5.08% Energy Yield of N-TOPCon vs P-PERC Modules on Grass Ground in Zhangbei, China

Due to the increase of N-TOPCon module installations globally, the research on the outdoor performance of n-TOPCon and p-PERC modules in actual operation conditions became an important issue from the practical point of view. The energy rating (in kWh/kWp) of N-TOPCon and P-PERC modules was analyzed to show the technology-specific differences. The study was conducted in Zhangbei, China, which belongs to temperate continental monsoon climate, devoted to the assessment of two different modules: N-TOPCon modules and P-PERC modules.

Figure 1.The location information of Zhangbei

Experimental Setup and Data Acquisition

The comparison field test on which the investigations carried out is located in Zhangbei, Northern China (41°29"N, 114°21"E) since July 11, 2022. 10 pieces of N-TOPCon 182" panel (nominal power 555W) and 10 pieces of P-PERC 182" panel (nominal power 540W) were installed on tracking system. The minimum distance between the modules and grass ground is 1 meter. Inverter selected is SG30CX-P2-CN and the data is collected by meter at an interval of every 1 minute.

The results show that the energy yield per watt of the N-TOPCon 182"modules is **4.57%** higher in July and **5.08%** higher in August, in comparison to the P-PERC 182" modules. The modules of N-TOPCon has exhibited higher energy yield under high irradiation combined with higher temperature which showed the role of low temperature coefficient of TOPCon technology. The power efficiency of the modules decreases with rising temperature; however, the power efficiency of the N-TOPCon modules is more stable. The impact of changing external conditions on the energy yields kWh/kWp was shown as below.

Conclusion:

Due to significant differences of external condition in the real world, photovoltaic modules as well as other parts of the installation are exposed to a broad range of irradiance and temperature changes. The rise of irradiation in the summer months is beneficial for the electric energy production but leads to the module temperature growth, which can decrease the efficiency of modules; however, it is beneficial for the N-TOPCon modules. The performance of panel is also influenced by the direction sunlight such as morning, dusk, cloudy, rain days, etc. During the low light part of the day, the drop of power of N-TOPCon is less influenced compared to P-PERC. According to the obtained data, the advantageous results are indicated that not only the energy density kWp/m2 but PV peak power kWh/kWp of N-TOPCon panels are higher than P-PERC in real external environment.

Figure 2. The project picture

Figure 3. Daily energy yield on Zhangbei project