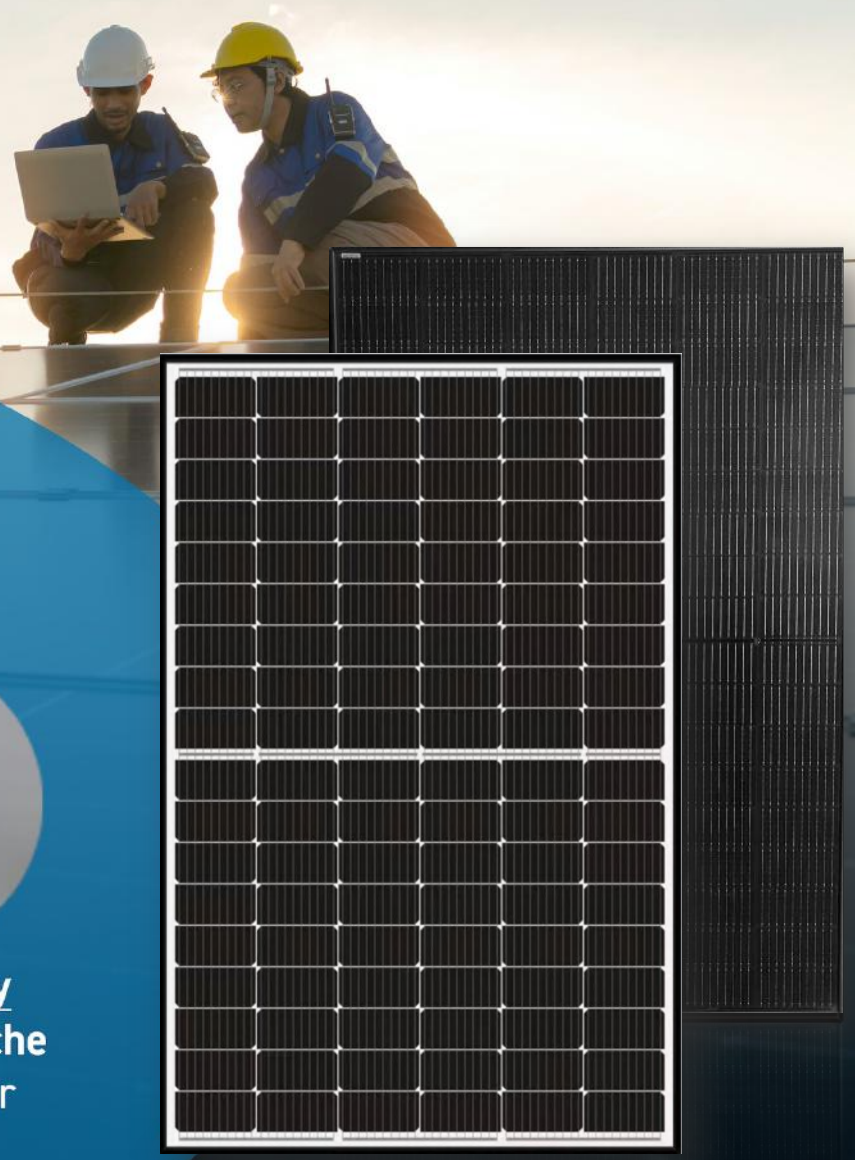
YINGLI SOLAR

WEBINAR

DATE: 27th September 2022

PVTECH TECHTalk



Understanding the evolving customer demands of residential solar PV

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Moderated by
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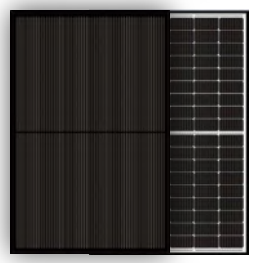
About Yingli

- We are one of the oldest, most experienced PV manufacturers - manufacturing since 1998 with over 35GW+ solar panels supplied internationally.
- BloombergNEF, Tier 1 panel manufacturer.
- Australian regional office was established in 2012, a 100% owned subsidiary of Yingli Solar, serving the Australian/Pacific region with a full local team including management, sales, logistics, engineering and customer service.
- 25-year product warranty on 108 Cell module and up to 30 years performance warranty on double glass bifacial solar panels.
- Module BOM and manufacturing facilities qualified independently by PVEL.
- Yingli Modules are compliant with international and Australian standards and approved by the Clean Energy Council (CEC) of Australia.
- Yingli is a pioneering participant in the Solar Panel Validation (SPV) Initiative. SPV aims to protect the integrity of the industry and offers an easy way to check and confirm that solar panels are genuine, backed by manufacturer warranties locally and meet Australian standards for quality and performance.
- Among the highest number of patents in the solar industry.
- Recognised by independent third party quality testing institutions such as TUV, DNV, PVEL and RETC.






Yingli History

1998
- Yingli Solar entered into the solar industry.

2003
- On October10th , Yingli Solar produced the first polysilicon ingot in China.
- Began commercial production and worldwide distribution.

2004
- Reached 6 MW capacity in ingot, wafer, cell and 50 MW in module production.
- Obtained UL, IEC and TÜV certifications.

2006
- Reached 100 MW capacity.
- Raised US$ 220 million through private equity and other investments.

2007
- Reached 200 MW capacity.

2008
- Reached 400 MW capacity.

2009
- Reached 600 MW capacity.

2010
- Yingli Green Energy became an Official Sponsor of the 2010 FIFA World Cup™.
- Fine Silicon started commercial production.
- PANDA and Hainan expansion began commercial production, and the total capacity reached 1GW.

2011
- Reached 1.7 GW capacity.
- Yingli Green Energy became an Official Premium Partner of FC Bayern München.
- Yingli Solar becomes an official sponsor of the 2014 FIFA World Cup Brazil™.

2012
- Transition from a pure PV module manufacturer to an integrated energy solutions company.
- Delivered 2.3 GW of PV modules which made it the largest PV module manufacturer in the world in terms of shipment volumes.

2013
- Approved the 2013 AA Class Enterprises by the General Administration of Customs.
- Yingli Solar delivered 3.2 GW of PV modules worldwide, and Yingli Solar remained the leading PV module manufacturer by shipment volumes.

2014
- Yingli Solar opened the first Power Generation Experience Store.
- Yingli Solar panels delivered higher than 10 GW around the world.

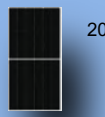
2015
- Overall arranges the "One Belt And One Road", the first freight train laden with PV modules launched.
- Provides solar modules for the largest PV greenhouse park in Asia.
- Becomes the first PV company which is awarded "The National Intellectual Property Superior Enterprise".

2016
- Yingli led the development of the first clean production evaluation system for China's pv industry.

2018
- PANDA became the first BIFACIAL product gained three certificates, and the power yield in Top Runner projects with PANDA technology ranked No.1 in 2018 reports.

2020
- Yingli provides high-efficiency photovoltaic products for the largest double-sided power station in the Middle East.

2022



2022 , New 8GW manufacturing facility adds 660W+ panels.

Yingli Solar 25th Anniversary

Tier 1 BloombergNEF

PVEL

2022, BOM quality qualified.

First 3MW solar panel commercial production facility, 1999.

YINGLI, develops **N-type** silicon solar cells, named PANDA, 2004.

YINGLI, supplies Australia's first large scale project using 1st 1500V framed solar modules.

2015, 50MW reclaimed mining land Datong City, Shanxi Province, China.

RETC 2022 HIGH ACHIEVER

YINGLI tops independent reliability tests by RETC, 2022.

Yingli starts constructing a new 5GW N-Type TOPCon cell factory in China.

Yingli Brand Building

The first solar company to sponsor the FIFA World Cup in 2010, bringing solar to the world stage

ESG

Approved modules

When on site, the Installer scans the serial numbers and sends the data via the app.

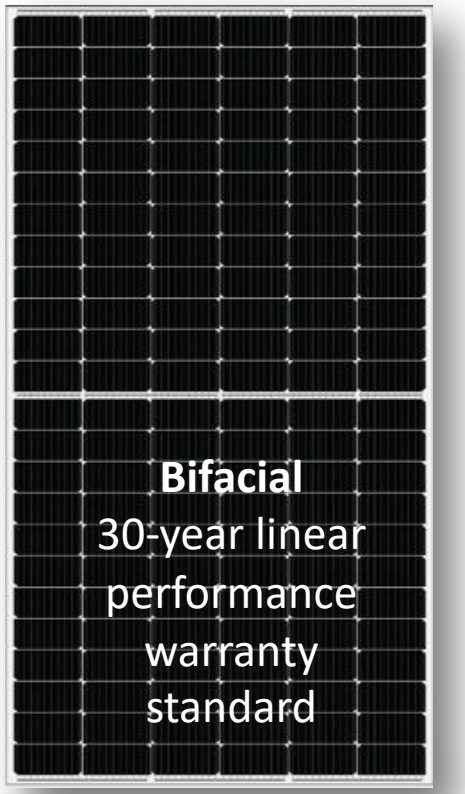
Solar Panel Validation (SPV)

Yingli Product Lines

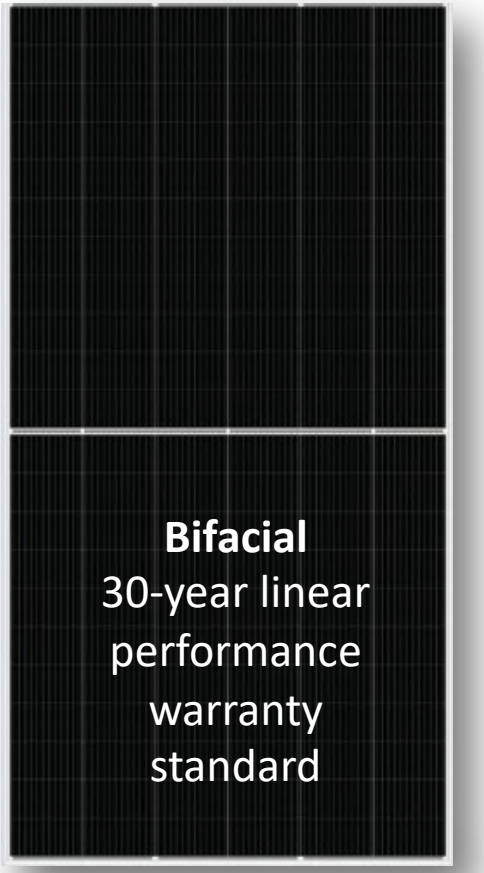
108 Cell
415W

1722 x 1134mm

550W+



660W+



Residential---> Commercial Utility

Independent Testing

PV MODULE INDEX REPORT 2022 AWARDEES

OVERALL HIGH ACHIEVEMENT IN MANUFACTURING

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HIGH ACHIEVEMENT IN QUALITY

Thresher Test

HIGH ACHIEVEMENT IN RELIABILITY

Damp Heat ---- Dynamic Mechanical Load ---- Thermal Cycling

HIGH ACHIEVEMENT IN PERFORMANCE

Module Efficiency ---- LeTID Resistance ---- PTC to STC Ratio

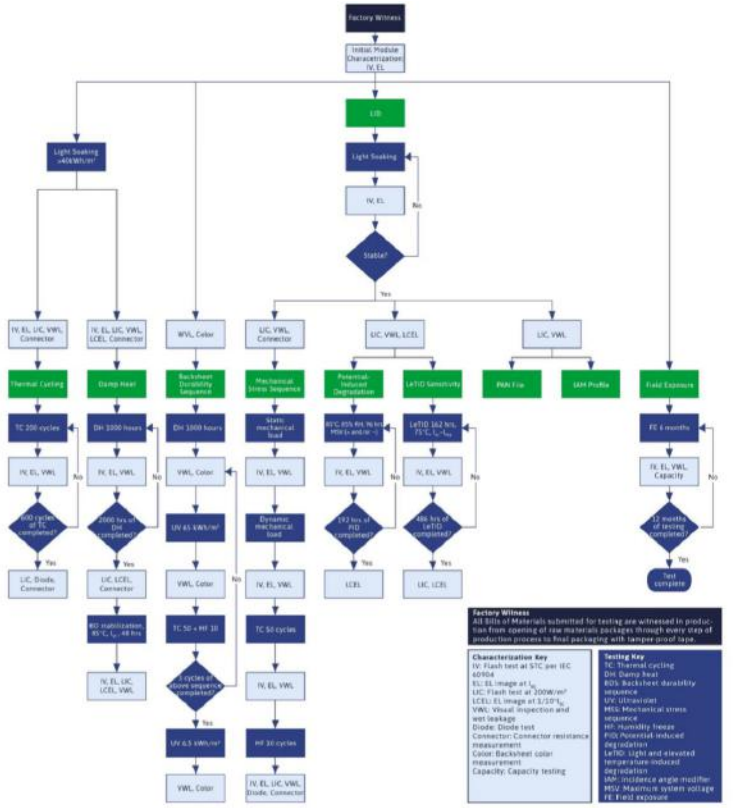
Module Production Monitoring

Yingli Energy

Product Qualification Program

PVEL

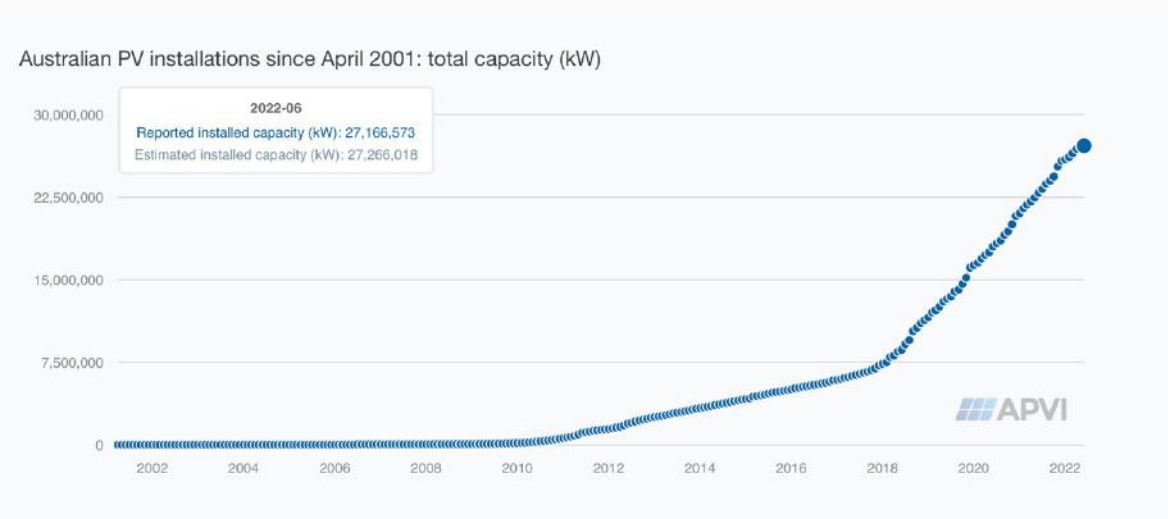
MAKE DATA MATTER.



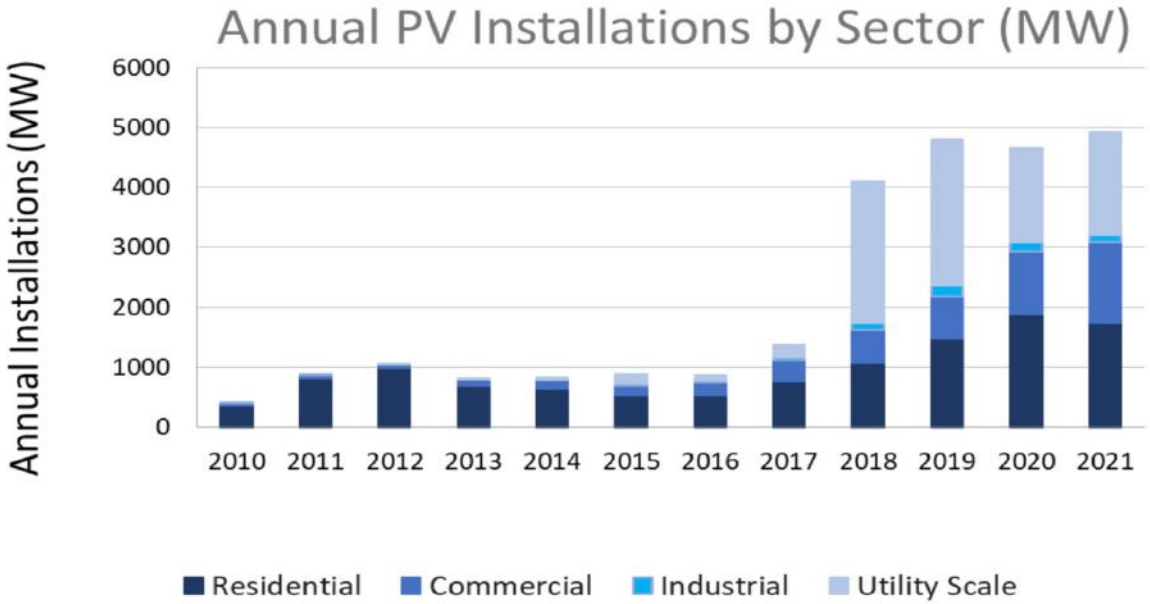
Third party inspections, auditing of raw materials and manufacturing equipment specifications.

Residential vs. C&I/Utility (Australian Solar Market)

As of 30 June 2022, there are over 3.19 million PV installations in Australia, with a combined capacity of over 27.2 gigawatts.



APVI web site



ViA-Report-2022-AUS

Target is for 82% of electricity to come from renewables by 2030.

New legislation will accelerate renewables uptake

415W 108 Cell - Optimised Solution For The Residential Market

- 25-year product + 25-year performance warranty.
  * Residential and commercial installations.
- Tier 1 Bloomberg qualified manufacturer. Manufacturing PV since 1998.
- RETC High achiever award for product quality, performance and reliability.
- Maximise Small-Scale Certificate value in Australia (federal incentive program).
  E.g., 16 x 415W = 6.6kW DC.
- Compact size and weight for easy installation and excellent rooftop packing density.
  Reduced logistics and warehousing costs *1722 x 1134mm, 21.5kg.
- Proven performance using durable and state of the art materials.
- Multi-bus bars reinforces the cell and reduces resistance at full irradiance.
- Gallium doped for excellent high temperature performance and stability.

Efficient, Reliable, Aesthetically Pleasing PV

High module conversion efficiency, supported by high quality materials and technology innovation.

Higher packing density to reduce logistics, warehousing and labour costs (or more Watts for the available roof space).

Reliable modules with long product warranty.

Aesthetically pleasing module, sleek appearance and design.

Flexible design, easy installation and maintenance.

Photo by **Buzz Energy**

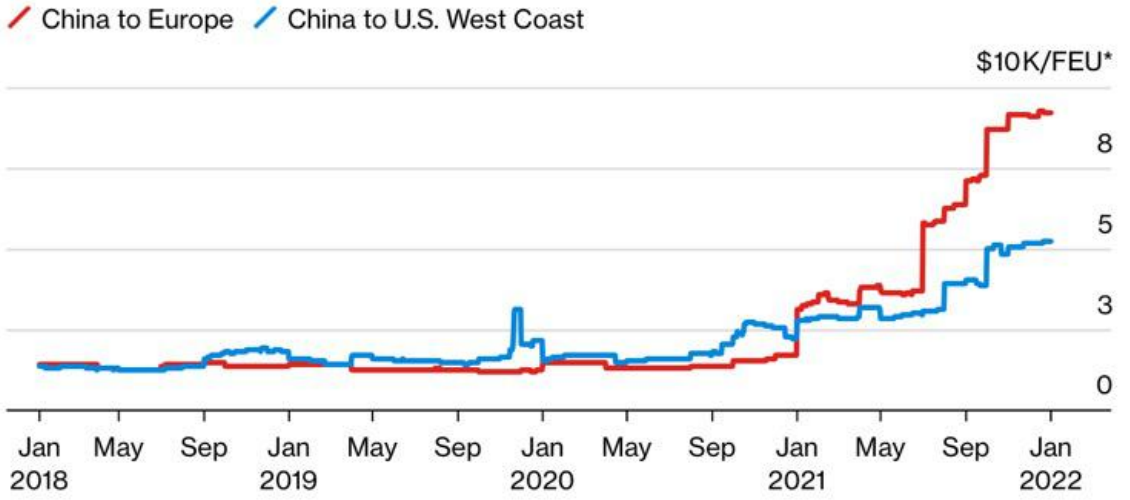
Logistics Benefits

Logistics costs have been climbing as a result of global uncertainty

Increased power /pallet /container.

Reduced global and local logistics costs (handling and warehousing).

Reduced installer handling and delivery costs.

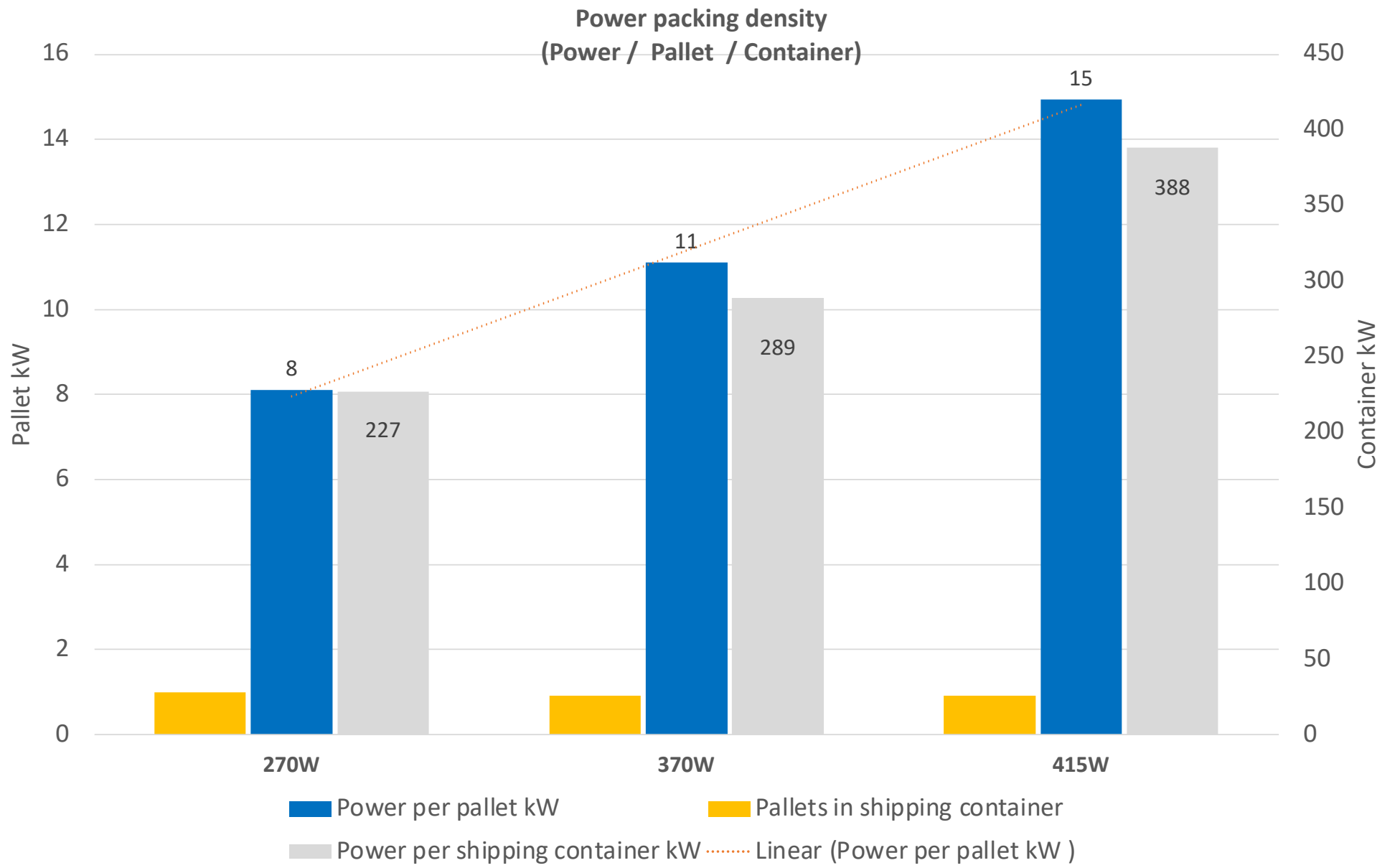


Source: www.Xeneta.com
*FEU = 40-foot equivalent unit, a standard size of shipping container

YINGLI Module	270W	370W	415W
Number panels per pallet	30	30	36
Watts per pallet	8100	11100	14940
Pallets in shipping container	28	26	26
kW per shipping container	**227**	**289**	**388**

**https://www.ipart.nsw.gov.au/all-day-solar-feed-tariffs

Packing Density : More Watts Per Pallet / Container / Truck / Available Roof Space



Home Solar For The Residential Market

Market : Over 3 million Australian households installed solar systems.*

Average domestic solar system size has increased to 8.5 kW.

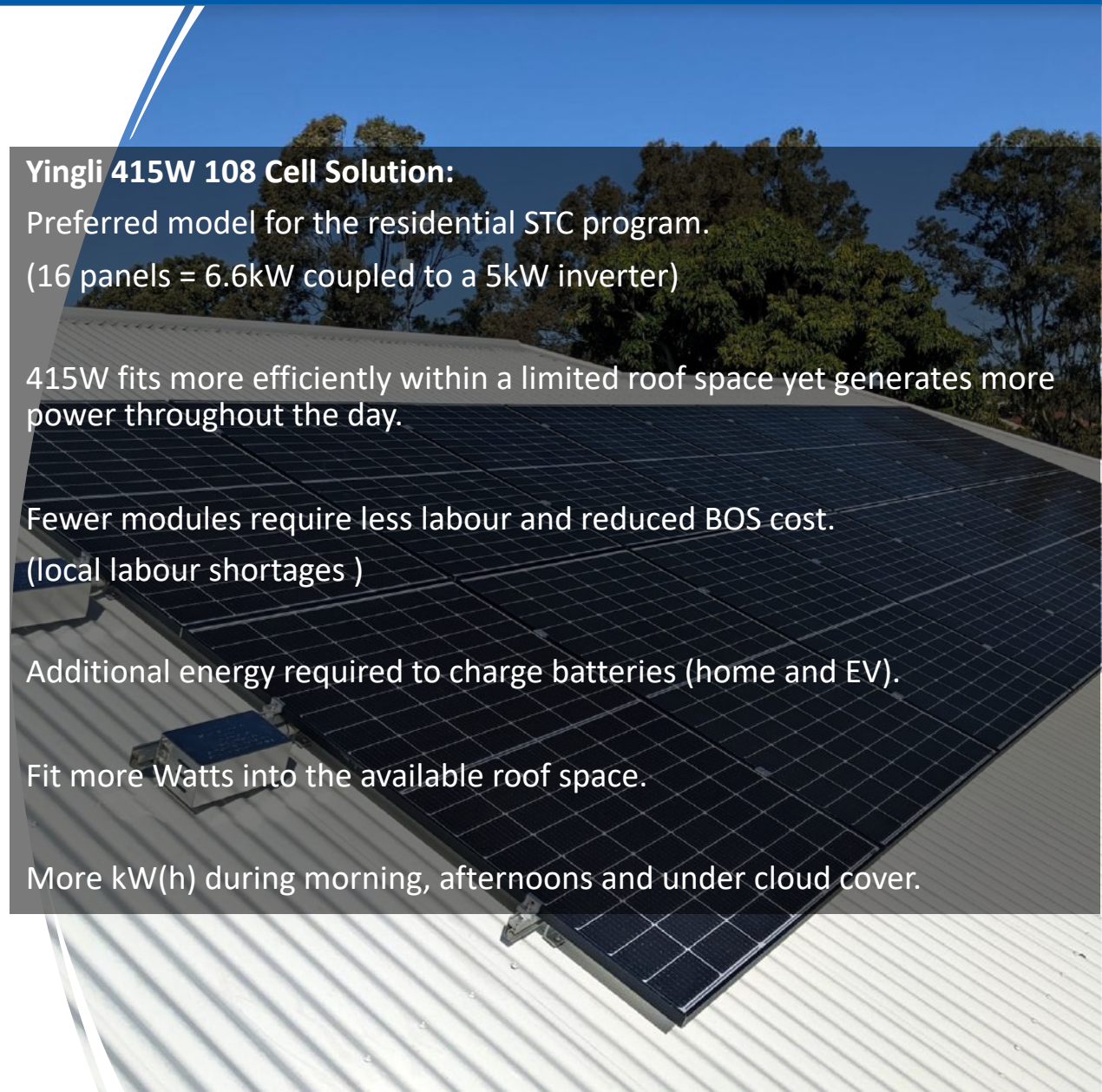
Specific system size is better suited to the Federal government Small Scale Certificates (STC) incentive program.

Onset of EV and the digital economy will increase demand for rooftop solar.

Work from home increases demand for domestic energy.

High electricity costs and low Feed in Tariff (FIT@~6c)**encouraging uptake of home storage systems.

(35K household batteries installed during 2021. A 30% increase over 2020 figures)



Yingli 415W 108 Cell Solution:

Preferred model for the residential STC program.

(16 panels = 6.6kW coupled to a 5kW inverter)

415W fits more efficiently within a limited roof space yet generates more power throughout the day.

Fewer modules require less labour and reduced BOS cost.

(local labour shortages)

Additional energy required to charge batteries (home and EV).

Fit more Watts into the available roof space.

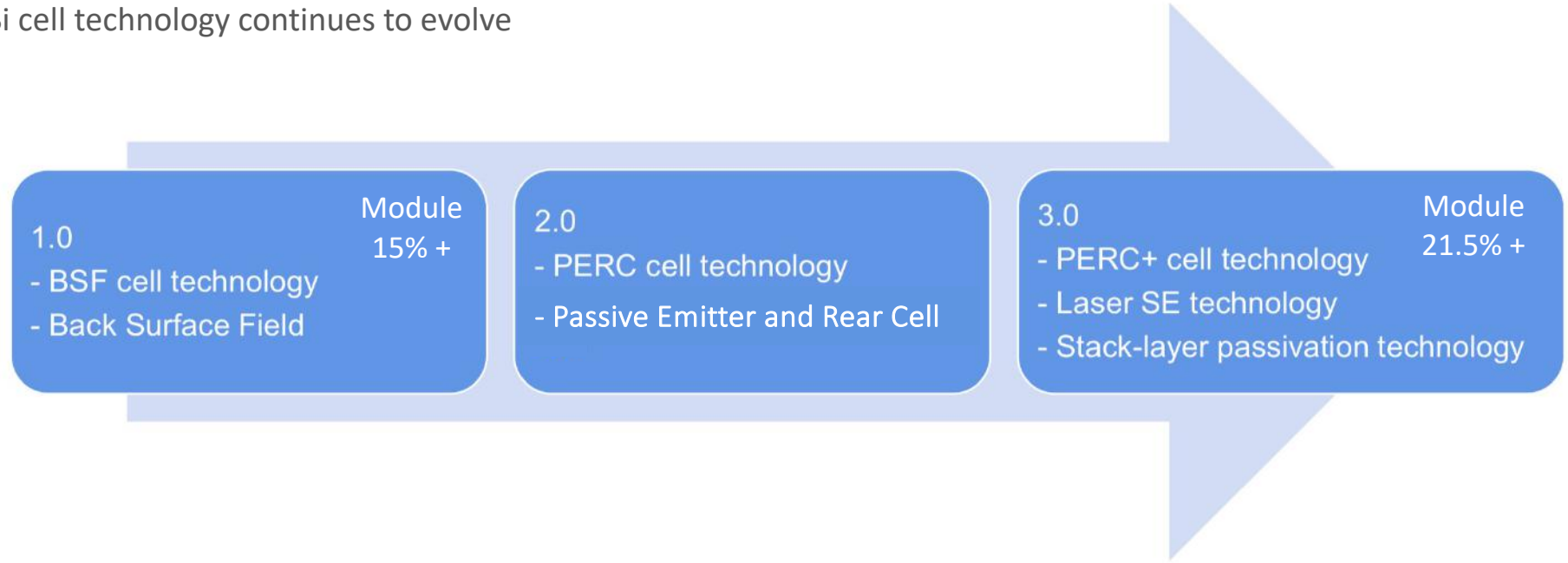
More kW(h) during morning, afternoons and under cloud cover.

*CEC, 2022 report

**https://www.ipart.nsw.gov.au/all-day-solar-feed-tariffs

Product Upgrade

P–type Mono-Si cell technology continues to evolve



Traditionally, in the transition from bare wafer to functioning PV cell, the first stage in the process is to dope the wafer with Boron. This is an important process that allows the photovoltaic effect. Unfortunately, using Boron for this allows the performance/efficiency to slowly degrade over time, in the form of Light Induced Degradation (LID) and Light and elevated Temperature Induced Degradation (LeTID) *.

Using Gallium for this process vastly reduces this performance degradation and allows modules with cells of this type to perform at closer to their maximum designed output for longer.

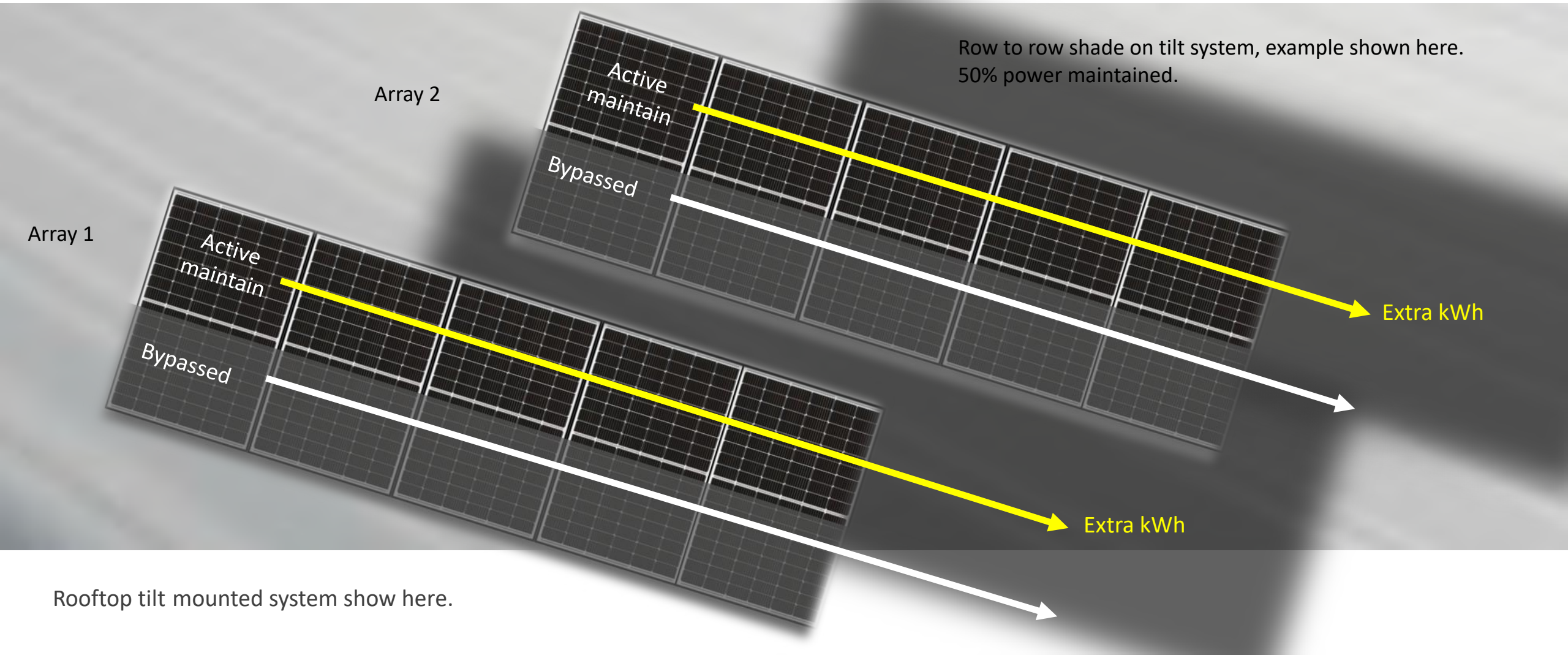
P-type Mono-Si is currently the most cost-effective technology. This means that P type Mono-Si PERC modules should continue to be supported well into 2023.

*Ref. Fraunhofer ISE

Shade Tolerance Of A 108 Cell Module

Improved cell string layout and split Junction-box increases power.

Lower cell resistive losses at peak irradiance and improved cell connectivity and strength.



Rooftop tilt mounted system show here.

3.0 PRO 108 Cell Module Designed Specifically For Rooftop Distributed Power Plants

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3.0 PRO modules use high efficiency p-type monocrystalline PERC cell technology. Designed with high quality encapsulation materials and toughened glass/back sheet structure.

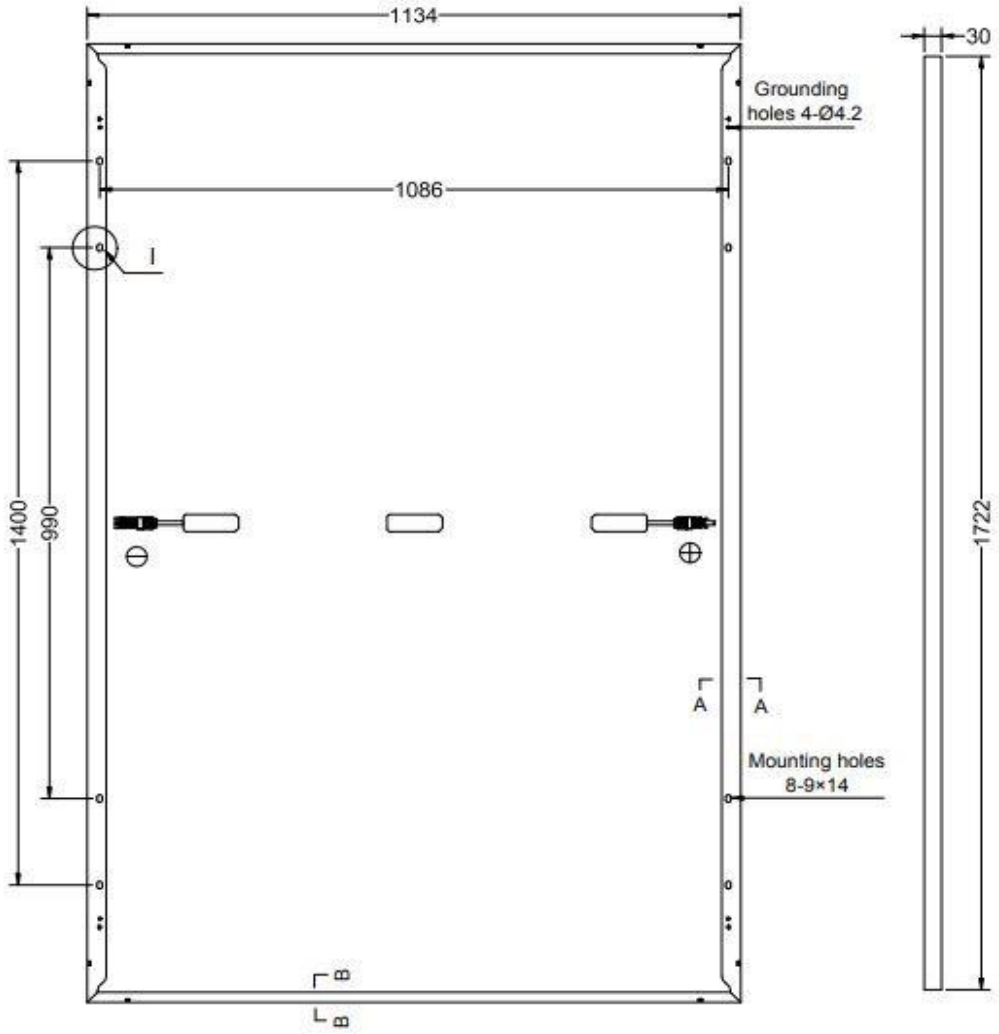
3.0 PRO offers high performance and reliability making it suitable for the harshest environments.

Power output	P_{max}	W	415
Power output tolerances	ΔP_{max}	W	0 / +5
Module efficiency	η_m	%	21.3
Voltage at P_{max}	V_{mpp}	V	31.10
Current at P_{max}	I_{mpp}	A	13.35
Open-circuit voltage	V_{oc}	V	37.39
Short-circuit current	I_{sc}	A	14.02

25 YEARS FOR MATERIALS AND PROCESSING

25 YEARS FOR EXTRA LINEAR POWER OUTPUT

STC: 1000W/m² irradiance, 25°C cell temperature, AM1.5g spectrum according to EN 60904-3.
Average relative efficiency reduction of 3.3% at 200W/m² according to EN 60904-1.



Weight 21.5kg

Aesthetics

415W 3.0 PRO 108Cell all black module is designed for rooftop distributed power plants.

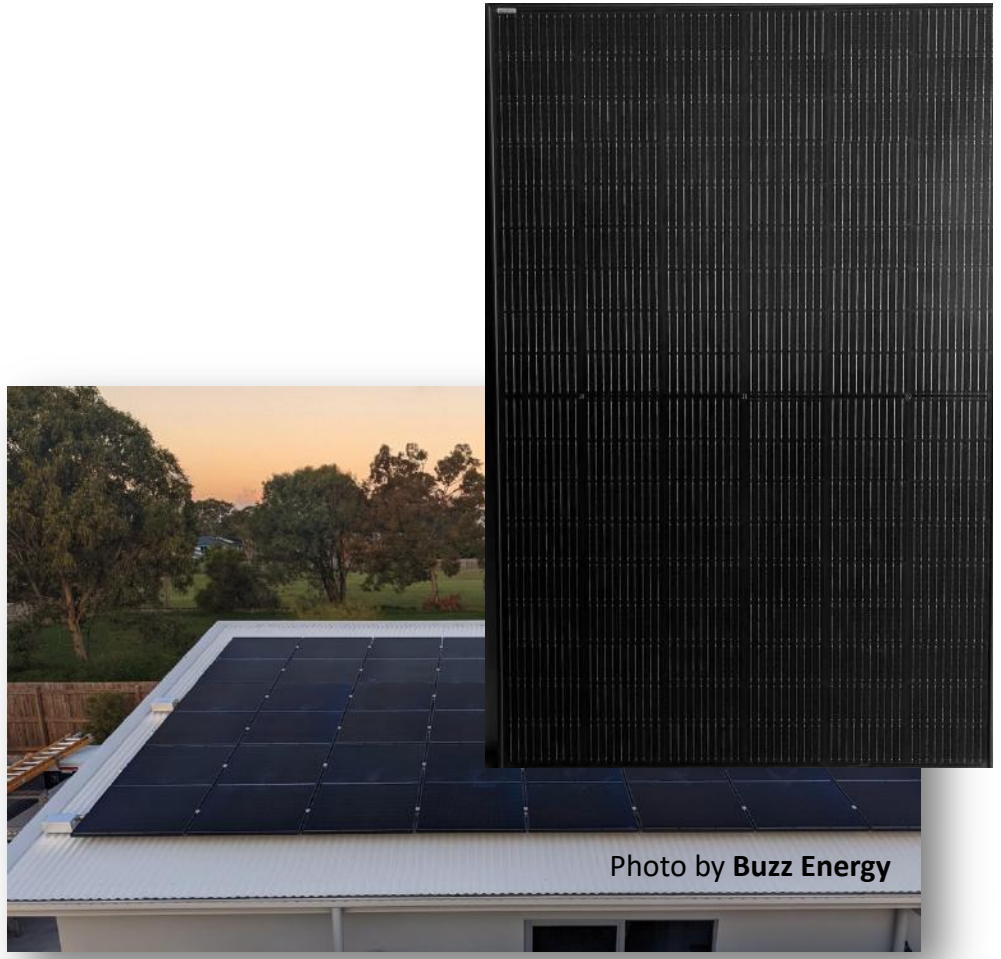
3.0 PRO 108Cell module is based on the industry's leading M10 size wafer, latest PERC cell technology and glass/back sheet encapsulation structure.

The 108 Cell black module presents an aesthetic design with an all-black appearance, incorporating black cells, back sheet, frame and main busbars.

To achieve flexibility, easy installation and maintenance, the PRO black module adopts a 108 Cell design with an area of only 1.95 m^2.

Efficiency of 21.3% and size, makes it suitable for residential roofs.

Longevity and peace of mind via local after-sales support.

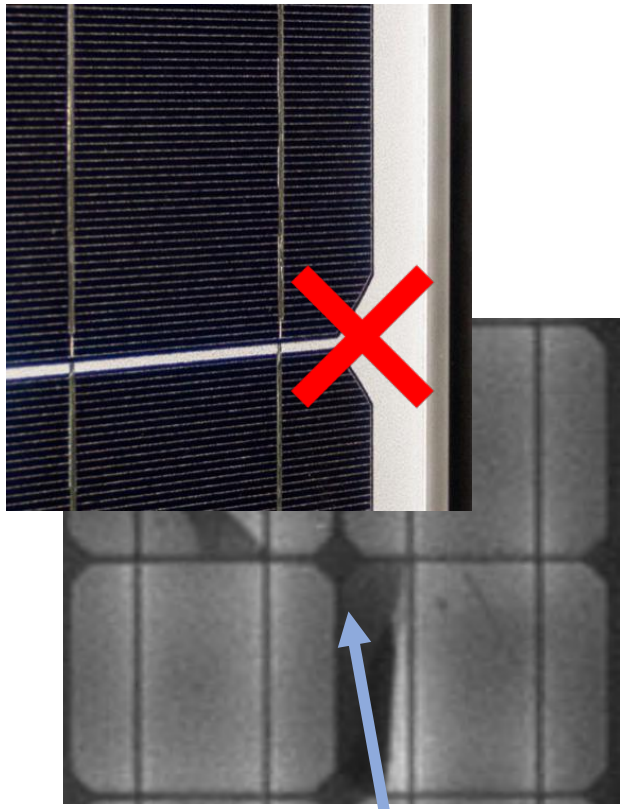


Yingli Multi Busbar Cell Technology
Stable Performance And Mechanical Strength

Traditional solar cell

Minimum number of busbars.

Lower strength and less efficiency.



EL test

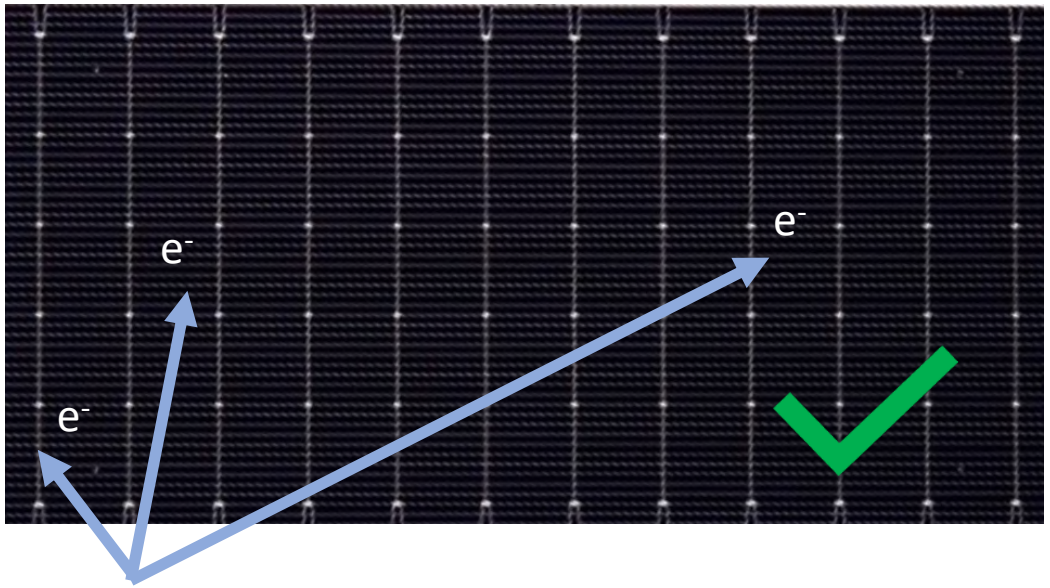
Crack de-activates the cell area (dark area).

Current cannot flow, therefore overall power reduces.

Yingli solar cells (maximum number of bus bars)

Multi busbars, 10 or more depending on cell width.

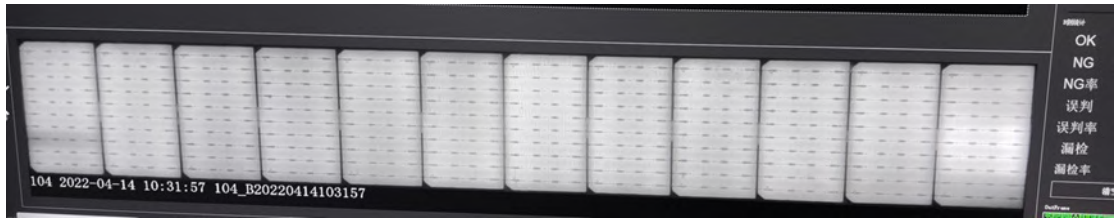
High strength and high-power efficiency.



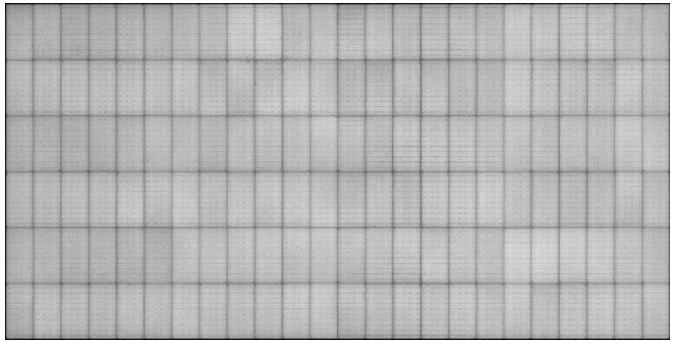
Increased power.

In the event of a crack there is reduction loss of electron flow.

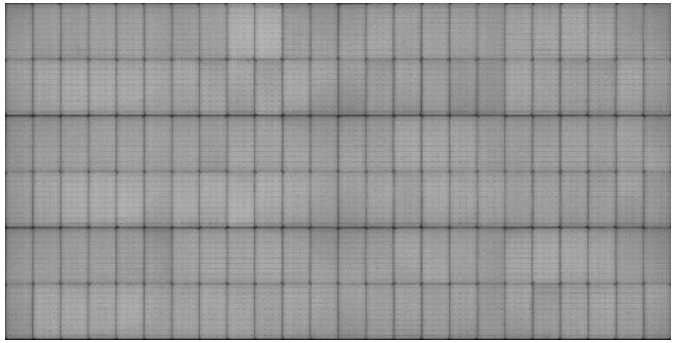
Yingli Quality Inspection



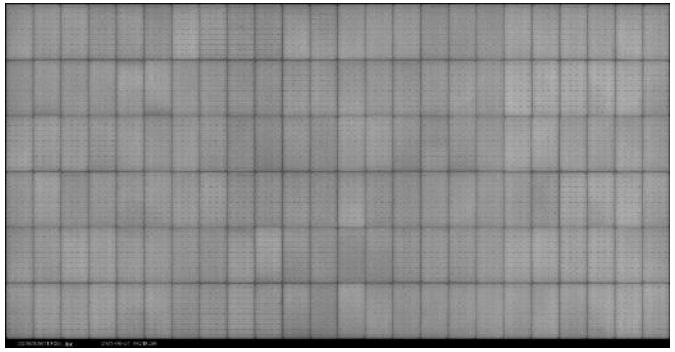
Cell-string EL (Electroluminescence) inspection



Pre-lamination EL inspection



Post-lamination EL inspection

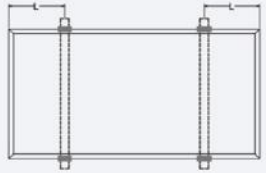


Pre-packaging EL inspection

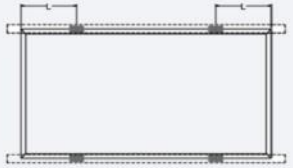
All modules on the Yingli Solar production line are fully inspected.
During the inspection process, there are at least 4 EL tests, including cell-string EL inspection, pre-lamination EL inspection, post-lamination EL inspection, and pre-packaging EL inspection.
Yingli quality inspection process ensures no cracked or defective module leaves the factory.

Support Flexible Clamping Zones

108 cell module		
type	Position L/mm	Max mechanical load
Long frame type-1	330～450	Front 5400Pa back 2400Pa
Long frame type-2	330～450	Front 2400Pa back 2400Pa
	0～200	Front 1600Pa back 1600Pa
Short frame type	0～200	Front 1600Pa back 1600Pa



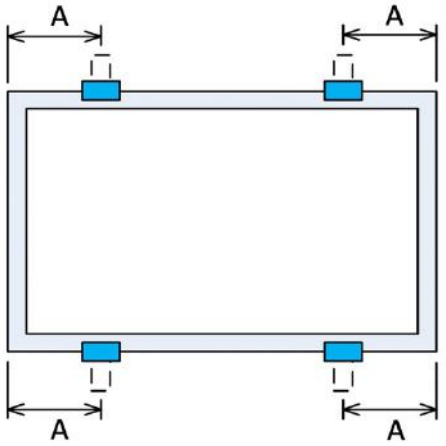
Long Frame Side Clamp Installation -1
(Clamp Length≥40mm)

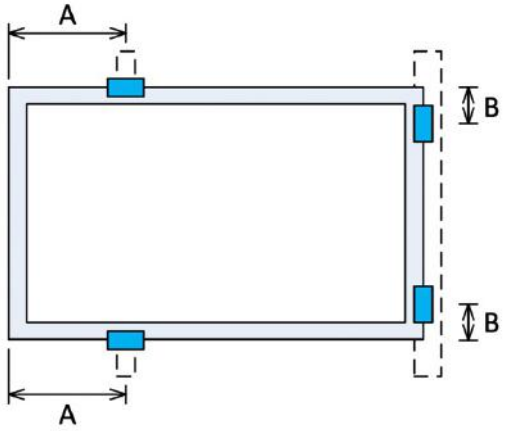


Long Frame Side Clamp Installation -2
(Clamp length≥40mm)

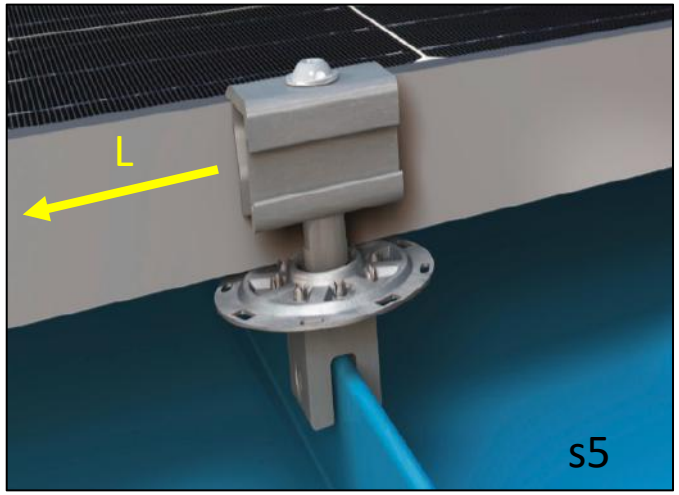
Short Frame side clamp Installation -1
(Clamp length≥40mm)

Alternative clamping zones



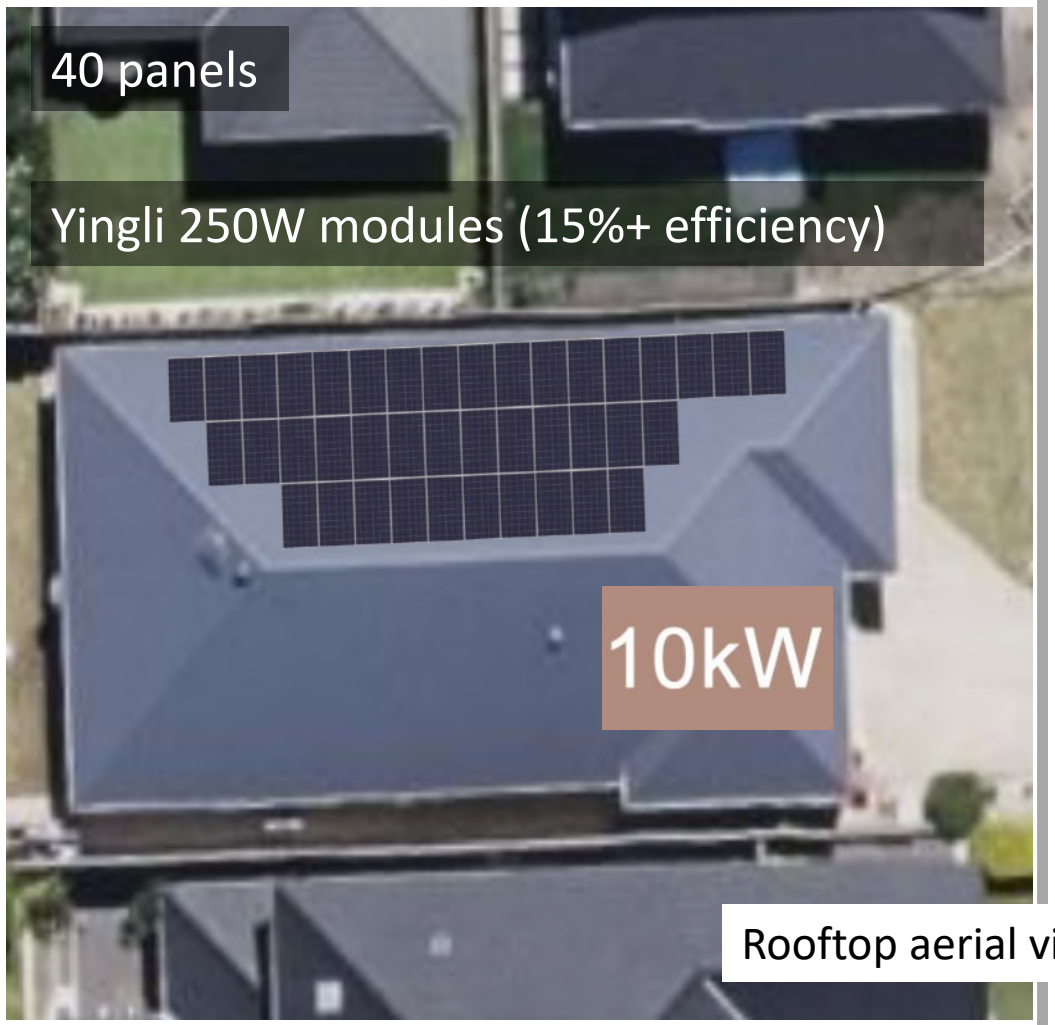


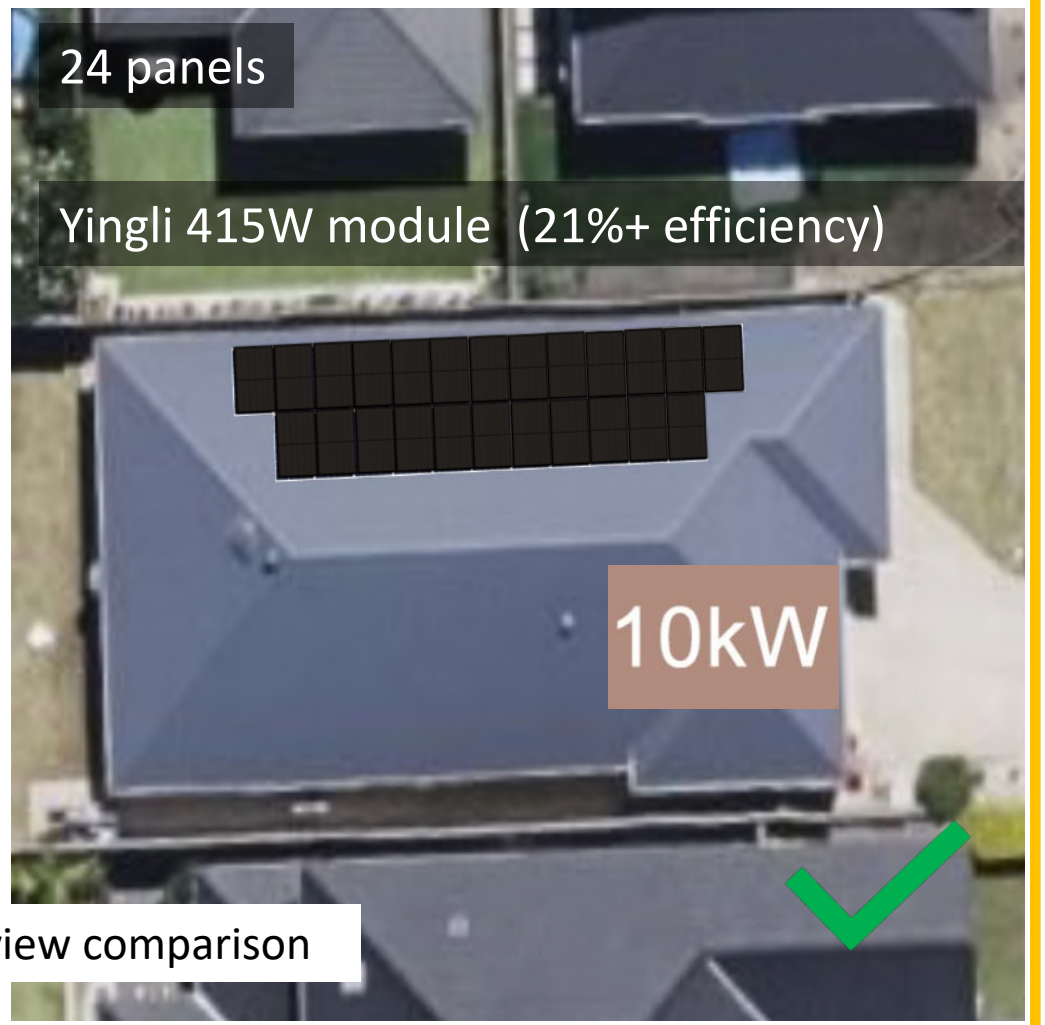
For installations under specific conditions, Yingli Solar may carry out mechanical load tests in the laboratory and provide guidance for actual installations.



Yingli Driving New Rooftop Efficiency

2014 → **2022**





Rooftop aerial view comparison

Improvements in technology
- ✓ Higher panel efficiency
- ✓ Reduced BOS. (e.g. rail, cabling) .
- ✓ Increased yield (kWh).
- ✓ Enhanced aesthetics.
- ✓ Utilise optimal roof face.

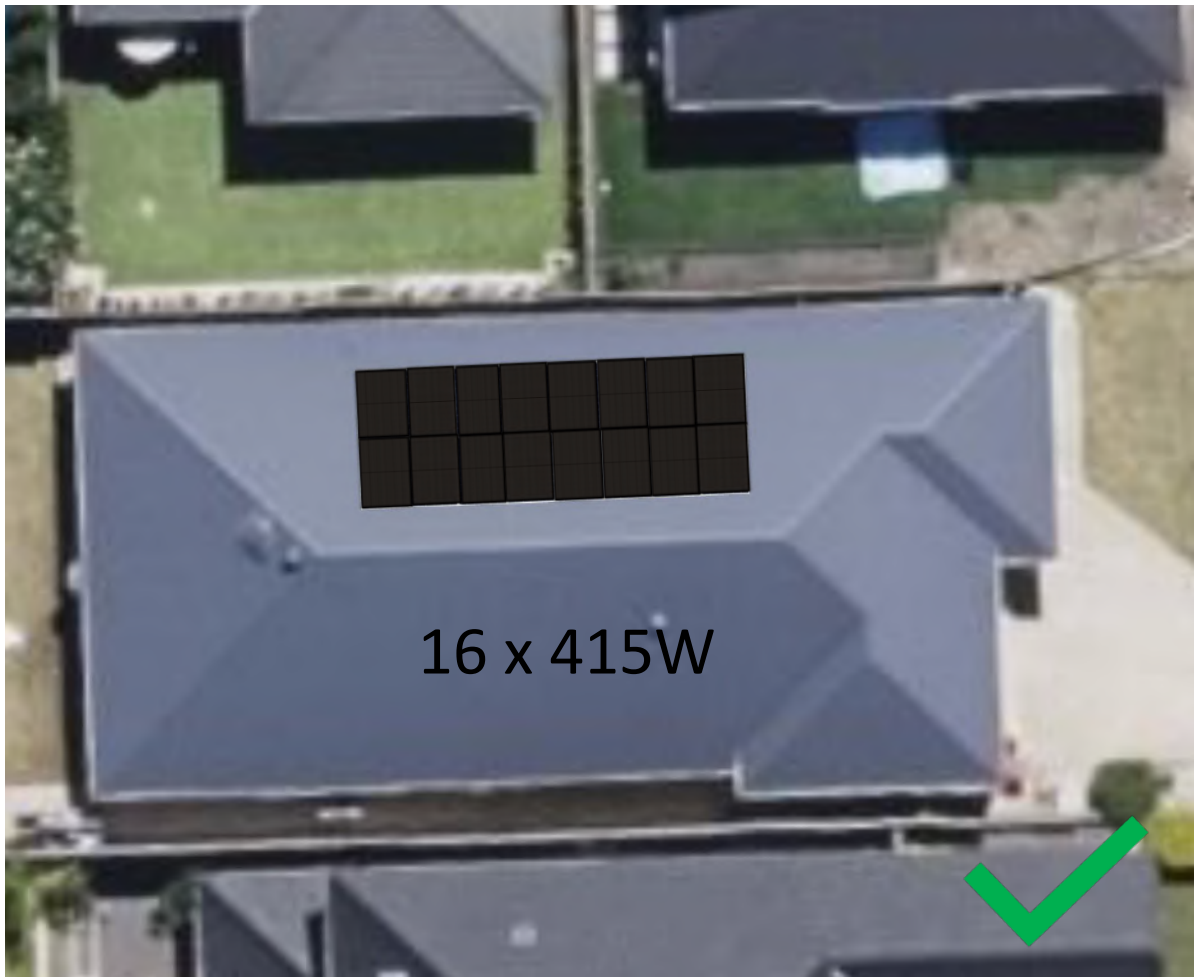
Efficient installation
- ✓ Increased speed.
- ✓ Reduced labour and handling costs.
- ✓ Increased Safety.

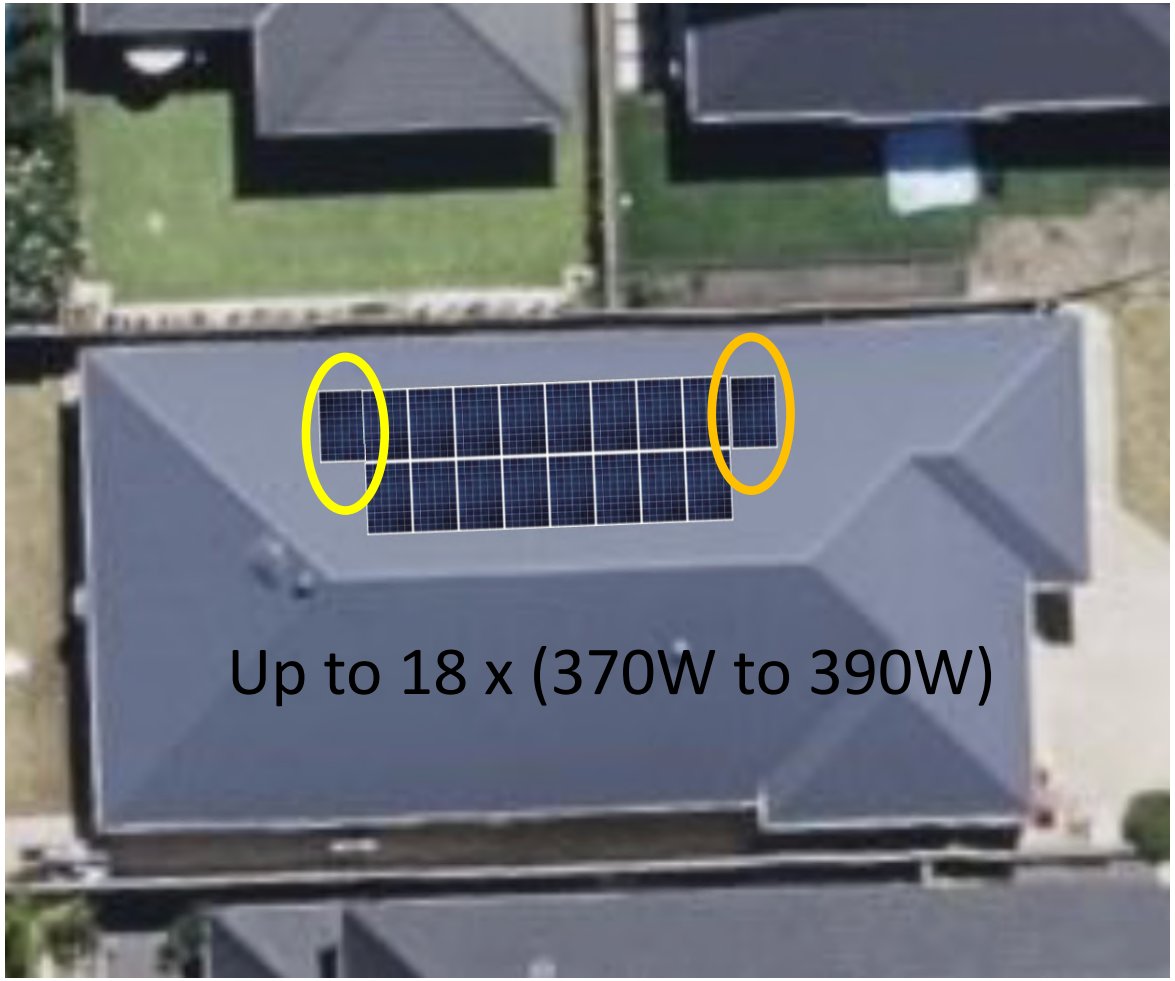
Structural / safety zones
- ✓ Workspace increased.
- ✓ Reduced roof load.
- ✓ Less roof penetration.

Less material waste
- ✓ Increase power density.
- ✓ Reduced packaging.
- ✓ Increased Watts per pallet.

Less logistics costs
- ✓ Reduced fuel.
- ✓ Reduced handling
- ✓ Reduced packaging.
- ✓ Increased safety.

Others 370W To 390W System Requires Up To 2 More Panels To Reach 6.6kW





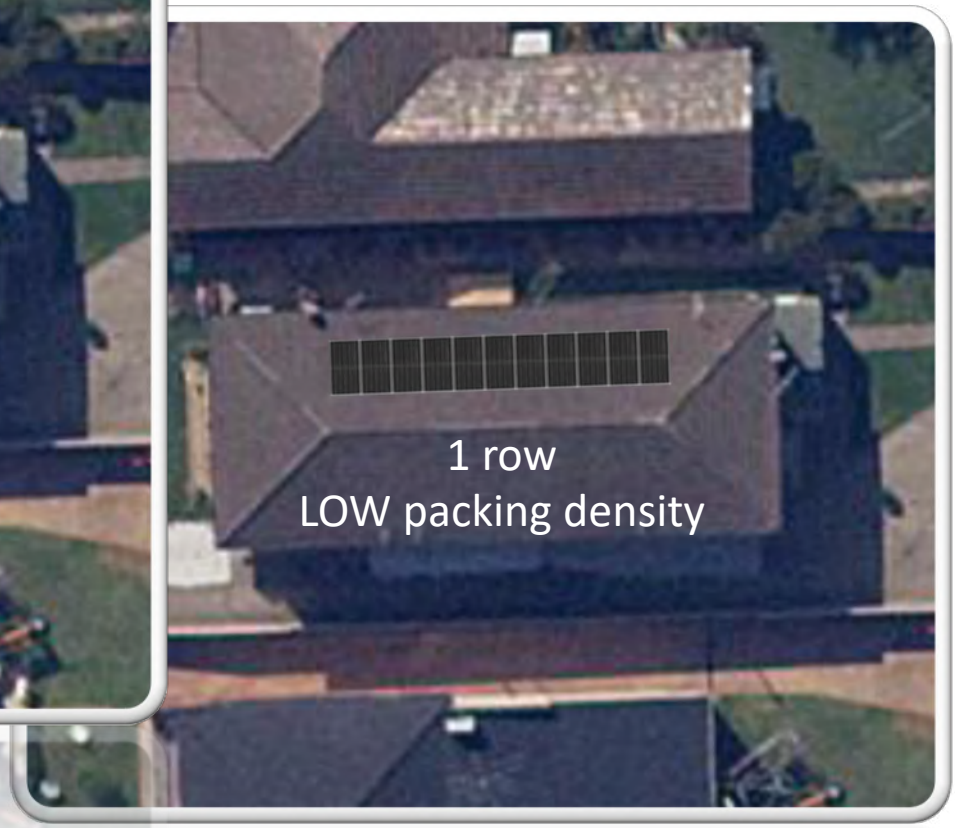
Rooftop aerial view comparison

415W 108 Cell
Better Managed Exclusion Zones And Improved Packing Density

415W (1722 mm) x 20 = 8.3kW

390W (1754 - 1855mm) x 20 = 7.8kW
Other manufacturers system

390W (1754 - 1855 mm) x 11 = 4.29kW
Other manufacturers system



Rooftop aerial view comparison

Case Studies

108 Cell Residential Installation (Queensland Australia)

Photo and installation by
Buzz Energy

White backsheet, black frame model shown here.

Example PV Installation Featuring Yingli Solar Panels In Australia And Around The World

Client: IKEA
Output: 1MW Yingli Solar,
Location/ year: Sydney, Australia, 2014

Client : Balance Group
Output: 5.8MW Yingli Solar,
Location/ year: Mobilong, South Australia, 2019

Client: Harvard University
Output: 592kW
Location/ year: Cambridge, Massachusetts, USA, 2012

One Of New Zealand's Largest Solar Systems, Yingli (N-Type Top Con Bifacial)

Client: Kea Energy
Output: 1.5MW Yingli Bifacial
Location/ year: Marlborough, New Zealand, 2021
***Panels purchase with Bitcoin.**

Example PV Installation Featuring Yingli Solar Panels In Australia And Around The World

Client : Balance Group
Output: : 13.3MW
Location/ year : Gullen, NSW Australia, 2014
ARENA Federal government funded (1st Australian solar system to use 1500V panels)

Client: Xiong'an railway station (high speed rail)
Output: 6MW
Location/year: Beijing-Xiong'an intercity railway, 2020
The largest railway station in Asia

Client: SANTOS
Location/ year: Eromanga, QLD Australia, 2019
Output: 267kW, 5B Portable ground mount

Example PV Installation Featuring Yingli Solar Panels In Australia And Around The World

Client: JAGUAR Engine Manufacturing Centre
Output: 5.8MW
Location/ year: U.K, 2014

Client: Power and Water / John Holland
Output: 8.8 MW
Location/ year: Northern Territory, Australia, 2016
ARENA Federal and state government funded project
Remote Aboriginal communities (SETuP program)

Thank You

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