

The yield gain of Jinko's N-type TOPCon modules reaches 5.02% in a 70MW plant

China Huadian Corporation (CHD), one of the five leading power generation corporations in China, has reported the results of energy yield carried out at its 70 MW solar PV plant installing Jinkosolar's N-type panels. The result verifies the power generation of N-type TOPCon bifacial modules, finding it to be 5.02% higher than that of a P-type PERC bifacial module.



Figure 1: Project Photos

Project Introduction

This 70MW project was located in the northern west of China, combining a typically temperate continental climate with an arid environment, with average annual radiation being 1533.6kWh/m², average annual sunshine duration of 2550-3000 hours and annual average temperature $8.2 \sim 9.4$ C.

The 70MW solar plant consisting of 22 arrays, was equipped with all Jinkosolar's N-type bifacial panels of 560Wp, and was compared to another project with P-type bifacial panels of 545Wp at the same location, grid-connected at the same day, adopting the same system design and module energy yield analysis. An inverter of 320kW for 29-30 strings, each string sets 26 panels. A fixed support structure with a tilt angle of 35° was adopted for installing the modules, at a height of about 0.6 meters above the ground.

Comparison of power generation performance

In the period (July 01-July 31), the energy yield performance of Jinkosolar's n-type modules and the PERC modules are shown in Table 1.

Module Type	Cumulative Power Generation (kWh)	Power generation per watt (kWh/kW)	Comparative Gain
N-type 560Wp Bifacial	72545.05	171.81	5.02%
P-type 545Wp Bifacial	69546.36	163.60	

Table 1: Comparison of power generation and energy yield of N-type TOPCon and P-type PERC

The accumulated generation of these two module types was 72545.05 kWh and 69546.36 kWh respectively, and the average energy yield per watt of N-type and P-type modules was 171.81kWh/kW and 163.60 kWh/kW, the N-type surpassing the PERC by about 5.02%. The power generation of a module depends on its power degradation, temperature coefficient, low irradiance performance, operating temperature and bifacial generation performance. While both types of module were based on half-cut bifacial solar cells, the energy yield difference was mainly due to cell technology performance.

Discussions and Conclusion

In terms of power degradation, due to the natural advantage of an n-type wafer for LID-free and enhanced LeTID performance compared to a conventional PERC cell, Jinkosolar' s N-type TOPCon panel provides a 30-year linear power output warranty, with less than 1% degradation in the first year and less than 0.4% annual degradation in subsequent years. Calculations show power generation gain in first-year can reach up to 1.2% based on the lower degradation of N-type TOPCon.

As for high temperature energy yield performance, mainly related to temperature coefficient and module operating temperature, The temperature coefficient of N-type is -0.29%/C while p-type PERC is -0.35%/C. During hot weather days, assuming a module operating temperature of 55°C (ambient temperature 30°C), n-type module power degradation loss is 1.2% lower than that of a p-type module and, with operating temperature continually increased, the high temperature performance of an n-type module will be significantly better. The power generation of the n-type module is much better in a high temperature environment, where it can be about 2% higher than that of the p-type PERC module.

Furthermore, Jinkosolar's TOPCon module has 80% bifaciality, much higher than the PERC module's 70%. Assuming the BSI to be 0.1-0.15, the 10% bifaciality difference can deliver an n-type module energy gain of 1%~1.5%.

In terms of low irradiance energy yield performance, mainly with a shorter carrier lifetime, open-circuit voltage, sheet resistance and under 600W/m² conditions such as morning or night fall, simulation shows the n-type energy yield gain to be about 0.2%.

The study of this 70MW real project of CHD verify the excellent power generation and performance reliability of Jinkosolar's N-type TOPCon modules.

