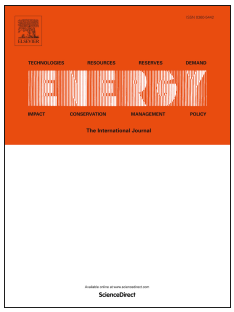
Accepted Manuscript



Proposal and assessment of a novel supercritical CO_2 Brayton cycle integrated with LiBr absorption chiller for concentrated solar power applications

Yuegeng Ma, Xuwei Zhang, Ming Liu, Junjie Yan, Jiping Liu

PII: S0360-5442(18)30183-X

DOI: 10.1016/j.energy.2018.01.155

Reference: EGY 12267

To appear in: *Energy*

Received Date: 12 September 2017

Revised Date: 26 January 2018

Accepted Date: 28 January 2018

Please cite this article as: Ma Y, Zhang X, Liu M, Yan J, Liu J, Proposal and assessment of a novel supercritical CO_2 Brayton cycle integrated with LiBr absorption chiller for concentrated solar power applications, *Energy* (2018), doi: 10.1016/j.energy.2018.01.155.

Proposal and assessment of a novel supercritical CO_2 Brayton cycle integrated with LiBr absorption chiller for concentrated solar power applications

Yuegeng Ma[a], Xuwei Zhang[b], Ming Liu[b], Junjie Yan[b], Jiping Liu[a]*

[a] MOE Key Laboratory of Thermal Fluid Science and Engineering, Xi'an Jiaotong University, Xi'an 710049, PR China

[b] State Key Laboratory of Multiphase Flow in Power Engineering, Xi'an Jiaotong University, Xi'an 710049, PR China

*Corresponding author, liujp@xjtu.edu.cn, Tel.: +86 29 82665742; fax: +86 29 82665741.

ABSTRACT

A novel recompression supercritical CO_2 Brayton cycle integrated with an absorption chiller (RSBC/AC) is proposed for air-cooled concentrated solar power (CSP) plants. The residual heat of CO_2 in the cold end of the supercritical CO_2 cycle is utilized to drive the absorption chiller, which chills the CO_2 exiting the precooler further before it enters the main compressor. Parametric analyses and optimizations are performed for the RSBC/AC. Energy and exergy analyses and comparisons are conducted to illustrate the mechanisms of RSBC/AC performance improvement. Sensitivity analyses of pressure drop and ambient temperature are performed to investigate RSBC/AC performance under various working conditions. Economic evaluations of a CSP plant integrated with RSBC/AC are performed to investigate its feasibility as an alternative to the stand-alone supercritical CO_2 cycle. Results show that the optimized thermal and exergy efficiencies of RSBC/AC are 5.19% and 6.12% higher, respectively, than those of the stand-alone supercritical CO_2 cycle. The exergy destruction/loss in the high-temperature recuperator and precooler of RSBC/AC are significantly reduced. The levelized cost of electricity and payback period for the plant integrated with RSBC/AC are reduced by 0.46–0.77 ¢/kWh and 0.67–5.27 years, respectively, with an annual full-load hour ranging from 5000 to 8500.

KEY WORDS: Concentrated solar power; Supercritical CO_2 cycles； LiBr absorption chiller; Air-cooled; LCOE