13.94% energy yield of TOPCon bifacial compared to PERC bifacial on a white flat roof in Qingdao

Study Test Introduction:

To investigate and compare the TOPCon panel and PERC panel in outdoor performance, an outdoor field test has been conducted in Qingdao (36°04'N, 120°30'E), China.

Figure 1.The location information of Qingdao

In total, 30 pieces of bifacial modules of two different technologies TOPCon and PERC were Installed in two fixed arrays at a tilt angle of 25 ° , and each bifacial module contains 144 pieces of the half-cut cell (182" size). Moreover, the height of the supporting system was 0.4 meter. The ground was painted white to acquire accurate results since bifacial modules are sensitive to the surroundings. The PASAN Sun simulator measured the front and rear sides' electrical characteristics. The bifaciality and the low light efficiency at 200W/m^2 were also measured and calculated. The outdoor energy generation was measured by GCI-36K-5G inverter in a 5-min interval. The energy yield performance of TOPCon, and PERC bifacial PV were revealed and systematically compared.

Figure 2. The project picture

Bifacial solar panels installed on flat rooftop of industrial buildings are an effective way to boost the yield. The albedo of the flat roof determines to great extent the bifacial gain. The yield for each module was determined with power optimizers and the extracted data, provided by the monitoring portal, were analyzed. The data were collected for each day since July 29,2022. The n-TOPCon bifacial module compared to a p-PERC module, showed initially an average benefit of **9.82%** in July and **13.31%** in August. The use of TOPCon panel with optimized low-light performance and high bifacial gain resulted in a highest generation improvement of up to **20.94%** compared to PERC panels on August 9, which features a cloudy day with low irradiance.

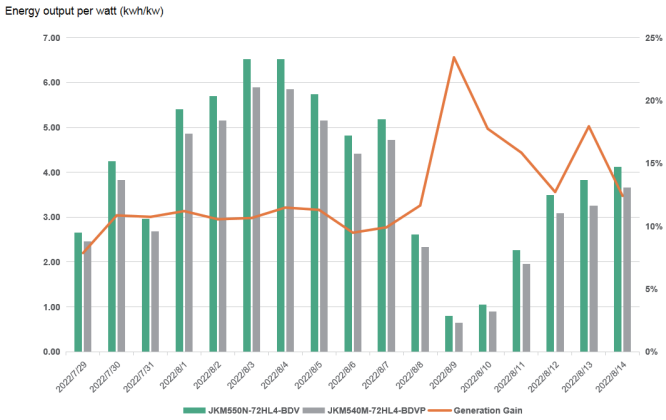

Figure 3. Daily energy yield on Qingdao project

Conclusion:

PV module' s outdoor performance is strongly influenced by various environmental parameters. The performance of PV modules in real-world conditions may differ from laboratory test results, especially for the bifacial modules, which are highly sensitive to the surrounding environment.

The comparison study shows the TOPCon bifacial module has the higher energy yield performance to **13.31%** on average compared to PERC bifacial modules on flat white roof, and up to **20.94%** yield gain in kWh is possible for a realistic system, the majority of the contribution from its high bifaciality, low degradation, optimized temperature coefficient and low-light performance.