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# A Direct Steam Generation Concentrated Solar Power Plant with a Decalin/Naphthalene Thermochemical Storage System

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## Highlights

- A concentrated solar power plant with decalin/naphthalene storage is proposed
- The performance of the system is comparative to existing plants with storage systems
- The system is not completely reversible due to imperfect separation of products

## Abstract

This study presents the design and analysis of a new integrated direct steam generation (DSG) concentrated solar power (CSP) plant with a decalin/naphthalene thermochemical storage system. Model simulations were performed in accordance with historical hourly solar radiation data over a year, using a combination of Aspen Plus v10, MATLAB 2016b, and Microsoft Excel VBA. It was found that the proposed plant feasibly stored and discharged energy, based on the solar radiation and chemical storage availability, to maintain base-load power productions (250 MW<sub>e</sub> or 120 MW<sub>e</sub>) with an overall efficiency of 14.6%. The effectiveness of the designed storage system was found to be comparable to a molten salt storage system which is currently used in existing CSP plants. The proposed integrated DSG CSP plant with a decalin/naphthalene thermochemical storage system shows promise for being an alternative to existing CSP plants.

**Keywords:** concentrated solar power; decalin; tetralin; naphthalene; hydrogen; simulations; thermochemical storage system.

## Nomenclature

### *Abbreviations*

CDC      cis-decalin

CSP      concentrated solar power

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