Outcomes

**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.

### 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.

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**Outcomes**

With high DC-AC ratio clipping being a concern, a lot of the bifacial energy benefits accrue during times when the system is not putting out max power. However, most of the energy generation happens at high irradiance. Performance agreement between measured and modeled data (considering measured irradiance and temperature†), is about the same for both technologies within about a 2% offset error. This suggests that going to a bifacial technology doesn't significantly increase the model error.

### Project Impacts

Collection of NREL-sited and commercially deployed bifacial systems provide confidence to owners and validate performance models.

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*Bifacial Energy Gain, $B_G = \frac{B_{\text{bifacial}}}{B_{\text{monofacial}}} - 1$

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

<table>
<thead>
<tr>
<th>Sensitivity Case</th>
<th>Albedo</th>
<th>PERC Base</th>
<th>Bifi Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>High case</td>
<td>0.30</td>
<td>0.75</td>
<td>0.95</td>
</tr>
<tr>
<td>Average case</td>
<td>0.20</td>
<td>0.70</td>
<td>0.90</td>
</tr>
<tr>
<td>Low case</td>
<td>0.15</td>
<td>0.65</td>
<td>0.85</td>
</tr>
</tbody>
</table>

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 $\phi_{\text{Bifi}}$ silicon heterojunction string.

$B_G$ is sensitive to albedo and module bifaciality. The range of typical $B_G$ 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.

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*References*


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


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