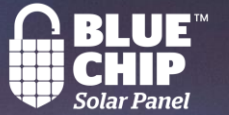




HYUNDAI ENERGY SOLUTIONS

BUILT TOUGH.
THE KNOWN SOLAR BRAND
AUSTRALIA TRUSTS.



25
YEAR PRODUCT
WARRANTY



84.8% Guaranteed ELECTRICITY PRODUCTION AT YEAR 25



 **HYUNDAI**
ENERGY SOLUTIONS

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.

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

Our History

1972

Hyundai Heavy Industries
start business

2004

Started Solar
business – oldest
in Korea

2007

Set up of Cell/Module
production line

2012

Set up of PV R&D Centre

Hyundai Heavy Industries
achieves 10th World record

2016

Established *Hyundai
Energy Solutions*

2019

Increased
Product
Warranty to **25
Years**

1983

No.1 in the
world for ship
orders and
construction

2009

Entered
Australian
market

2011

Signed \$20M
supply contract in
Australia

2014

Produced high
efficiency Mono
cell/module (PERC)

2018

Start of EPD &
ESS/Inverter
business

2020

Hyundai increase sales
target in Australia



25
YEAR PRODUCT
WARRANTY

HYUNDAI
ENERGY SOLUTIONS

Introducing the next generation 350W Shingled Module

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

1. Better space utilisation delivers higher efficiency
2. Electrically Conductive Adhesive for higher reliability
3. Improved shade resilience
4. Lower current reduces risk of hot spots
5. Improved mechanical load resilience

What is Shingled Cell Technology?

Start with a high performance Mono PERC cell



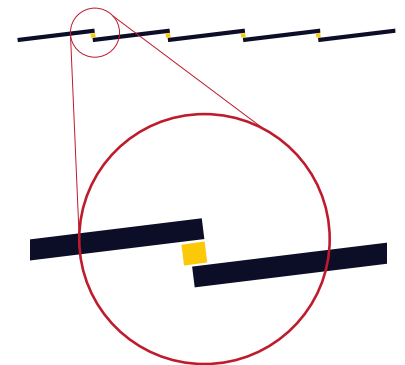
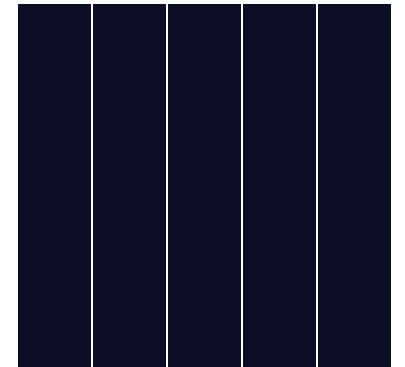
Laser cut the cell into five strips



Apply Electrically Conductive Adhesive to each strip



Overlap the cells in a shingled arrangement



Shingled Module Advantages

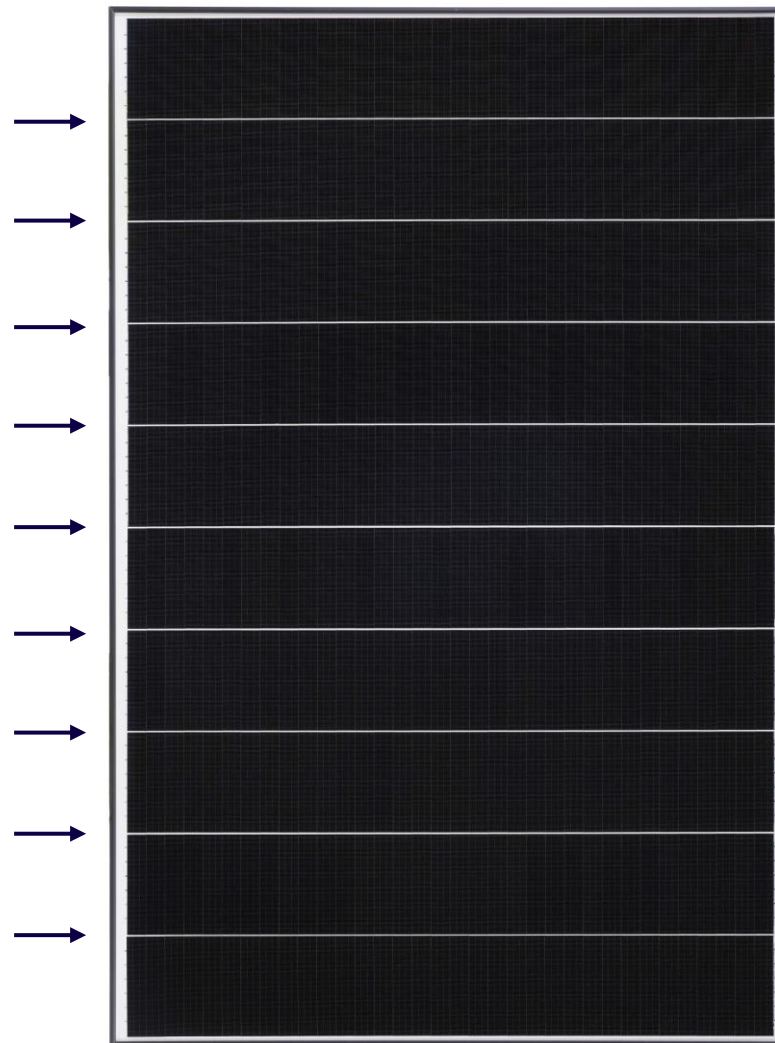
Nearly 100% of the module is covered with solar cells to deliver higher power and outstanding 20.2% efficiency.

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.

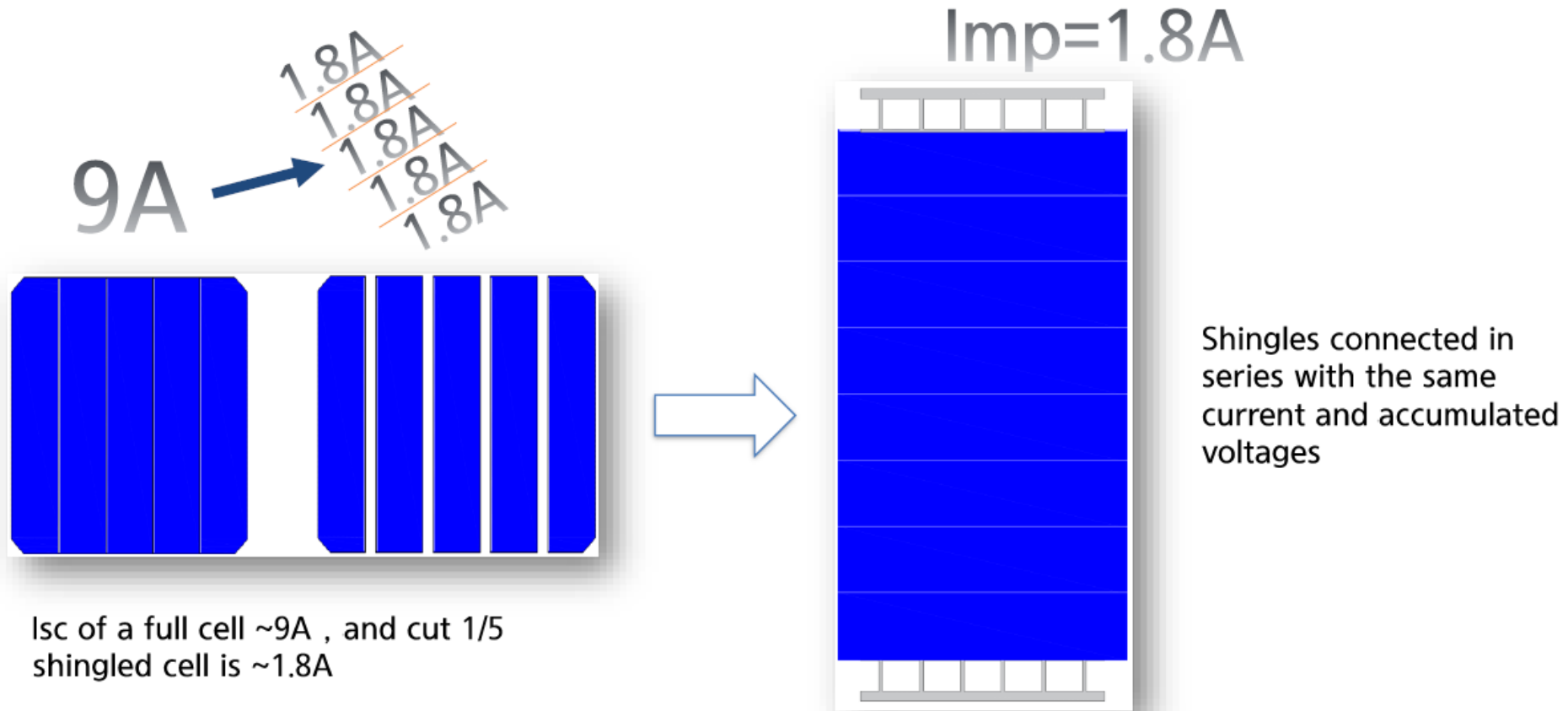
1. More Power & Less BOS

Less space between the cells...

means more power per panel



1. More Power & Less BOS

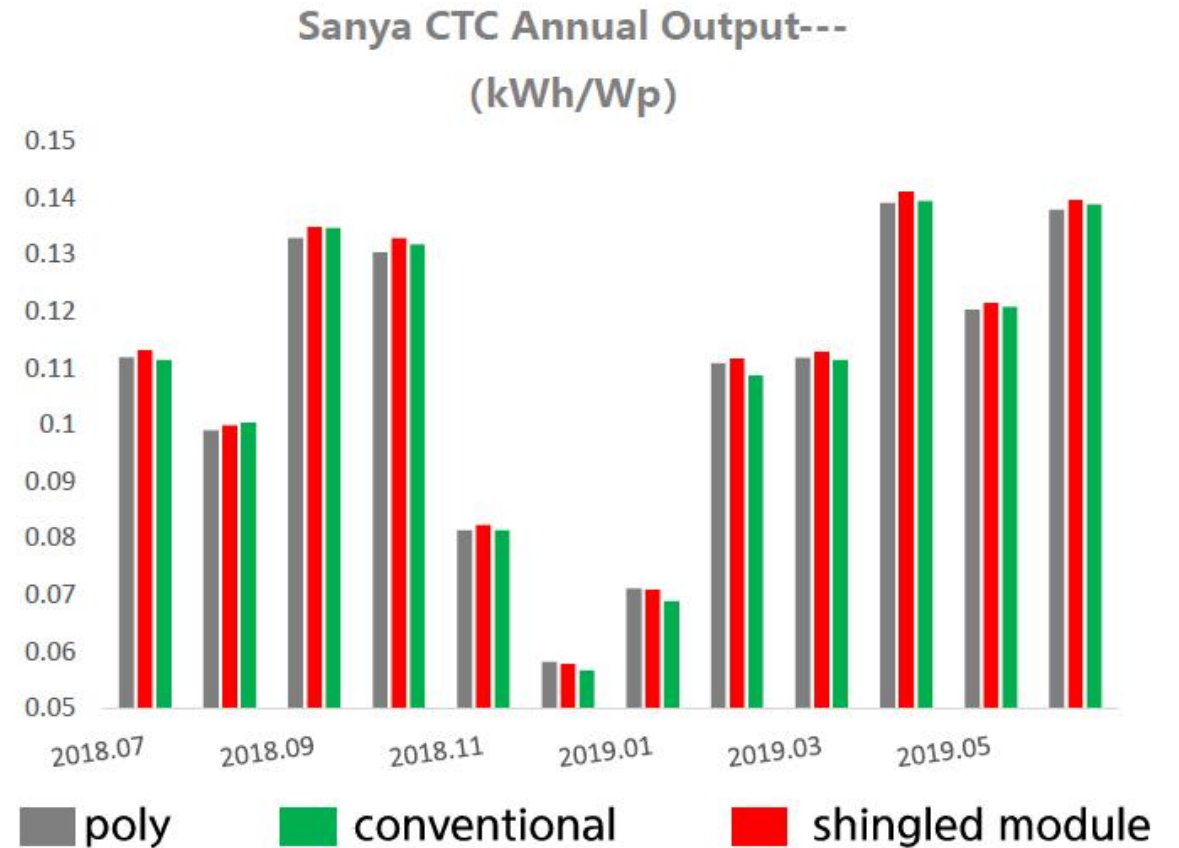


Isc of a full cell ~9A , and cut 1/5 shingled cell is ~1.8A

$P_{\text{loss}} = I^2 \times R$ → Each small pc cell 'I' decreased (9A→1.8A), resistance loss becomes much lower.

1. More Power & Less BOS

Outdoor Performance Test – Hainan Province, China

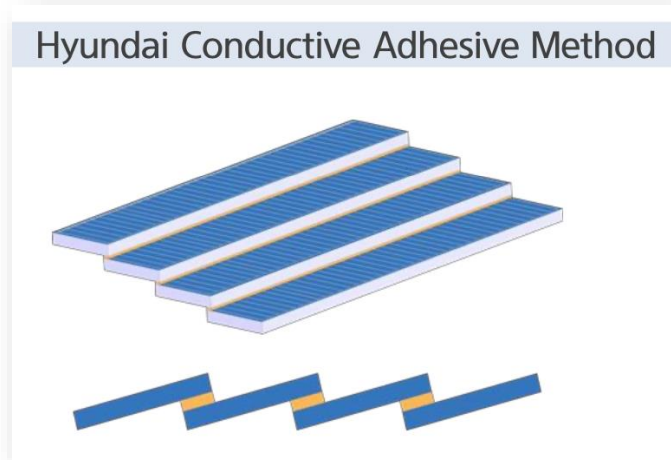


Shingled Module Advantages

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

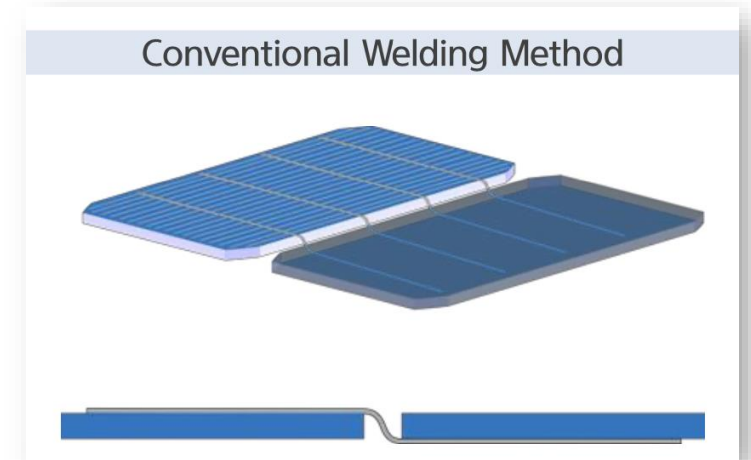
As panels get hot in the day and cold at night, traditional solder ribbon expands and contracts but the silicon cells don't causing more stress.

2. ECA for higher reliability



Lower cell stress...

means higher reliability

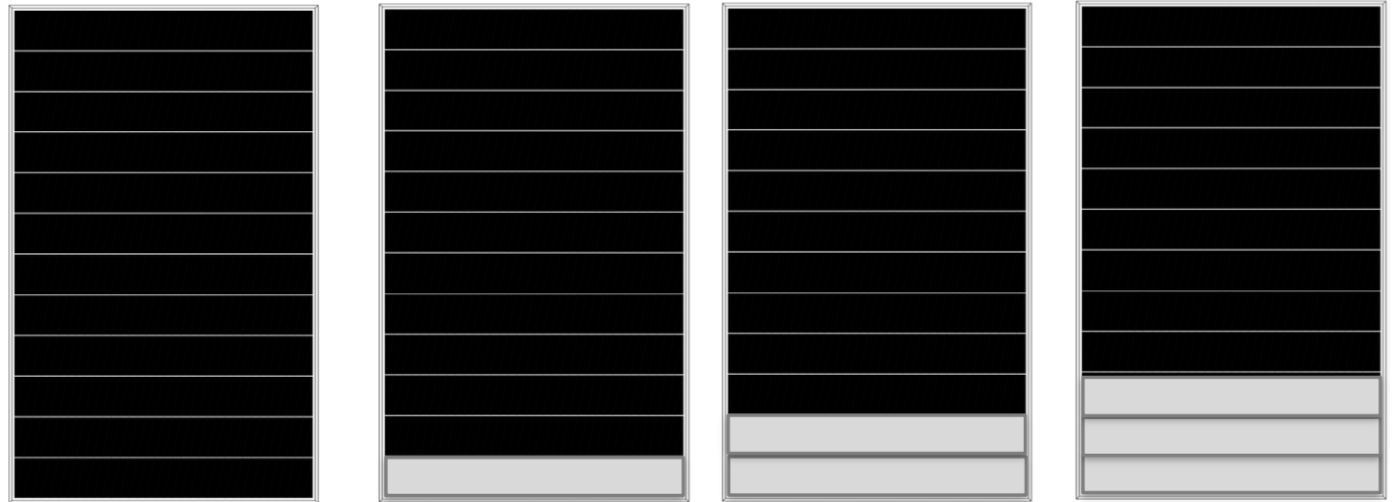


Shingled Module Advantages

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

The optimal layout results in lower impacts from shade as compared to common full and half-cut cell modules.

3. Better Shade Resilience



Parallel circuits...

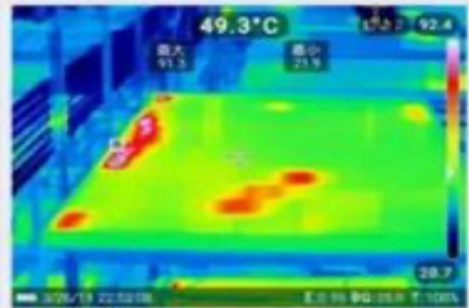
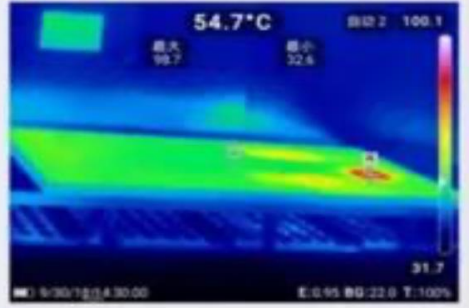
means lower loss of power in rising shade

Shingled Module Advantages

Hyundai starts with full solar cells and then laser cuts them into five strips before arranging them into shingled circuits.

With each cell strip handling just 1/5 the current of the original full cell, every circuit works at a lower current and hence a lower temperature that reduces the risk of hot spots and improves high temperature performance.

4. Lower Hot Spot Risk

Module Type	Shingled Module	Standard Module
The highest Cell Temp.	91.3°C	98.7°C
IR Image		

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

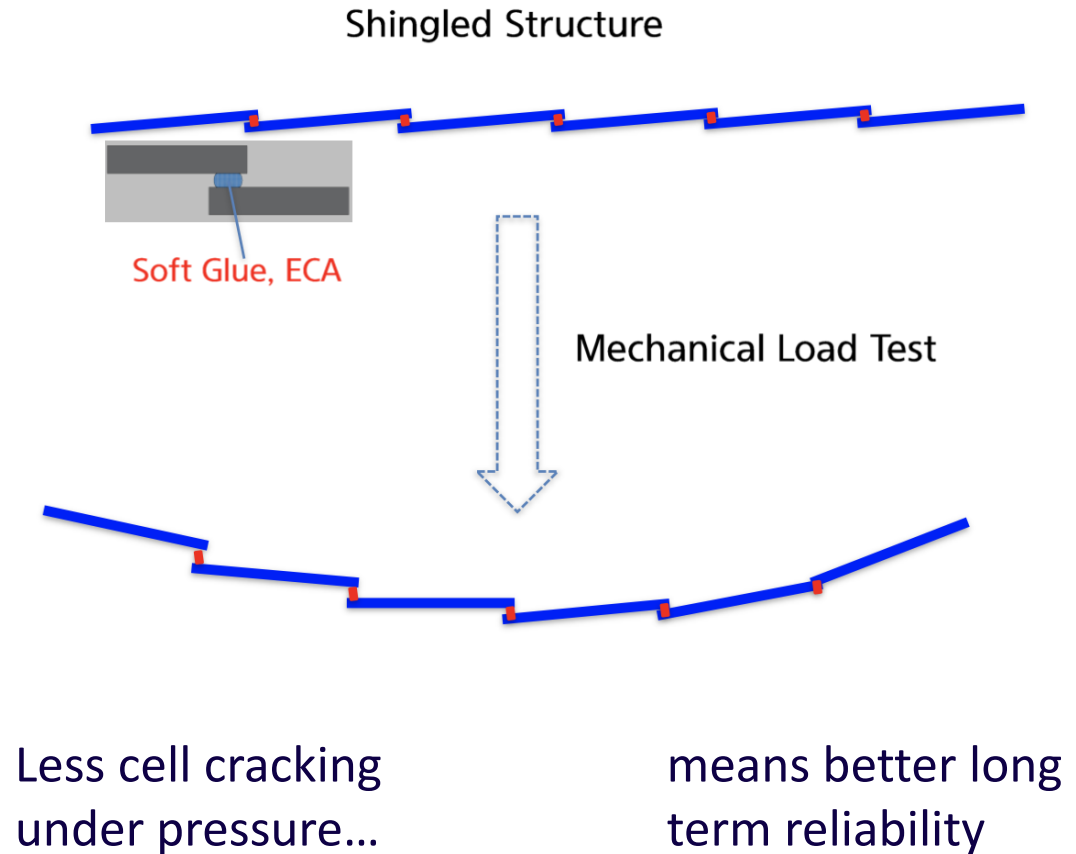
and a low temperature coefficient of power of -**0.34% / °C**

Shingled Module Advantages

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



6. Quality Assurance

Item	IEC Standard	HES' Internal Standard
Damp Heat	85°C, 85%RH 1000hr	85°C, 85%RH 3000hr (x 3)
Thermal Cycling	-40°C~+85°C 200cycle	-40°C~+85°C, 600cycle (x 3)
UV Exposure	60kWh/m ²	90kWh/m² (x 1.5)
PID	85°C, 85%RH, 192hr, -1000V	85°C, 85%RH, 600hr (x 3), -1000V



[Hyundai test laboratory]

IEC 61215
IEC 61730 & CE



KS C 8561



PID
IEC TS 62804-1



UL 61730 / 61215



Salt Mist Corrosion
IEC 61701



Ammonia Corrosion
IEC 62716



Dust and Sand
IEC 60068-2-68





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

K. BENN - 2019

60kW Ground Mount, St George, QLD Australia

Why choose Hyundai solar panels?



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.



CORROSION RESISTANT

Various tests under harsh environmental conditions such as ammonia and salt-mist passed **SEVERITY LEVEL 6**.



UL / VDE TEST LABS

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



25 YEAR PRODUCT WARRANTY

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

A lot can happen in 25 years in a Hyundai Solar household

2020



Family install a Hyundai System

Their son is born in the same year. He will grow up in a Hyundai house where comfort doesn't mean big bills.

Invested in Energy Storage

Son is now five years old. Family enjoys airconditioning in Summer and heating in Winter.



2025

2036



Electric Vehicle

As a sixteenth birthday present, they buy their son a Hyundai electric vehicle which gets charged from their Hyundai Solar System

Online Energy Trading

Their son is now 19 years old. He moves out, rents a house & buys his power off his parents.



2039

2043



Warranty Transfers on Sale

Family sells their home. The warranty on their Hyundai solar panels are fully transferable. Peace of mind for the next family to enjoy.



Rural Solar Pumping Site, Australia



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Warranty: www.hyundaisolar.com.au/warranty

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

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