

Solar Energy



Solar maintenance and safety

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No. 101037141. This material reflects only the views of the Consortium, and the EC cannot be held responsible for any use that may be made of the information in it.



In this video you will learn:

- What is maintenance in solar PV systems
 - The role of O&M in solar PV growth
 - O&M actions for each maintenance category
 - Hazards associated with PV systems
 - Electrical safety actions for operators
 - Emergency actions and personal safety near PV systems



What is Maintenance ?



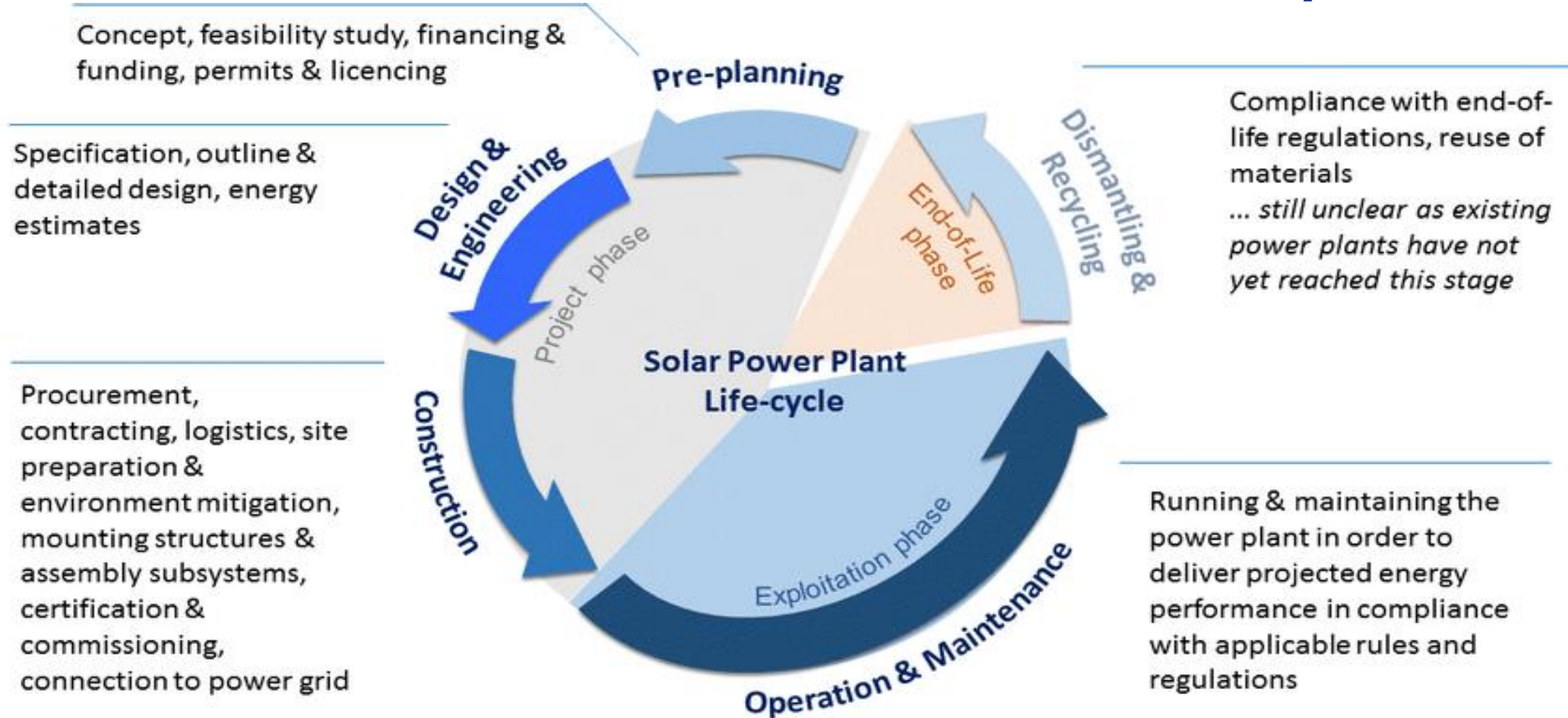
Maintenance is defined as all actions focused on preserving the defined system in good operating conditions by avoiding its degradation. Proper maintenance increases the availability and improves the efficiency of the system.

STRATEGIES OF MAINTENANCE

- **Corrective maintenance** applied when a fault is detected; it is unexpected and at a high cost
- **Preventive maintenance** is based on maintaining a certain level of efficiency in the factory with scheduled interventions in order to avoid breakdowns and maintain the health of components at a certain level of service.
- **Predictive Maintenance** relies on knowledge of the plant's health in order to predict or anticipate possible breakdowns and to intervene before they occur; This is usually achieved with a monitoring system and advanced algorithms.



Maintenance related to Solar systems



Camarinha-Matos, Luis & Oliveira, Ana & Ferrada, Filipa & Thamburaj, Victor. (2017). Collaborative services provision for solar power plants. *Industrial Management & Data Systems*. 117. 10.1108/IMDS-06-2016-0246.



O&M as a key enabler for Solar PV growth

Recent studies has shown that even if PV systems have reached a degree of maturity, O&M do make an important role in order to keep these PV systems running at a high degree of efficiency and productivity. Appropriate O&M actions can therefore elevate PV systems profitability by reducing the time of ROI (return of investments).



Source: IRENA report, Future Of Solar Photovoltaic : Deployment, investment, technology, grid integration and socio-economic aspects (2019)



O&M Actions : Corrective maintenance



Fixing inverter error



Defective cable replacement



Electrical components replacement



Defective panels replacement



O&M Actions : Preventive maintenance



Module and equipment Cleaning



Vegetation management



Inverters, transformers and MV switchgear periodic and grounds maintenance



Source: altestore.com



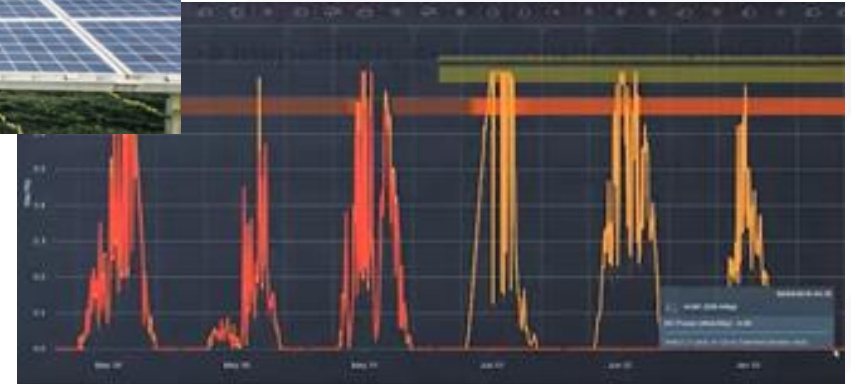
O&M Actions : Predictive maintenance



Drone inspection



Thermographic Studies



Performance Analysis, Planning
based on the annual range



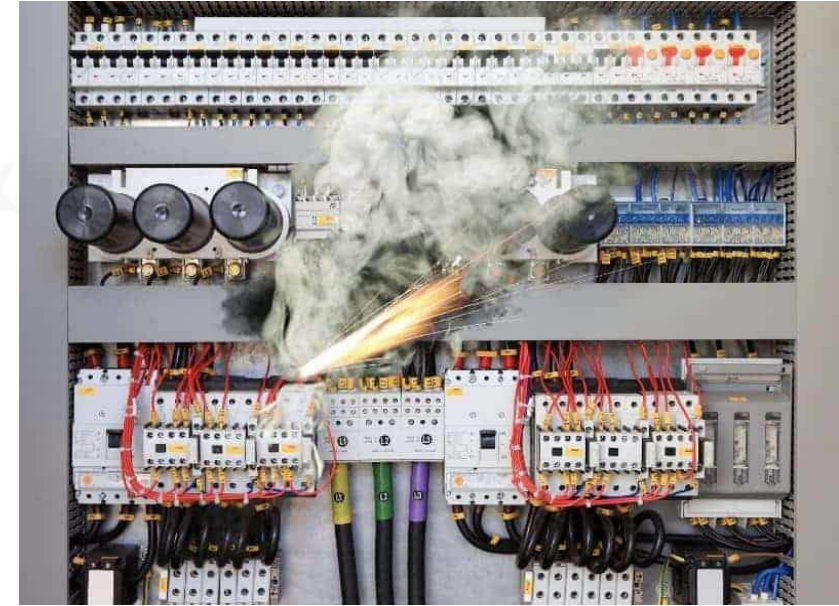
Hazards associated with PV Systems



Fire due to other types of failure



Fire due to PV panel



Electrical Shock

Source : <https://www.pv-magazine.com/2021/07/02/australias-unsafe-solar-installation-standards-under-fire/>

Source : <https://fsri.org/research/firefighter-safety-and-photovoltaic-systems>



Electrical Safety actions for operators

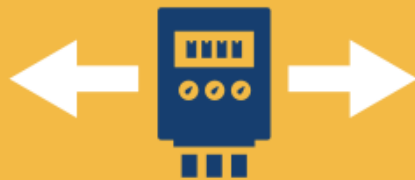
PV Panel Electrical Safety



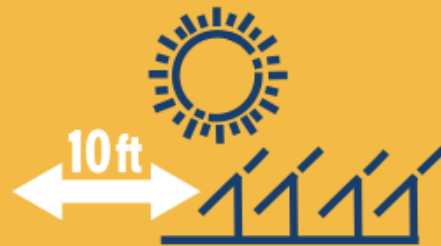
Solar disconnects only disconnect building from PV panels. **Panels can still generate power.**



Never walk or climb on a solar PV panel.



Beware of **bi-directional power**, mark all bi-directional meters.



Stay at least **10 feet** away from solar installations.

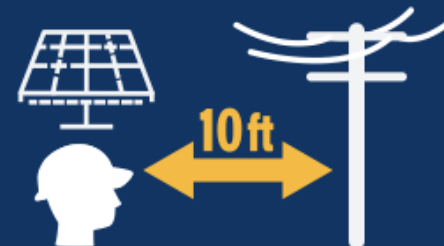
PV Installation Electrical Safety



Locate all overhead power lines.



Consider all overhead lines to be **live, energized and dangerous.**



Keep self and equipment **10 feet away** from all overhead lines.



Carry ladders and other equipment **horizontally** when on the ground to avoid overhead lines.

Source : <https://www.esfi.org/solar-pv-electrical-safety/>



Emergency actions

In Case of Emergency Involving Solar Panels



If possible, **turn off AC side of solar panels.** Solar panels may still generate DC power.



Remind first responders of the PV system.

Key statistics

- 650 solar PV installers were injured between 2011 and 2019
- 51% of injured installers were employed for 1 to 5 years

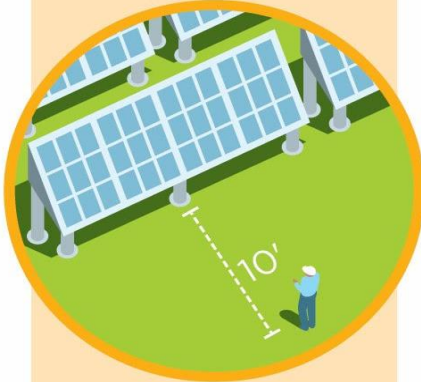
Source : <https://www.esfi.org/solar-pv-electrical-safety/>



Personal safety near PV systems

SAFETY NEAR SOLAR

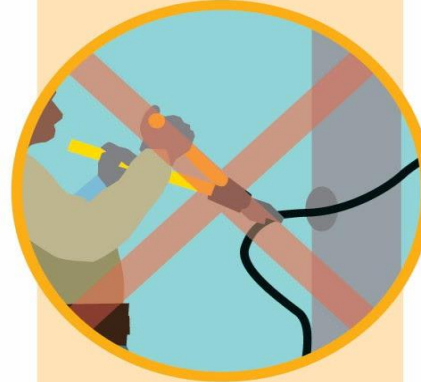
Like any other source of electricity, solar panels can pose potential hazards. Keep these safety tips in mind when you're near solar panels.



Stay at least
10 feet away
from the
installation.



Never walk on
solar panels.



Never cut any
wiring to the
solar panels.



Never touch
broken or
damaged solar
panels.

Fall River Rural Electric Cooperative
<https://www.fallriverelectric.com/solar-panel-safety>



Additional References

- Research article : Camarinha-Matos, Luis & Oliveira, Ana & Ferrada, Filipa & Thamburaj, Victor. (2017). Collaborative services provision for solar power plants. Industrial Management & Data Systems. 117. 10.1108/IMDS-06-2016-0246.
- IRENA report, Future Of Solar Photovoltaic : Deployment, investment, technology, grid integration and socio-economic aspects (2019) : [irena.org/publications/2019/Nov/Future-of-Solar-Photovoltaic](https://www.irena.org/publications/2019/Nov/Future-of-Solar-Photovoltaic)
- Fire Safety Research Institute Resources and training courses : <https://training.fsri.org/>
- The Electrical Safety Foundation International (ESFI) resources : <https://www.esfi.org/?s=solar>
- Best Practices in OPERATION AND MAINTENANCE of Rooftop Solar PV Systems in India : <https://solarrooftop.gov.in/knowledge/file-79.pdf>
- Photovoltaic field inspection guideline : <http://brooksolar.com/files/PV-Field-Inspection-Guide-June-2010-F-1.pdf>



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