The Stellio heliostat reflects the solar radiation to the solar tower 400 metres away.
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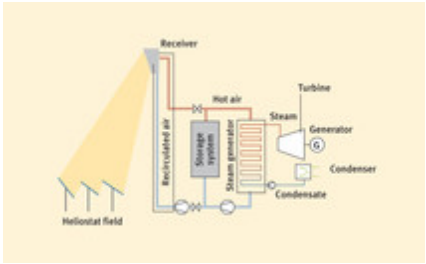
New heliostat developed for solar tower power plants 19.07.2017

Pentagonal mirror reflects the sun precisely

In solar tower power plants, multiple mirrors – called heliostats – direct the sunlight to the receiver at the top of the tower. Heliostats have previously had a rectangular shape. However, engineers have now developed a pentagonal concentrator mirror. They are combining this with a low-cost linear drive and new control software. Five of these heliostats are now being mounted and tested on test platforms at Jülich.



Heliostats concentrate sunlight on the receiver on the top of the tower.
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In solar thermal power plants, the solar radiation is focussed on a point (the receiver).
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Heliostats are mostly arranged in rings around the central solar tower. The receiver absorbs the concentrated solar radiation and converts it into high-temperature heat. A heat transfer medium removes the heat and transfers it directly to the power plant process or a storage system. In order to achieve high efficiency it is important that the heliostats accurately track the sun and reflect the sunlight precisely. Newly developed software now controls their position even more precisely. It detects the orientation of the axes, calculates how strongly the heliostat deforms through its own weight, and registers how the drives change. The developers used inclined drive axles for the new ‘Stellio’ heliostat. “Thanks to the clever arrangement of the axes, a linear drive is sufficient for both the horizontal and vertical axis. This is more cost-effective than a rotary drive, which is often used in the vertical axis to enable a 360 degree pan,” explains Dr Gerhard Weinrebe, a member of the senior management at sbp sonne, the Stuttgart-based engineering office responsible for the project management. Combined with the intelligent control system, this makes it possible to save on steel and foundation costs.

Heliostat with five instead of four corners

But why does the heliostat have a pentagonal shape? Weinrebe explains: “Actually, a circular shape is optimal. However, mirrors are manufactured in bands. This makes it very complex and costly to produce a circular heliostat, and there are a lot of waste offcuts. For this reason, a ‘quasi-circular’ shape provides the optimal solution.”The arrangement of the heliostats needs to be recalculated for each power plant project, partly because the topography has to be taken into account. The mutual shading caused by pentagonal heliostats is less than with the rectangular models that were previously usually used. The mirrors must be arranged so that the receiver is uniformly irradiated and the heliostats need to be positioned as close as possible to the tower but so that they

do not mutually shade one another.

Five Stellio models will be installed this week on the site of the experimental solar thermal power plant in Jülich, one of them on the new ‘Helitep’ test platform. Here it will be possible to investigate, for example, the influence of external loads on the heliostats such as the wind, temperature and gravity. In addition, the scientists will be able to test the optical quality and the tracking accuracy.

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