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Sustainable Technology and Low Carbon Building

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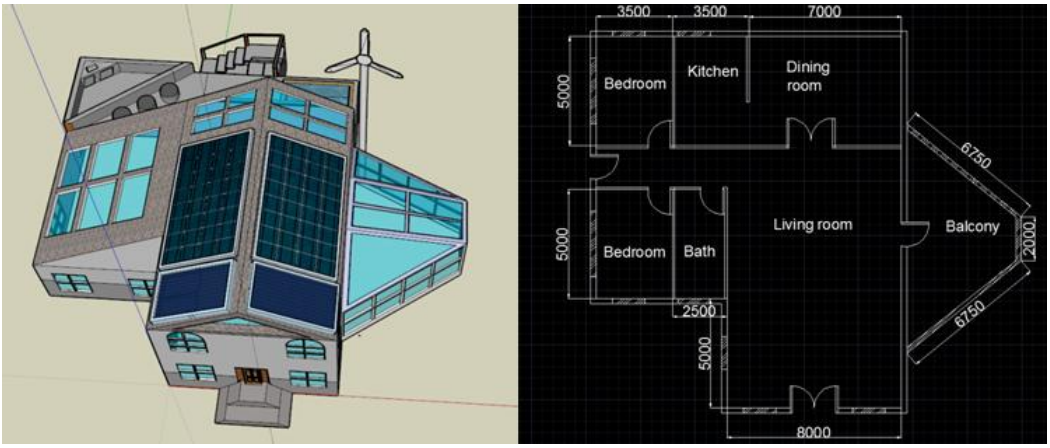
Abstract: ***For the sustainable development purpose, European energy policy must pursue the objective of a sustainable, competitive and secure supply of energy. Sustainable buildings have to be a significant part of any strategy directed at reducing energy consumption. In this project, an eco-house will be designed in Nice. The house utilizes sunlight as both heat gain source and natural lighting. The design also includes a number of sustainable materials and technologies including rain water harvesting and dew collection for daily water supply, solar hot water heating system.***

Keywords: eco-house sustainable development heat gain source natural lighting sustainable materials

1. Design Strategies

The general view of this eco-house and layout are shown below.



1.1. Orientation

The sunpath stereographic diagram in Figure 1.1 indicates that north side of the house will get the smallest solar gain and direct daylight. As a result, in order to produce sufficient daylight, the house should be south faced. wind direction is always from south to north due to the temperature difference between continent and ocean. To summarize, the best orientation of this eco-house is facing south.

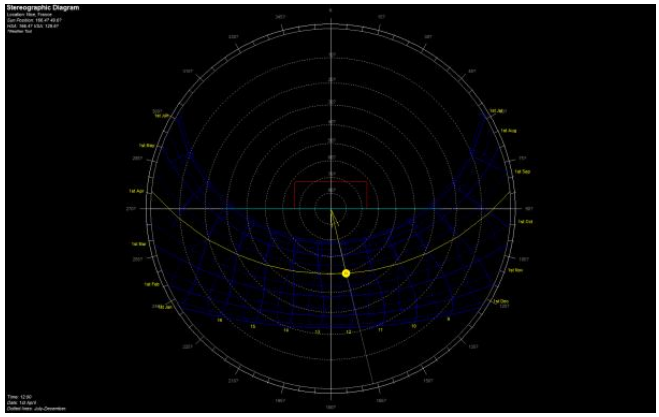


Figure 1.1

1.2. Solar Hot Water System

The solar hot water collector is auroTHERM plus VFK 155 provided by Vaillant. It is premium flat plate collector installed on the roof that can deliver up to 60% of annual domestic hot water requirement according to Vaillant. The technical data of the collector is listed in table 1.2.

Table 1.2: Technical data of Solar Hot Water Collector

auroTHERM plus VFK 155	
Dimension	1233*2033*80
Absorber type	Serpentine
Absorber material	Aluminium (vacuum coated) 0.5*1178*1978
Absorption	95%
Glass type	Solar safety glass(anti-reflection coating)
Transmission	96%
Efficiency	83.3%

1.3. Chilled Panel Cooling System

In summer the temperature is around 30℃, only ventilation cannot achieve the comfortable temperature range, i.e. 24℃-26℃. Cooling system is necessary to control the inside temperature. Since the house is near the sea, relatively cooler

sea water can be used for cooling. As a result, chilled panel with cool sea water running through is installed. The selected chilled ceiling is CT 135/135-D2428-PB15-l-BG, which is the code for chilled ceiling tile 1.35m x1.35m with diagonal pitch perforation holes (2.2mm diameter) representing 30% open area with 15 plain border around each tile. All chilled tiles are insulated and suitable for fitment with a beam grid. The detailed structure is shown in figure 1.3.

Figure 1.3: Chilled Ceiling Structure

1.4. Rain Water Harvesting

Rain water harvesting is an effective and eco-friendly method of reducing water usage, which will lead to reduced water bills. The rain water harvesting system used for the house is Monsoon Facorit 20F 1500 which is provided by Stormasaver. There are two main benefits of Stormsaver's Rainwater Harvesting. Harvested rainwater will collect and automatically be used for toilet flushing, laundry, garden watering, etc. The result will be up to 50% lsee usage and cheaper bills. Besides, as no heavy equipment is required, it is simple and quick for setting up. The Monsoon Facorit 20F 1500 liters home rainwater harvesting system is made up of four main parts which are 1500 liters shallow dig underground storage tank, control panel, floating suction filter kit and 20m suction hose. The technical details are listed in table 1.4.

Table 1.4: Technical details of rain water harvesting system

Monsoon Facorit 20F 1500	
Size	595*550*265mm
Power consumption	0.8kW
Working pressure	2.5 - 4.5 bar
Maximum flow	80 L/min
Noise level	60dB

1.5. Dew Water Collection

Dew water collection can be applied due to two reasons. Firstly, relative humidity is quite high and the temperature of spring, autumn and summer is usually over 10 degree. Secondly, deep sea water has very low temperature which is below 5 degree. Deep cold sea water is pumped to circulate through the condenser which has large conductivity. Warm air contact with the cooling coil is condensed when the temperature drop lower than its dew point. The condensed water is as clean as tap water. Take air temperature to be 15^0, deep water temperature to be 5^0. The condensation rate is 0.2587 which is calculated by EES. The results are shown in figure 1.5. And details of EES program is pasted in appendix. Hence, dew water collection system is feasible and can provide sufficient clean water for daily usage.

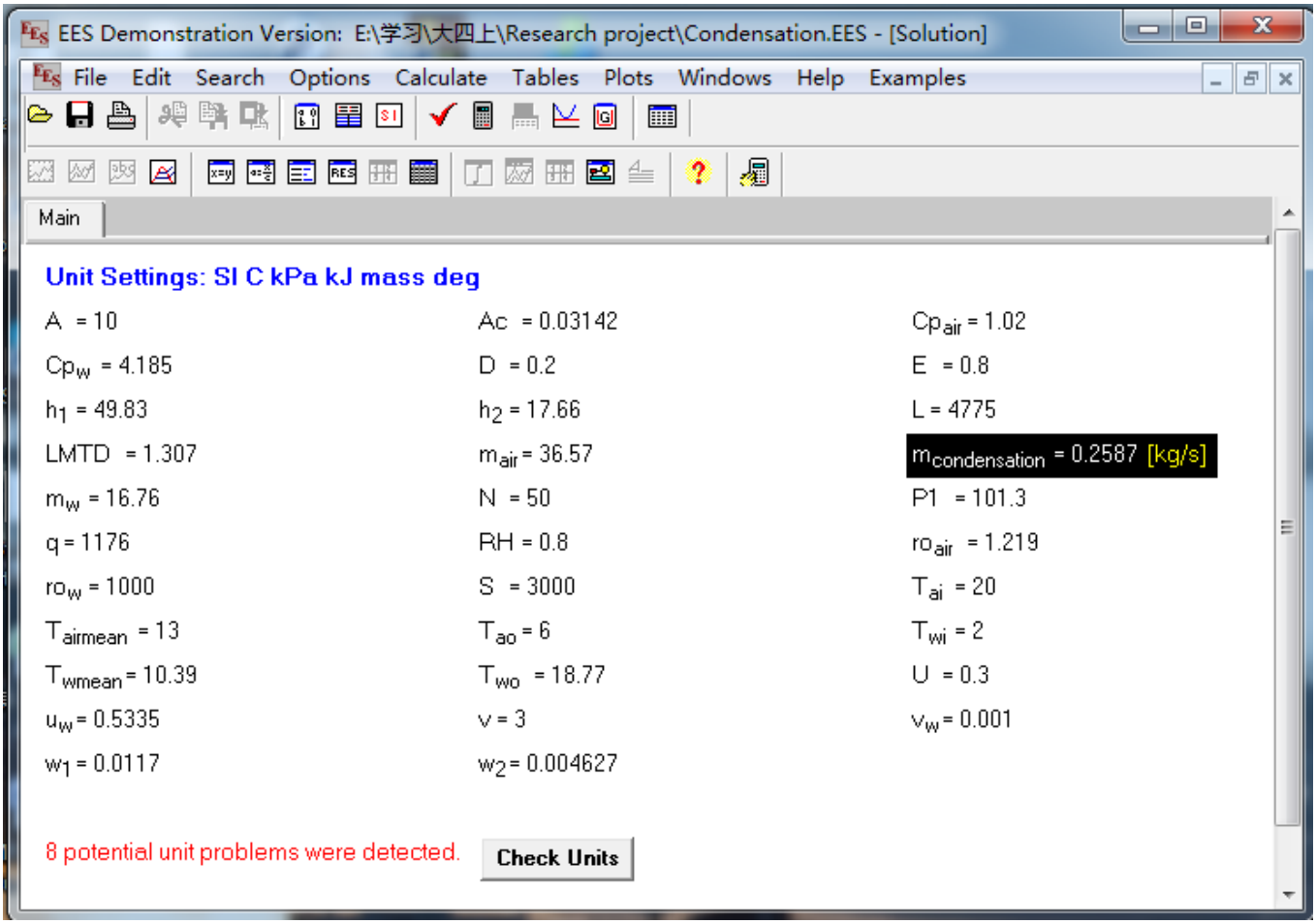


Figure 1.5: EES test result

References

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