The Outdoor Bifacial PV Testing Facility and Technical University of Denmark

Riedel, Nicholas; Aguilar Protti, Alexander Corazon de; Jakobsen, Michael Linde; Pedersen, Henrik Chresten; Thorsteinsson, Sune; Poulsen, Peter Behrensdorf; Santamaria Lancia, Adrian Alejo; Benatto, Gisele Alves dos Reis; Demurtas, Giorgio; Arrighi, Fabio

Publication date: 2019

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
The Outdoor Bifacial PV Testing Facility at Technical University of Denmark

Nicholas Riedel¹, Alexander Aguilar Protti², Michael L. Jakobsen³, Henrik C. Pedersen³, Sune Thorsteinsson³, Peter B. Poulsen³, Adrian A. Santamaria Lancia³, Gisele A. dos Reis Benatto³, Giorgio Demurtas³, Fabio Arrighi³, Djaber Berrian³, Joris Libal³, Dale Barnard⁴, Jan Vedde⁴

¹DTU Fotonik, Roskilde, 4000, Denmark; ²Startak, Hvidovre, 2650, Denmark; ³ISC Konstanz, Konstanz, 78467, Germany; ⁴European Energy A/S, Søborg, 2860, Denmark

Background: Since summer 2018, European Energy A/S and DTU have measured the performance of bifacial PV strings mounted on trackers and fixed tilt systems located in Northern Europe (55.6° N, 12.1° E). A new publically funded project is underway with the intent to evaluate in-house and commercially available bifacial PV performance models. The facility includes several sub-systems where the conditions known to affect bifacial performance are varied including tracker spacing (GCR), albedo (ρ) and module tilt (θ).

Equipment and Layout
- Monofacial and bifacial strings of similar front side power mounted side-by-side.
- Horizontal East-West (HSAT) trackers (x8) and south facing 2V racks with adjustable tilt angle (x8).
- Tilted single axis trackers (x2) and dual axis tracker (x1).
- Multiple ground covers under test:
  - Seasonal grass
  - Coarse sand
  - Medium-size gravel
  - White polymeric tarp
  - µ-structured reflector

Sensors and Detailed Monitoring
- Max-power current (I_{max}) and voltage (V_{MP}) measurements on 64 individual strings.
- DC Power meters with isolated surface mount resistors and digital filtering.
- Spectroradiometers for diffuse and beam measurements (300-1100 nm) for investigation of spectral effects.
- Solar radiation measurements include:
  - DNI (spectral)
  - DNI (broadband)
  - DHI (spectral)
  - DHI (broadband)
  - GHI (broadband)

Performance Modeling
We are using the on-site meteorological data as inputSs to bifacial PV models. The model’s output is then compared to our electrical measurements. View factor models under consideration currently include MoBiDiG (ISC Konstanz), PVsyst, and SAM. Ray trace models currently being tested include Zemax and Radiance.

Acknowledgements
The work is supported by the Danish Energy Technology Development and Demonstration Program (EUDP) under project contract 64018-0624 which is gratefully acknowledged. We are also grateful for European Energy’s financial support for most of the capital equipment at the facility.