Bifacial Tracking Testbed at NREL

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Project Summary

Bifacial demonstration plant with 10 rows of single-axis trackers. Each row is independently monitored and grid tied. This project continues our work on bifacial photovoltaic modeling, field evaluation and standards development.

Project Impacts

Collection of NREL-sited and commercially deployed bifacial systems provide confidence to owners and validate performance models. Improved bifacial models assess system performance impact from rear irradiance mismatch and rack shading.

Outcomes

With high DC-AC ratio clipping being a concern, a lot of the bifacial energy benefit accrue during times when the system is not putting out max power. However, most of the energy generation happens at high irradiance.

The average case is our best estimate for our site, and it coincides with field measured bifacial gains of 6% for the PERC bifacial system, and 9% for the higher efficiency silicon heterojunction string.

BG is sensitive to albedo and module bifaciality. The range of typical BG values for other conditions are between 4 and 8% for PERC and 6.5 and 11% for the heterojunction system. Site measured albedo is 0.19 – 0.21 during this period, matching “average case” assumptions.

3 sensitivity cases were selected to model bifacial energy gain in SAM for our site.

PERC bifacial gain 4-8%

BG = \frac{E_{bifacial}}{E_{monofacial}} - 1

String kWh_{dc} monitoring

Front, rear POA irradiance

20 modules (7.5 kW) / row
Module electronics / monitoring

4 PERC, 1 SHJ bifacial strings
3 PERC monofacial strings

References


Marion, 2019, “Albedo Data to Facilitate Bifacial PV System Planning”, 2019 PV Systems Symposium, Albuquerque, NM.

Deline, C., et al. Area BIPV demonstration Bifacial PV system performance, separating fact from fiction. 46th IEEE PVSC, Chicago


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