

HPDC technology takes utility-scale solar to the next level



LONGi has been at the forefront of the solar industry for decades, becoming the world's most valuable solar company through a combination of envelope-pushing technology leadership and unrivaled manufacturing scale. But even by its lofty standards, its new Hi-MO 7 modules represent an impressive step forward for solar technology. CJ Fu, Head of Product and Solutions, sat down with PES to talk about the company's new offering and its innovative approach.

PES: Most of our readers are probably familiar with LONGi already, but in case they aren't, could you give us an introduction to the company?

Chengjiang Fu: LONGi is a fully vertically integrated solar company, producing solar wafers, cells, and modules for all market segments and project types. In the last eight years, we have supplied more than 129.3 GW of solar modules globally, which is enough to meet about a quarter of total worldwide demand.

I'd say that the secret to our success has been a holistic philosophy that puts customer value at its core, with a goal of delivering products with the highest quality, reliability, and performance in the market at a competitive price.

This has required both a commitment to innovative technology development, as well as a life-cycle approach to quality across every link of the production and value chain, from component design to mass production to after-sales support.

PES: And yourself, have you been involved in the solar industry for a long time?

CJF: I joined LONGi in 2020 as Director of Product & Solutions, leading the product management, product marketing, technical service, and qualification, contract negotiation and after sales for the company focusing on North America markets.

I am a seasoned solar product management professional and have been a part of industry leading organizations such as GCL System Integration Technology, SunEdison and Suntech.

PES: I think your manufacturing prowess is well-known in the solar industry, but what can you tell me about your approach to technology innovation?

CJF: We've seen tremendous advancements in solar technology and LCOE over the past two decades, but we've also seen many large



Chengjiang Fu

solar manufacturers go out of business when they fail to keep pace. Thus, we see a commitment to continuous technology leadership as essential, not just for achieving our goal of accelerating the clean energy transition, but to our success as a company.

That's why we invest hundreds of millions of dollars every year in R&D into breakthrough innovations at both the wafer and module level, more than any other manufacturer in the industry. And we back this up with rigorous, independent testing to ensure that our technology outperforms competitors.

As a result, we have been at the forefront of many of the major technology trends driving the industry today, including the mainstreaming of monocrystalline cells, the advancement of PERC technology, the widespread adoption of bifacial modules, and the standardization of large format module sizes. We think the new Hi-MO 7 module and its underlying HPDC cell technology will be the next step in this trajectory, drawing on our expertise in each of these areas to push the industry forward again.

PES: That's a great segue. What can you tell me about the new Hi-MO 7 module?

CJF: Hi-MO 7 is a large-scale, high-efficiency product for utility-scale applications, with a M10-72c module size and module power of up to 580W with 22.45% efficiency. It incorporates our n-type silicon wafers into our new, proprietary HPDC bifacial solar cell, which stands for Hybrid Passivated Dual Junction Cell. By using different passivation technologies on the front and back of the cell, the HPDC design reduces carrier recombination more effectively and enhances power generation capacity. Surface recombination is further reduced by the combination of high and low junctions on the backside of the module, which allows for full passivation.

This HPDC cell design, and more broadly our integration of optimized silicon wafer, cell, and module technology, gives Hi-MO 7 several performance advantages compared to current mainstream bifacial products. This translates into higher power generation capacity, lower system costs, and improved reliability.

PES: Let's talk about each of those advantages in turn. How does your HPDC technology lead to improvements in power generation, and how does Hi-MO 7 compare to mainstream bifacial modules on the market?

CJF: The HPDC cell used in the Hi-MO 7 modules is an upgrade on LONGi's HPC (Hybrid Passivation Contact) cell design and offers several performance advantages compared to other bifacial products. The HPDC's technology and superior passivation lead to higher power, higher bifaciality reaching approximately 80%, with improved power temperature coefficient of -0.28% per °C and better low-irradiation power generation. Additionally, the HPDC cells enjoy lower power degradation, which ensures robust generation throughout the module's 30-year life.

All this adds up to a 2 to 3% increase in power generation compared to mainstream PERC bifacial modules, which can make a significant difference in overall project economics.

PES: That's impressive. How do those improvements in energy yield translate into reductions in overall system costs? I imagine that's an even greater consideration than before, with module costs rising across the industry.

CJF: The performance advantages of HPDC cells and Hi-MO 7 modules are multiplied when deployed across a utility-scale solar farm. The improved efficiency and resulting 2-3% improvements in energy yield of Hi-MO 7 effectively reduces the number of modules and land required to achieve a given power plant capacity, or, alternately,

it allows capacity to be increased by about 4.5% for the same area.

Moreover, in combination with the M10-72c module size, they provide advantages in balance of system costs, since it reduces expenses for racks, cables, inverters, and labor, as well as overall O&M costs.

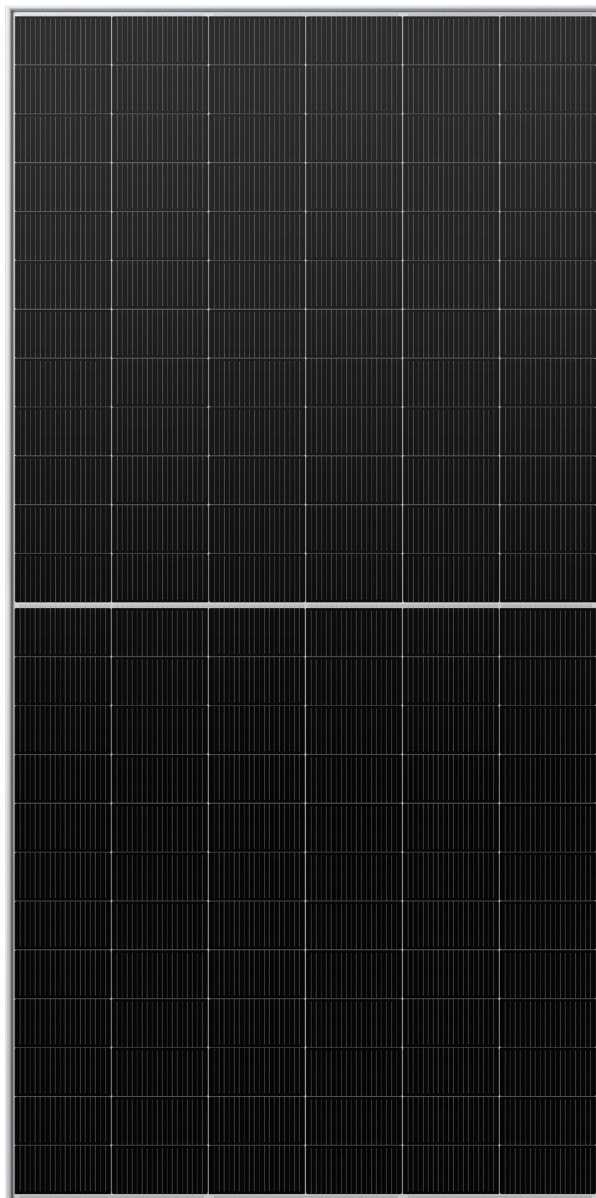
All of these improvements in project economics add up. We estimate that Hi-MO 7's advantages can reduce LCOE costs for utility-scale solar projects by about 4.4%, which is huge. And, as you note, module costs are up across the industry due to a variety of factors, but we believe this only increases the importance of a careful evaluation of lifecycle project economics by project developers.

PES: You've already mentioned Hi-MO 7's low degradation performance. What else

can you tell me about the reliability and durability of these modules?

CJF: First of all, ensuring reliable long-term performance is absolutely essential to delivering the customer value we strive for. That means implementing a high standard of reliability throughout the product life cycle, including how we design our products, the materials we use, the manufacturing processes we employ, the quality assurance testing we subject our modules to, and of course customer service.

When it comes to the Hi-MO 7, that means embracing what we call 'six-dimensional design.' We start by using A+ grade monocrystalline silicon wafers with low impurities and low LID characteristics, and cutting them using advanced wafer slicing technology, which ensures the quality of the wafer.



At the cell level, we use a Super Multi BusBar (SMBB), which reduces the sensitivity of cell crack, improving ML/TC performance and the non-destructive cutting process reduces risk of cell microcrack, improving ML performance. Finally, for the module, we use an optimized encapsulation system with high gram weight film to reduce potential induced degradation, paste optimization to improve mechanical load performance and high-reliability welding to ensure the safety performance of power stations.

All of this translates into reliable performance over the projected 30-year life of the Hi-MO 7 module. Our warranty guarantees first year degradation of 0.8% or less, and linear degradation no higher than 0.38%, which as I noted earlier ensures robust power generation performance. Moreover, the superior light-induced degradation and

mechanical load performance, as well as Hi-MO 7's low temperature coefficient, makes this module suitable for use in all environments, from hot and sunny deserts to snowy and windy climates.

PES: Thanks for all that detail, I think that sometimes reliability, and all the aspects that go into it, can be glossed over by some companies. As you know, there are a growing number of TOPCon products coming to market that also use innovative technologies. How does Hi-MO 7 compare?

CJF: TOPCon products are at a stage of rapid development right now, which is great to see, but there are major differences in quality between different manufacturers. For example, in PV Evolution Labs testing, the TOPCon module of one manufacturer showed 67.5% power degradation after the DH2000 damp heat test! In general,

Hi-MO 7's optimized wafers, cells, and modules offer more assured power generation and temperature coefficient performance, and this is borne out in our product warranty.

Beyond the quality of some of the TOPCon products themselves, at LONGi we treat module size changes very cautiously. Some emerging modules deviated from the current standardized module size and further increased the module to various unstandardized lengths.

Merely increasing the module length only brings very limited increase in power, does not improve module efficiency, and brings no significant values on the system end. The unstandardized module size may also cause confusion in the manufacturing and supply of the industry chain.

Thus, we strongly believe that the standardization of the module size is beneficial to the entire industry and uncoordinated module size changes like this risk disrupting the upstream and downstream ecosystem.

PES: I think that perspective on standardization is one that many in the industry share. Finally, from a market perspective, how does Hi-MO 7 fit into your existing product portfolio?

CJF: We aim to evolve alongside the industry to meet the diverse needs of developers across all sectors. For example, we also serve the distributed generation market with our Hi-MO 6 product, which achieves a similarly high level of efficiency and reliability with our HPBC, or Hybrid Passivated Back Contact, technology. For utility-scale projects, we will continue to offer the Hi-MO 5 as well as the Hi-MO 7, as the most appropriate choice for a given customer can vary.

Hi-MO 5 remains very well-suited for projects developed in regular-albedo environments that are highly sensitive to initial investment costs and less sensitive to land use. However, we believe that Hi-MO 7 will be the more appealing choice for projects with limited land availability and high labor costs, as well as projects in high-albedo and extreme weather environments. That means strong market potential in regions of North America, Western Europe, Japan, and South Korea, as well as in desert areas of Asia, Australia, and America.

Because technology leadership is so central to maintaining our status as a trusted brand, together with our position in the market, we will continue to advance our HPDC cell technology so that Hi-MO 7 and subsequent products will be suitable for more and more scenarios.

But at the end of the day, nurturing a trusted relationship with our customers is much more important than any particular product, so we work with developers on a case-by-case basis to determine the most suitable LONGi modules for their specific conditions and applications.



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