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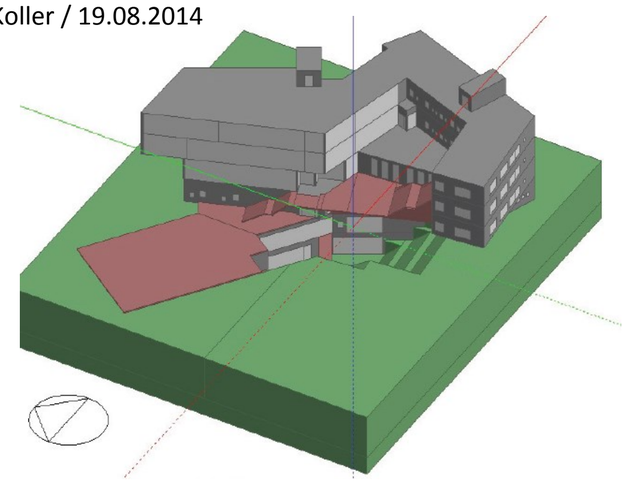
ZEBISTIS Tools and Technologies for Energy

C a s e S t u d y S t . P a u l ’ s g r e e n s c h o o l [Part 2]



METHODOLOGY

Model A

1. Only hot domestic water (HDW) covered by a solar thermic system with support of a heat pump and heat recovering (1/3 of used energy can be recovered).
A photovoltaic system provides the electricity demand of the heat pump.
2. Heating with a heat pump supported with- and without a geothermal energy sources.

Model B

Heating and HDW combined in one storage tank with the support of a water-to-water heat pump and a solar-and geothermal energy source.
This simulation should show differences between model A to improve the best performing system.
The target of this simulation was to find the best relation between hot water storage tank size, collector area and a maximum of solar cover ratio with a minimum of electrical energy-consumption caused by the heat pumps.

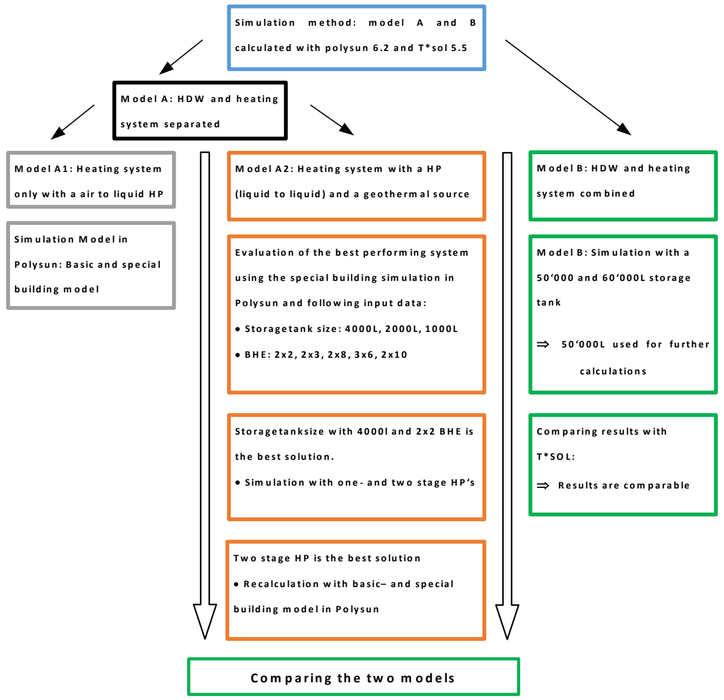


Figure 1: Overview on the simulation process for model A and B; HP – heat pump; BHE – borehole heat exchangers

RESULTS

The simulations showed the most efficient system is directed south with a 278,4 m2 collector-area installed in the facade and the values listed below.

Best performance of Model A1						
Water/water System two stage Heat Pump				**Brine/water System** two stage Heat Pump		
Heat pump type: two stage modulated Manufacturer CTA AG; Type: OH 55 Power: 55,2kW at W10°C/W35°C COP 5,6				Heat pump type: two stage modulated Manufacturer CTA AG; Type: OH 42e Power: 41kW at B0°C/W35°C COP 4,5		
special building layout			basic building layout	special building layout		
Storage tank	1000L	4000L	4000L	1000L	2000L	4000L
2x2 borehole heat exchang-ers (BHE) [kWh]	11'144	**10'910**	**6'268,15**	11'416	11'411	11'180
Storage tank				8000L		
2x8 BHE [kWh]		9'693				9'932
2x10 BHE [kWh]		9'389				9'619

Potential for saving energy up to 60% compared to the system without geothermal energy solution

CONCLUSIONS

- Building structures according to the Passive House standard (D) or the Minergie label (CH) are a useful basis for designing ZEB`s. To fulfill the criteria of these labels is still ambitious. There must be a special focus on renewable building materials with little “grey-energy”.
- The climate in Korea causes peaks for energy not only in wintertime but also during summertime because of air conditioning.
- Heating systems with modulating heat pumps connected in series are the most efficient solution for heat pump systems. Source temperatures are geothermal source and a solar collector field