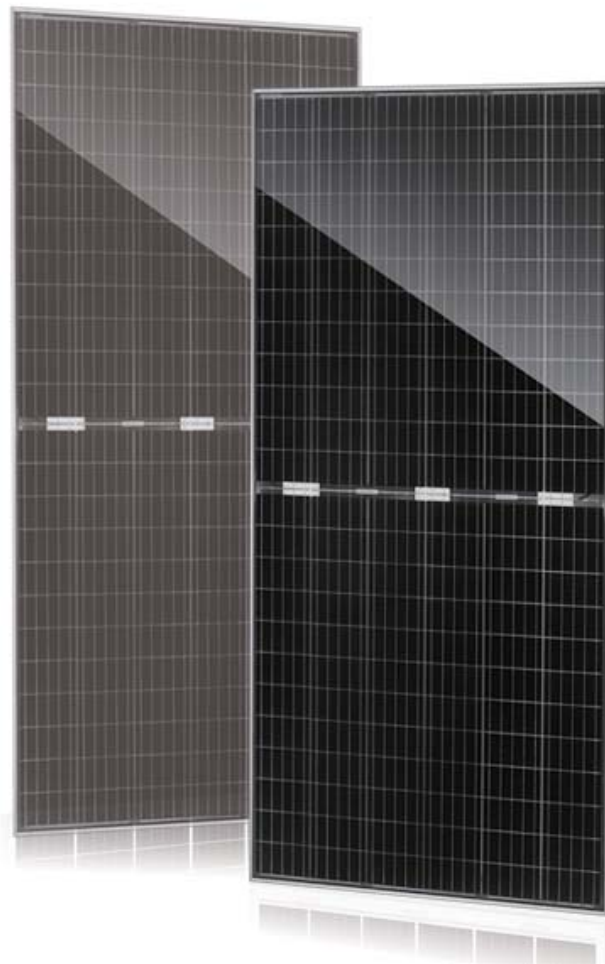


Whitepaper

Swan Bifacial Field Test Whitepaper



JinkoSolar's Bifacial Field Test Report Demonstrates How Swan Ensure the Best Bifacial Gains

Since 2018, Jinkosolar has been committed to the research and development of bifacial technology. In 2019, Jinkosolar launched the Swan bifacial with transparent backsheet, which won the 2019 Intersolar Award as the only module product with its innovative technology, excellent performance and forward-looking product design. Up to now, the total order of Swan bifacial modules is nearly 2GW. In addition, Jinkosolar has carried out field test projects all over the world, and has cooperated with PVEL, Chinese Academy of Sciences, Nextracker and other third parties to study the power generation performance of bifacial modules and factors affecting the bifacial gains, to provide reference and suggestions for customers to design bifacial power stations.

Table 1 Project information

Location	Test Performer	Types of Ground	Type of Installation	Module Type	Test Type	Test Duration	Bifacial Gain
Haining, Zhejiang province, China	Chinese Academy of Sciences	White paint	Fixed (Module elevation: 1.2m, Tilt:30°)	Bifacial with dual glass Monofacial with dual glass	Module level	2018.5.23 - 2019.1.17	16%
		Sand	Fixed (Module elevation: 1.2m, Tilt:30°)	Swan bifacial with transparent backsheet Cheetah Monofacial Module	Module level	2019.2.1 - present	10.22%
		Cement	Fixed (Module elevation: 0.7m, Tilt:30°)	Swan bifacial with transparent backsheet Cheetah Monofacial Module	String level	2019.8.2 - present	9.74%
Qionghai, Haining province, China	China Quality Certification Centre (CQC)	Sand	Tracking (Module elevation: 2.7m, 2P tracker)	Swan bifacial with transparent backsheet Cheetah Monofacial Module	String level	2019.10.23 - present	16.66%
Fremont, CA, USA	NEXTRACKER	Gravel	Tracking (Module elevation: 1.5m, 1P tracker)	Swan bifacial with transparent backsheet Cheetah Monofacial Module	String level	2019.8.22 - present	8.34%

◆ Project Location: Haining, Zhejiang, China

1、Bifacial gain on white paint

The data gathered through May 23 2018 to January 17 2019 provides measured energy output of Jinkosolar bifacial with dual glass (156mm size cell) and monofacial modules. The average bifacial gain is about 16% during the whole testing period, while higher in summer (up to 19%) and lower in winter.

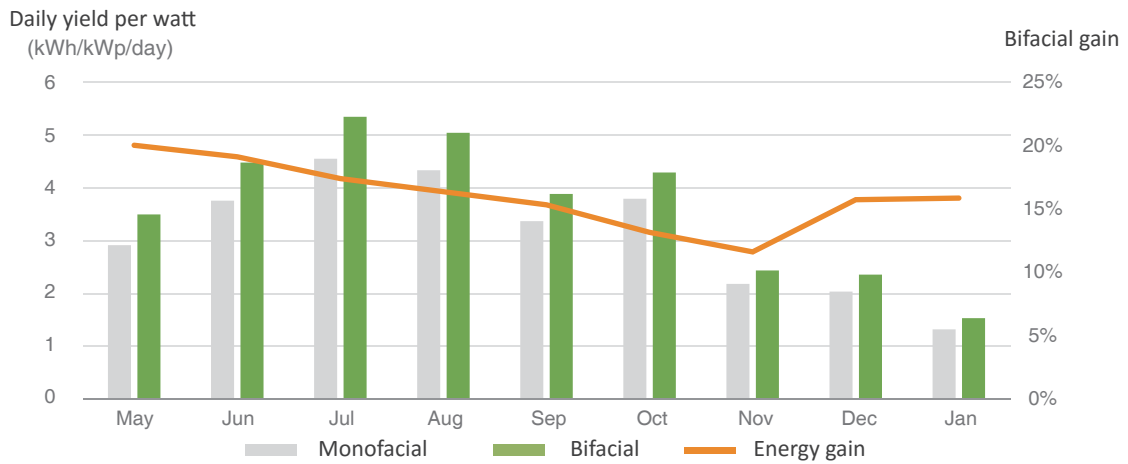


Figure 1 Daily generation per watt of Monofacial vs Bifacial & Bifacial Gain

2、Bifacial Gain on Sand

Swan bifacial with transparent backsheets reaches bifacial gain of 10.02%, with the same variation between seasons that is a little bit higher in summer, lower in winter.

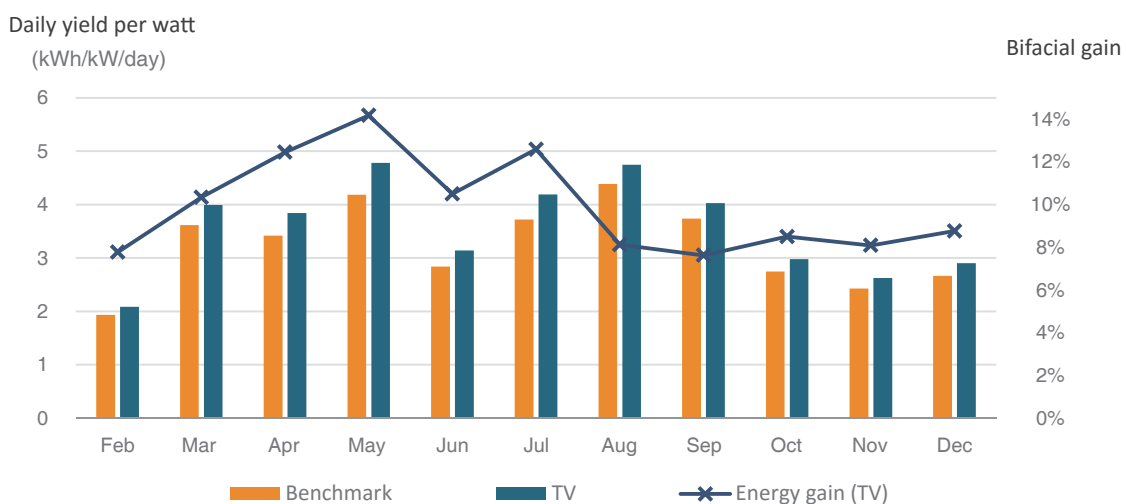


Figure 2 Daily generation per watt and bifacial gain in sand project

3、Bifacial Gain on Cement

This string type test on cement surface was performed on Jinkosolar factory's rooftop. The system was designed similar to C&I project, adopting horizontal installation. The lowest point of modules is 0.7m higher off the ground. The average bifacial gain of Swan with transparent backsheet is 9.74%. Bifacial modules show better low-irradiance performance. As irradiance become lower, the energy generation per watt become lower but bifacial gain increases conversely.



Figure 3 Picture of Haining cement project

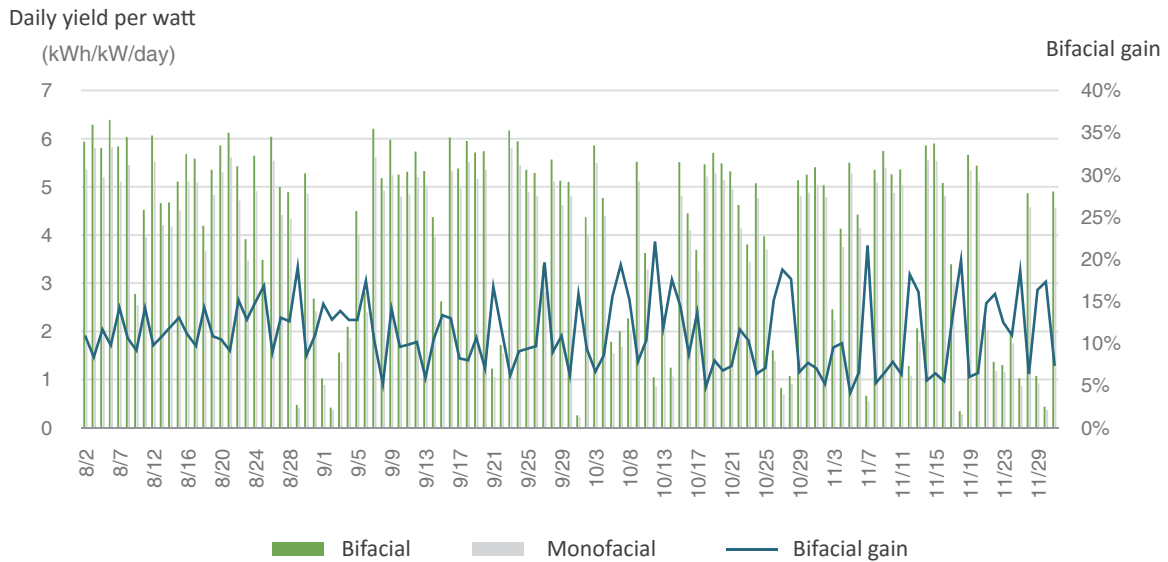


Figure 4 Daily yield per watt and bifacial gain in cement project

◆ Project Location: Haining, Zhejiang, China

Qionghai, located in the southernmost Hainan province of China, has a humid tropical climate featuring of high temperature high humidity across the year. Modules were mounted in 2P tracker configuration (two-in-portrait). Module height (flatwise) is 2.7m. The ground type is sand, albedo 19%-20%. The bifacial gain of P type Swan TB bifacial module is significantly high, up to 16.66% against Cheetah monofacial mounted on the same scenario. This high bifacial gain can effectively cut down the LCOE.



Figure 5 Picture of Qionghai Project

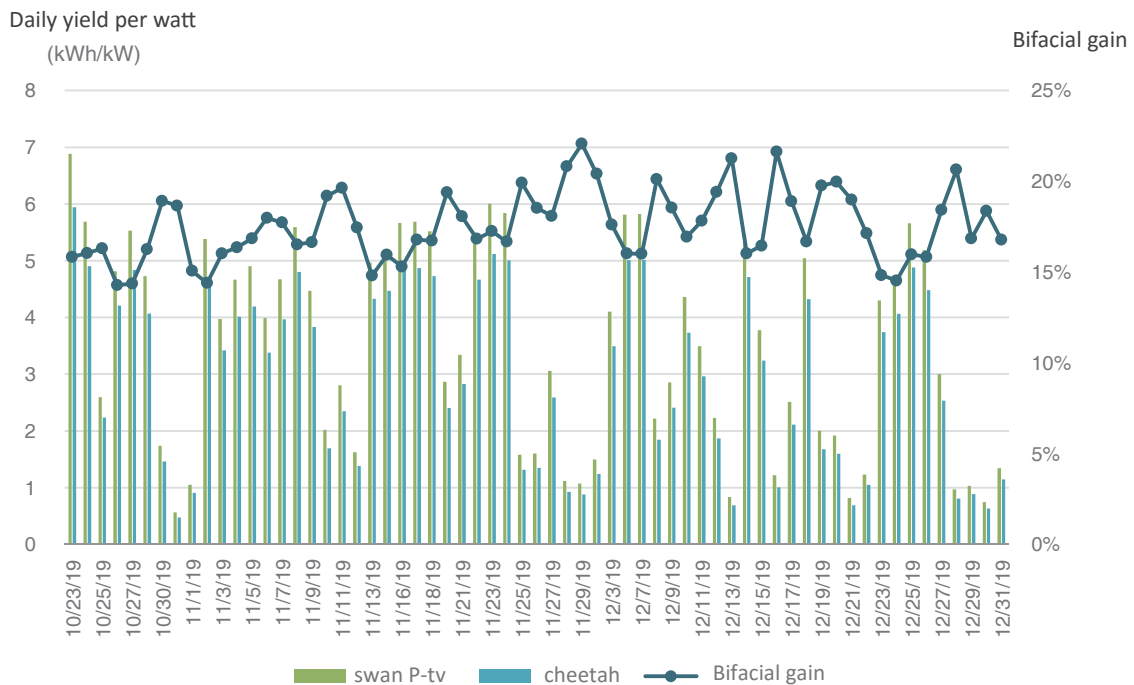


Figure 6 Daily generation per watt and bifacial gain in Qionghai project

◆ Project Location: Fremont, CA, USA

Fremont, located in California on the west coast of the United States, has a Mediterranean climate with dry and warm summer as well as wet and rainy winter. The project is located in the outdoor field test station of Nextracker. The ground is light gray gravel, and the measured albedo of the site is around 20%. The bifacial gain of transparent backsheet module is 8.34%. Considering the control group is monofacial modules installed in same tracker and ground albedo is 20%, bifacial gain of 8.34% is considerable.



Figure 7 Picture of Fremont project

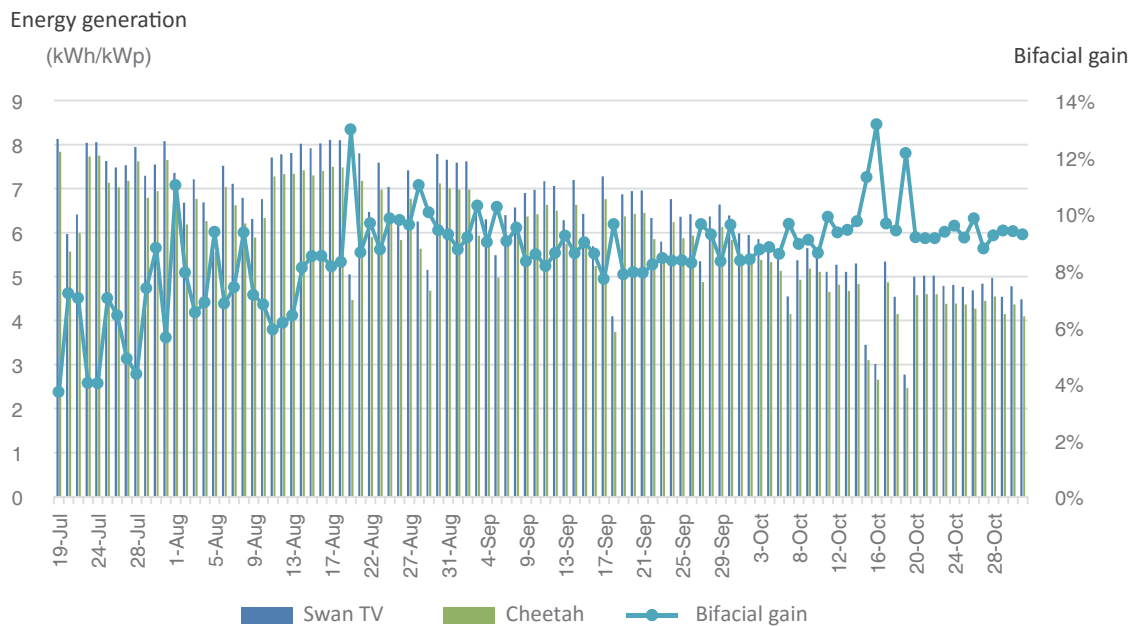


Figure 8 Daily generation per watt and bifacial gain in Fremont project

Conclusion

This white paper presents a summary of the results obtained from three bifacial and monofacial comparison tests performed in different climate, over various ground type, deploying different mounting system. The results reveal that Swan bifacial exhibit a high Bifacial Gain at different scenario. It also provides reference and key factors for customers to consider when design their bifacial system.

In C&I project, applying fix-mounting and white paint ground with high albedo (80% - 90%) can ensure more than 16% bifacial gain, so that the same power generation can be realized with fewer modules and less initial investment to cut down the LCOE of the project. On the other hand, the transparent backsheet product is light and high efficient, providing higher reliability and safety for the roof-top project. Using ordinary cement ground can also achieve a bifacial gain of more than 9% without additional cost of ground laying.

In the scene of large-scale power station, the bifacial modules are always adopted with tracking system. When the albedo is only 20%, besides the energy gain from tracker, bifacial modules provide another 8% energy generation gain, effectively reducing LCOE. Thus bifacial modules with tracker become the best option of large-scale station developers.

In Qionghai, where the irradiance condition is poor, Swan bifacial with transparent backsheet ensures more power generation with excellent low-irradiance performance, lower operating temperature and remarkable outdoor reliability. With 2p tracker, the bifacial gain is as high as 16.6%, thus effectively reducing the LCOE of the project.

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