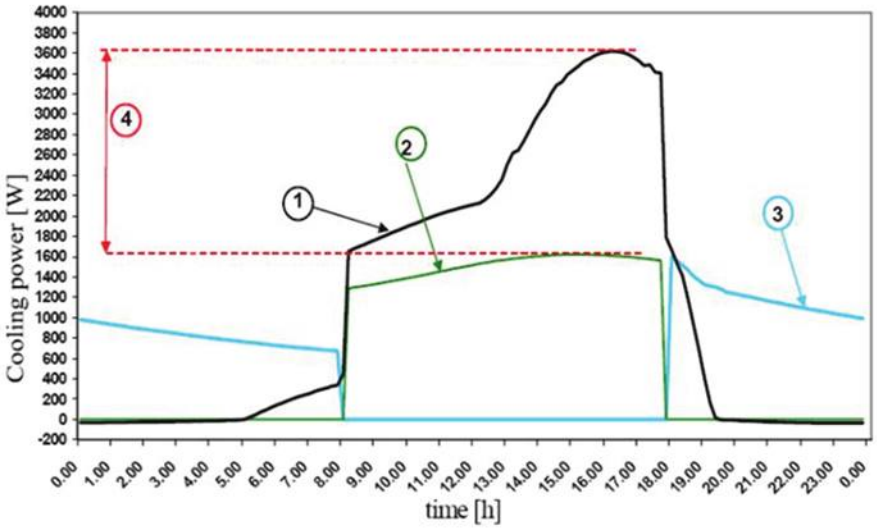


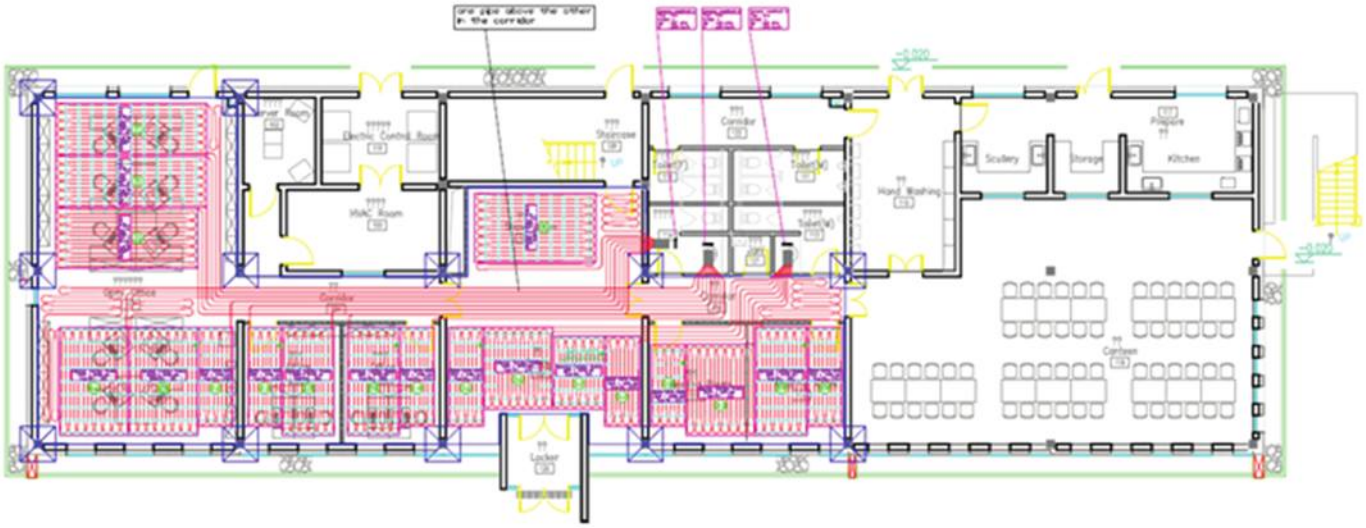
Figure 2 – Example of peak-shaving (reducing the peak load) effect (time vs. cooling power [W],)

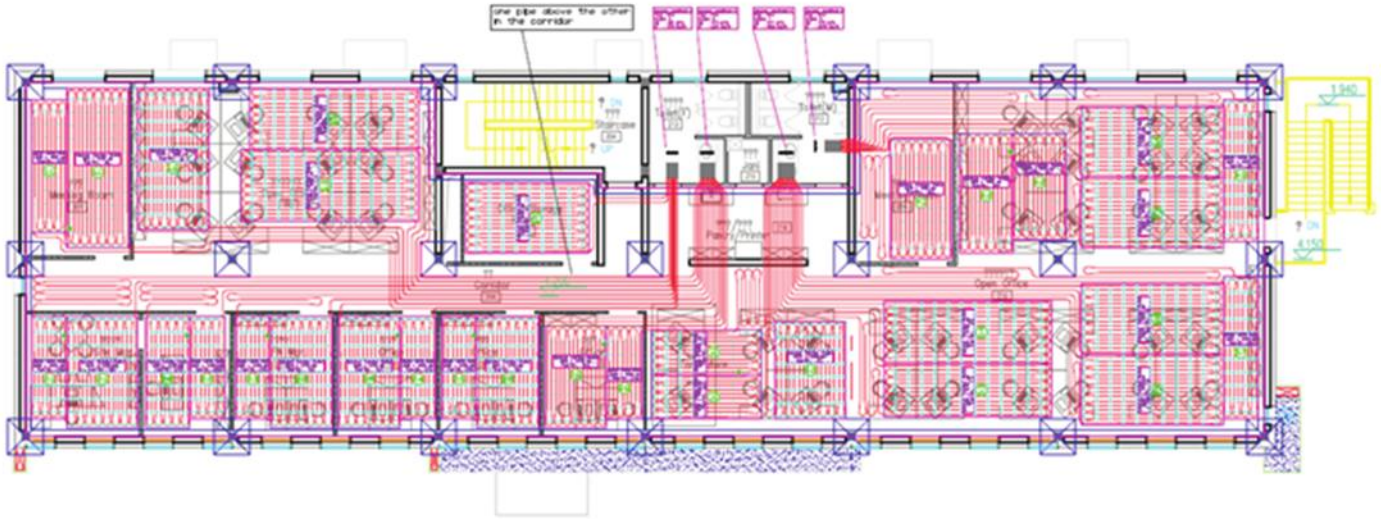
Where: 1) heat gain, 2) Power needed for conditioning the ventilation air, 3) Power needed on the water side, 4) Peak heat gain reduction.

• Heat exchange coefficient between surface and space

		Total heat exchange coefficient W/m².K		Acceptable surface temperature °C		Maximum capacity W/m²	
		Heating	Cooling	Max. Heating	Min. Cooling	Heating	Cooling
Floor	Perimeter	9-11	7	35	20	165	42
	Occupied Zone	9-11	7	29	20	99	42
Wall		8	8	~40	17	160	72
Ceiling		6	9-11	~27	17	42	99

Design


one pipe above the other in the corridor
Electric Control Room
HVAC Room
Corridor
Staircase
Toilet(W)
Toilet(M)
Hand Washing
Scullery
Storage
Kitchen
Canteen
Locker


one pipe above the other in the corridor
Staircase
Toilet(W)
Toilet(M)
Corridor
Open Office
1.940

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Projects worldwide



ABC-Bogen (office-building) , Hamburg



Museum, Bregenz Austria



dvg bank-building, Hannover

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Projects worldwide



Sheikh Zayed Desert Learning Centre, Al Ain, United Arab Emirates



National Library, Prague Czech Republic



Bavaria insurance-building, Munich

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Projects worldwide



Semmelweis University, Budapest Hungary



Mercedes am Salzufer
(showroom), Berlin



Euro-med Clinic, Fürth

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Heatpump / Chiller

$$EER = \frac{\text{Cooling power}}{\text{Electrical capacity}}$$

$$COP = \frac{\text{Heating power}}{\text{Electrical capacity}}$$

$$ITEE = \frac{\text{Cooling + heating power}}{\text{Electrical capacity}}$$

ITEE = 8,08

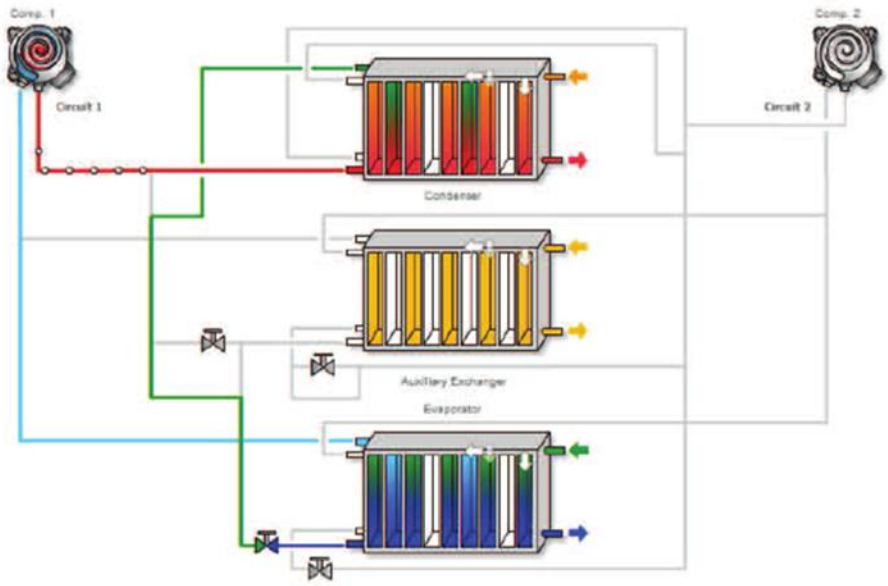
50 % Cooling duty
50 % Heating duty

ITEE = 8.08
Index of Total Energy Efficiency

Chilled water:	12/7 °C
Warm water:	40/45 °C
3rd HX inlet.:	14 °C

Calculation:

$$\frac{Q_0 + Q_c}{P_{total}}$$



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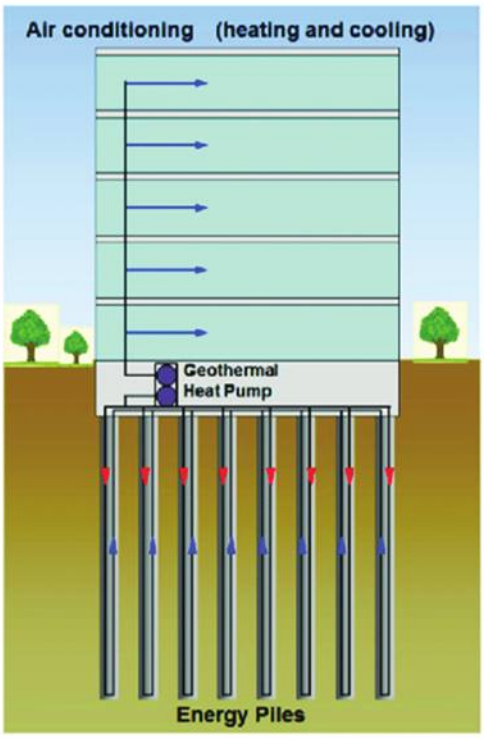
Heatpump / Chiller

No dry coolers or cooling towers.



Ground source





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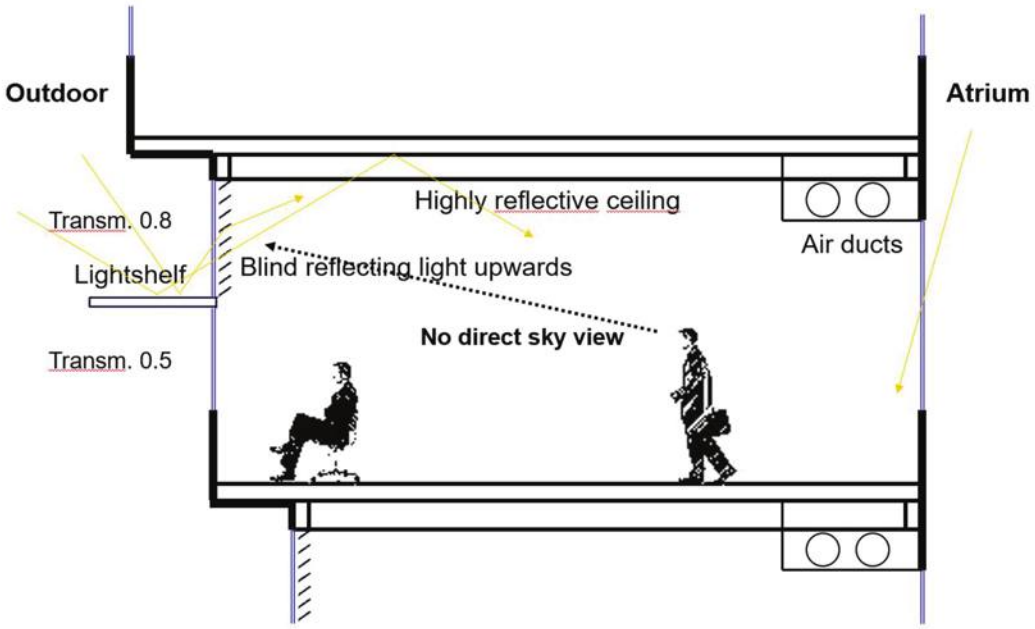
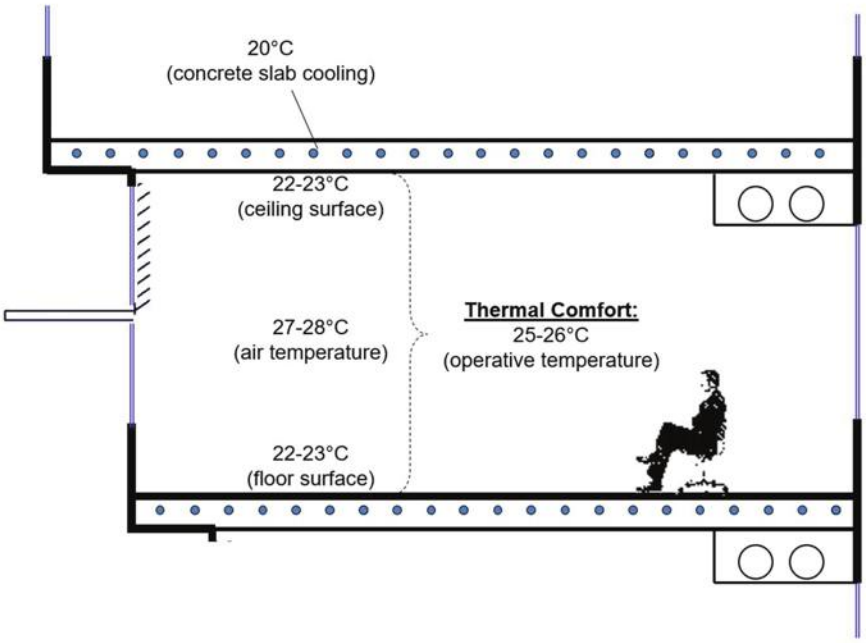
Heatpump / Chiller

• How to deal with light and solar energy from the windows



• Thermal Comfort with higher air temperature.



*outdoor temperature is 30°C

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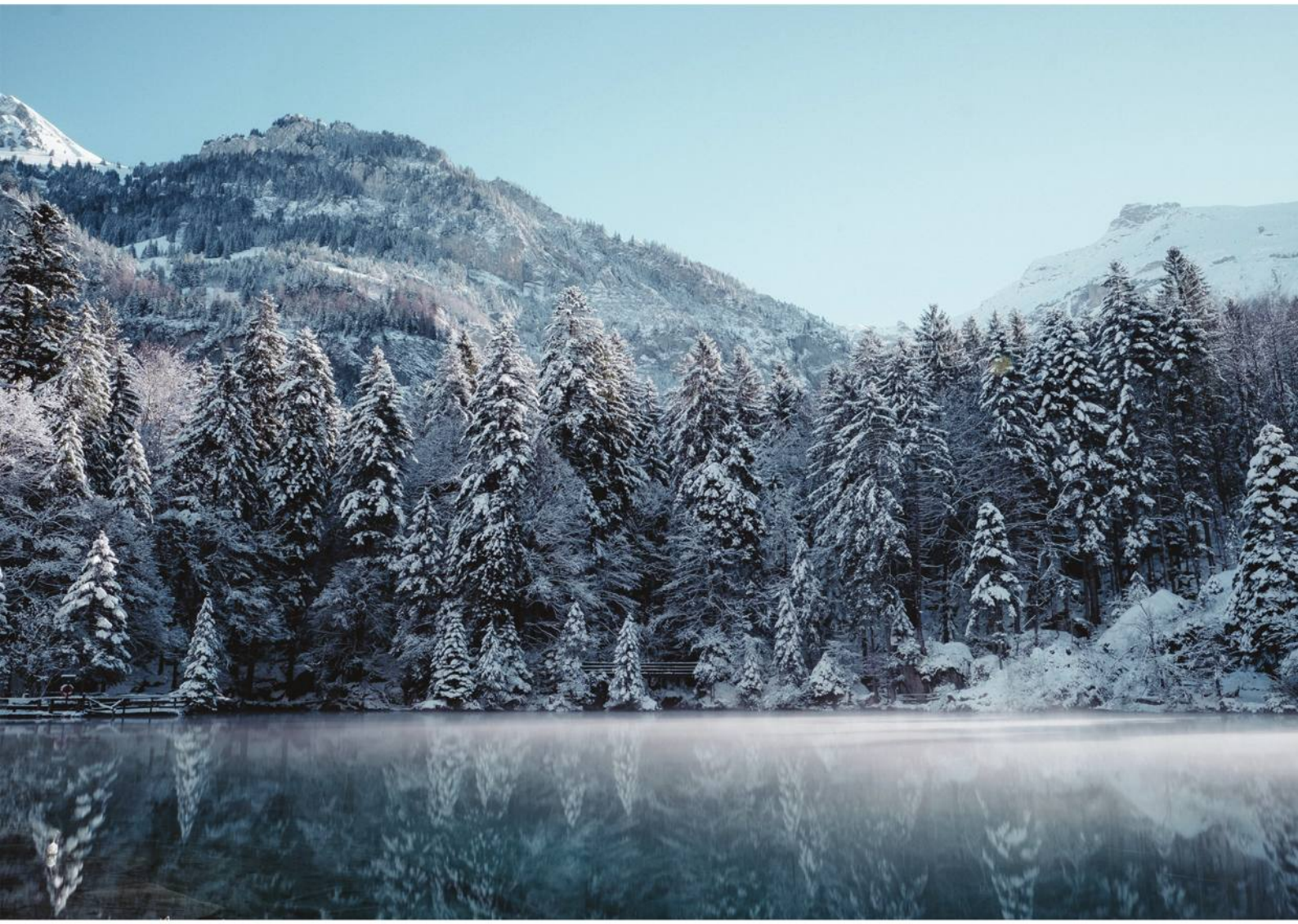
No sence for individual tempeature control

The target was in office and other such kind of buliding, there is not much sense to have inoor climate controlled by rooms and persons individually. Proposal was that buliding would be homogeneus according to the situation of each room and its technical features.

It is a fact that individual controllers and thermaostats are increasing the usage of cooling and heating energy.

Only target is to find the range where most of inhabitants are in comfort zone.



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Result

Outcome of the used ideology and systems is :

- Efficient indoor climate, per square meter the drop of running costs of heating and cooling are yearly up to 45%
- Size of cooling plant was reduced 40%
- The plant night time heats or cools the slab and in day time it serves air handling units
- Unsatisfied personell in the bulinding is in minimum rate colose to ideal on Fanger scale.
- Minimum, close to 0 draught complaints
- Higher comfort was achived with lower operative temperatures and higer air temperatures
- 17% of less peak from the grid
- 75% of building's used water comes from rainfall (depends on the season)



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KEY Points of the system

- Heating and cooling in one system, efficiency coefficient up to 8 (on separate systems about 4)
- Heat from the rooms will not be just exhausted to environment
- Reduced need of the dry coolers or no need at all. Rood area could be used for different purposes.
- Dry coolers are creating noise, so less noise to the surroundings
- Chiller is installed anyway so why not to add to the chiller heat pump mode. Investment is nearly the same to the unit itself.
- Longer life time of the system to compare with „regular "system.
- Suits perfectly to thermally activated systems or systems where the cooling medium temperatures are high and heating medium parameters are low.
- Heating energy low cost because it is „recycled heat energy"
- More environment friendly solution.



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