next-CSP

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

European funded project - Grant Agreement number 727762

Deliverable D2.3

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

Deliverable D2.3 Report about heliostat field layout and aiming strategy

Date of Delivery: May 2019

Deliverable Author(s): V. Schönfelder (sbp), T. Keck (sbp)

Document identifier: next-CSP-WP2-D2.3

Deliverable leader	sbp
Deliverable contributors	
Related work package	WP2
Author(s)	T. Keck, V. Schönfelder
Due date of deliverable	31.03.2019
Actual submission date	17.05.2019
Approved by	Gilles Flamant
Dissemination level	CO
Website	http://next-csp.eu/
Call	H2020-LCE-07-2016 Developing the next generation technologies of renewable electricity and heating/cooling Specific Challenge: Concentrated Solar Power
Project number	727762
Instrument	Research & Innovation Actions
Start date of project	01/10/2016
Duration	48 months

0 Introduction

0.1 Sequence of subtasks

This report (D2.3) focuses on the development of an optimized solar field for a high temperature solar power tower. It regards the design of the heliostat field, as well as a suitable aiming strategy. As the heliostat field in combination with the correlated aim points has an impact on the receiver design changes are made to the receiver in relation to other work packages. In addition, the design of the tower is regarded.

Task 2.2 “Techno-economic optimization of high solar flux dedicated heliostat” has been postponed to bring Task 2.3 forward, as the results of the latter task have considerable impact on other work packages. Task 2.3 is the subject of this report.

0.2 Scope of works

During first phase of solar field layout and aiming strategy investigations it became obvious that these cannot be separated from receiver design and geometry. Therefore, receiver design and optimization had to be included into the work scope.

Summary

As mentioned before the results presented in this report are preliminary as optimization was only a 1^{st} order optimization.

The present study showed that in order to reach the desired net output power of 44.2 MW at design point, high quality heliostats and a sufficiently high tower are key prerequisites. With the tower height of 93 m the required output power can be met concisely, but still it is necessary to optimize the tower height techno-economically in a further step. To be able to do this, boundaries as masses and dimensions of the installations into the tower need to be known as well as cost figures for tower and solar field have to be applied. Furthermore, heliostat optical and tracking quality have considerable impact on the achievable output power.

The obtained receiver efficiency is lower than expected. There are many parameters and factors to be further optimized, however the optimization potential cannot be estimated reliably. To improve efficiency, several more factors than those varied so far can be regarded, such as reflectivity of ceramic walls, absorptivity of absorber coating and spacing of absorber tubes. A targeted receiver of 80 % should probably be reached by reducing the radiation/convection losses through a better design of the cavity receiver (reduction of surfaces that are not covered by the absorber) and a more accurate estimation of the convection losses that seem too high for this type of receiver.

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