



Zurich University of Applied Sciences Department N, Grüntalstrasse 14, CH-8820 Wädenswil, Switzerland / Talmon-Gros Max Jacques & Christoph Koller / 19.08.2014

ZEBISTIS Tools and Technologies for Energy

Case Study St. Paul's green school [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.

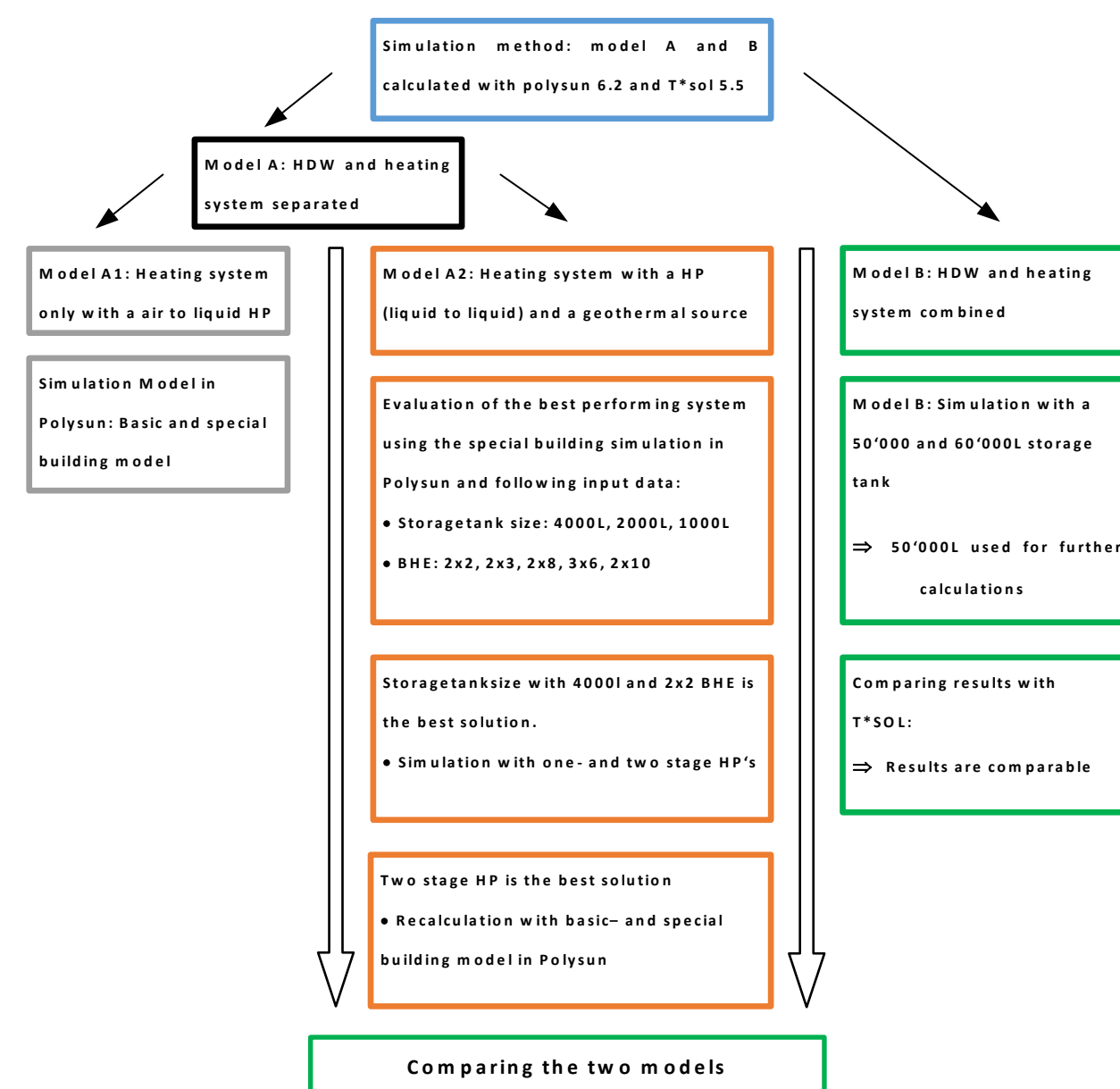
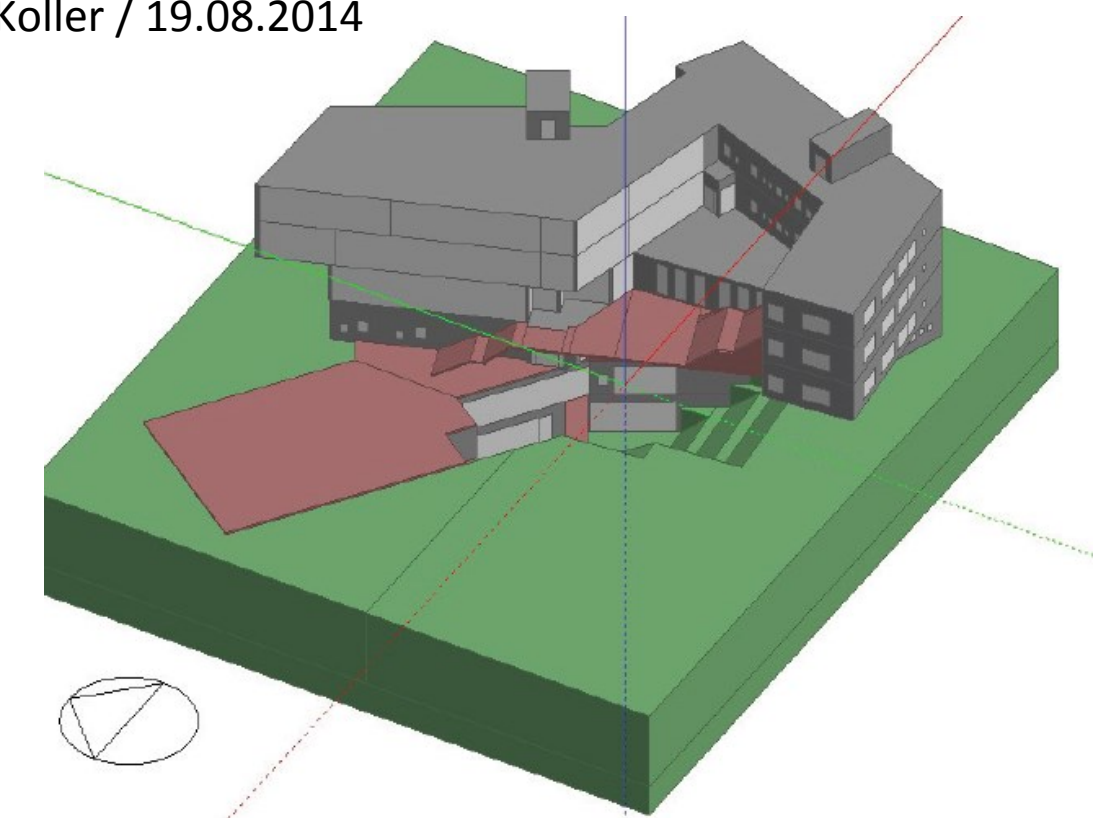


Figure 1: Overview on the simulation process for model A and B; HP – heat pump; BHE – borehole heat exchangers



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				Brine/water System		
two stage Heat Pump				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 exchangers (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