Optimizing a Modular Beam-Down Concentrated Solar Power Concept

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Abstract

This template provides a clean starting point to convert a DOCX document into LaTeX for the BD-TPR optimisation study. Replace this text with your abstract.

Contents

1 Introduction

Motivation and context. Transition to high shares of renewable energy and the role of thermal storage. Prior BDR and particle receiver work. Contributions of this paper.

2 Methods

2.1 Optimisation Framework

Brief overview of the optimisation loop and modules (optics, receiver, costing).

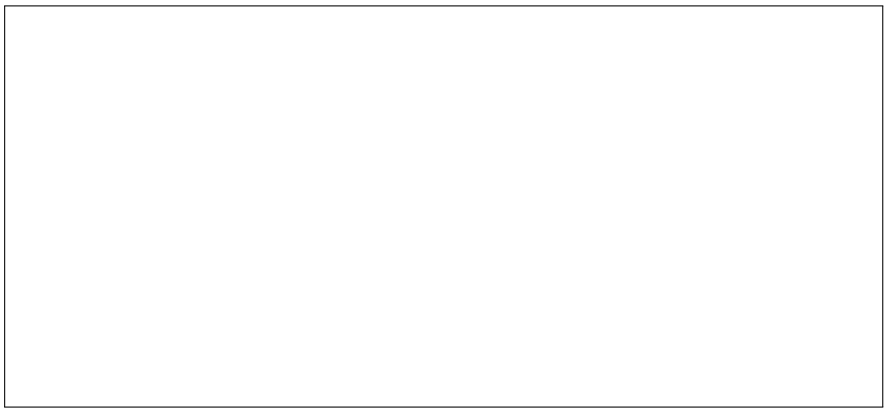

Figure 1: Optimisation algorithm flowchart.

2.2 Cost Model

We compute the Levelized Cost of Heat ($LCOH$) using:

$$LCOH = \frac{C_C \left(1 + C_{O\&M}\, TPF\right)}{TPF\, P_{\mathrm{yr}}} \tag{1}$$

with the total payment factor (TPF):

$$TPF = \frac{1}{DR}\left(1 - \frac{1}{(1+DR)^N}\right). \tag{2}$$

Define all symbols after the equations.

2.3 Optical and Thermal Models

High-level description; refer to previous validated modules.

3 Results

3.1 LCOH Minimisation

Key plots and summary of trends.

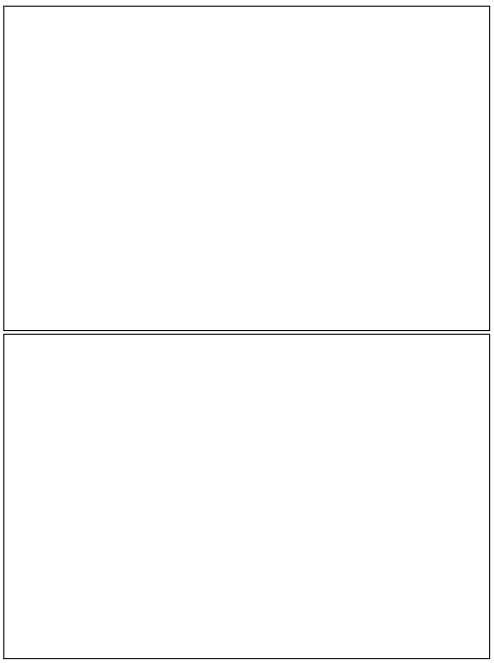

Figure 2: LCOH minimisation across receiver power, tower height, and flux levels.

$$P_{\text{rcv}} = 4.0\, e^{0.029\, z_f}, \tag{3}$$

$$Q_{\text{avg}} = 1.54 - 1.93\, e^{-0.047\, z_f}, \tag{4}$$

$$f_{zv} = 0.78 + 0.24\, e^{-0.040\, z_f}, \tag{5}$$

$$LCOH = 22.0 + 32.6\, e^{-0.079\, z_f}. \tag{6}$$

3.2 Technical Parameters

Describe final selected case and include panel of figures if available.

Table 1: Summary of key technical parameters for the selected design.

Parameter	Value
Tower height, z_f	50 m
Receiver power, P_{rcv}	19 $\mathrm{MW_{th}}$
Mean radiation flux, Q_{avg}	1.25 $\mathrm{MW\,m^{-2}}$
Vertex ratio, f_{zv}	0.818
Receiver efficiency	83.1 %
Solar field efficiency	63.4 %

3.3 Cost Distribution and Sensitivity

Pie/bar charts for costs; tornado plots for sensitivities.

3.4 Annual Performance

Monthly energy flows and efficiencies; capacity factor.

4 Conclusion

Main findings and recommendations. Future work.

Acknowledgements

Data and Code Availability

References