

A recent field test conducted by TÜV Nord in Kagoshima, Japan, reveals that the latest generation of N-Type TOPCon modules demonstrated significantly higher energy yield per watt compared to N-type BC modules over a three-month period from October to December 2024 (part of a year-long study). The TOPCon modules generated an average of **8.82%** more energy per watt than N-type BC modules, with the highest monthly gain reaching **9.84%**. Key findings include:

- 1. The rainy season in Kagoshima from October to December 2024 resulted in predominantly cloudy and low-irradiance conditions, providing an ideal setting to showcase the superior low-light performance of TOPCon modules. For instance, during a continuous 15-day stretch of rain from October 15 to October 29, TOPCon modules achieved a remarkable average daily energy gain of 9.13% per watt.
- 2. On sunny days, the high bifaciality of up to 80% gave TOPCon modules a distinct edge. The reflective gravel surfaces in Kagoshima amplified this advantage, bouncing more light onto the rear of the modules and boosting energy production.
- 3. Installed just 2 km from the coastline, the modules endured challenging environmental conditions, including high humidity and salt spray. Reliability is particularly important under such conditions. TOPCon modules have proven their high reliability and durability in nearshore and offshore scenarios, maintaining efficient energy yield and extending the system’s lifespan in such demanding settings.

Background of the project:

Currently, many PV manufacturers are actively transitioning to technologies centered on N-type TOPCon and promoting them to mainstream markets. In recent months, the industry has engaged in extensive discussions about the XBC technology pathway. XBC manufacturers claim that their busbar-free cell design improves rated power and front-side efficiency. With TOPCon and XBC being gradually deployed in multiple field projects, we can now observe their actual performance under varying climatic conditions. Evidence so far indicates that TOPCon modules consistently demonstrates better yield performance.

Project Introduction:

This field test was conducted at the Kagoshima Field Testing Base in Japan (32° 3' 57" N, 130° 19' 53" E). Two types of modules were installed: N-type TOPCon modules and N-type BC modules. The test setup consisted of two modules from each manufacturer installed on fixed mounts at a height of 1.2 meters from the ground and a tilt angle of 32°. The initial power of the

