Power Generation Comparison of Datang Huayin's Tin Mine 200MW Project in Loudi city : JinkoSolar's N-TOPCon Yield Gain Reaches 5.21%

P-type solar cell limitations are driving the PV industry's attention toward high efficiency n-type solar cells. N-type TOPCon cells, modules, and systems are rapidly overtaking the market share of PV technologies. This is happening due to "four higher and four lower" advantages of TOPCon over PERC, i.e. higher efficiency, higher power, higher bifacial factor, and higher energy generation (kWh per watts), meanwhile the lower degradation, lower temperature coefficient, lower BOS and LCOE. Combining all these benefits resulted in yield gain of N-type TOPCon from 3% to more than 10% over PERC depending on installation environment. Nowadays, so many hundred-MW scale utility projects have converted to applying N-type TOPCon modules.

Recently, Datang Huayin Electric Power Co., Ltd. released a comparison power generation data collected from its 200MW real project in Loudi, Hunan province, China. The report shows that the outdoor field gain yield of N-TOPCon is about 5.21% compared to the conventional P-type products, higher than its theoretical benchmark of 3%.

Project Introduction:

This 200MW project is located in Loudi, (27° 42' 6.0948"N,111 °59' 45.6036"E), the central part of Hunan Province, China. The mentioned area belongs to the subtropical monsoon humid climate. The month that is graced with the most daily hours of sunshine is July, in which sees an average of 10.3 hours of sunshine daily speaking and 319.45 hours in total for this month. The total sun shines are for an average of 2522.55 hours per year. The warmest month of the year is July, with an average temperature of 28.7 °C | 83.7 °F. January is the coldest month with temperatures averaging 5.6 °C | 42.2 °F. Throughout the year, temperatures vary by 23.1 °C | 41.5 °F. The difference in precipitation between the driest month and the wettest month is 226 mm | 9 inches.

As per the information provided by the client, the 265 MWp (200 MW-AC) solar power project is based on PERC bifacial technology using 545Wp and N-type TOPCon bifacial technology using 570Wp. The 196kW string inverters were used to connect 17-18 strings, each of which consists of 26 modules. Fixed tilts are used in this project with south facing, 15° tilt, and 2 meters height from the ground.

Detailed results of comparison are presented in Table 1
The daily generation performance of comparison groups from December 01-March 09 is depicted in Figure 1

Comparison	Capacity (MWP)	Cumulative Power Generation (kWp)	Power Generation per Kilowatt (kWh)	Gain (%)
P-Type	0.25506	55862.41	219.02	Baseline
1#N-Type	0.26676	60788.31	227.88	**4.05%**
3#N-Type	0.26676	61467.37	230.42	**5.21%**

Table 1: Comparison of energy yield and gain of N-type and P-type modules

Result:

The Loudi 200MWac Power Plant started to collect data in December 2022 and has been monitored since then. The performance analysis was done for since December 01-March 09. The analysis of the data indicates that the yield gains of N-type TOPCon over PERC arrays is of average **4.05~5.21%.**

Conclusions:

N-type TOPCon solar cell technology promises to improve energy yield and reduce LCOE compared to PERC technology. Both small-scale installations and large-scale installations across the world support this general conclusion. A standalone n-TOPCon bifacial module, if optimally tilted and elevated, would yield minimum 5% more energy than the p-type module based on the same location, same environment and same system design. The yield gain of a n-type solar PV system in the real world which involves complicated trade-offs dependent on multiple factors including mutual shading, temperature, tilt-angle, and more will be maximized due to advantage of TOPCon technology. Substantial gain will be achieved as systems move further in hot temperature, optical elevated, high albedo, low irradiance condition, ground-sculpting etc.

Figure 2: Project Picture

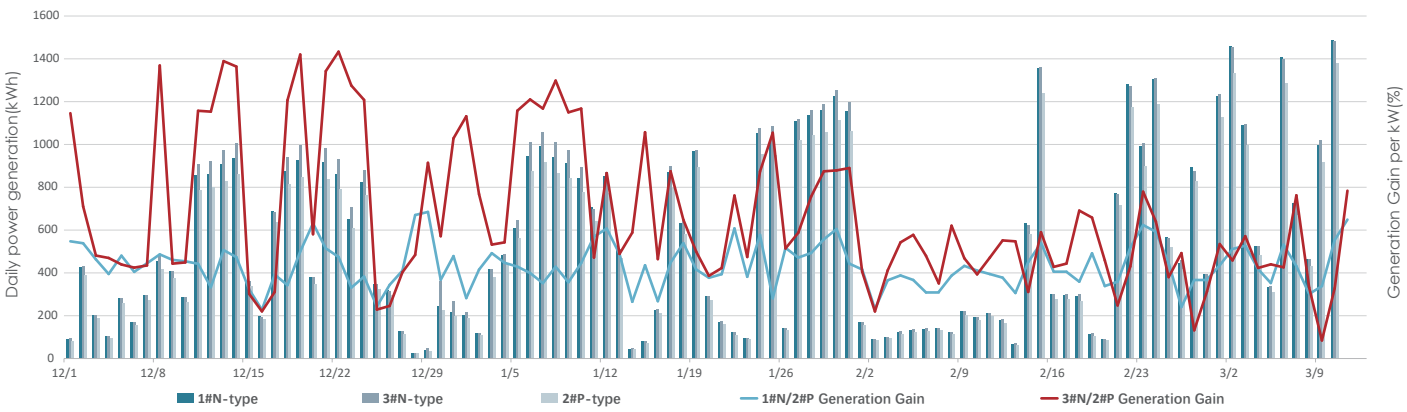

Figure 1: Comparison of daily energy yield of N-type and P-type modules