Industrial Bifacial Silicon Heterojunction Technology that Improves System LCOE

Bo Li, boli@sunpremem.com
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- 12.8MW
- Cost-competitive
- Eco-friendly

Empowering the Sun from all Directions
Sunpreme Introduction

Milestones:
- Founded 2009
- 1st shipment 2012
- Mono certification 2013
- 1st bi-facial module 2014
- 21.8+% production cell 2015

Advanced R&D, Sunnyvale, CA, USA
50MW capacity in 2016, Jiaxing, China

World-class team of 250 people, with experience from:

World-class investors:

World-class advisory board, including:

Richard Swanson  
SunPower founder

Eicke Weber  
Fraunhofer Institute director

Reyad Fezzani  
BP Solar ex-CEO

Empowering the Sun from all Directions™
ITRPV

2016 PV Roadmap: World market share of different technology
Sunpreme High Volume Heterojunction Cell Production

Sunpreme HJT history

- World class R&D team from China and US

Typical production lot distribution

- Average: 0.2208
- STD: 0.002364
- N: 200
Sunpreme is independently ranked among top 3 global providers

Current Efficiencies of Selected Commercial PV Modules Sorted by Bulk Material, Cell Concept and Efficiency

Note: Exemplary overview without claim to completeness; Selection is primarily based on modules with highest efficiency of their class and proprietary cell concepts produced by vertically integrated PV cell and module manufacturers; Graph: Jochen Rentsch, Fraunhofer ISE. Source: Company product data sheets. Last update: Nov. 2015.
**SUNPREME, INC.**

**Location:** Sunnyvale, CA  
**SunShot Award Amount:** $4,993,823  
**Awardee Cost Share:** $6,976,508  

**Project Summary:** This project is developing an advanced manufacturing toolset and process technology for low-cost copper metallization of high-efficiency heterojunction solar cells and glass-glass bifacial modules. While copper electrodes are well-known to be the best option for high-performance solar cells, very few are made with copper due to the complex and costly process needed to pattern it.
Electricity generation by Sunpreme module is 20.6% higher than same name plate p-mono-Si module

1. Bifaciality: 12.5% (conservative);
2. LID: 2.5% (compare with AlBSF mono);
3. Temp coeff: 2.43% (based on Sunpreme -0.28% vs. mono -0.41%)
4. Regular degradation: 2.14% (based on Sunpreme 0.6% vs. mono 0.7%, for 25 years).
5. Better low light performance, higher Voc
More Than 50 MW Deployed on 5 Continents and 24 Countries

Commercial Rooftop  
Distributed Generation  
Ground Mount  
Residential  
Carport  
Extreme Environments

Empowering the Sun from all Directions™
New Jersey 12.8Mw Bifacial Power Plant

New Jersey, USA

Ground mount

Size: 12.8 MW

Product: GxB 360W

The 12.8 MW installation project, which began in mid-2015 was commissioned in February 2016. Initial energy production numbers are showing the results expected with an 8-10% additional energy harvest. Different albedos will be evaluated to further maximize the energy harvest of the system.
Martin Luther King (MLK) School Cambridge City, MA

Roof Mount
Size: 600KW
GxB 370W

As a result of the project, the school building has not only exceeded its energy conservation goals but is on track to achieve the prestigious LEED Platinum certification. As for the energy output, the site has generated over 250 Megawatt-hours of power since commissioning in Q2 of 2016.
Our 500W Duo panels produce a nearly flat, 3-peak power profile with 17% greater energy and 18% more energy hours and no inverter clipping.

- In Duo configuration (red) the composite produced a broad, nearly flat top plateau, with extended width on the time scale.
- No need for power clipping at mid-day.
- The Duo power profile yields 17% greater energy and extends the daily production hours by ~18%.
- A significant improvement over an equivalent number of “status quo” panels.
- The Duo may compare favorably with 500W panels on single or dual axis trackers.
Then, Sunpreme Bifacial Modules can do Applications which others simply cannot, e.g. Highway Smart Noise Barriers in Sweden

Byggvesta

Test location from April 2016.
Shows yields clearly without self-shading effect.
Summary

• Sunpreme has been in high volume production of bifacial silicon heterojunction cell and module in the past 3 years. Module efficiency was rated as number 3 in the industry by Fraunhofer ISE

• High efficiency silicon heterojunction technology, bifaciality and competitive cost all contract to low LCOE
Thank You!

boli@sunpreme.com
+1 (408)318.9380