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Design and Cost Analysis of a Heliostat Field in an Air-based 150 MWe Solar Tower Power Plant

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The chief advantage of air solar tower power plants compared to the other concentrating solar power technologies is the ability of achieving temperatures as high as 700 °C. This latter depends on the receiver design and the heat transfer fluid used. The heliostat solar field in central receiver systems is considered as the main subsystem due to its high costs (up to 50% regarding the capital expenditure of the total plant) [1]. Therefore, the main focus of this study is the design and cost analysis of a heliostat field in an air-based 150 MWe solar tower power plant.Due to its high insolation with annual DNI of 2712 kWh/m², this study was conducted for De Aar region in South Africa.The SF is designed, using SolarPILOT, such that the power delivered meets only the power required by the PB or the TESS at design conditions in order to have an operation strategy that covers peak hour demand with a receiver thermal power of 1210 MWth.

In order to demonstrate the high potential of multi-tower configuration in terms of solar energy gained and reduction of investment costs, this configuration was compared to a multi-receiver configuration, where four receivers are mounted on the top of the same tower. Each receiver was designed with a thermal capacity of 302.5 MWth.The results show that, in the first configuration, the annual energy reaching the receiver is about 2296.33 GWh, with a 477 M$ of solar field cost investment, while in the second configuration, the annual energy produced is about 2490 GWh with only 184 M$ of solar field cost investment.It can be concluded that the greatest gain of energy is achieved with multi-tower configuration with a low cost comparing with the first configuration.Future work includes an estimation of the overall techno-economic performance of the plant coupled with thermocline packed bed storage system and steam Rankine cycle.

There is proof that such huge zone sunlight based focusing establishments can murder winged creatures that fly over them. Close to the focal point of the cluster temperatures can arrive at 550 °C which, with the sun powered transition itself, is sufficient to burn winged creatures while further away plumes are singed prompting the possible demise of the fowl. Laborers at the Ivanpah sun based force plant call these flying creatures "decorations," as they touch off in midair and plunge to the ground following smoke. During testing of the underlying backup position for the heliostats, 115 feathered creatures were murdered as they entered the concentrated sun powered transition. During the initial a half year of tasks, an aggregate of 321 winged animals were slaughtered. In the wake of modifying the reserve method to concentrate close to four heliostats on any one point, there have been no further winged animal fatalities. The Ivanpah Solar Power Facility is named an ozone harming substance producer by the State of California since it needs to consume non-renewable energy source for a few hours every morning so it can rapidly arrive at its working temperature.

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