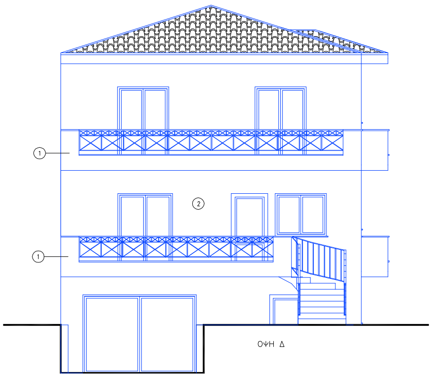
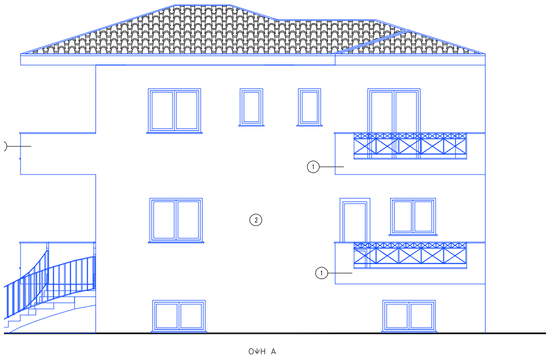
Feasibility Study

solarcombi+

Single family house in Korinthos





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Subject of Feasibility Study:
To design a solar combi system and the possibility of a solar combi+ System for a new house in Korinthos - Greece

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This feasibility study concerns the installation of a solar combi+ system in a single family house with 4 inhabitants in the city of Korinthos at Peloponnese in southern Greece (37°56′N 22°56′E).

Building data:

The building is new and still in the construction phase. It is composed of three floors, a basement used as garage and storage, ground floor where the living room and the kitchen are located and the first floor with 3 bedrooms and the main bathroom. It is a very good insulated building with the external walls made out of 10cm brick, 5cm XPS and 10cm brick. The roof of the building will be a green roof and will serve as a yard. The house is not planned to be used on a daily base but mainly on weekends.

The main key figures are as following:

Space:	157 m²
Volume:	471 m³
Persons:	4
DHW load:	7.66 kWh
Space heating load:	12 kW
Cooling load:	9 kW, max. 26°C room temperature
Ventilation:	Windows (no ventilation system designated)
External wall:	brick-XPS (5cm)-brick
Roof:	green roof
Orientation:	12° east

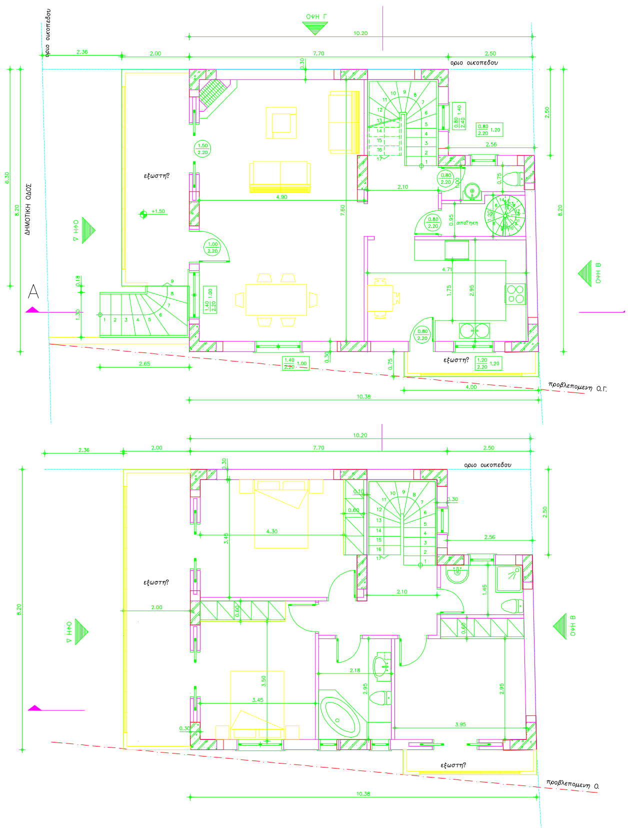

Figure 1: Floor plan of the building

Current situation:

The initial heating system design was composed of a water/air fire place in combination with fan-coils. The cooling of the house was implemented using individual split units.

Proposed system:

The proposed system is a small combi+ system designed to cover part of the buildings thermal and cooling loads. The system uses 2 storage tanks, one 200lt with internal heat exchanger for the DHW and one 1000lt buffer tank for the heating support. The two tanks are loaded by 13.5m² of vacuum tube solar thermal collectors with parabolic reflectors. The SH storage tank is slightly over-dimensioned in order to allow the daily (not used) energy to be accumulated so as to be used in the weekends. As with the original design, the system is backed up by a water/air fire place connected in series with the solar space heating (SH) system. Whenever cooling is required, the system supplies hot water to a small 4.5kW solar chiller connected in parallel to the distribution network. The layout of the system can be seen on the next picture

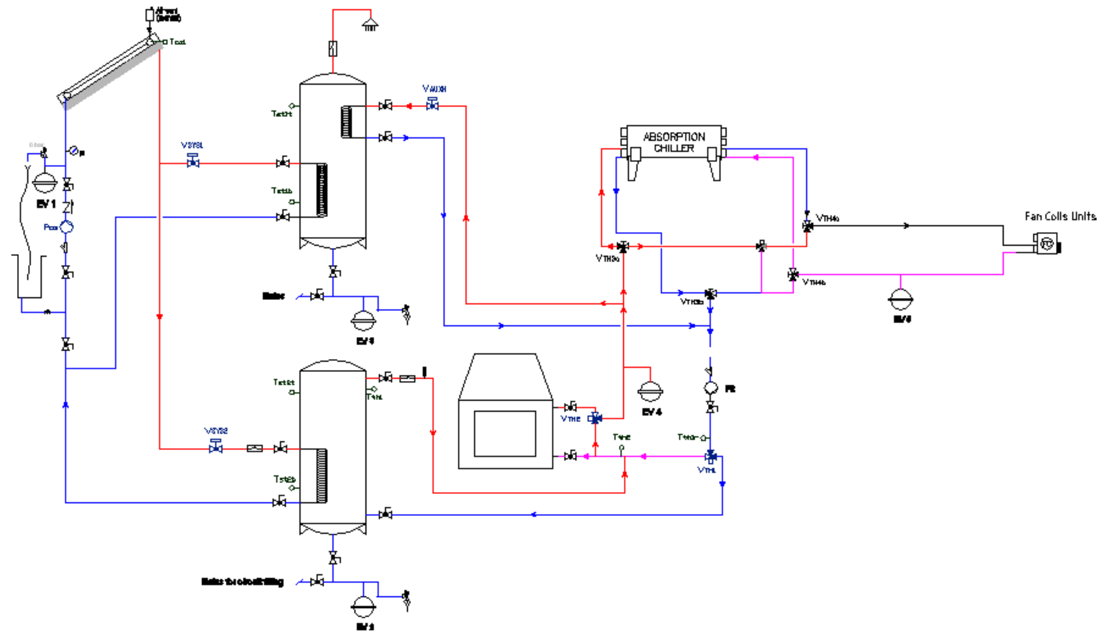

Figure 2: Schematic layout of system

As priority, the solar collectors charge the DHW to 70°C. When this temperature in the DHW tank is reached, the collectors charge the SH tank. Whenever heating is required, the return temperature of the distribution network is measured and if the temperature of the water in the SH tank is higher, SH water is drawn from the SH tank. If extra heating is required, the SH water passes through the water heat exchanger of the fireplace. If the temperature of the water in the SH tank is sufficient to drive the fan-coils, the fireplace heat exchanger is bypassed.

Whenever cooling is required, the distribution network is connected to the output of the chiller while the hot water from the system is directed to the chiller. The change of state from heating to cooling is performed manually through triode valves.

The next table presents the main system components

Table 1: System Components

Collectors	6 Calpack 14VTN
DHW storage tank	ASSOS BL2-200
SH storage tank	ASSOS BL1-1000
Solar Chiller	Rotartica Solar 045v

As the roof will be used by the users, the collectors are proposed to be installed at the southern semi-roof at the edge of the roof. Metallic bases were installed during the construction phase for this purpose. The inclination of the semi-roof is at the optimum for Greece at 35° while the azimuth is 12°. The semi-roof where the installation of the collectors is proposed is shown on the next pictures

Figures 3 & 4: Base for solar collector installation

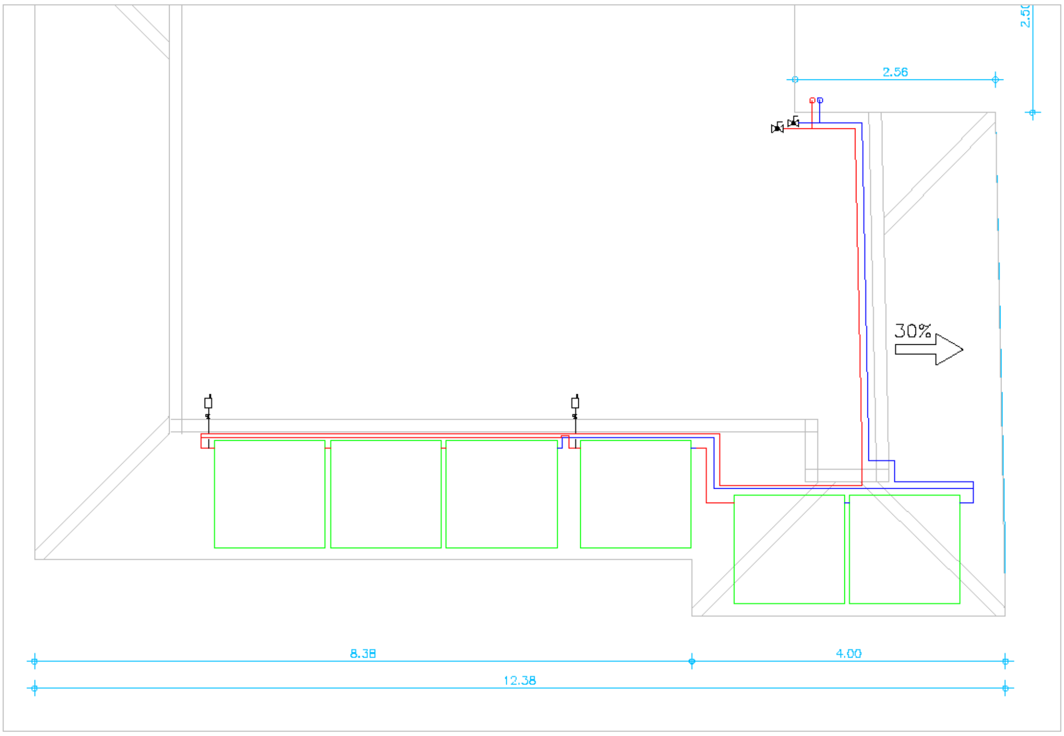

Figure 5: Solar collector installation layout

Energetic contribution:

According to the system's simulations, the system should supply 100% of the DHW needs, 30% of the heating needs and 60% of the cooling needs. The average incident solar irradiation for Korinthos in a summer day is 6.1kWh/m². Under these conditions the system produces on average about $30kWh_c$. In the worst winter days, the incident irradiation is about 2.5kWh/m² with an average system production of $18kWh_{th}$