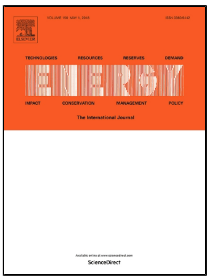
Accepted Manuscript



Fatigue analysis of the steam generator of a parabolic trough solar power plant

P.A. González-Gómez, J. Gómez-Hernández, J.V. Briongos, D. Santana

PII:	S0360-5442(18)30818-1
DOI:	10.1016/j.energy.2018.04.193
Reference:	EGY 12832
To appear in:	*Energy*
Received Date:	10 March 2018
Revised Date:	25 April 2018
Accepted Date:	30 April 2018

Please cite this article as: P.A. González-Gómez, J. Gómez-Hernández, J.V. Briongos, D. Santana, Fatigue analysis of the steam generator of a parabolic trough solar power plant, *Energy* (2018), doi: 10.1016/j.energy.2018.04.193

Fatigue analysis of the steam generator of a parabolic trough solar power plant

P.A. González-Gómez*[1], J. Gómez-Hernández[1], J.V. Briongos[1], D. Santana[1].

[1]Department of Thermal and Fluid Engineering.

University Carlos III of Madrid

Campus of Leganes, 28911 Madrid (Spain)

*Phone number: +34 916246032, Fax: +34 916249430, e-mail: pegonzal@ing.uc3m.es

Abstract

This work proposes a methodology to perform the fatigue analysis of the steam generator of a parabolic trough power plant. The following methodology assumes cycling duty scenario (300 start-ups and shut downs per year). Two start-up operations of the steam generator are analyzed: evaporator temperature ramp and heat transfer fluid temperature ramp. Furthermore, a part load operation is studied.

The results show that the most compromised parts of the steam generator are the reheater tubesheet for the TEMA CFU design, the steam drum-downcomer junction and the superheater nozzle. Besides, former reheater design (TEMA CFU) does not fulfil the 25-year lifetime condition. To overcome this problem, two alternative designs for the reheater are proposed: U-shell and two TEMA CFU in series. Finally, the lifetimes of TEMA NXU and kettle evaporator designs are compared. Our results show that TEMA NXU allows temperature ramps up to 9°C/min without putting the steam generator lifetime at risk, whereas kettle temperature ramps greater than 5ºC/min do not fulfill the designed lifetime of 25 years.

Respect to the load changes, the evaporator drum is the most stressed element. A 50% load change produces a damage equivalent to 60% of the damage produced by a daily start-up/shut-down cycle.

Key words: *Parabolic trough plant; Steam generator; Stress analysis; Fatigue analysis.*

Nomenclature

Abbreviations

CCPs : combined-cycle plants

CSP : concentrating solar plants.

EV : evaporator.

EVts : evaporator tubesheet.

HCF : high cycle fatigue.