

ABSTRACT

- An R&D effort is necessary to support the expected multi-GW PV deployment in the Gulf region by providing solutions to PV modules reliability in Qatar-like environment.

- A joint effort is being carried out by both **GreenGulf** and **QEERI** in order to:

- **Identify** the key environmental stress factors that can decrease performance and lifetime of PV modules in hot environments like Qatar
- **Design** solutions to mitigate such a problems by introducing improvements in PV modules design, particularly in the materials side.
- **Validate** such new improvements through accelerated testing at both outdoor and indoor labs.

BACKGROUND

- PV module manufacturers offer nowadays a power yield guarantee of 90% for the first 10-15 years and 80% for the rest till a 25-year panel lifetime. (Zielnik, 2013)

- Hot and dusty environmental conditions in Qatar may seriously handicap the power yield and even the life span of PV modules. (Mani, 2010)

- Accelerated aging techniques, both indoor and outdoor, allow to obtain results in reasonably short testing periods for both:

- Validation of new solutions
- Degradation of existing PV panel products

METHODOLOGY

1. **Collect field data** about most relevant environmental factors with an influence on PV module degradation:

- UV spectrum within solar radiation on ground
- Dust composition and deposition rate
- Other chemicals in the atmosphere, aerosols, salinity....
- Meteorological variables: temperature, relative humidity..

2. **Set-up indoor and outdoor labs** for accelerated aging and performance testing of PV modules, in addition to existing ones from **GreenGulf**.

3. **Design and implement engineering solutions** to prevent PV modules performance and lifespan to be handicapped in hot climates as Qatar's one.

4. **Commercialize solutions** through Qatar Foundation's dedicated mechanisms

CURRENT WORK / FINDINGS

- **Qatar Foundation (QSTP), GreenGulf and Chevron** partnered in 2010 to establish the **Solar Test Facility**. Its purpose is to determine which solar technologies are most suited to Qatar, by measuring their energy production and response to heat and dust.
- The 35,000 m² site at QSTP was installed with crystalline silicon, thin film and concentrating PV technologies from multiple manufacturers.
- This site was commissioned in December 2012, and data recorded since February 2013..
- **Preliminary results about the effect of soiling on power output of c-Si modules are presented in this poster.**
- PV modules are mounted at 22° fixed tilt South, as single strings of 1.5 – 2.0 kW.
- Arrays are cleaned manually with a dry cloth under one of three cleaning schedules: weekly, every two months, and every six months. A reference c-Si module and one sample of each thin-film technology are tested simultaneously.
- Three hydrophilic and one resin-based anti-soiling coatings from commercial suppliers are tested, but none of them have so far had a significant effect on soiling.
- DC energy production is measured by dedicated sensors and meteorological data is recorded.



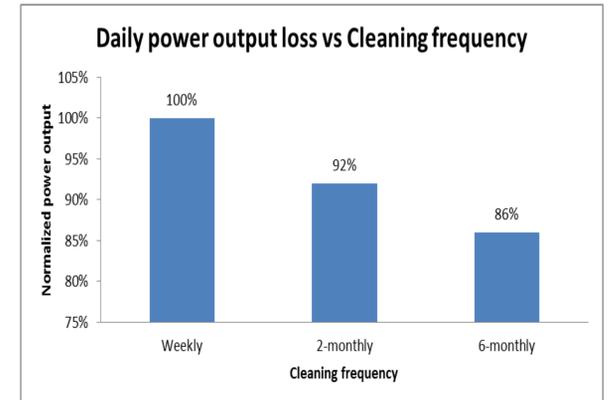
Two identical modules with different cleaning frequencies



The Meteo Station at the STF



Overall view of the STF



CONCLUSIONS/ SUMMARY

- PV is to be massively deployed in the Gulf region, but problems concerning **outdoor degradation of PV modules** need to be addressed.
- **GreenGulf** is already running the **Solar Test Facility** where many different PV module samples are under testing.
- **QEERI** plans include the **set-up of both indoor and outdoor facilities** to characterize the problem and test newly developed solutions.
- Some resources to be deployed are:
 - Weathering chamber, corrosion cabinet, IR imaging system, spectrophotometer, electroluminescence device
 - Exposure solar trackers, test stands, UV spectroradiometer and dust measurement sensor

REFERENCES

- Mani, M. (2010) 'Impact of dust on solar photovoltaic (PV) performance: Research status, challenges and recommendations'. Renewable and Sustainable Energy Reviews. Volume 14: pg. 3124-3131
- Zielnik, A. (2013). 'Validating photovoltaic module durability tests'. Solar America Board for Codes and Standards.

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