Improving Power Tower Competitiveness with Stellio – the Smart Heliostat

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• Introduction

• Increasing Competiveness by
  1. Investment cost reduction
  2. Superior heliostat performance
  3. Better heliostat field performance

• Summary
Heliostat Technology needs more Innovation
Three reliable companies join forces to invest in the development of a smart heliostat
sbp sonne - Consulting Engineers for Renewable Energy
# Experience Ingemetal Solar

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<th>Developer</th>
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<th>ANDASOL 3</th>
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<th>LA DEHESA</th>
<th>ASTEXOL 2</th>
<th>GODAWARI</th>
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</table>
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Existing heliostat designs and optimized variants have been analyzed in detail.
Cp (wind tunnel test)

Survival wind pressure on heliostat

Structural layout
Cost reduction: Drives

Drive Costs: 25%...39%
Linear drives are more cost efficient than slewing drives.
Challenge: Linear drives allow only for a limited angular range

Two linear actuators & crankshaft: > 180°

Single linear actuator ≤ ~115°
The solution: slope drive with inclined main axis
• Due to lower costs of linear drives as compared to slew drives, slope drive versions constantly result in lowest LCOE values.

• Medium sized heliostats of 40 to 60 m² result in lowest LCoE.

• Very large concentrators and aspect ratios higher than 1.4 should be avoided because of astigmatism and resulting spillage losses.

• Classical T-Type design has significant disadvantages
Right concentrator size lies between $40 \text{ m}^2$ and $60 \text{ m}^2$

Central-symmetric structural system (better optics, higher stiffness, lower wind effects)

CAPEX

Benchmark: $150 \text{ €/m}^2$

Stellio: $<120 \text{ €/m}^2$

$\Rightarrow$ 20% reduction!
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Tracking Quality

$\sigma_{\text{tracking}}$

Benchmark: 0.75 mrad

Stellio: 0.5 mrad

$\Rightarrow 25\%$ improvement!

Optical Quality

$\sigma_{\text{slope, 2D}}$

Benchmark: 2.0 mrad

Stellio: 1.25 mrad

$\Rightarrow 38\%$ improvement!
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Minimum distance between heliostats must be kept to avoid collision. This distance is defined by circumcircle around heliostat pivot points.
As compared to square or rectangular fields, a pentagonal heliostat allows denser packing:

**Square**
Rectangular is slightly less favorable than square

**Pentagon**
Required Distance reduced to ~92 % (1D)
required area (2 D) reduced to = ~ 85 %
(= 92 % * 92 %)

Example: 50 m² reflective area
Circumcircle diameter: 10 m

Circumcircle diameter: ~ 9.2 m

Based on first principles, field consisting of pentagonal heliostat MUST be more efficient due to more compact layout!
Improving heliostat field layouts for large plant in ZA

DNI weighted annual solar field COP

Benchmark: 60.4 %

Stellio field: 61.5 %

→ 1.1 % points improvement!

sbp STELLIO

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PERFORMANCE GUARANTEES
Slope & Tracking

DIRECT SUPPLY

FULL SOLAR FIELD TURNKEY SOLUTION

HIGHER PERFORMANCE

PRICE LEADER
Thank You!