Good operation and maintenance practices in photovoltaic plants for greater efficiency and reliability

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Overview

Solar photovoltaic technology is expected to become the dominant source of electricity generation worldwide and a fundamental basis of future energy systems. In this domain, scaling up economic electricity from solar technologies is crucial for the decarbonization and transformation of the electricity sector.

The growth of solar sources is explained, in part, by the consolidation of the photovoltaic industry in developed countries. In Brazil, the growth of this industry was fostered by Normative Resolution No. 482/2012, which initially regulated the so-called Micro and Mini Distributed Generation (MMGD). Currently, Law 14,300/2022 establishes the regulatory framework for this generation modality.

To be able to improve the value of photovoltaic technology for this industry, the performance and useful life of its equipment must be improved, through monitoring and operation and maintenance (O&M) strategies. Good O&M practices are important to ensure optimal photovoltaic performance of systems already installed in the country, and, at the same time, minimize downtime due to failures. In this way, they guarantee greater reliability to the electrical system and greater efficiency in energy conversion.

This work aims to establish good practices for the Operation and Maintenance of solar plants with a view to achieving greater efficiency in the conversion of electrical energy and increasing the reliability of the electrical system.

Methods

To achieve this objective, a documentary and bibliographical analysis will be carried out, taking as a scientific basis mainly academic articles, some master's theses, monographs on the subject in question, among other technical documents proven to be relevant to the topic. Based on the definitions of good maintenance practices, interviews were carried out with professionals from companies operating in the Brazilian solar energy market, to validate the theoretical material studied and brought into the scope of this work. Finally, with the interviews we seek a qualitative analysis of the application of these practices in each stage explored, and a macro view of how they are adopted in the professional practice.

Results

From the interviews carried out, it was possible to have an overview of whether or not Brazilian companies adhere to the good O&M practices discussed after a vast literature review. It was found that most of the practices are actually applied in the field by these companies. It was also possible to obtain others to increase the theoretical scope. The good practices studied that were not mentioned by the interviewees could serve as measures to be implemented by companies, in order to make their processes more efficient.

Thus, it was possible to map experiences on good O&M practices in Brazilian companies, which were discussed, considering the following areas: (i) Design and construction of the plant; (ii) Maintenance planning; (iii) Operation, supervision and monitoring; (iv) Performance indicators; (v) Knowledge of professionals; and (vi) Innovation in maintenance.

Conclusions

As a suggestion for future work, it is recommended, with aim of deepening the topic and optimizing processes in the O&M sector, to carry out interviews with more companies, as the greater the number of companies interviewed with the same Roadmap, the closer will be the consensus to reality regarding the practices carried out in Brazilian companies. From the verification of the facts, it will be possible to define

which good practices are not being applied, and with this a manual can be drawn up with good O&M practices in solar photovoltaic plants for companies at national level.

Key-words:

Photovoltaic solar energy; Operation and maintenance; Good practices; System efficiency; System reliability