



## Educational facilities in different climates - a practical comparison

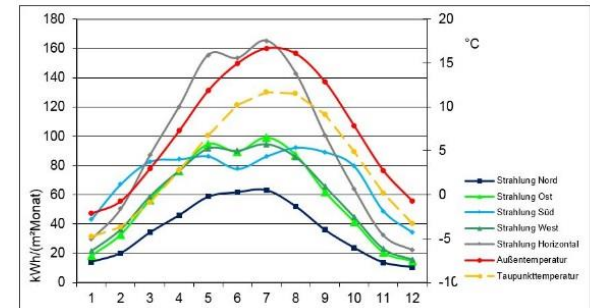
Gernot Vallentin , architect, cert. Passive House Planer  
21th international Passivhaus Conference Wien/ Austria 28-29th April 2017      NON-RESIDENTIAL BUILDING



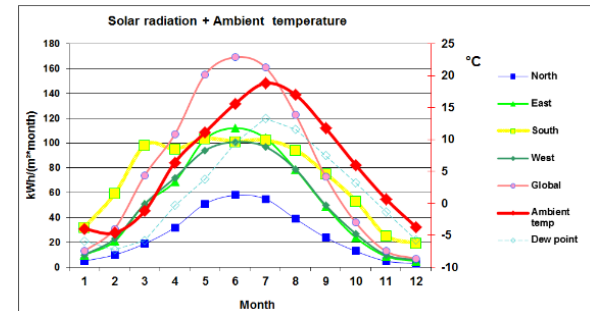
This contribution will point out some different planning approaches which are necessary and appropriate for the different climatic conditions found at various sites.

In comparison to the Montessori school in Aufkirchen which has been operating for a long time in a moderate climate, we can draw conclusions on similarities and differences in architectural and building services design.

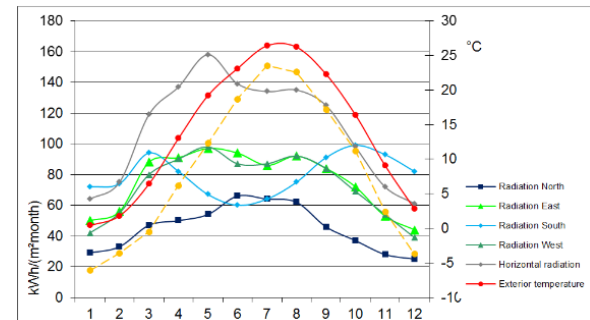
## climagraph munich/ germany



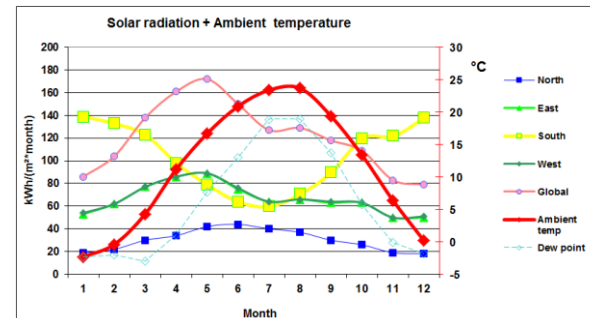
## climagraph polva/ estonia



## climagraph goasan/ korea



## climagraph qingdao/ china





# MODERATE CLIMATE – MONTESSORISCHOOL IN AUFKIRCHEN/ GERMANY

Architect: Grotz, Loibl, Vallentin, Walbrunn - Munich/ Germany

House Services: Andy Lackenbauer - Traunstein/ Germany



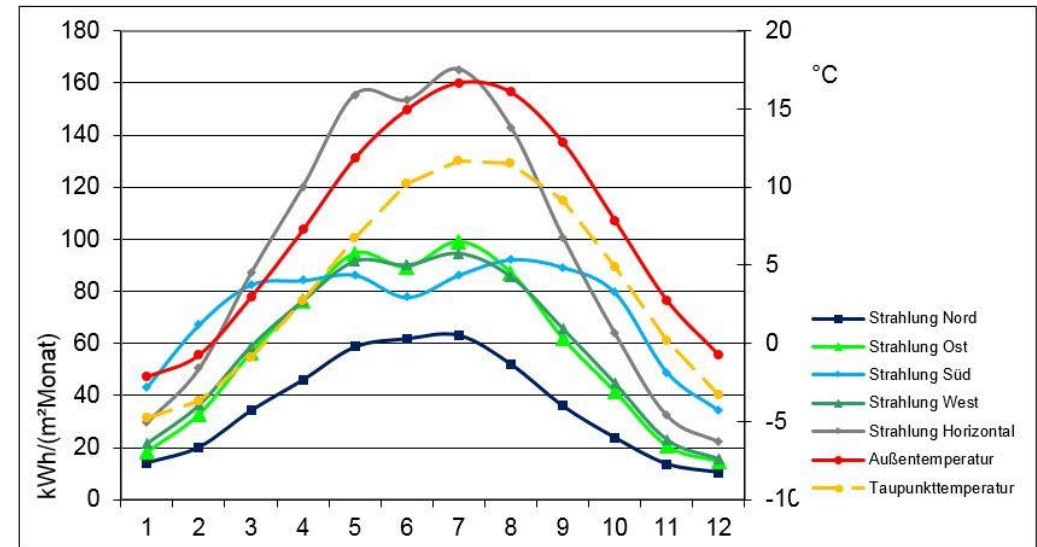
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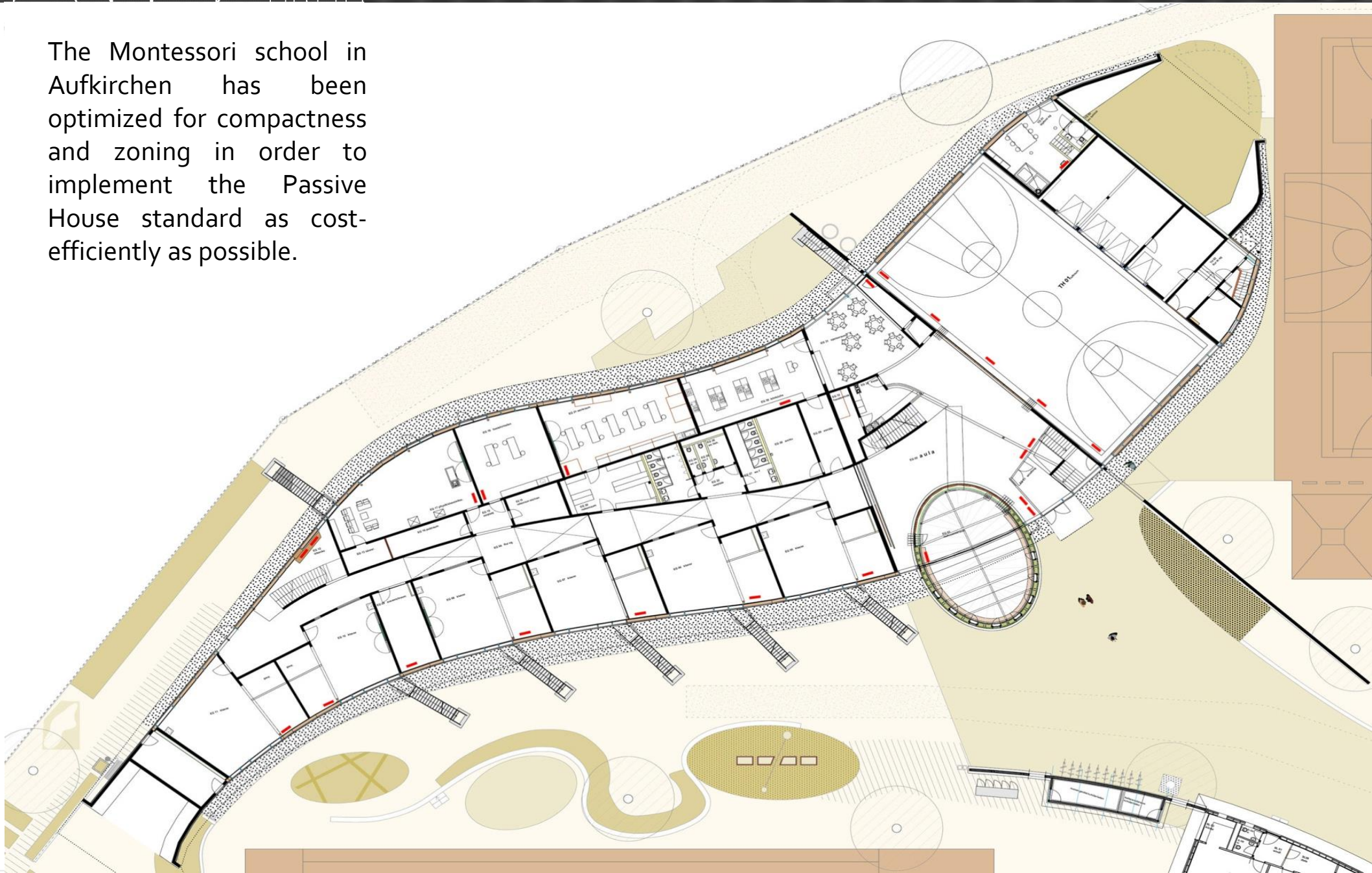
The moderate climate of middle Europe requires all Passive House requirements: minimization of transmission losses and clear orientation towards the south.

During summer and especially in the transitional period, passive sun protection measures are useful.





The Montessori school in Aufkirchen has been optimized for compactness and zoning in order to implement the Passive House standard as cost-efficiently as possible.





To maximize solar gains for the main class rooms the building is basically orientated to the south while administration and specialized class rooms are situated in the north.



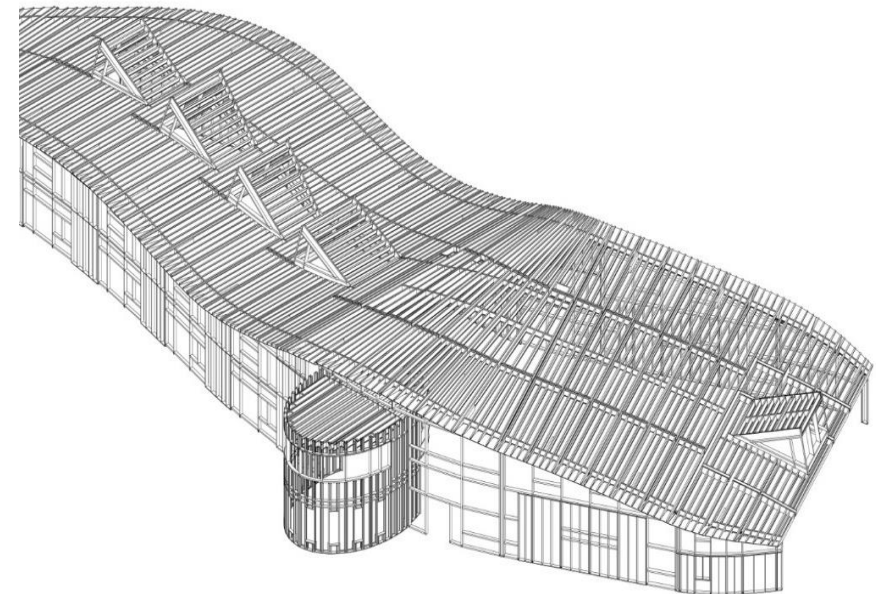


Floor areas and additional rooms are organized inside the building as a "supply zone", which results in a building with a large depth of approx. 20 to 28 meters. The resulting interior hallway is generously lit by skylight glazing. .





The building structure is designed as a hybrid construction in order to make best use of the advantages of solid construction (sound insulation, fire protection, storage mass) and timber construction (thermal insulation). Thus, components could be reduced to an absolute minimum.





In addition to the central ventilation system, the building is supplied by a gas heater with a CHP unit. The heating is distributed via radiators. Active cooling is not provided. By means of passive measures such as roof overhangs and a movable sun protection (awnings), summer warming protection is maintained



Central ventilation unit



gas heater

CHP unit





The entire concept is very simple and could be implemented extremely cost-effectively.



## COLD CLIMATE – HIGH SCHOOL IN POLVA/ ESTONIA

Architect: ArchitekturWerkstatt Vallentin - Munich/ Germany

House Services: Tõnu Mauring - TU Tartu/ Estonia

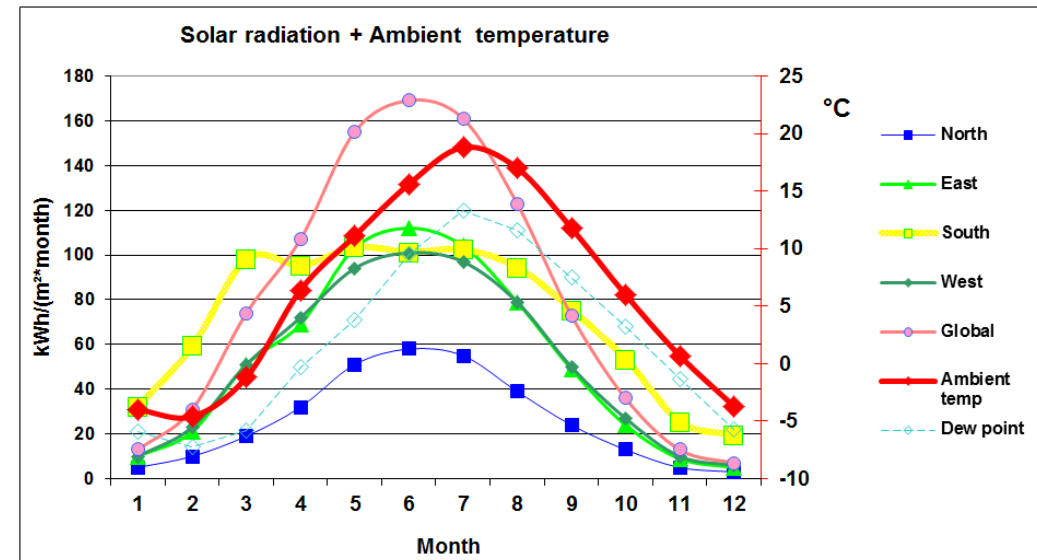


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The cold, dry climate requires extreme minimization of transmission losses and clear orientation towards the south.

During summer and especially in the transitional period, passive sun protection measures are essential.






South façade with balcony and rescue staircase

Here, large roof and balcony overhangs in combination with window blinds have been implemented. In order to cope with a limited budget, the building was very compact and oriented directly to the south.





The compactness of the building has its consequences in the interior of the inner hall:  
Atrium with a gallery  
All rooms around  
Skylight  
The main staircase like a big furniture

**Atrium with  
Gallery +  
inner staircase +  
skylight**



All structural elements of the three-story school building are built using reinforced concrete. The outer wall is made from timber-frame construction and wooden mullion/transom façade placed in front of the concrete structure.



Bearing structure  
in concrete



Wooden structure  
for the facade



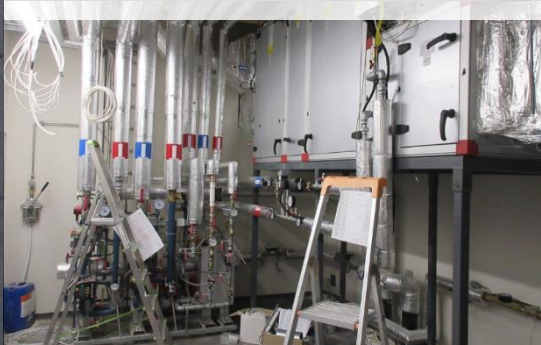
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A solar thermal system supplies about 80% of the annual heat requirement for heating and hot water. Solar thermal energy is supported by a groundwater heat pump, heat distribution via floor heating. The system is completed with a PV system and a Passive House ventilation system.



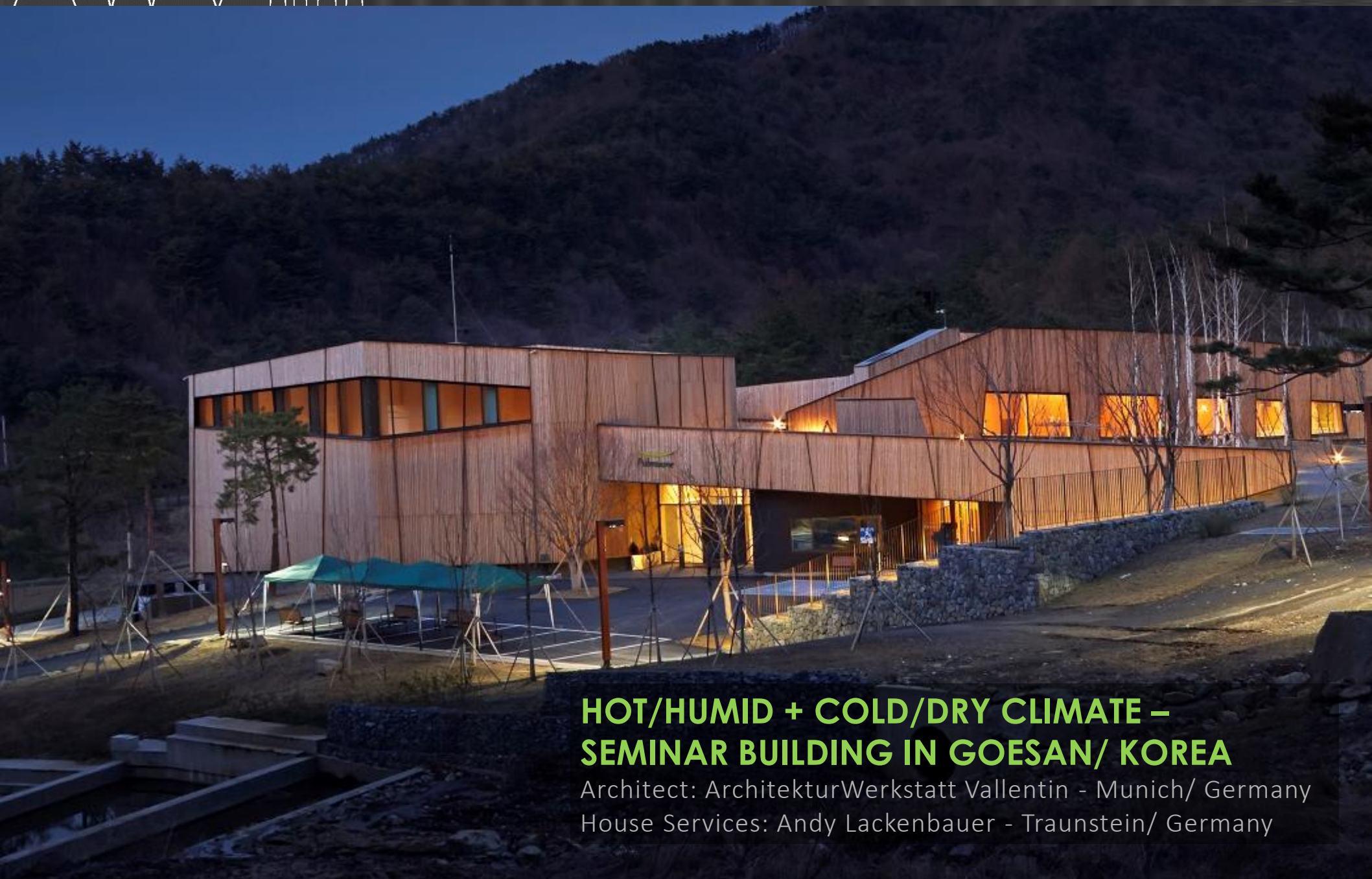
photovoltaik on the roof





Entrance with  
overloading ceiling



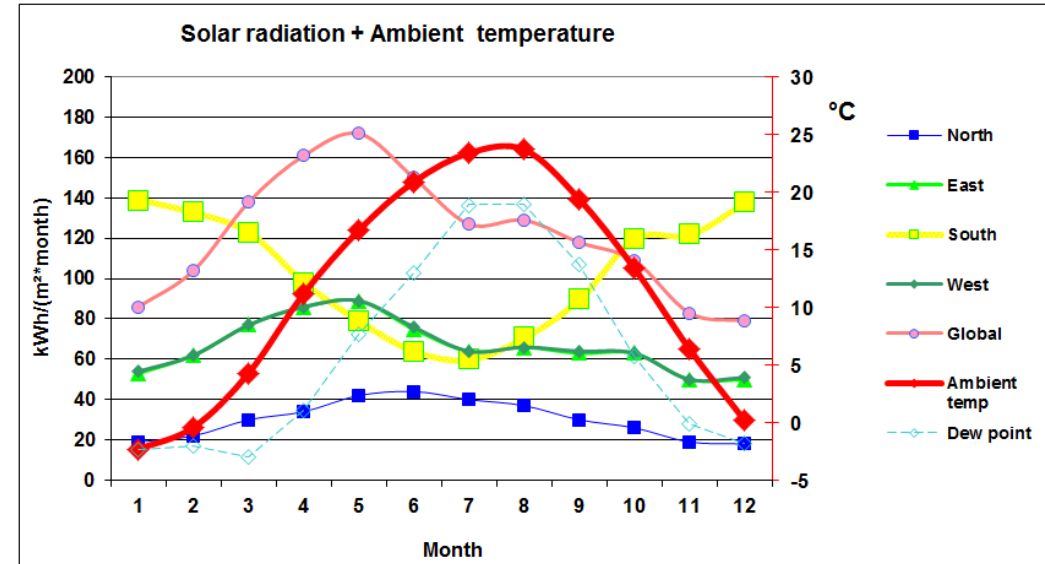


## **HOT/HUMID + COLD/DRY CLIMATE – SEMINAR BUILDING IN GOESAN/ KOREA**

Architect: ArchitekturWerkstatt Vallentin - Munich/ Germany  
House Services: Andy Lackenbauer - Traunstein/ Germany



The hot and humid climate in summer and the cold and dry climate in winter are equally to be taken into consideration in the architecture and house technology of the Seminar und Guesthouse Building in Goesan/ Korea.





Due the massive concrete construction from the ground to the roof, temperature control is facilitated both in winter and in summer. The guest apartments are facing north to provide comfort in summer and in transition periods.



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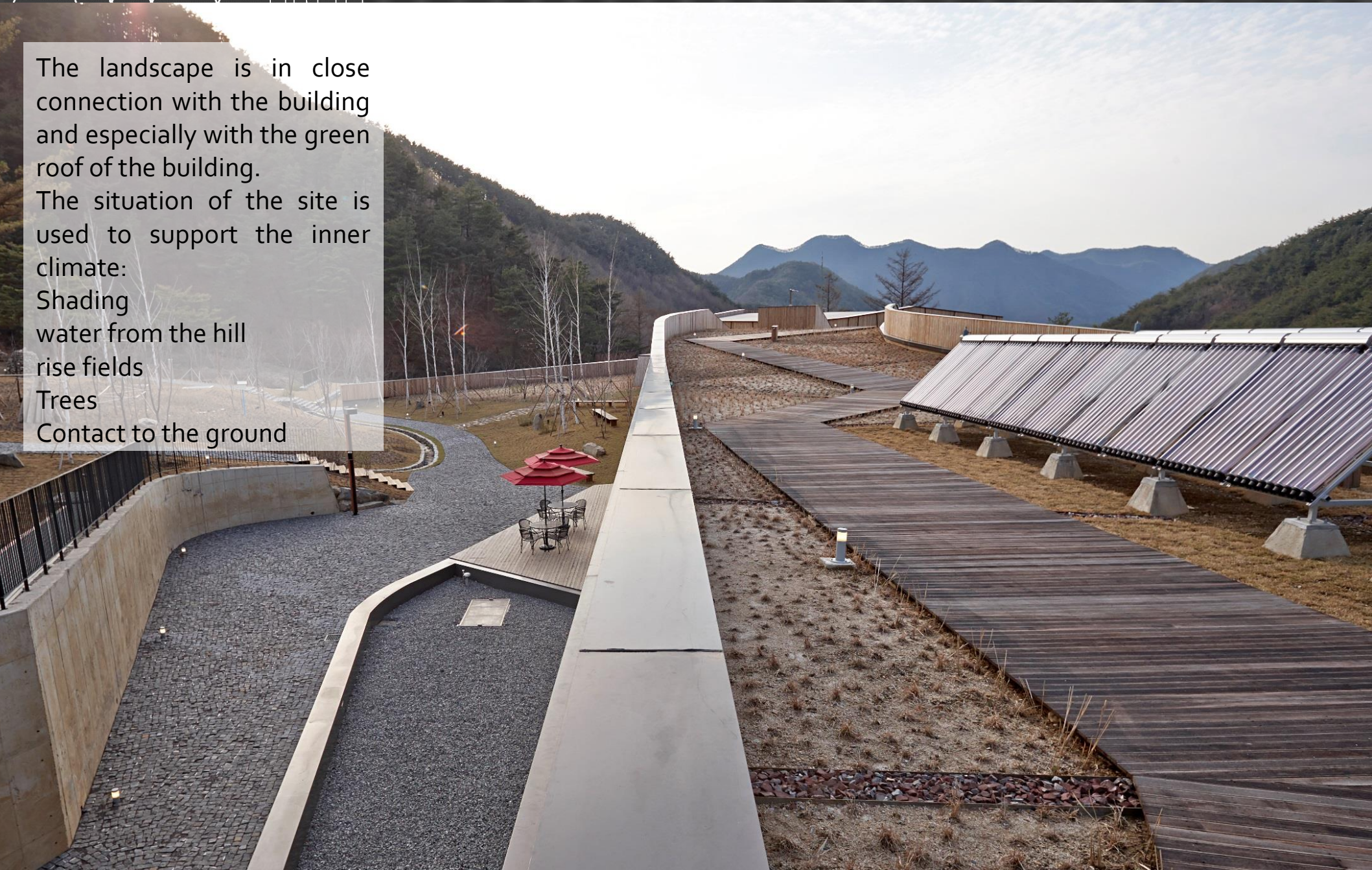
The landscape is in close connection with the building and especially with the green roof of the building.

The situation of the site is used to support the inner climate:

Shading  
water from the hill  
rise fields

Trees

Contact to the ground



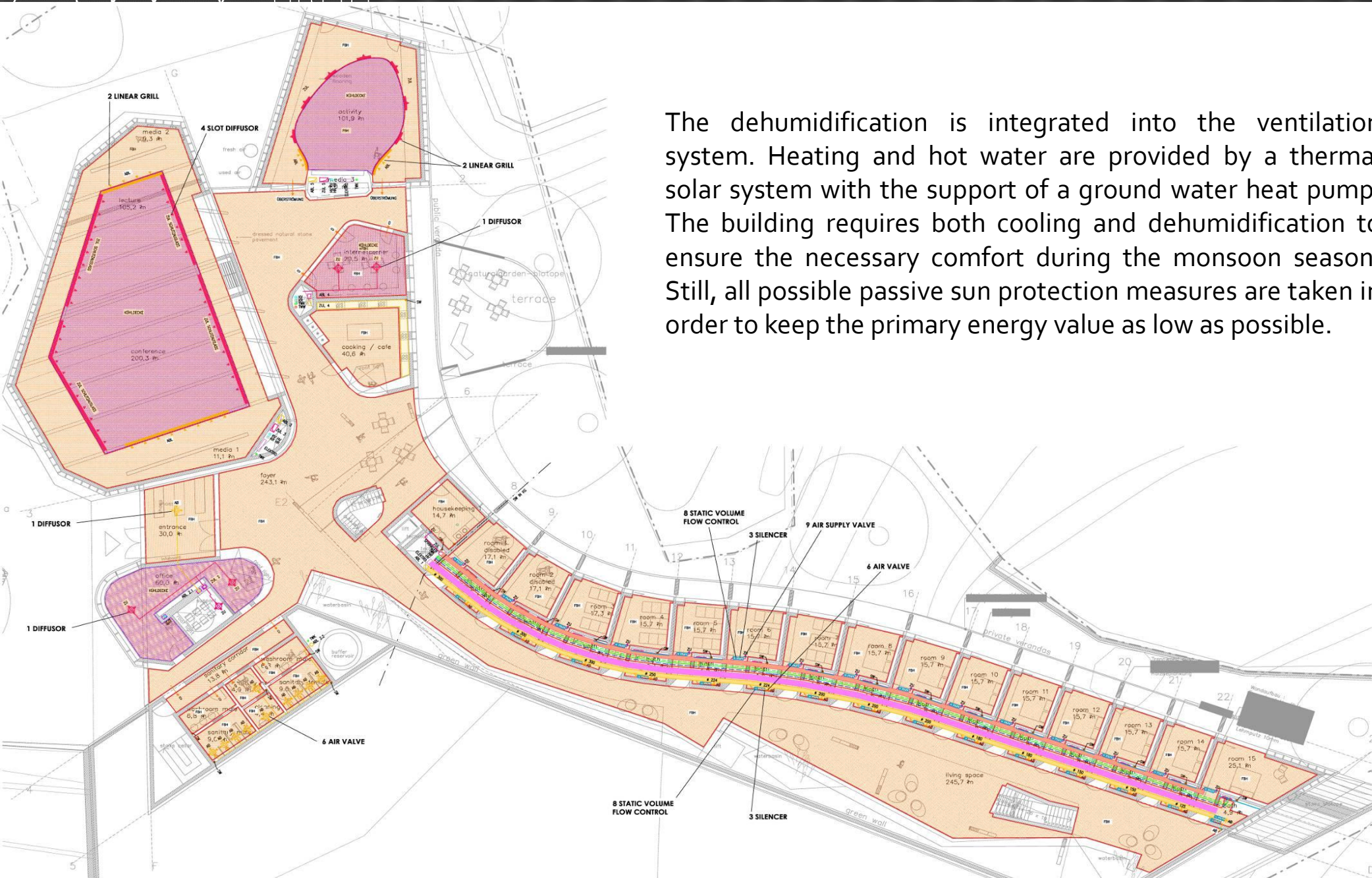


Mixed construction using reinforced concrete structurally and wood facades. The inner walls are covered with clay plaster as a natural material. Building services: Temperature control in summer and winter by combined floor heating/cooling. In rooms with special requirements such as the kitchen, offices, seminar and activity rooms, a cooling ceiling has been added.





## HOT/HUMID + COLD/DRY CLIMATE: Seminar Building Goesan/ Korea



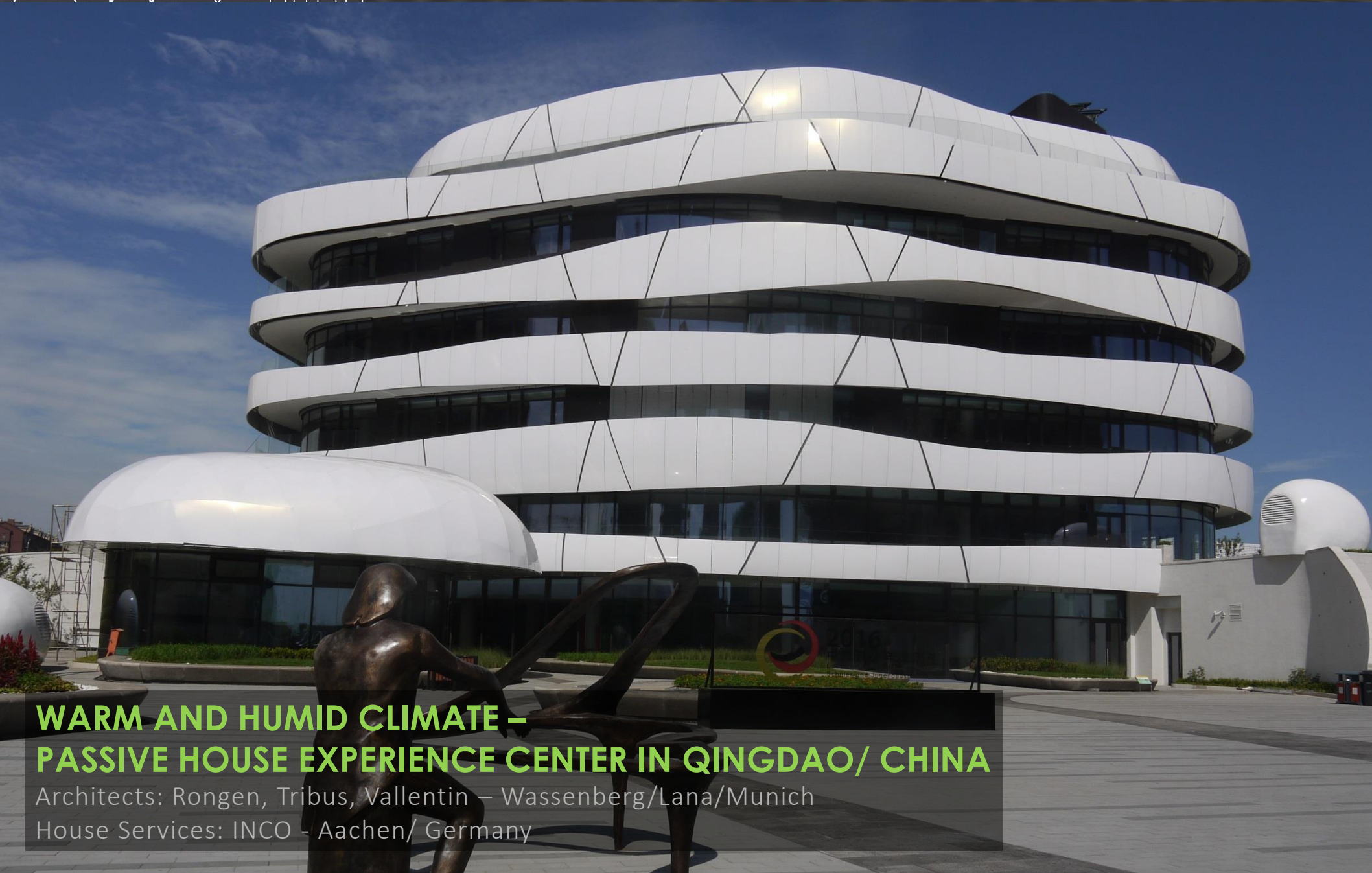
The dehumidification is integrated into the ventilation system. Heating and hot water are provided by a thermal solar system with the support of a ground water heat pump. The building requires both cooling and dehumidification to ensure the necessary comfort during the monsoon season. Still, all possible passive sun protection measures are taken in order to keep the primary energy value as low as possible.





The concept is aimed at integrating the high consumption levels for cooling and dehumidification into the passive house concept.





## **WARM AND HUMID CLIMATE – PASSIVE HOUSE EXPERIENCE CENTER IN QINGDAO/ CHINA**

Architects: Rongen, Tribus, Vallentin – Wassenberg/Lana/Munich

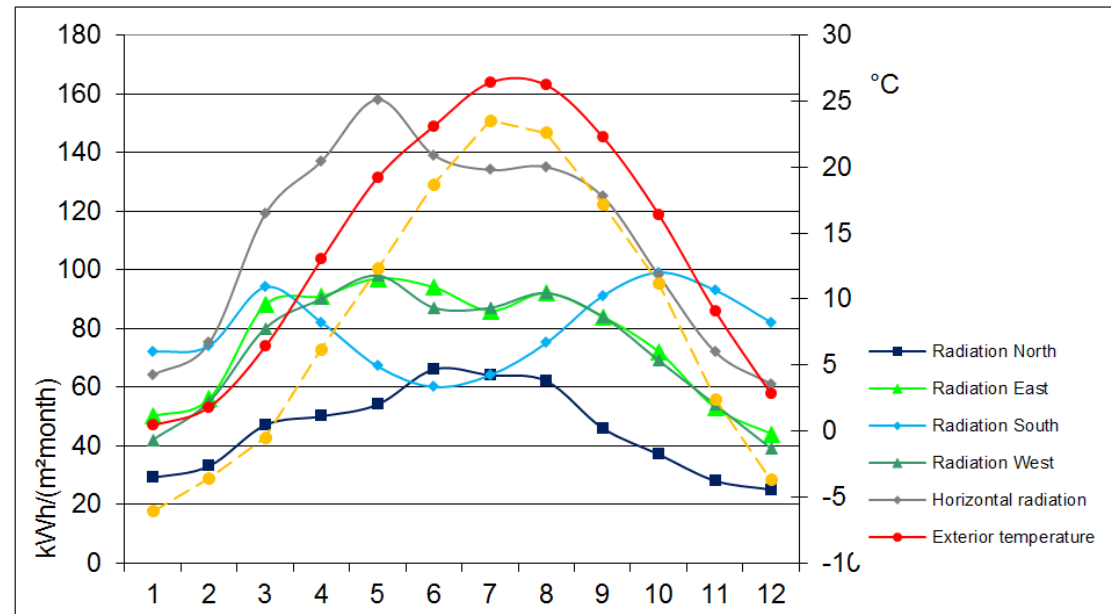
House Services: INCO - Aachen/ Germany

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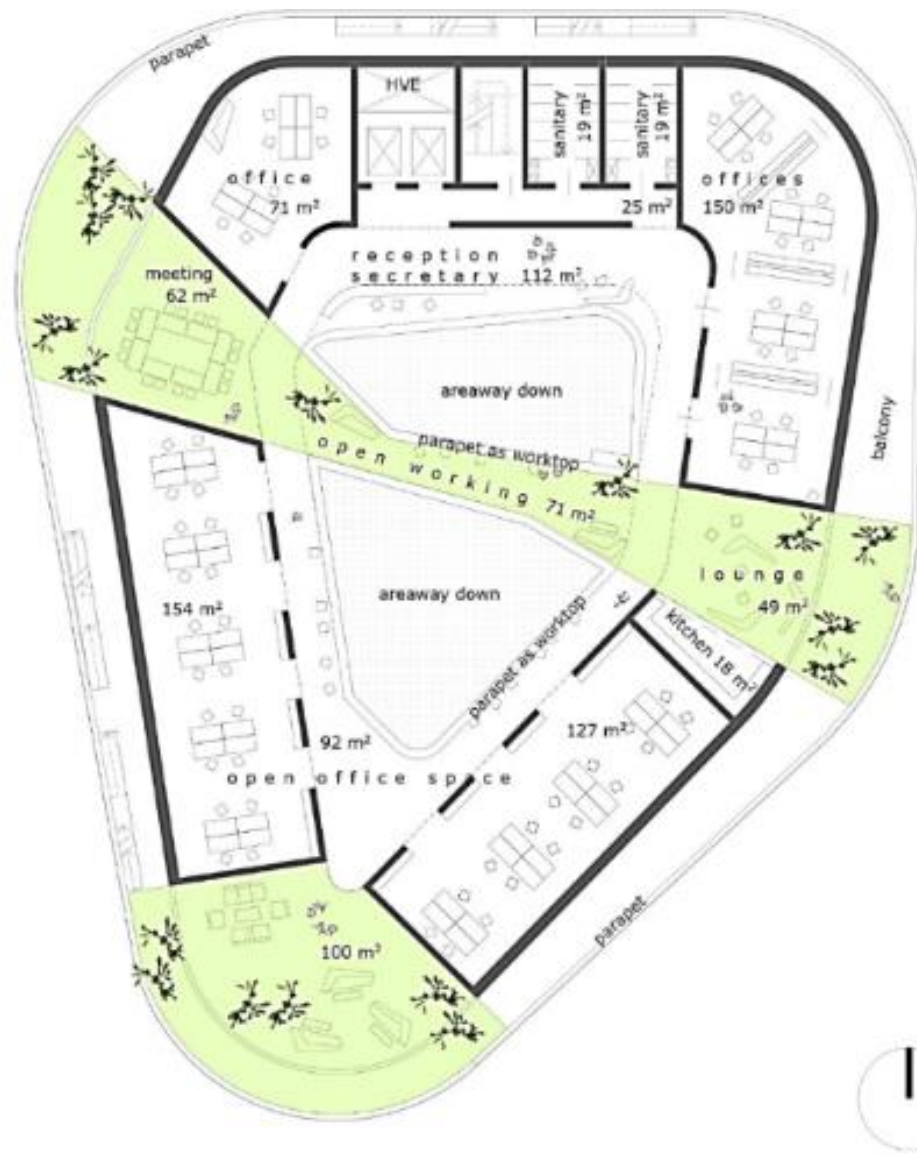


The climatic requirements are characterized by hot summers with a high moisture.



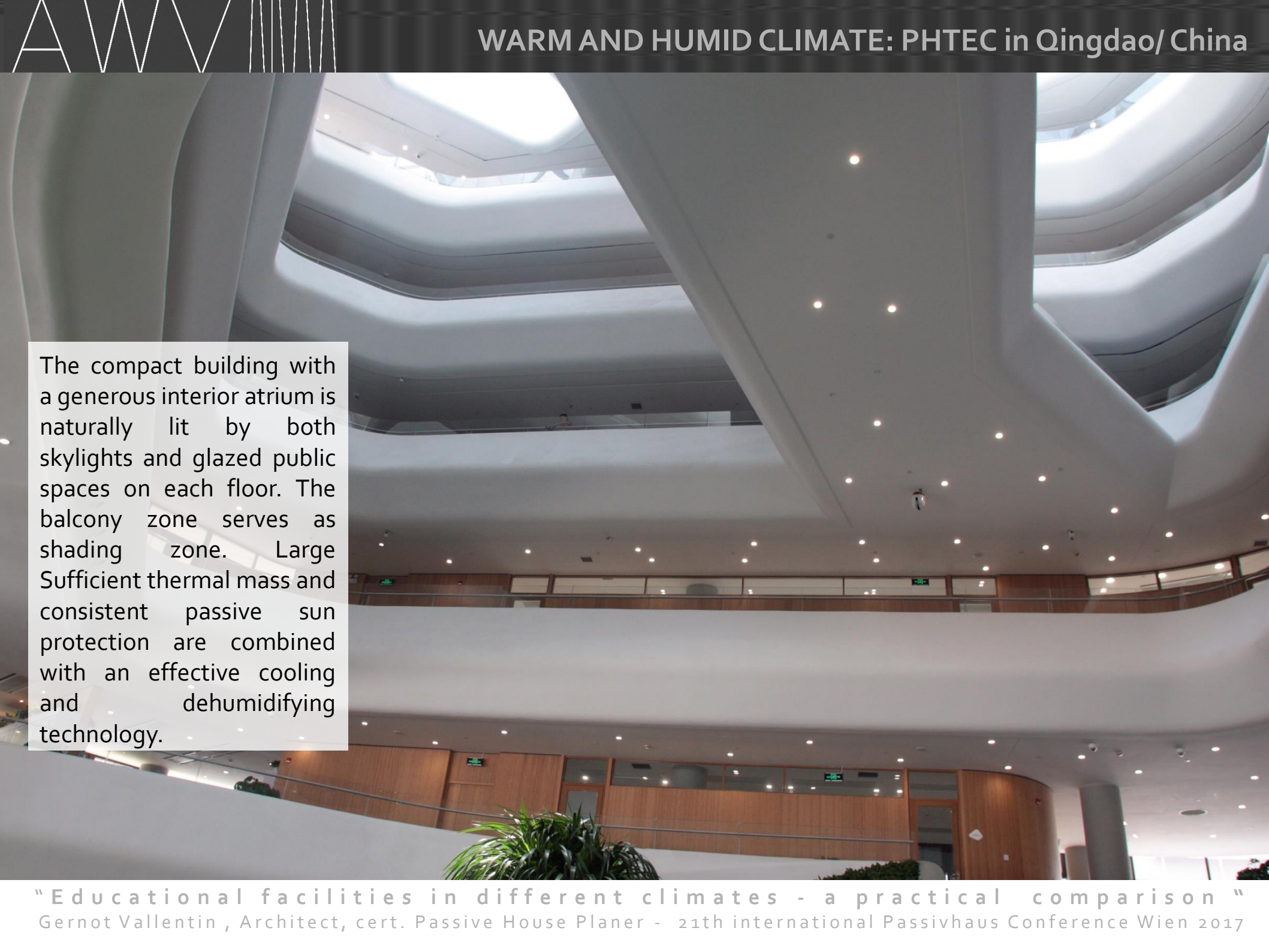


Due to its multifunctional use as a seminar building, high internal loads must also be taken into account: several classrooms and lecture rooms, meeting rooms, office / administrative floors, exhibition areas, apartments add to addition to the warm outside temperatures and the humidity.



standard floorplan



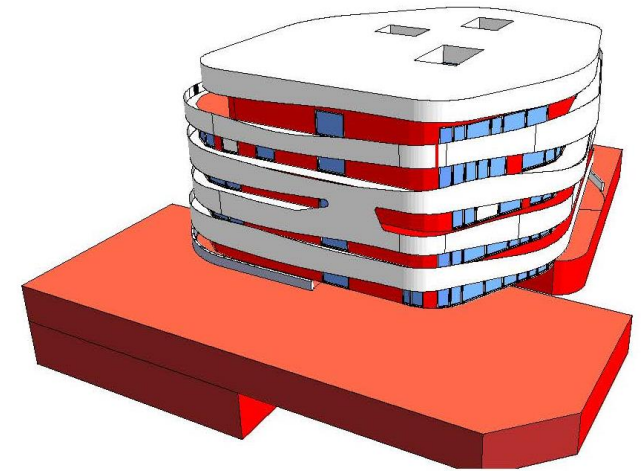
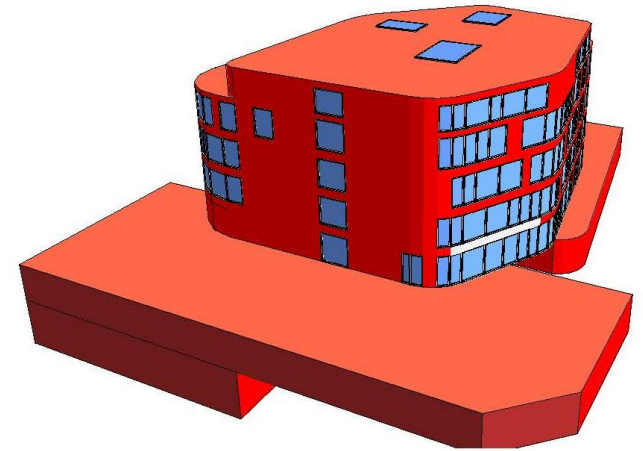


The compact building with a generous interior atrium is naturally lit by both skylights and glazed public spaces on each floor. The balcony zone serves as shading zone. Large Sufficient thermal mass and consistent passive sun protection are combined with an effective cooling and dehumidifying technology.

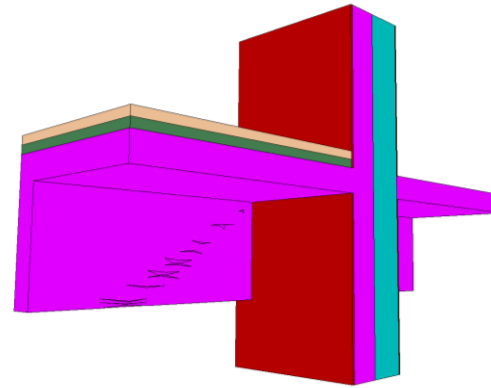


The compact building with a generous interior atrium is naturally lit by both skylights and glazed public spaces on each floor. The balcony zone serves as shading zone. Large Sufficient thermal mass and consistent passive sun protection are combined with an effective cooling and dehumidifying technology.

Separation of the thermal shelter and the facades

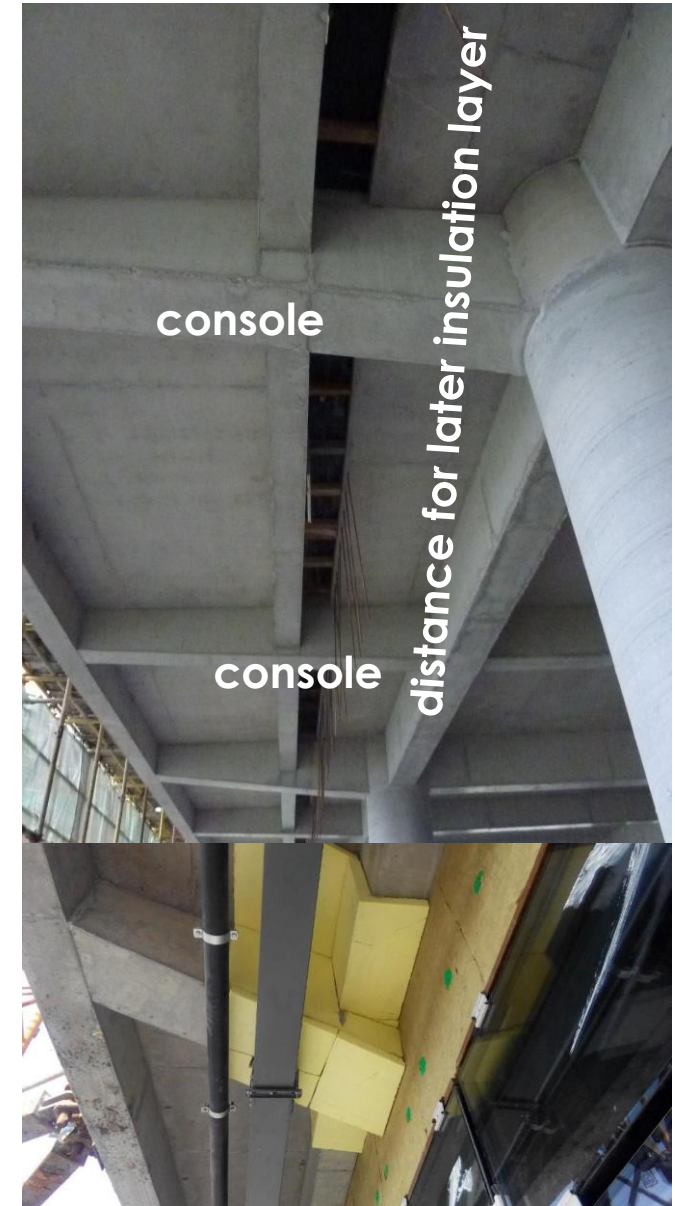






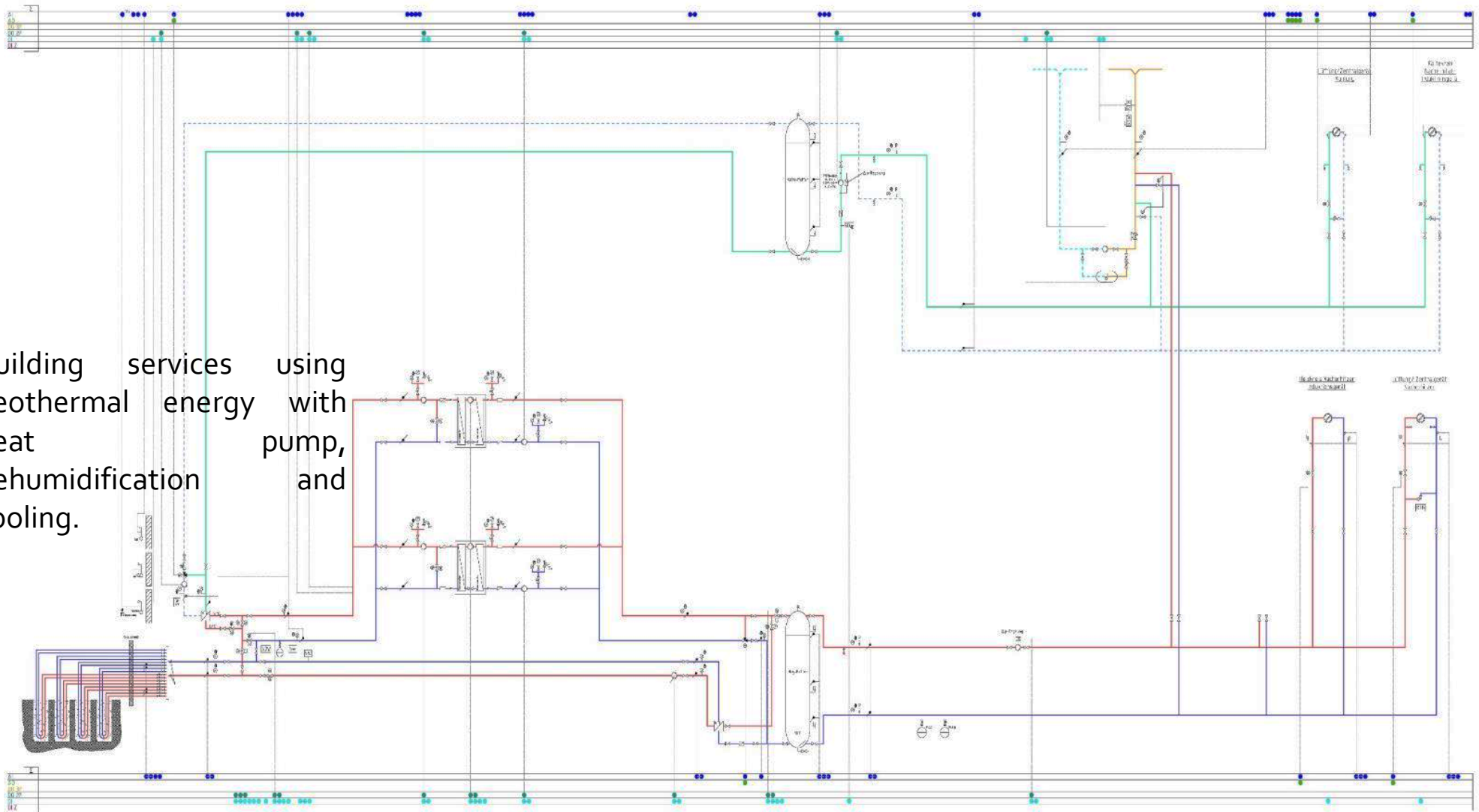
Construction in reinforced concrete with curtain façade with a focus on a practical and cost-effective solution of the thermal bridge of the surrounding balconies.

Construction of the balcony-  
What about the thermal bridges?






Building services using geothermal energy with heat pump, and dehumidification cooling.


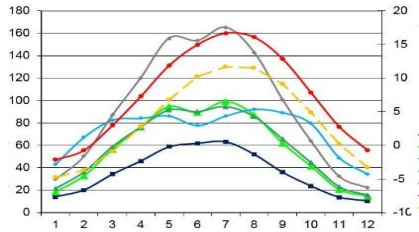

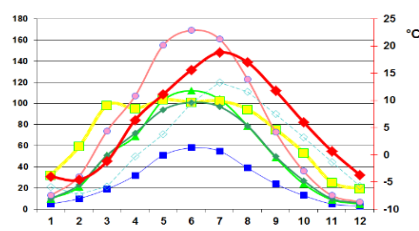

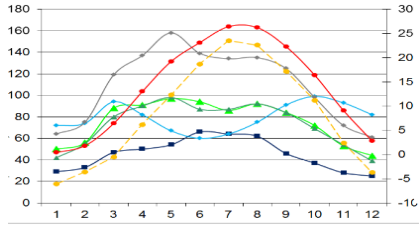

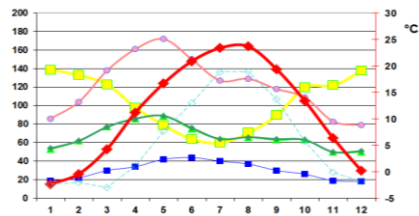






Building services using  
geothermal energy with  
heat pump,  
dehumidification and  
cooling.



		Climate	U-Value/ [W/(m²K)]	Window Frame [W/(m²K)]	G-Value/ U-Value	EFA[m²]	HSV System
		Aufkirchen moderate	0,15	0,76	0,51/ 0,70	3.275	Gas/ CAP
		Polva cold	0,08	0,64	0,61/ 0,64	2.346	HP + PV
		Goesan hot/ humid cold/dry	0,12	0,73	0,52/ 0,70	2.744	HP + Solar
		Qingdao Hot/ humid	0,12	0,99	0,52/ 0,70	7.535	HP + Groundwater





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thank you for attention

