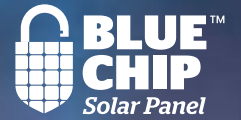




BUILT TOUGH.  
THE KNOWN SOLAR BRAND  
AUSTRALIA TRUSTS.

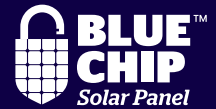


**SHINGLED  
MODULE**

84.8% GUARANTEED ELECTRICITY  
PRODUCTION AT YEAR 25



No. **81** FORBES  
2020 WORLD'S MOST VALUABLE BRANDS



# What is the value of a Brand?

Hyundai is one of the biggest consumer brand names in the world. As a long established international brand, Hyundai Energy Solutions solar panels have been installed within Australia for over 10 years. In 2019 we increased our product warranty to 25 years. By purchasing panels from a trusted and well known consumer brand, you're making a safer investment for the long term.

## Our History

<p><b>1972</b> Hyundai Heavy Industries start business</p>		<p><b>2012</b> Set up of PV R&amp;D Centre Hyundai Heavy Industries achieves 10th World Record</p>			
	<p><b>2004</b> Started solar business</p>	<p><b>2007</b> Set up of Cell/Module production line</p>		<p><b>2016</b> Established <i>Hyundai Energy Solutions</i></p>	<p><b>2019</b> Increased Product Warranty to <b>25 years</b></p>
<p><b>1983</b> No.1 in the world for ship orders and construction</p>	<p><b>2009</b> Entered Australian Market</p>	<p><b>2011</b> Signed \$20M supply contract in Australia</p>	<p><b>2014</b> Produce high-efficiency Mono Cell/Module (PERC)</p>	<p><b>2018</b> Start of EPC &amp; ESS/Inverter business</p>	<p><b>2020</b> Hyundai increase sales target in Australia</p>

Introducing the next generation

# SHINGLED MODULE



Outstanding performance under the hot Australian sun!

Enjoy the peace of mind of long-term performance and reliability from Hyundai's superior technology

- 1 Low temperature coefficient and reduced risk of hot spots
- 2 Electrically Conductive Adhesive for higher reliability
- 3 Improved shade resilience
- 4 Better space utilisation delivers higher efficiency
- 5 Improved mechanical load resilience

**25**  
YEAR PRODUCT WARRANTY



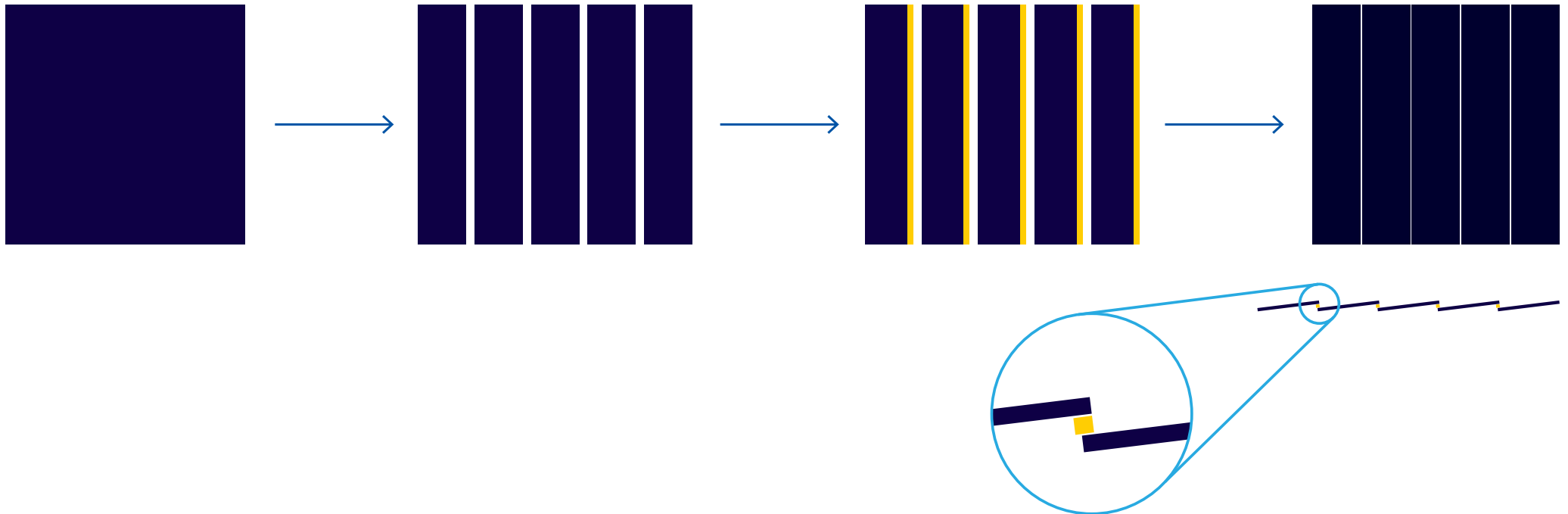
# What is Shingled Cell Technology?

Start with a high performance Mono PERC cell

Laser cut the cell into five strips

Apply Electrically Conductive Adhesive to each strip

Overlap the cells in a shingled arrangement in the module



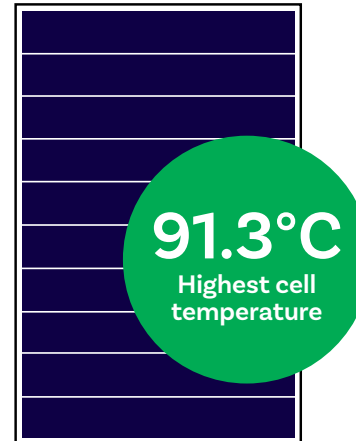
Hyundai shingled cells carry just 1/5 the electrical current of the original full cell, meaning that every circuit **operates at a lower current** and hence a **lower temperature**.

There are two **critical outcomes** of this lower temperature operation,

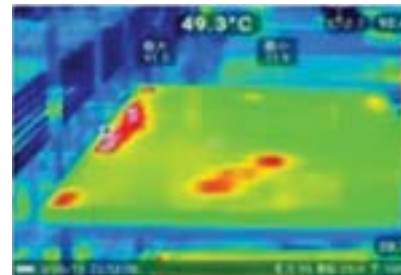
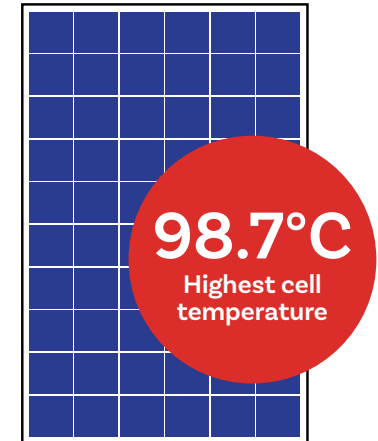
- a) **outstanding performance in high temperatures**, and
- b) **reduces the risk of hot spots**.

## 1 Lower Hot Spot Risk

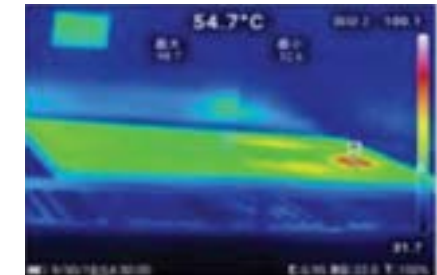
Shingled Module



Standard Module



IR Image



Lower current per cell means **lower hot spot risk...**

and a **low temperature coefficient** of power of  $-0.34\% / ^\circ\text{C}$

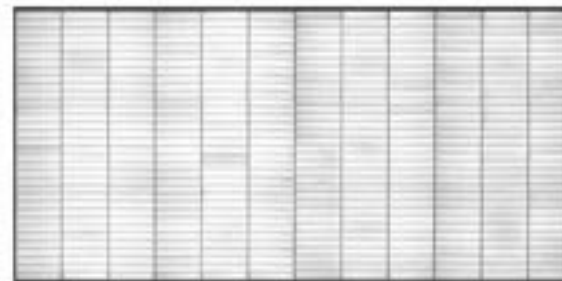
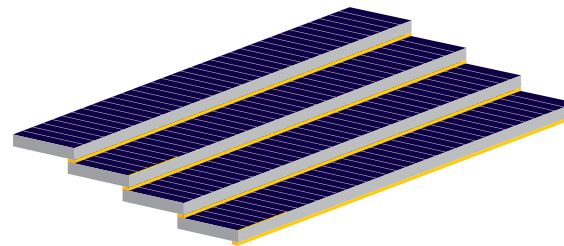


## ② ECA for higher reliability

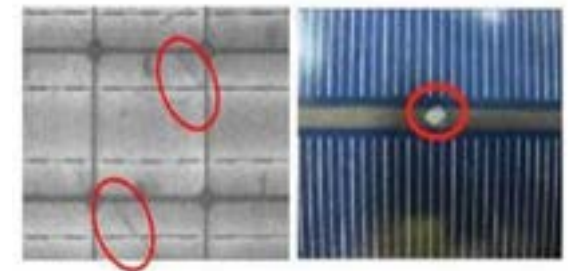
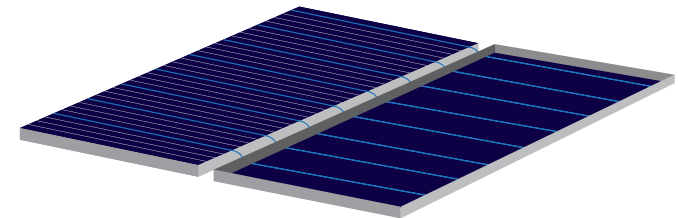
Shingled modules use **Electrically Conductive Adhesive** instead of solder ribbon to electrically connect the cells. This **reduces stress on the cells** during manufacturing.

As panels **get hot in the day and cold at night**, traditional solder ribbon expands and contracts but the silicon cells don't causing more stress.

Hyundai Conductive Adhesive Method



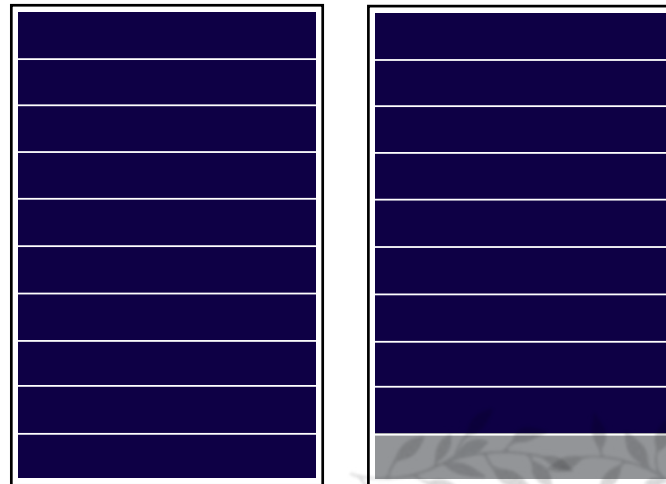
Conventional Welding Method



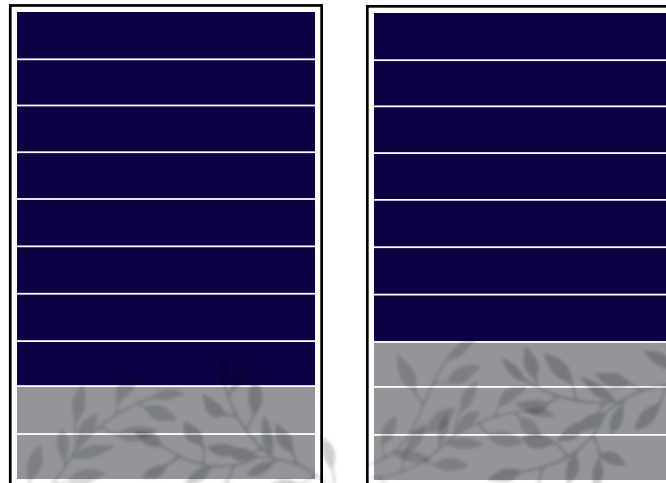
Hyundai shingled solar modules are made in parallel with a brickwork layout circuits design.

The optimal layout results in **lower impacts from shade** as compared to common full cell modules.

### 3 Better Shade Resilience



Parallel circuits...



means **lower loss of power** in rising shade

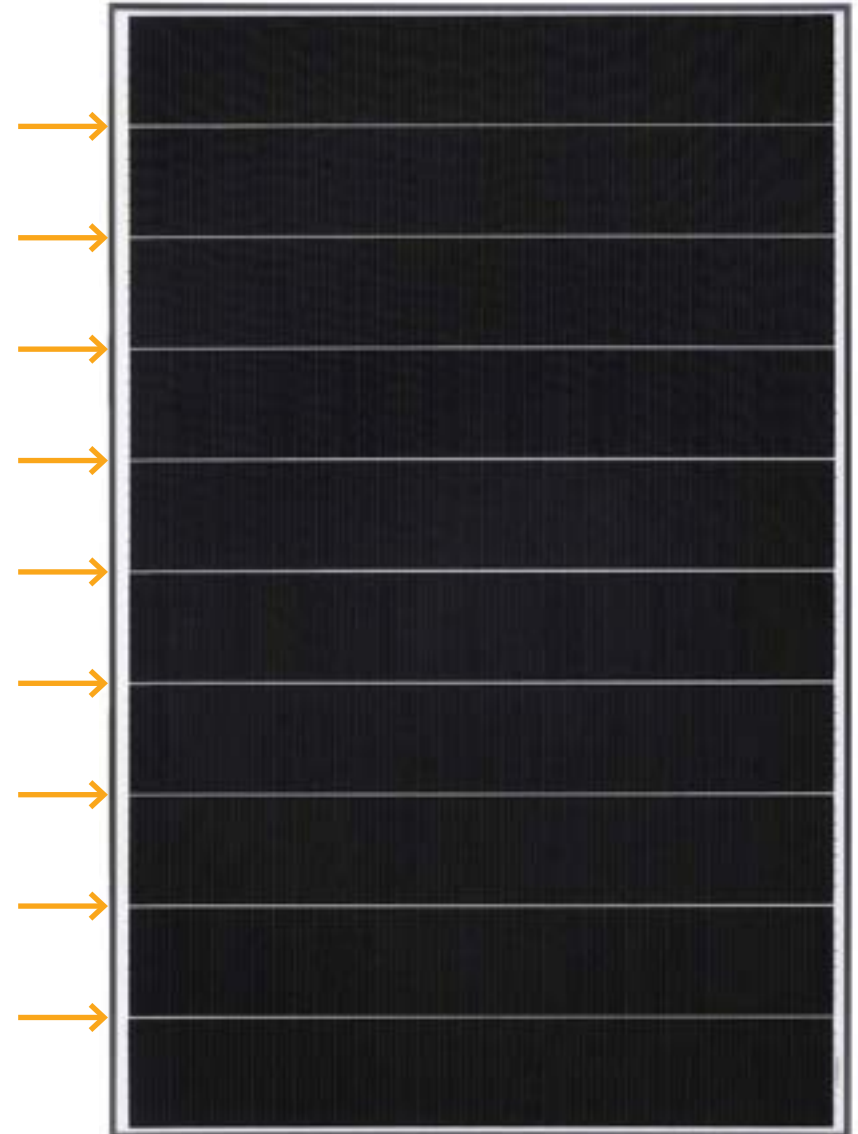
Nearly 100% of the module is covered with solar cells to deliver **higher power** and **outstanding efficiency**.

Higher efficiency means that **less total solar panel area** is required to deliver a given power output, **leading to savings** on balance of systems components and labour.

### ④ Better space utilisation

Less space  
between the  
cells...

means  
**more power  
per panel**

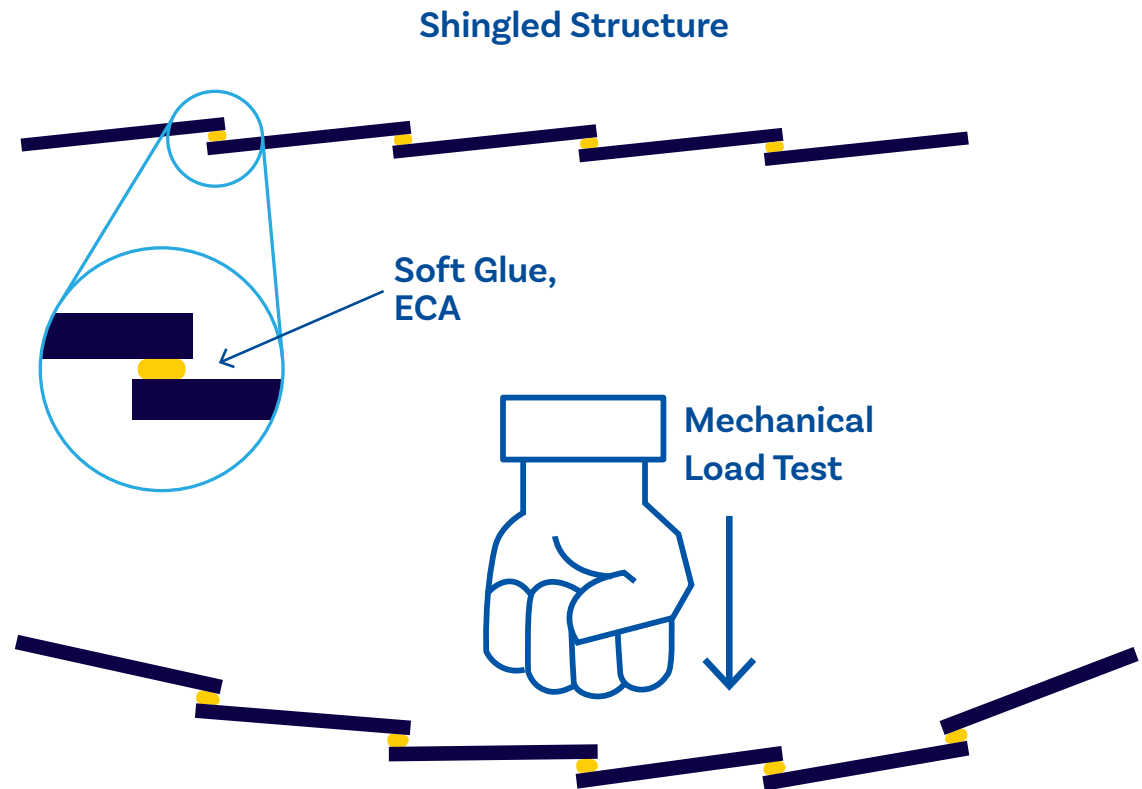




Hyundai shingled module cell joints have **superior flexibility** compared to standard solder ribbon with the Electrically Conductive Adhesive absorbing bending energy.

During periods of high wind or under mechanical loads such as snow, Hyundai modules are **less likely to develop cell cracks** that hamper long term reliability.

### 5 Improved Load Resilience



Less cell  
cracking under  
pressure...

means **better**  
**long term**  
**reliability**



There has been no noticeable drop in electricity production in 8 years!

**K. BENN** (2019)  
60KW Ground Mount installed 2011  
St George, QLD Australia

# Why choose Hyundai shingled solar panels?



**PERC SHINGLED TECHNOLOGY**

PERC Shingled Technology provides ultra-high efficiency with better performance in low irradiation. Maximises installation capacity in limited space.



**ANTI-LID / PID**

Both LID (Light Induced Degradation) and PID (Potential Induced Degradation) are strictly eliminated to ensure higher actual yield during lifetime.



**MECHANICAL STRENGTH**

Tempered glass and reinforced frame design withstand rigorous weather conditions such as heavy snow and strong wind.



**25 YEAR PRODUCT WARRANTY**

Hyundai Energy Solutions have a market leading product warranty for all our solar panels.



**CORROSION RESISTANT**

Various tests under harsh environmental conditions such as ammonia and salt-mist passed.



**UL / VDE TEST LABS**

Hyundai's Research and Development Centre is an accredited test laboratory of both UL and VDE global safety certifications.



**SUPERIOR TEMPERATURE COEFFICIENT**

Lower internal cell current results in superior performance in hot climates.



## TIMBER YARD, 40KW

- Located in Falls Creek, Australia
- 40kW Hyundai Solar Panels installed
- Reducing power bills for a machinery-heavy business



## SOLAR PARK, 18 MW

- Located in Albacete, Spain
- 7MW Hyundai Solar Panels installed
- Financed by Deutsche Bank



## SOLAR PARK, 100 MW

- Located in Crimea, Ukraine
- 20MW Hyundai Solar Panels installed
- Constructed by Activ Solar



## ASAN MEDICAL CENTRE 150KW

- Located in Seoul, Korea
- Turnkey installation by Hyundai
- Glass-to-glass Module installed

## HYUNDAI AQUAMAX™ - THE WORLDS NO 1. TECHNOLOGY IN GLOBAL SHIP BUILDING, OFF SHORE AND ENGINEERING



## HYUNDAI AQUAMAX™

- Located in Goheung-gun, Korea
- 2MW Hyundai Panels installed
- Operating from: October 2018



## HYUNDAI AQUAMAX™

- Located in Jindo-gun, Korea
- 1MW Hyundai Panels installed
- Operating from: September 2018



A safer, more efficient  
solar system built for  
Australia

**You deserve Hyundai  
Energy Solutions**

Rural Solar Pumping Site, Australia



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