Yingli Spain recommendations for O&M tasks in PV plants in desertic areas of Perú and Senegal

Workshop “INVIVONexth on O&M and Acceptance for PV plants in arid climates”
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Who is Yingli Solar?

- Yingli Solar is one of the largest PV module manufacturers in the world.
- The Company is publicly traded in the NYSE since 2007.
- HQ is in Baoding (China): commerzializes products in more than 90 countries.
- 2017: Yingli Green Energy Spain (YGES) has become Yingli Green Energy Europe (YGEE).
- YGEE in Spain is the head-quarters of Yingli Solar for Europe, LATAM and Africa.

R&D, Aftersales Service Center in Madrid, Spain

Yingli Solar in the World

- 15 offices and subsidiaries.
- 6 production centers in China.
- **2 R&D, Afersales Service Centers (Baoding, Madrid).**

Yingli Solar in Spain (Europe)

2004 Commercial presence

Yingli Solar Spain

2011 Opening of R&D, Aftersales Sercice Center for Europe in San Agustín del Guadalix (Madrid)

2017 European Head-Quarters

YGES overcomes 1000 MWp

Commercial Management in Spain and Portugal

Opening of new markets in North Afica and Latin America

R&D tests on modules and new products and services developement

(**EPC and O&M services**)

Reference customers: Iberdrola, X-Elio, Endesa, Elecnor, Acciona, Proinso/OPDE, etc…

R&D, Aftersales Service Center for Europe

- Technical and Aftersales Sercice
- Technical assistance in pre-Sales and Engineering

Considerations of arid climates in PV plant O&M

- Desertic areas are in many cases isolated.
- Dust and mineral salt soils have effects on the PV plant operation.
- Effects of dust on:
  - PV modules: cleaning and shading
  - Structures
  - String boxes
  - Buildings and electronics: water cooling
- PV module cleaning considerations (not presented):
  - Climate characteristics: typical rainfall
  - Cleaning strategy

PV plants in desertic areas

- Desertic areas isolated from cities make more complicated the access to water and supplies.
- Maintenance tasks need to be scheduled with personnel availability.

Dust effect on low tilted modules

- Large irradiance reduction due to dust coverage.

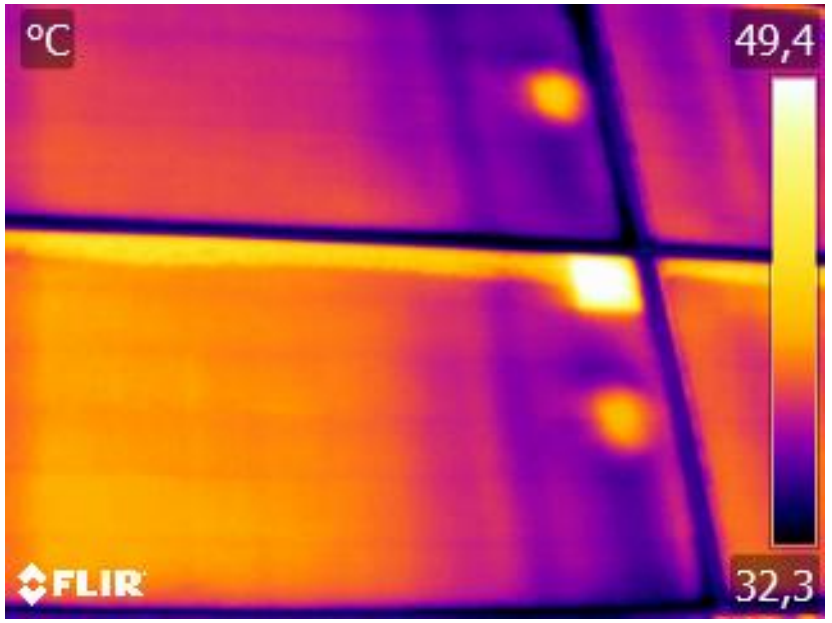
Dust accumulation on PV modules

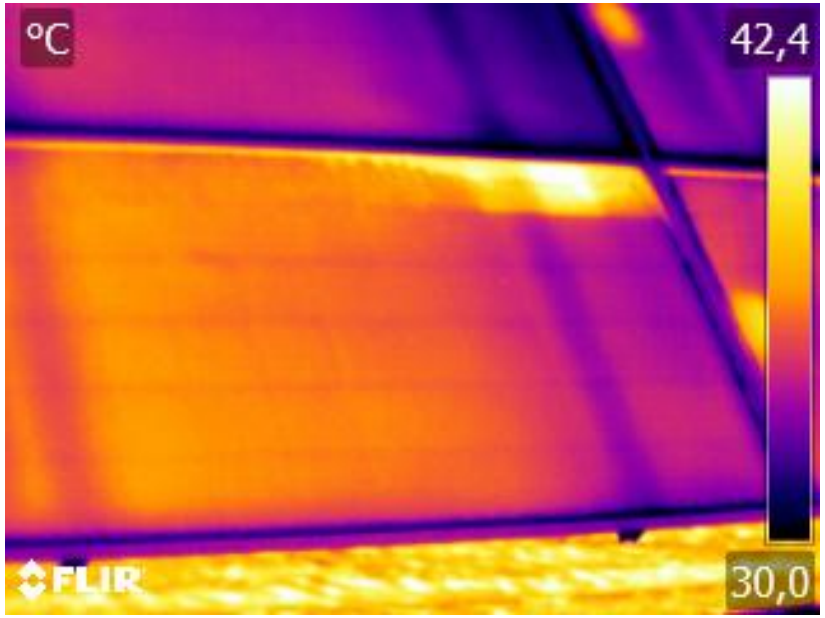
- Stow position: constant low tilt.
- Consistent accummulation of soiling on edge

Dust accumulation on PV modules

- Desertic areas with morning mist.

Dust effect on shading: Thermographic comparison





Mineral salt deposits effect on conductors and connectors

Mineral salt deposits effect on structures

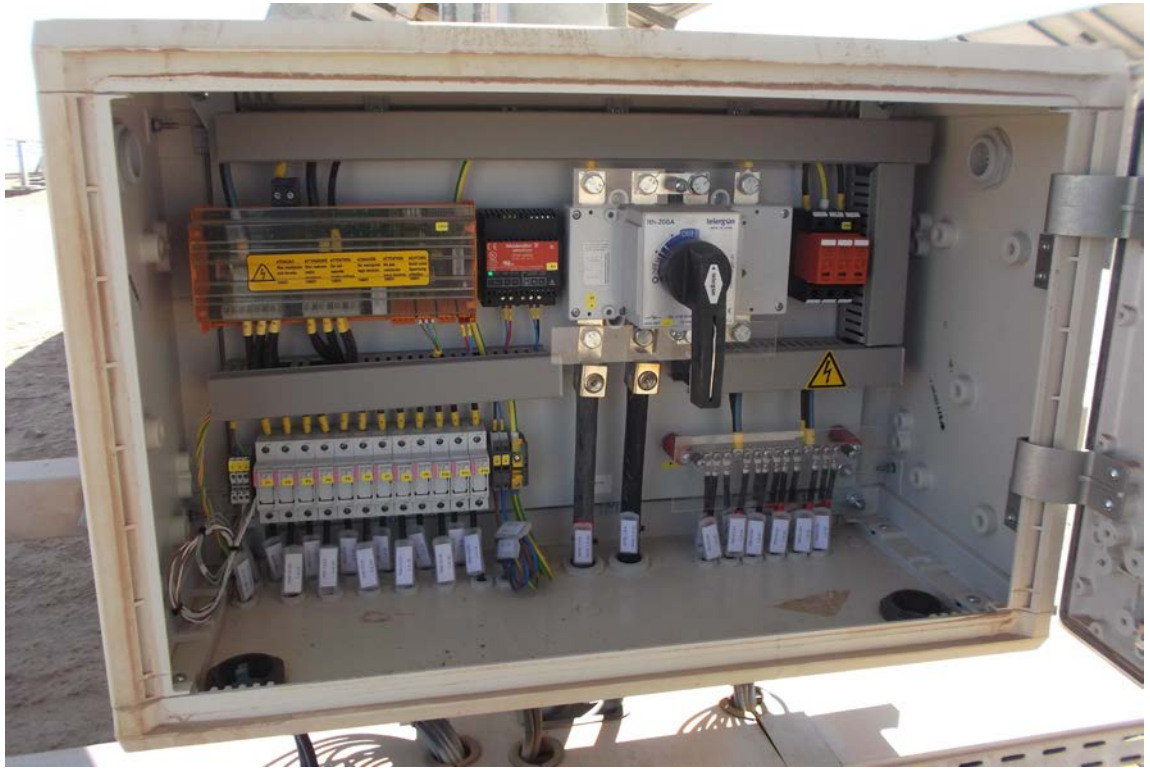
- Ingress of dust in tracker gears.
- Corrosion of structure beams.

Mineral salt deposits effect on structures

- Dripping morning mist erodes soil.
- Mineral salt corrodes materials.

Dust mitigation on string boxes

- String boxes with IP 65 or better to prevent ingress of dust inside the cabinet.
- The gaskets are in good condition.



Dust mitigation on electronics

- Vent grids reduce dust ingress in inverter sheds.
- Water cooling system reduces dust ingress in inverter sheds.

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Thank you for your attention!