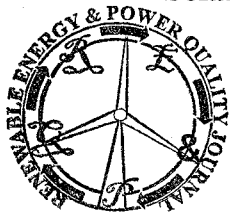


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Solar Panels for Auger Southern Observatory: "SPIDERSHADOWS"



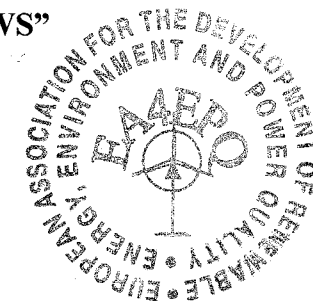
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Abstract. During the winter of 2009, technicians inform about how during a visual inspection they detect failures in the surface of different solar panels. The inspection was not casual, but due to problems with the level of charge of the batteries. Because of the aspect on the failure we will name it "spiders" (*arañas*). But other anomalies, associated to the expected ageing, have been observed, like panels with blued cells, browed surface and others. In the present note, we will describe each of the observed failures, their possible causes and their effect on the solar panel operation. The full data sample we used has been obtained either on dedicated laboratory test (PAO, USC, CIEMAT) or by direct measurement in the field.

Key words

Photovoltaic modules, anomalies, quality check.

1. Introduction

The aim of this technical note is to evaluate the effects of the different alterations in a solar module. In principle, we could consider the huge number of data collected from the monitoring as a more than enough data sample. Unfortunately this sample it is not clear. In fact, the solar panel behaviour is mostly moderated by the battery state of charge and hence, in the monitoring data, the real performance of the panel appears 'shadowed' and cannot be used for absolute analysis. Moreover, monitoring data will allow us to identify the relative performance tendencies as well as to perform an off-line quality check (la otra GAP).

To have absolute evaluations, dedicated laboratory tests are mandatory. In the following, we will describe the exhaustive set of data taking performed to quantify, the influence of the different observed anomalies on our solar module performance, the corresponding data analysis and the evidences obtained.

We perform two scenarios of data taking: Measurements at laboratory (in Malargüe, Santiago of Compostela and CIEMAT) and direct measurements in the field. Data were taken both in open-circuit, short-circuit and charge. These measurements were supported by thermometric analyses (USC) and luminescence analysis. The full measurements have been cross-checked in the official certification laboratory at the CIEMAT [1].

There are several questions to answer: The effect of the different failures in the panel performance and, probably more relevant, the causes of them, in order to predict the future evolution of the most common damages. Moreover, in order to perform a simple protocol to test the panels' health in the field and, if possible, perform algorithms that are able to detect the appearance of new failures by means of a non visual inspection from the analysis of indirect measurements in monitoring data.

2. Problem definition

Standard technical details of photovoltaic modules are recorded in [2]. In the process of buying, the uniformity of behaviour was stressed. Even though, in the last months a power loss in several solar modules has been detected and, in some of them, the replacement of the PV system's batteries was even unavoidable. By September 2009, we were informed about some anomalies that technical staff did at least three stations of the PAO, concerning their solar modules, all of them related to the technical check of the station, which consisted mainly on a rough inspection of the panel. Each station is visited about 2 times per year. At the moment, 172 of them present spiders even if in different number and size (see annexe I for details). The common of this anomaly suggest the possibility of a manufacturer default. But spiders are not the only alteration reported by