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

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 1]

Introduction

The ZEBISTIS project was associated with the process of design of a “green school” in South Korea. This pilot study gives an overview of possibilities in order to cover the energy demand of a green school in Korea

BUILDING FRAME CONDITIONS

THE BUILDING STRUCTURE IS BASED ON THE PASSIVE HOUSE STANDARD WITH FOLLOWING KEY DIMENSIONS		
U-value	Heating E demand (Climate dependent factor)	Below 15kWh/m².year
	Primary energy demand	Below 120kWh/m².year
	Opaque envelope	Below 0.15W/m2.K
	Exterior wall	0.08-0.15W/m2.K
	Roof	0.06-0.15W/m2.K
	Window below	0.80W/m2.K (g-value: over 50%)
	Basement Floor / Basement Ceiling	Below 0.15W/m².K
	- requires mechanical air ventilation: heat recovery up to 90%	

Size of the conditioned area	4599 m² (unconditioned 3364 m²)
Occupants	690
School class days	195
Operation time for the heating system [days]	85
Hot water demand	30 l/day and person
ENERGY DEMAND (FIRST DRAFT OF THE SCHOOL)	
Heat demand (with frame values - Passive House Standard)	68`986 kWh/a
Heat demand for hot water	644 kWh/d (30 l/pers. and day)
Electrical consumption lights and facility equipment	6`7425 kWh/a

All calculations were done with the Polysun 6.0, T*SOL 5.5. and PVSOL 6.0.

TECHNOLOGY FOR SOLAR ENERGY
PHOTOVOLTAIC
Mono-crystalline modules (LG295N1C-G3 from LG Electrics Inc. Korea) are high end performing photovoltaic panels to be used on the roof to reach optimal performance without risk of shading.

- 295 Wp (STC) with a effectiveness of approximately 18%
- panels facing direction south with an angle of 30° (optimal orientation for Korea)

SOLAR THERMAL COLLECTORS
are usually used to preheat, with typical cover ratios of 60% for hot domestic water (HDW) or 30% for heating systems (yearly energy usage). Vacuum tube- or flat collectors are suggested to reach high cover ratios up to 90%.
Vacuum-tube collectors to be installed in the façade (orientation: W, E and S)

HEAT PUMP SYSTEMS
• Air to Air/water heat pumps (ASHP):
Easy to install and cheap but with low efficiency at cold source temperatures (air in for example at winter days).
• Brine-/water to water heat pumps in connection with an earth collector (shallow geo-thermal energy approx. 5 m under the ground):
Low operation and maintenance costs and high efficiency but relatively high investment and installation costs. Efficiency depends on the quality of the ground.
• Brine/Water heat pumps (with a earth probe):
System with one of the highest efficiency and small operation and maintenance costs. Usable also for large scale buildings with a field of geo-thermal probes. These systems need precise calculations for the drilling costs of the boreholes, which is difficult