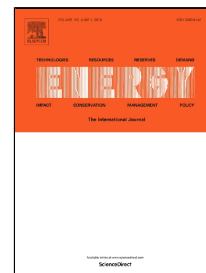


# Accepted Manuscript

Thermodynamic analysis and optimization of single and combined power cycles for concentrated solar power applications

Alireza Javanshir, Nenad Sarunac, Zahra Razzaghpanah



PII: S0360-5442(18)30971-X  
DOI: 10.1016/j.energy.2018.05.137  
Reference: EGY 12972  
To appear in: *Energy*  
Received Date: 15 December 2017  
Accepted Date: 21 May 2018

Please cite this article as: Alireza Javanshir, Nenad Sarunac, Zahra Razzaghpanah, Thermodynamic analysis and optimization of single and combined power cycles for concentrated solar power applications, *Energy* (2018), doi: 10.1016/j.energy.2018.05.137

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.



# Thermodynamic analysis and optimization of single and combined power cycles for concentrated solar power applications

**Alireza Javanshir**

PhD student of Mechanical Engineering and Engineering Science, UNC Charlotte  
Charlotte, NC, USA, Zipcode:28223  
Email: [ajavansh@uncc.edu](mailto:ajavansh@uncc.edu),  
Tell:7049544395

**Nenad Sarunac**

Faculty of Mechanical Engineering and Engineering Science, UNC Charlotte  
Charlotte, NC, USA, Zipcode:28223  
Email: [nsarunac@uncc.edu](mailto:nsarunac@uncc.edu),  
Tell:7046871089

**Zahra Razzaghpanah**

PhD student of Mechanical Engineering and Engineering Science, UNC Charlotte  
Charlotte, NC, USA, Zipcode:28223  
Email: [zrazzag@uncc.edu](mailto:zrazzag@uncc.edu), Tell:7047732923

## Highlights

- Analyzing thermodynamic performance of single and combined power cycles.
- Evaluating the thermodynamic performance over a range of operating conditions.
- Combined Brayton/ORC cycle has the highest thermal efficiency.
- ORC is the best power cycle for low temperature applications.
- Working fluids were selected based on a systematic multi-step method.

## Keywords

Combined Brayton/ORC cycle- Organic Rankine cycle- Steam Rankine cycle- Brayton- Combined Rankine/ORC cycle- CSP

## Abstract

Thermodynamic analysis and optimization of the power block of concentrated solar power (CSP) plants were performed in this study. Single and combined power cycles such as regenerative steam Rankine cycle with reheat (RSRC), organic Rankine cycle (ORC), combined Rankine/ORC cycle, regenerative Brayton cycle (RBC), regenerative Brayton cycle with recompression (RBCR), and combined Brayton/ORC cycle were compared. Thermodynamic performance of the power cycles was evaluated by performing parametric calculations over a range of operating conditions (maximum temperature, minimum temperature, maximum pressure). Selection of the best power cycle(s) is the main focus of this study. Performance maps which present performance information on the best power cycles in a graphical and straightforward manner were constructed. Results show that for the maximum cycle temperatures lower than 300°C, the ORC has the highest thermal efficiency. For the medium maximum cycle temperatures (between 300 °C to 650°C), the combined Rankine/ORC and RBCR are the best choices. For the maximum cycle temperature higher than 650°C, depending on the maximum pressure, the combined Brayton/ORC cycle and RBCR give the highest thermal efficiency. Also, for low and medium maximum temperatures, RSRC produces the highest specific net work output, followed by the combined Helium Brayton/ORC cycle.



Download English Version:

<https://daneshyari.com/en/article/8071196>

Download Persian Version:

<https://daneshyari.com/article/8071196>

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