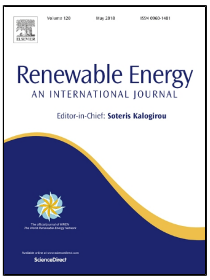
Accepted Manuscript



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PII:	S0960-1481(18)30308-2
DOI:	10.1016/j.renene.2018.03.013
Reference:	RENE 9882
To appear in:	*Renewable Energy*
Received Date:	06 September 2017
Revised Date:	05 March 2018
Accepted Date:	06 March 2018

Please cite this article as: Daha Hassan Daher, Léon Gaillard, Mohamed Amara, Christophe Ménézo, Impact of tropical desert maritime climate on the performance of a PV grid-connected power plant, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.03.013

Impact of tropical desert maritime climate on the performance of a PV grid-connected power plant

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ABSTRACT

This paper provides experimental results on the performance of a grid-connected PV power plant operating under dusty, desert maritime climate conditions using data from the first installation of its kind in Djibouti. The first 4 years of operation were evaluated in terms of IEC 61724 measures, and the impact of climate factors was estimated using a novel combination of analysis techniques. The monthly average daily array yield and final yield were 5.1 kWh/kWp and 4.7 kWh/kWp, respectively. The average performance ratio for respective PV arrays and the global grid-connected system were 90% and 84%, corresponding to monthly average daily PV module and system efficiencies of 12.68% and 11.75%. The seasonal variation in PV module efficiency was found to follow a funnel-shape with a sharp minimum centred on July. The impact of ambient temperature and soiling-induced losses were evaluated, revealing a reduction in the performance ratio by 0.7% for each 1°C rise in daily ambient temperature. Losses due to soiling varied from 0.03% following rainfall events, to 14.23% during dry dusty periods. Finally, to maintain the modules performances losses less than 5%, a cleaning schedule is recommended every two weeks.

Keywords: grid-connected PV system, performance ratio, desert maritime climate, soiling loss.