



## Renewable Energy Solutions

### Solar Thermal Combi Plus Systems

#### 2. Technical Information

*The demand for air conditioning in the hotel sector is increasing due to a demand for improved comfort, but also because of the higher temperatures that have occurred during the last decade. Solar Combi Plus systems can supply energy for solar cooling, and combined solar space heating-cooling and domestic hot water systems.*



#### How does a solar combi plus system work?

Solar combi plus systems use heat from solar thermal collectors to provide heating in winter, cooling in summer and domestic hot water (DHW) all year round. The cold is produced by a thermally driven cooling machine, a **sorption chiller** which is fed with heat (hot water 70-100°C). The main benefit of using the solar thermal energy to feed the chiller is that, in general, the demand for cooling is the highest when the levels of solar radiation are high. Solar thermal cooling systems have then a high potential to replace conventional cooling machines based on electricity.

#### What are the basic components of a solar combi system?

A solar combi system includes the following main parts:

- **Solar thermal collectors:** to provide the heat, usually backed up by an **auxiliary heat source**, both flat plate collectors and evacuated tube collectors are suitable. Typically vacuum tube collectors have better properties in the transition- and winter periods, but the investment costs are higher than for flat plate collectors.



- **Flat-plate collector:** glazed flat-plate collectors are insulated, weatherproofed boxes that contain a dark absorber plate under a glass.
- **Evacuated-tube collectors:** they feature parallel rows of transparent glass tubes. Each tube contains a glass outer tube and metal absorber tube attached to a fin
- **Hot water storage tank:** As solar radiation represents an intermittent energy source: the heat produced by the solar thermal collectors needs to be stored into a water storage tank to be used in any time.
- **Domestic hot water preparation (DHW) unit:** The domestic hot water preparation can be performed with an immersed heat exchanger or in an internal/immersed storage tank (tank in tank).
- **Auxiliary heating system:** the auxiliary heating required by the building can be provided in different ways according to the features and the needs of the building. Several types of auxiliary heating are available to be used in solar combi systems: biomass boilers, heat pumps district heating, oil, gas burners or electricity.



- **Sorption chiller:** is fed with hot water (70-100°C) so as to produce cold by using a thermo-chemical process. From this process, the heat rejection at intermediate temperature (30-40°C) needs to be dissipated through a cooling tower (dry or wet) or another heat sink (e.g. a swimming pool).

The Solar Combi Plus system can be connected to the existing heat distribution (preferably a low or medium temperature system) or cold distribution system (e.g. a chilled ceiling, fan-coils or air handling units)

**Closed systems:** in these ones, thermally driven chillers provide chilled water, that is either used in air handling units to supply conditioned air (cooled, dehumidified), or that is distributed via a chilled water network to the designated rooms to operate decentralized room installations, e.g. fan coils. Market-available machines for this purpose are absorption chillers (most common) and adsorption chillers

**Open systems:** allowing complete air conditioning by supplying cooled and dehumidified air according to comfort conditions. The “refrigerant” is always water, since it is in direct contact with the atmosphere. Most common systems are desiccant cooling systems using a rotating dehumidification wheel with solid sorbent.

As the application uses a renewable energy source it offers environmental benefits: a reduction in conventional energy use, as well as lower levels of harmful emissions. The use of solar thermal energy also reduces the need for electrical energy, especially at midday during summer, which is a peak time for electricity use.

### Is a solar cooling system suitable for my hotel?

A solar cooling system will work for you if:

- Your hotel is located in a high solar radiation area like in the Mediterranean.
- Your hotel has big demand for space cooling (summer), space heating (winter), domestic hot water, swimming water heating, etc.
- Your hotel has the space available for a storage tank and for the equipment to dissipate the exceeding warm (i.e. cooling tower).

**Combi+ Systems** are gaining market share where space heating and space cooling is required in addition to domestic hot water. These systems are larger and save more energy. System performance depends on both the integrated control of system’s components and their respective sizing, with respect to the building and each component with regard to the other. In particular the following ratios have to be respected:

- Collector’s area/chiller rated power
- Storage tank
- Volume/collectors area. The systems are controlled electronically and require a yearly maintenance, as most of the heating system.

### Link with other technologies Swimming pools

The surplus heat produced can be used by the swimming pool. Using the heat rejection at intermediate temperature (30-40°C), as any heat sink or cooling tower. This heat is generated when transforming the heat into cold in the cooling machine; It is then a waste which can be valorized by heating the swimming pool.

### Solar Combi System

A thermally driven cooling machine can be combined to an existing solar thermal combi system so as to make a Solar Combi Plus system.





## BENEFITS FOR THE HOTELS

### COST REDUCTION



In comparison with a conventional air conditioning system the investment costs for a solar-powered cooling system are around twice as high. However, the monthly energy savings are significantly higher than the monthly repayment costs, resulting in monthly savings, making the extra investment worthwhile. The balance looks even better if the cost savings for pool heating and domestic hot water are included.

### STAFF INVOLVEMENT



Train your staff as guides to show guests the solar cooling machine you have installed and explain them how it is cooling down your hotel, you can both attract more tourists and further involve your staff in order to get them feeling more responsible for their working place!

### GUEST INVOLVEMENT



Install a demonstration diagram to show your guests how a your thermally driven solar cooling machine is producing cooling for your hotel. By motivating your guests, they will also feel more responsible and involved in taking care of your hotel! Guests will value the fact that your hotel is environmentally conscious.

## BENEFITS FOR THE ENVIRONMENT



### CARBON EMISSIONS REDUCTION

Slash carbon emissions, significantly reduce power grid load, and make full use of additional summer energy available from solar collectors.

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