next-CSP

High Temperature concentrated solar thermal power plant with particle receiver and direct thermal storage

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Deliverable D2.2

WP2 – Assessment of solar fields for high temperature solar power tower

Deliverable D2.2 Report on heliostat for the commercial plant

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0 Introduction

0.1 Sequence of subtasks

The sequence of working on subtasks 2.2 “Techno-economic optimization of high solar flux dedicated heliostat” (this report) and 2.3 “Heliostat field layout and aiming strategy” (report D2.3) [1] was changed as it turned out that outcomes of 2.3 are needed to perform subtask 2.2, and also to give necessary input to task 7 “Scale-up to a 150 MW solar power plant”.

For these reasons, Task 2.2 “Techno-economic optimization of high solar flux dedicated heliostat” has been postponed. Task 2.2 is the subject of this report.

0.2 Scope of works

In a first phase, possible improvements to the Stellio heliostat were defined and their impact on plant performance was estimated by hand calculations and FEA.

A valuation matrix was created to rank the potential technical improvements. From this, measures with high impact and expected reasonable design effort and cost were selected.

These improvements were then analysed in detail to obtain performance gain and related cost.

0.3 Abbreviations

BLDC	Brushless Direct Current motor
CAPEX	Capital expenditures
DNI	Direct Normal Irradiance
FEA	Finite Element Analysis
LCoE	Levelized Cost of Energy
RMS	Root Mean Square

Conclusions

All investigated measures reduce the LCoE and therefore can be regarded technically and economically worthwhile. The additional mirror supports provide about half of the possible savings. The ball screw actuators also make up a considerable part of the total reduction while the improved pylon head stiffness and improved calibration accuracy have a smaller share.

It should be noted that engineering effort for the improvements has not been figured into the LCoE calculations.

In total, a LCoE reduction of 5.93 €/MWh can be achieved when all measures are implemented. This corresponds to approx. 6.2 % of the absolute LCoE in the reference case. For a commercial particle receiver project based on next-CSP technology, the high-performance version of Stellio should be realized and will support the effort for becoming competitive.

List of references

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4. Siros, Frederi et al.
Report on Cost Analysis: Capex, Opex, LCOE - Positioning in the Global Energy Mix. Chatou, France: Deliverable D7.3 of the next-CSP Project, 2020