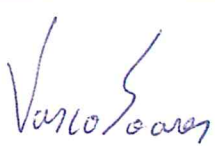
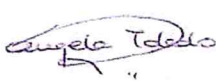




**WATER MANAGEMENT FOR PV CLEANING
IN SOLAR PHOTOVOLTAIC PLANTS**

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v.00

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0 CHANGE CONTROL

Version	Date	Description
00	06/03/2015	Initial Edition

1 OBJECTIVES AND SCOPE

This document describes the main existing procedures and means in EDP Renewables Portugal (EDPR PT) for proper management of water resources used for cleaning, maintenance and operation of its Solar Photovoltaic Plants which are included in the EMS scope set out in the file *“Facilities in the EMS scope”*.

The creation and development of this procedure was done according to the document EXPR-GLB_TSO&M-SPF-00025 *“Water Management for Module Cleaning”*, acting as an addition to this document and main reference for PV Module maintenance and cleaning procedures in EDPR PT’s Solar Photovoltaic Plants.

2 REFERENCES

- ISO 14001:2004 standard.
- EMS Manual.
- EXPR-EU/EMS-EU/GP-00007 *“Operational control, monitoring and measurement”*.
- EXPR-GLB/TSO&M-SPV-00005 *“O&M Procedures for PV Modules - Cleaning of modules”*
- EXPR-GLB_TSO&M-SPV-00025 *“Water Management for Module Cleaning”*

3 DEFINITIONS

Not applicable.

4 ABBREVIATIONS

- **EDPR PT:** EDP Renewables Portugal.
- **PV:** Photovoltaic.
- **SP:** Operation and Maintenance Service Providers.

5 PROCEDURE

Regarding the specific case of Solar Photovoltaic Plants, the responsibility associated with the management of water resources used for cleaning and maintenance operations of PV modules is delegated to the corresponding service providers. This is due to the nature and specific properties of the equipment. This action should always be based in legal and formal support, that contractually binds both parts.

One of the main factors that condition and negatively influence PV function and overall production efficiency is the accumulation of dirt and dust on its surface.

Considering the fact that maintenance and cleaning activities regarding this kind of equipment is fundamental water based, according to the procedure EXPR-GLB_TSO&M-SPV-00025 “*Water Management for Module Cleaning*”, the current procedure aims to establish an adequate and efficient management of water during these activities.

It should also be noted that, while this document does serve as a generic procedure for the management of water in PV cleaning activities, any kind of instructions from the PV modules manufacturer shall be attended at all times when cleaning the modules (failure to comply with this might void module warranty) and should always prevail over this document.

PV module cleaning should be executed with clean, additive-free water and preferably with low mineral content. Such is to prevent the possibility of mineral deposits and formations on the equipment’s surface. However, if called for, due to exceptional circumstances, the use of specific detergents (mild, non-abrasive and non-caustic detergent) is allowed, as long as all the legal, environmental and manufacturer requirements are met.

Before cleaning activities are performed, the Service Provider (SP) should always make sure that water shall be abstracted from a legitimate source and that its properties comply with the

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existing specifications. Whenever water becomes a limited resource, other solutions, such as the use of harvested rain waters, manual washing or air cleaning should be explored, after EDP PT's approval on the matter.

Water consumption for PV module cleaning will vary according to the cleaning method. Regardless, all SP must account and monitor (or, whenever such is impossible, estimate) water consumption and quarterly report these values to EDP PT, which will be included in SIS. All Service Provider's reports should indicate, at least: designation of the Solar Photovoltaic Plant, quarterly water consumption and origin of this resource. Whenever direct monitoring is impossible, estimates should be based on an average consumption of 3 l/m² of PV module.

Cleaning operations should be done according to the following procedures: EXPR-GLB/TSO&M-SPV-00005 "*O&M Procedures for PV Modules - Cleaning of modules*" and EXPR-GLB_TSO&M-SPV-00025 "*Water management for module cleaning*" and should consider possible leak prevention and rational use, in order to prevent wasteful scenarios. This includes careful analysis regarding the necessity of cleaning PV modules, as well as programming these activities in order to avoid periods during the day and associated with higher solar intensity, and preferably before yearly seasons associated with higher temperatures and radiation.

The use of high pressure valves comes as an advantage, improving cleaning efficiency for the same amount of water. In these cases, the PV module's physical resistance specifications according to the manufacturer should be accounted for.

If there is no water supply on site, or it cannot be used for module washing, vehicles provided with high capacity water tanks may be driven to the PV plant. In these cases, the maximum circulation speed is 20 km/h.

PV module cleaning with clean water also prevents the generation of pollutants, since the generated wastewater will be contaminant free, allowing its direct discharge on to the ground. However, for particular cases that demand the use of detergents, the necessary precautions should be taken by the SP, regarding environmental and legal compliances for both wastewater rejection or collection resorting to specific collecting equipment.

Excess water from these activities, may be generally use for plant watering and vegetation development, according to the procedure: WIT-EU/EMS-SPF-00006 – "*Vegetation Control In Solar Photovoltaic Plants*".

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6 RESPONSIBILITIES

EDPR PT EMS Manager:

- Obtain the quarterly water consumption information associated with PV module cleaning activities from the SP, and report the data in SIS.
- Obtain the necessary documentation regarding water abstraction and consumption for PV module cleaning activities, whenever it is acquired from external (non EDPR PT) sources from the SP.

EDPR PT O&M Manager for EMS:

- Guarantee that the SP provides immediate solution for any and all contract / side letter breaches.

Photovoltaic Plant Manager:

- Periodically check the state of the PV modules and the respective cleaning methods used by the Service Provider.

Service Provider:

- Report the quarterly water consumption and abstraction (when applicable) information associated with PV module cleaning activities and other uses to the EDPR PT EMS Manager and EDPR PT O&M Manager for EMS.
- Uphold every legal and contractual aspect associated with these activities in EDPR PT's Solar Photovoltaic Plants.

7 TEMPLATES

Not applicable.