A Performance Comparison of N-type TOPCon and PERC Module in Shandon Liaocheng

Shandong province is considered as one of the most promising areas in China for PV deployment because of its vast solar potential and favorable local policy. However, due to local weather conditions, the combination of high ambient temperatures and increased UV irradiance levels in summer pose challenges in PV module reliability. This comparative study focuses on the real world performance and energy yield of PERC and n-type TOPCon modules, as well as influence of local climate effects on their performance.

Figure 1.The location information of shandong liaocheng

Comparative group:

The outdoor experimental systems are installed at Liaocheng in Shandong province, Eastern region of China(35° 47' ~37° 02' N, 115°16' ~116°32 'E). The comparative groups consists of a 30kW rooftop system of N-type TOPCon modules and a 34.44kW rooftop system of PERC modules.

Figure 2. The project picture

The modules selected for the energy yield measurements of this study consist of a PERC and a TOPCon, where their electrical characteristics based on their manufacturer datasheet are shown on Table 1.

	N-type	P-type
Technology	TOPCon	PERC
System Capacity	30kW	34.44kW
Pmax(W)	475	455
Efficiency(%)	21.2%	20.9%
Power/W (Wh/W)	+4.2%	Base line

Table 1. Parameters comparison

The modules were installed in a standard rooftop mounting system with South facing orientation, at 30 degree tilt angle.

Energy Yield comparison results:

Compare the electrical performance characteristics of the PV modules obtained from the measured ones. Figure 3 shows a typical example of the measured energy yield (EY) for a set of PERC & TOPCon modules measured during the period from August to September 2021. The chart shows that the high efficiency n-type TOPCon modules slightly outperform the PERC one, while the TOPCon delivers the highest energy yield during day 3, day 9 and day 22 which were cloudy days, which can be attributed to its low light performance.

Conclusion:

The N-type TOPCon modules have shown an average 4.2% higher performance compared with PERC modules. It is also conclude that output power of modules increases linearly with the increase of solar irradiance. The N-type modules have shown higher average output power as well as higher normalized output power in low irradiance condition.

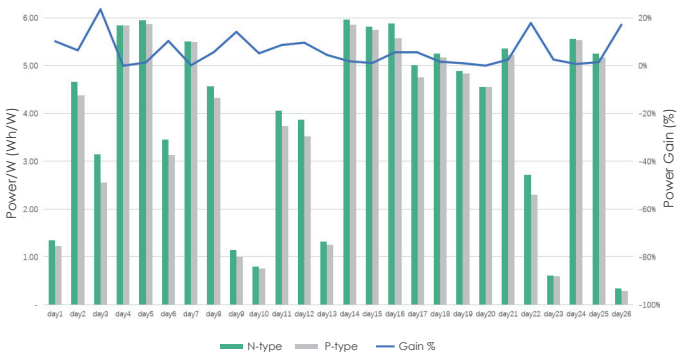

Figure 3. Energy yield of rooftop systems in Shandong