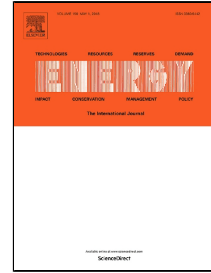


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Fatigue analysis of the steam generator of a parabolic trough solar power plant

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# 1 **Fatigue analysis of the steam generator of a parabolic trough solar** 2 **power plant**

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## 8 **Abstract**

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

14 The results show that the most compromised parts of the steam generator are the reheater  
15 tubesheet for the TEMA CFU design, the steam drum-downcomer junction and the superheater  
16 nozzle. Besides, former reheater design (TEMA CFU) does not fulfil the 25-year lifetime  
17 condition. To overcome this problem, two alternative designs for the reheater are proposed: U-  
18 shell and two TEMA CFU in series. Finally, the lifetimes of TEMA NXU and kettle evaporator  
19 designs are compared. Our results show that TEMA NXU allows temperature ramps up to  
20 9°C/min without putting the steam generator lifetime at risk, whereas kettle temperature ramps  
21 greater than 5°C/min do not fulfill the designed lifetime of 25 years.

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

25  
26 **Key words:** *Parabolic trough plant; Steam generator; Stress analysis; Fatigue analysis.*

## 28 **Nomenclature**

### 29 **Abbreviations**

30 *CCPs* : combined-cycle plants

31 *CSP* : concentrating solar plants.

32 *EV* : evaporator.

33 *EVts* : evaporator tubesheet.

34 *HCF* : high cycle fatigue.

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