



Food and Agriculture Organization
of the United Nations

TOOLS AND TECHNIQUES FOR OPERATION AND MAINTENANCE

SPIS IN PLACE

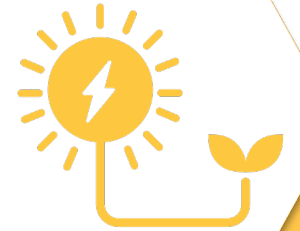
Ahmed Abdelfattah

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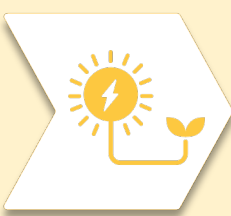
Tunis, 14 December 2022

Regional gathering

Tunis, 12 – 16 December 2022



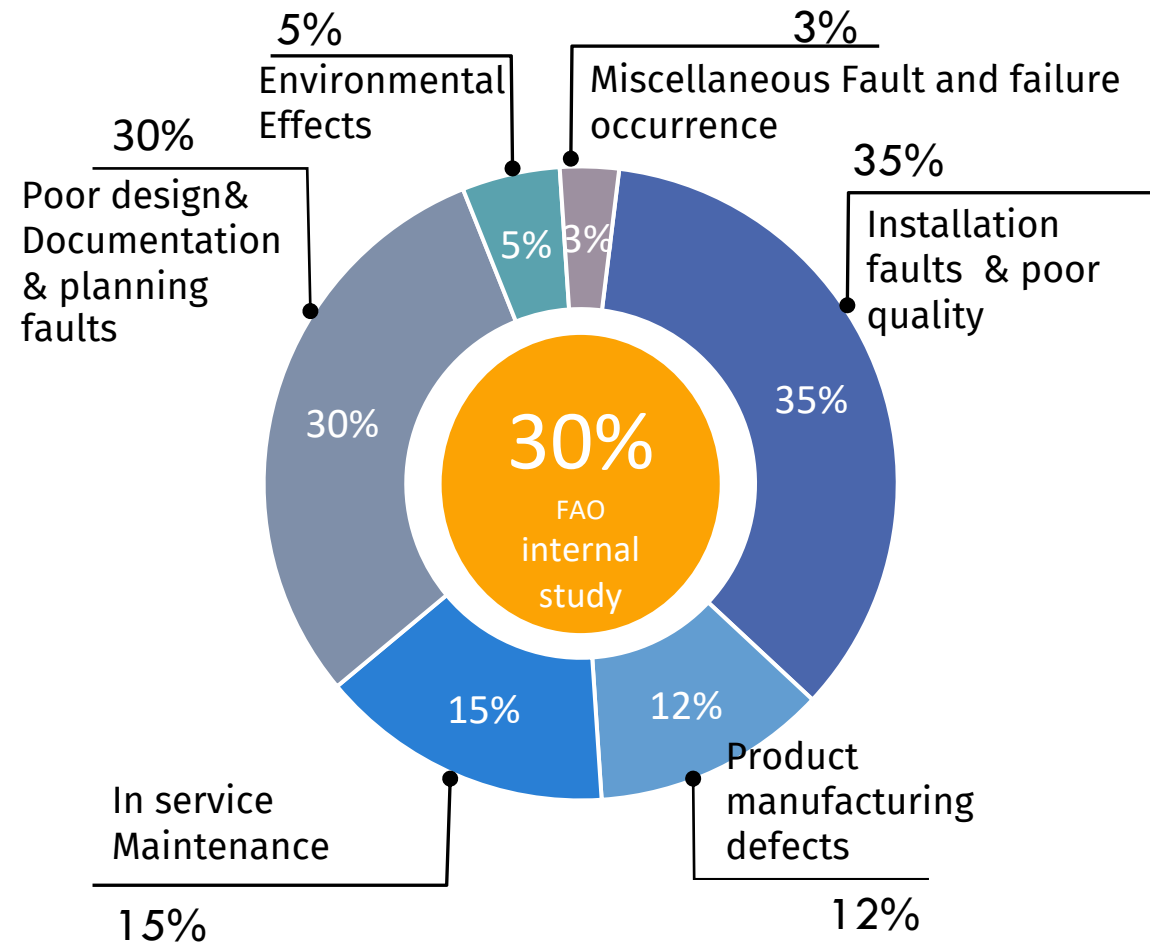
ITALIAN AGENCY
FOR DEVELOPMENT
COOPERATION

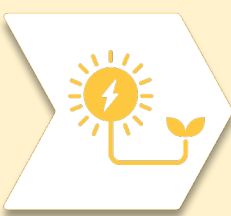


GENERAL O&M

Operation and Maintenance (O&M) has become a standalone segment within the solar industry. One of most general effect of faults is loss of produced energy, caused by one or more independent faults cause in service O&M.

Based on FAO projects studies (2017-2019) we found > 15 % of defects are caused by in service O&M in our projects.





STANDARDIZATION

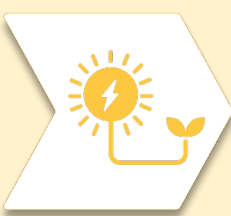
Operation and maintenance are among the most important activities that influence the efficiency of a solar water pump.

Increasing the quality of O&M services is important and, in contrast, neglecting O&M is risky since offers a wide range of practices and approaches.

Today, existing standardization procedure still work to fill in all the gaps or clarify all the requirement. Their implementation, in line with a number of technical international standards, should be followed

General O&M activities	Performance & monitoring	Specialized technical inspections	PV Components
<ul style="list-style-type: none">• EN 13306• IEC 62446-1: 2016• IEC 62446-2• IEC YS 63049: 2017• IEC 60364-7-712: 2017• IEC 62548	<ul style="list-style-type: none">• IEC 61724-1: 2017• IEC TS 61724-2: 2016• IEC TS 61724-3: 2016• IEC TS 61724-4• IEC TS 63019: 2019• ISO 9847: 1992	<ul style="list-style-type: none">• IEC TS 62446-3: 2017• IEC 61829: 2015• IEC TS 60904-13: 2018	<ul style="list-style-type: none">• EN 50380• IEC 61215*• IEC 61439• IEC 61557*• IEC 61730*• IEC 62093• IEC 62109*• IEC TS 62804*• IEC TS 62915• IEC TS 63126
Other supporting standards			
<ul style="list-style-type: none">• IEC 61836• IEC TS 62738: 2018• IEC TR 63149: 2018• IEC TR 63149: 2018	<ul style="list-style-type: none">• IEC TS 62548• IEC 61853-1: 2011• IEC 61853-2: 2016• IEC 61853-3: 2018	<ul style="list-style-type: none">• IEC 61853-4: 2018• IEC 61853-5: 2011• IEC 60904-4• IEC 60891: 2009	<p>* all parts</p>

A list of international standards has been added to support these best practices and to avoid misunderstandings in wording and doing. These are of high value for a professional and to provide high-quality service provision.



OPERATION OF PV SOLAR POWER PUMPING SYSTEM

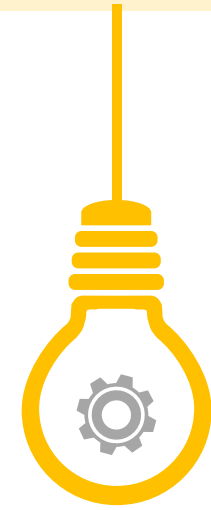
It is good practice to develop a day-to-day operation plan, so that all actors have a clear understanding of what activities will need to be conducted and at what frequency.

Operations is about remote monitoring and performance analysis, supervision and control of the PV Facility, as well as coordination of the maintenance activities



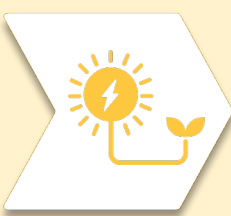
Significant

Solar powered pumps have a significantly longer life expectancy compared to diesel pumps. Solar panels continue to produce electricity for the pump for even longer than 25 years.



Strategy

The necessary features of an operation strategy of a PV solar power system. Starting from system performance monitoring, the operator should monitor the operational performance of the system devices on continuous basis. Any shortfall in power generation capacity and notification of faulty devices should be reported with an alarm. The reported notification is then sent to the operations contractor or manufacturer to initiate appropriate maintenance or action.



SYSTEM OPERATIONS

IDENTIFICATION AND RECTIFICATION

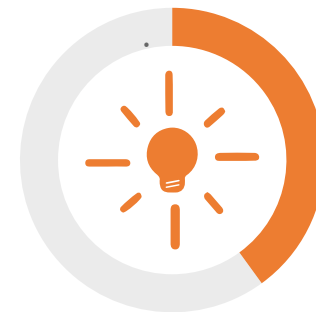
The operation and maintenance of the PV solar power pumping system deal with the day-to-day power generation activities, interconversion between DC/AC, identification and rectification of system faults, and electrical power transmission to run water pumps. The system's operational performance is monitored continuously to reduce downtime and produce the guaranteed output sustainably.

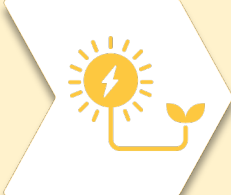


REPORTING

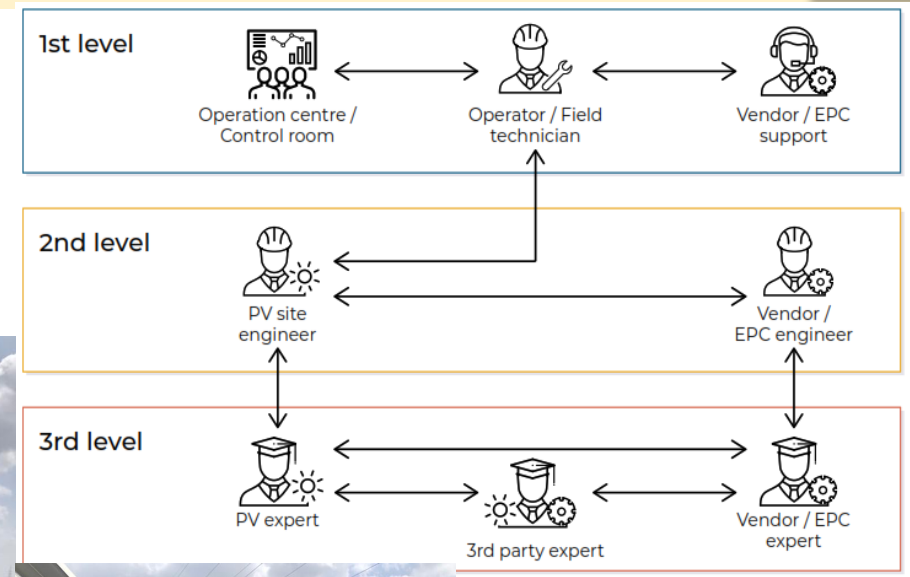
For weekly and monthly reporting, the system operations team shall provide monthly performance reports including:

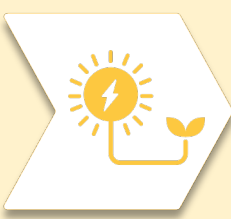
- actual electricity produced by the system;
- frequency and duration of the outage;
- cleaning report;
- summary of corrective actions of each equipment with details of the defect and executed rectification measures;
- summary of emergency response;
- summary of the spare parts replaced and the actual status onsite;
- extraordinary events and site observations with photo evidence;
- overall summary of corrective actions reported by the O&M technicians;
- duration of pumps operation;
- availability of water in the overhead storage tank or surface reservoir;
- status and number of open valves; and





TRAINING AND TOOLBOX TALK





MAINTENANCE

Maintenance is usually carried out on-site by specialised technicians, according to the Operations team's planning and consists of the following activities:

Preventive

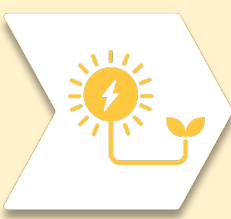
- Visual Inspections
- Periodic testing
- Manufacturer checklists
- Landscaping
- PV cleaning
- Thermography

Corrective

- Responding to faults within guaranteed response times
- Correcting faults
- RCA

Predictive

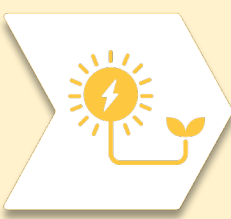
- How can a fault be prevented?
- Trends of sensor readings
- Manufacturer recommended life cycle replacements



GENERAL MAINTENANCE PROCEDURE

PV solar systems are characterized as “low maintenance” due to the lack of moving parts. However, regular inspection and maintenance guarantee optimum performance. Regular maintenance activities and inspections enable a pre-warning before something can go wrong or might help to find the cause after a failure or malfunction.





SCHEDULE OF MAINTENANCE ACTIVITIES

Cleaning

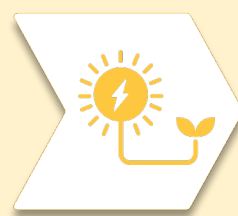
- Depending on the location, cleaning might be required up to once a week.
- Consult manufacturer's manual for cleaning tools. Soft brushes are usually ok
- Water must be tested and must not be hard (it must be low in mineral content)
- Water should not be a lot warmer than the PV module at the time of the cleaning
- No chemicals or soap are allowed!
- Cleaning a cracked/deformed PV module is dangerous
- Some modules (thin film) are damaged if cleaned while generating power

training session on the cleaning of PV modules for the beneficiaries of FAO's Al-Afir project, El- Behiera Governorate,



Different between clean and Dirty accumulation modules





THANK YOU

Ahmed Abdelfattah

Land and Water Division (NSL)

Natural Resources and Sustainable Production Stream

Food and Agriculture Organization of the United Nations (FAO)