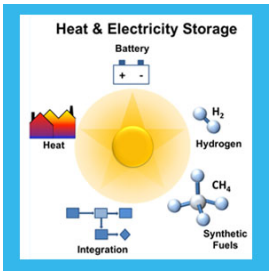

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Industrial Packed Bed of Rocks Thermal Energy Storage

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Thermal energy storage (TES) systems enable dispatchability of concentrated solar power (CSP) plants and are therefore a crucial component in increasing the overall value of such plants. However, in commercially available CSP plants, typically using molten salt as TES, the cost of the TES system is about 10-15% of the total plant cost. Airlight Energy's solar collector uses air as heat transfer fluid which enables the use of a simple yet effective TES system. The TES is based on a packed bed of rocks in a concrete container that is charged via direct heat exchange with air. Besides the drastically cheaper heat storage medium, the TES system eliminates the need for heat exchangers, typically necessary for molten salt TES systems, hence reducing significantly the overall TES costs. Consequently, the TES in an Airlight Energy CSP plant contributes to only about 1-2% of the overall plant cost. Several practical issues needed to be overcome for the realization of a reliable, industrial packed bed TES system. These challenges will be presented in the talk, together with the prototypes and industrial TES units built and tested so far. Fig. 1 and 2 show two of these units. Besides CSP applications, the cost effective and efficient nature of the packed bed of rocks TES makes it an attractive candidate for other applications requiring heat storage with air as heat transfer fluid, such as advanced adiabatic compressed air energy storage (AA-CAES). In an AA-CAES plant, the TES is used to store the heat created during the compression stage and later release it before the expansion stage. In this way, the efficiency of the plant can be significantly increased from typically 40% in conventional CAES plants, to above 70%. The TES is used in an AA-CAES test plant currently under construction in the Swiss Alps.

Fig 1: A packed bed of rocks TES pilot unit in Biasca. Fig 2: A 100 MWhth TES for a CSP plant in Morocco

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