

## The CESA tower at PSA for SolAir3000 testing

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PSA was founded by the Spanish state in the early 1980's with the primary objective to produce electricity to the local power supply on a commercial basis. The 82 meter high concrete tower is built with sliding form at 10 meter diameter and rests on a 250 ton heavy foundation. The 8th floor is the top platform with access from both a steel staircase and an elevator. A cable driven crane with a capacity of 5 tons situated on the top of the steel platform lifts the test units into place. Central Electro-Solar de Almería ( CESA-1 )



The 300 heliostats with a combined area of 11880 m<sup>2</sup> are all delivered by CASA (Construcciones Aeronáuticas, S.A.), covers an ground area of 70000 m<sup>2</sup> and installed in 1987. Each one is equipped with 32 similar silver coated glass mirrors with a reflectance of >92%. Each reflector has a slightly concave area of 39.6 m<sup>2</sup> which is cleaned manually once a month. Quite positively, 12 years of use have not reduced the general output of the heliostats. Even the original VAC Unix control has survived. Maximum power is 7,5 MW (950W/m<sup>2</sup> irradiance) distributed over a single surface or distributed over several test units on the tower, 99% within a 4 meter diameter and 90% within a 2,8 meter diameter. Thus, the maximum flux is 3,3 MW/m<sup>2</sup>, which is quite impressive.



The German firm Steinmüller GmbH (recently taken over by Babcock) has delivered the volumetric receiver that is being tested during the Spring of 1999. This concept is based on Inconel 600 wire-mesh modules knitted to a stocking and rolled up flatly to a 40 mm high flexible disc with a diameter of 250 mm. 22 discs are pressed separately into to a hexagon and gathered into one receiver surface of app 3 meter diameter. The re-circulation of the air medium is limited to 60% by this VR design. Maximum operating temperature for this 3 MW electricity receiver is 650°C which does not, however, prevent melt-down.



Depending on the concept, the 700-1000°C hot air is drawn out the back of the receiver by a centrifugal ventilator and immediately afterwards through a tube heat exchanger. A thermal storage (6 ton/MW) attached via valves acts as energy buffer. It equalizes a possible energy drop should f. ex. a cloud pass by and generally prolongs the daily operating time with a couple of hours. Isolated on the inside with porous stones, the container holds a mineral granulate that can handle a storage temperature >700°C. The air, now cooled to 100°C, is then re-circulated to the receiver with a maximum air flow capacity of 1250 m<sup>3</sup>/h. The blower is connected to a 37 kW motor and accept 0,45 mBar differential pressure. The right side of the photo shows the backside of VR with pipe outlet at the top. The yellow container is the steam generator. Air pumps and return channels are placed under the floor. The distance from the heat exchanger to the turbine is 125 meter.



The final testing of 270 pcs ceramic VR-units from the SolAir project spring year 2004.

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