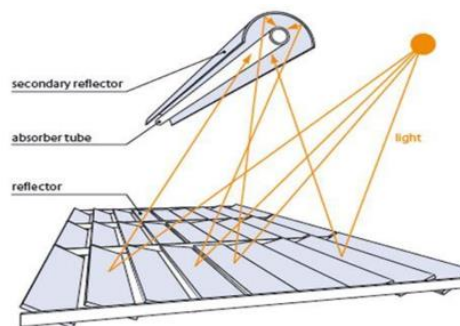


Linear Fresnel Plant: Modelling and Performance Evaluation

Introduction

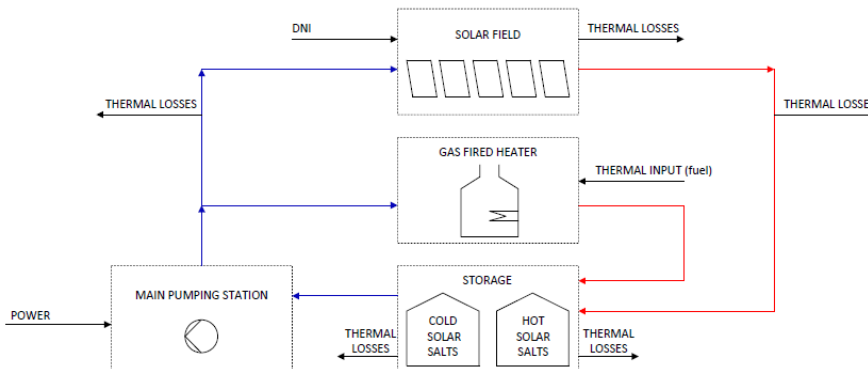
The Concentrated Solar Power (CSP) is a promising renewable technology that consists of a solar field, a solar receiver and a power block. The solar field concentrates the solar radiation on the target surface of the solar receiver; the latter transfers the solar energy to a heat transfer fluid producing high temperature heat with the aim to drive a common thermodynamic cycle (power block). Typically, a thermal storage is also included in a CSP plant to generate power in a dispatchable way.

In a line-focusing CSP system the solar radiation is concentrated along a line. Among the line-focusing technologies, the Linear Fresnel Reflector (LFR) has been proposed as a cost-effective alternative with respect to the most commercially diffuse parabolic through. The LFR consists of a set of parallel-placed flat or slightly curved mirrors stripes, which focus the solar radiation onto a fixed receiver tube that is equipped with a secondary concentrator (Figure 1a).



<https://www.semanticscholar.org/paper/Design-and-Analysis-of-Rooftop-Linear-Fresnel-Solar-Gouthamraj-Rani/6771c01a265a0b2e975e29edfd0371057a308cf3>

(a)



(b)

Figure 1: (a) Linear Fresnel systems and (b) whole system

Aim of the work

In this thesis, a reference LFR plant, which is being commissioned in the south of Italy, is considered. The aim of the thesis is to develop a dynamic lumped-parameters numerical model of the LFR plant using the Modelica language. Particularly, the model should include the LFR system (mirrors field, secondary concentrator and receiver), the thermal storage unit, the (backup) gas fire heater and the pumping system (Figure 1b). The opportunity to perform a CFD analysis to better estimate the convective and radiative heat losses occurring from the receiver tube will be evaluated during the thesis work. Example of system modelling approaches applied to CSP problems are [1, 2].

The final goal is to simulate the LFR system considering the most relevant transient scenario (e.g. start-up, shutdown and cloud passing) as well as the steady-state operation in order to predict the thermal

performance of the plant. This thesis will be carried out in strict collaboration with the company responsible for the plant design and construction.

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References

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