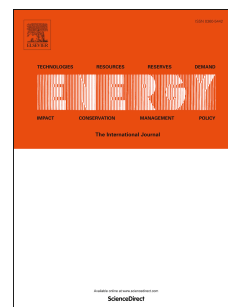


# Accepted Manuscript

Techno-economic assessment of solid–gas thermochemical energy storage systems for solar thermal power applications

Alicia Bayon, Roman Bader, Mehdi Jafarian, Larissa Fedunik-Hofman, Yanping Sun, Jim Hinkley, Sarah Miller, Wojciech Lipiński



PII: S0360-5442(17)31942-4

DOI: [10.1016/j.energy.2017.11.084](https://doi.org/10.1016/j.energy.2017.11.084)

Reference: EGY 11872

To appear in: *Energy*

Received Date: 18 April 2017

Revised Date: 27 October 2017

Accepted Date: 14 November 2017

Please cite this article as: Bayon A, Bader R, Jafarian M, Fedunik-Hofman L, Sun Y, Hinkley J, Miller S, Lipiński W, Techno-economic assessment of solid–gas thermochemical energy storage systems for solar thermal power applications, *Energy* (2018), doi: 10.1016/j.energy.2017.11.084.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Techno-economic assessment of solid–gas thermochemical energy storage systems for solar thermal power applications

Alicia Bayon<sup>1,\*</sup>, Roman Bader<sup>2</sup>, Mehdi Jafarian<sup>3</sup>, Larissa Fedunik-Hofman<sup>1,4</sup>, Yanping Sun<sup>1</sup>, Jim Hinkley<sup>1</sup>, Sarah Miller<sup>1</sup> and Wojciech Lipiński<sup>2,\*\*</sup>

<sup>1</sup>*CSIRO Energy, P. O. Box 330, Newcastle, NSW 2300, Australia*

<sup>2</sup>*Research School of Engineering, The Australian National University, Canberra, ACT 2601, Australia*

<sup>3</sup>*Centre for Energy Technology, The University of Adelaide, Adelaide, SA 5005, Australia*

<sup>4</sup>*School of Environmental & Life Sciences, The University of Newcastle, Callaghan, NSW 2308, Australia*

\*First corresponding author: [alicia.bayonsandoval@csiro.au](mailto:alicia.bayonsandoval@csiro.au)

\*\*Second corresponding author: [wojciech.lipinski@anu.edu.au](mailto:wojciech.lipinski@anu.edu.au)

## Abstract

Thermochemical energy storage (TCES) systems are a promising alternative to conventional molten salt systems for integration with solar thermal power plants. TCES systems can offer high storage densities and high storage temperatures. Thus, they have the potential to increase the efficiency and reduce the levelized cost of electricity of solar thermal power plants. The present study investigates reacting systems with alkaline carbonates and hydroxides and metal oxides performing redox and chemical looping combustion reactions for their near-term deployment potential. 17 solid–gas TCES systems are identified from the initial set of 21 systems for techno-economic assessment. A quantitative assessment methodology based on techno-economic performance indicators (TPIs) is proposed for the comparative analysis. The techno-economic analysis indicates that energy consumption by auxiliary equipment and the cost of the feedstock are the most important factors affecting the system capital cost. Eight TCES systems are identified as competitive with molten salts in the near term, with an estimated capital cost lower than \$25 MJ<sup>-1</sup>: hydroxide looping with Ca(OH)<sub>2</sub>/CaO, Sr(OH)<sub>2</sub>/SrO and Ba(OH)<sub>2</sub>/BaO; carbonate looping with CaCO<sub>3</sub>/CaO and SrCO<sub>3</sub>/SrO; redox with BaO<sub>2</sub>/BaO and chemical looping combustion with Fe<sub>3</sub>O<sub>4</sub>/FeO and NiO/Ni.

**Keywords:** thermal energy storage, solar, power, techno-economics.

## 1. Introduction

Concentrated solar thermal power (CSP) technologies can become cost competitive with conventional power generation technologies within a decade through a combination of

Download English Version:

<https://daneshyari.com/en/article/8071939>

Download Persian Version:

<https://daneshyari.com/article/8071939>

[Daneshyari.com](https://daneshyari.com)