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## Chapter 3

# Components of Solar Thermal Systems

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The heat production sub-system is the part of the overall system which provides heat to a thermally driven air-conditioning system. With regards to the solar-driven equipment, the solar collector is the main component of the sub-system. A brief review on the present state-of-the-art with respect to performance characteristics and available certification schemes of solar collectors is given in the following chapter.

Besides the solar collector field, the storage unit and the back-up heat source unit are also important components. An overview of these items and the identification of other relevant components of the solar thermal system are given in the following sections.

### 3.1 The Solar Thermal Collector

A solar thermal collector has the absorber surface as its main component where the absorbed solar radiation is transformed to heat. Part of this heat is transferred to the heat transfer fluid and the remainder is lost to the environment.

Solar thermal collectors used in solar cooling systems usually have a transparent cover which separates the absorber from the environment and simultaneously allows as much incident solar radiation as possible to pass through to the absorber. In non-concentrating and non-tracking flat plate collectors, the back of the collector is insulated to reduce losses to the environment. Concentrating collectors include a reflector as an additional component which redirects the radiation incident on the collector aperture to the absorber.

In a steady state, the incident radiation on the collector surface is equal to the sum of useful heat and the heat losses, as is evident from the absorber energy balance and is given by the following expression:

$$A_A G = \dot{Q}_{\text{use}} + \dot{Q}_{\text{loss,opt}} + \dot{Q}_{\text{loss,convective}} + \dot{Q}_{\text{loss,conductive}} + \dot{Q}_{\text{loss,radiative}}$$

Eq. 3- 1