# CGC Sanya Test: TOPCon Bifacial Modules Show Significant Power Gain of 3.6% Over BC Bifacial Modules, with Morning and Evening Increase Reaching 8.92%

As photovoltaic modules are increasingly used in renewable energy systems, the energy yield is the most key parameter that can directly affect the LCOE, so ensuring real-world performance and reliability in different daytime and weather conditions has become the focus of current research. Herein, the three-month performances of both TOPCon and N-type BC bifacial modules were monitored, compared, and analyzed in Yazhou District, Sanya City (18.39 ° N, 109.22 ° E ), Hainan province from May 1 to July 31, 2025.


Figure1 Jinko Sanya Empirical Project

The environmental parameters were investigated for both systems under ambient conditions. Irradiance was determined as the primary influencing parameter in the system.

**System design**

Each of the 10 modules in Jinkosolar' s TOPCon and N-type BC has an average measured power of **634.15 W** and **641.81 W**, respectively, (shown as Table 1)

Control group

| Sample type | Experimental group | N-type BC |
|---|---|---|
| | JinkoSolar TOPCon | 2382*1134*30mm |
| Norm | 2382*1134*30mm | 10 |
| Number | 10 | 10 |

Table 1 Module Parameters

The two solar arrays were installed in the same location to ensure the same ambient conditions, at a height of 2 meter above grass ground with the tilt angle of the module was 15° to the south.

For three months from May 1 to July 31, 2025, the energy yield, irradiance, as well as the module, and ambient temperatures were monitored. Additionally, the electrical parameters for the two modules were compared in the different hours per day and different irradiance conditions during the study period.(shown as Table 2)

20°

| | | | |
|---|---|---|---|
| Testing location | Sanya | Calculate latitude | 2.9m |
| stand type | Fixed bracket | Row spacing | SUN2000-30KTL-M |
| Number of PV arrays | 2 | Inverter | Grassland |
| Environmental Monitoring | Base Automatic Weather Station | Ground conditions | 草地 |
| Temperature measurement methods | In 2 photovoltaic arrays, thermocouples were affixed to the top and bottom of the back of the module at the same location and under the same irradiation conditions for comparative analysis of the operating temperatures of the modules of the arrays. | | |

Table 2 Basic Parameters of the Empirical Base

**Results**

The energy yield (kWh/kWp) from the two test group modules cell were compared. **The yield of TOPCon bifacial module system was 3.6% higher than that of the N-type bifacial system**. The PR values of the TOPCon and N-type BC from the STC were found to be 98.98% and 95.55%, respectively(shown as Figure 2)

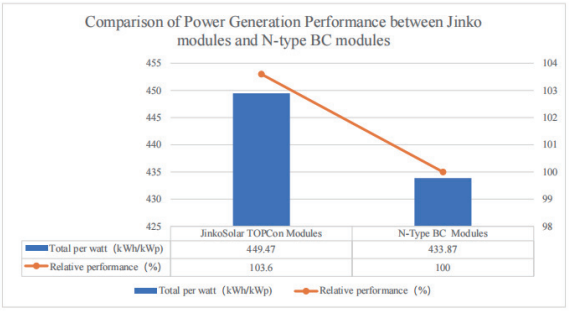


Figure 2 Comparison of Power Generation Performance of JinkoSolar TOPCon Modules and N-Type BC Modules

The energy yield gain varies in different time duration across the day. The highest yield gains occurred in early morning 6am-7am and late afternoon 6pm-7pm, which were **11.25%** and **7.62%**, respectively (shown as Figure 3)

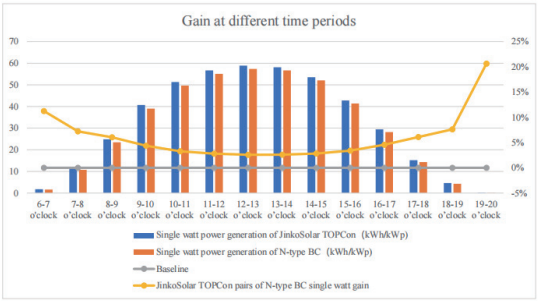


Figure 3 Comparison of power generation between TOPCon and BC modules at different time periods

The energy yield gain also differs in different irradiance condition. The lower the irradiance, the higher the yield gain of TOPCon over N-type BC, the highest of **9.13%** at irradiance if 0-100W/m²(shown as Figure 4).

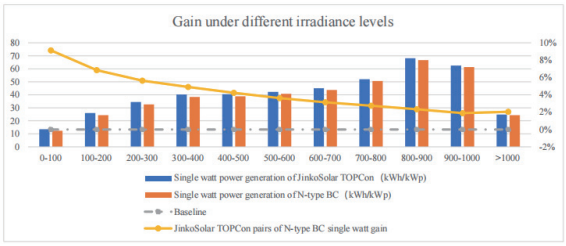


Figure 4 Comparison of power generation between TOPCon and BC modules under different irradiance levels

**Conclusions**

These analysis results revealed that the lower the irradiance the higher the energy yield of TOPCon versus N-type BC to a value higher than that obtained in present study (+3.6%).

The loss mechanism for lower yield of N-type BC was attributed to low bifaciality and poor low irradiance performance due to cell properties (multiple leakage current effects and grid on the back side) . These analyses also revealed that the TOPCon energy yield gain over N-type BC can be increased further to **11.25%** and **7.62%** in early morning 6am-7am and later afternoon 6pm-7pm respectively.The average energy yield gain of TOPCon over N-type BC module is **8.92%** in dusk and dawn. This study can contribute to achieving higher energy yield from PV systems during field applications. This can contribute to the design of products with higher energy yield and lower LCOE in the PV industry.