**ANALYSIS FOR THE INTEGRATION OF A PARABOLIC TROUGH SOLAR CONCENTRATOR INTO A CONVENTIONAL LOW-PARAMETER STEAM GENERATION CYCLE**

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# ABSTRACT

This work analyzed a concept for the integration of a Parabolic Trough Solar Concentrator (PTSC) into a low-parameter steam generation cycle based on heavy Fuel Oil. The concept was evaluated in a facility dedicated to provide heat for food preparation located in the center of Cuba (Latitude 22.4369.Longitude -79.8981). The facility operates 6 hours per day, from the 7th to the 13th hour, to cover a heat demand of about 8000 MJ, the heat is delivered utilizing saturated steam at 7 bar. Apart from photovoltaic, parabolic trough solar concentrators are the most extended solar technology, due to their simplicity and good efficiency ratio. The exploration of the meteorological conditions of Cuba has shown that direct irradiation in most of the country is appropriate for the utilization of solar concentrators for heat and power applications, in the center of the Island the annual average of direct irradiance in 2022 was about 6.4 kWh/m2/day. This suggests that the integration of a parabolic trough solar concentrator into conventional steam generation cycles to provide head could be a feasible solution to reduce the dependency on fossil fuels and greenhouse gas emissions. The objective of this work was to evaluate the performance of a simple integration concept into existing systems with minimal modifications and the lowest investment cost. For this purpose, a system consisting of a PTSC connected to a boiler and fed with saturated water extracted from the boiler was modelled. A circulation pump was used to force the water to flow through the collector, and the steam generated was back injected into the boiler. For the calculation, a collector with an aperture area of 96.4 m2 and a global efficiency of 61% was selected. It was found that under the irradiation condition of the location the system was able to provide about 16% of the steam demand, this represents fuel savings of 13.3 Ton/year and 5134 USD, and also 41 Ton/year of CO2 emissions reduction. The results suggest that with the cash flow derived from the fuel-saving, with a goal of a payback period not longer than 7 years, investments in a project with this technology should not be higher than about 35,000 USD.

***Keywords:*** Solar-hybrid steam generation system; **P**arabolic **T**rough **S**olar **C**oncentrator; techno-economic performance analysis.