



LG Solar & Energy Solutions



The 5 business units of LG Australia



Home Entertainment



Mobile Communication



Information System Products



Home Appliances



Energy Solutions - Solar, Air Conditioning & Lighting



Our journey into solar



- 1985** Conduct 1st solar cell Multi-Crystalline R&D
- 1998** LG Industrial Systems sets up PV traffic signals
- 2005** Launched silicon thin film and crystalline solar R&D
- 2007** LG Solar energy operates its first 14MW solar farm
- 2008** Solar panel manufacturing approved
- 2009** Solar Test Lab certified by TÜV and UL
- Jan 2010** LG solar panel mass production begins

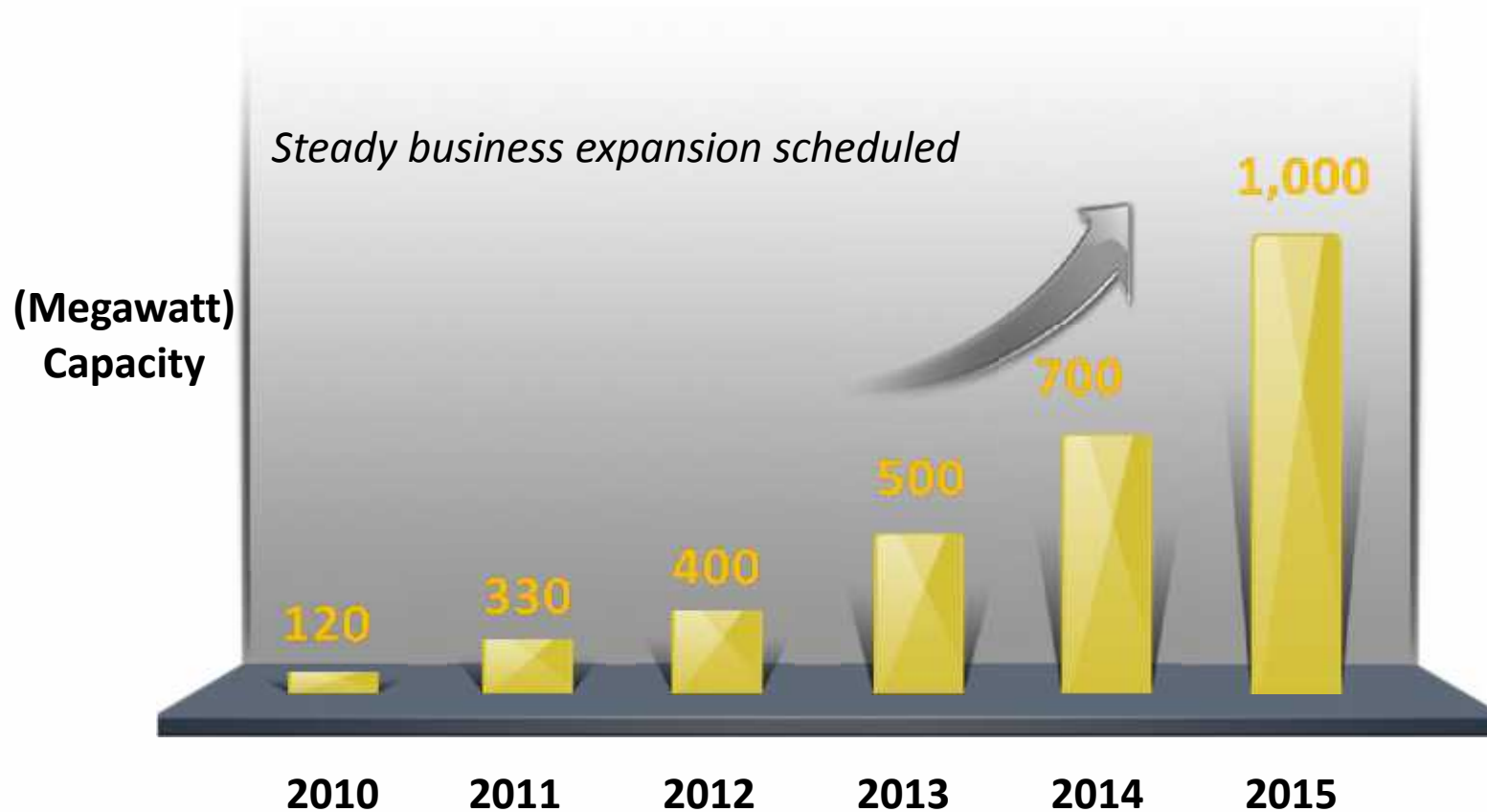


LG solar module factory in Gumi, Korea

Our growing capacity



LG plans to be a large capacity solar module manufacturer within the next few years



Key success factors for solar



Technology Leadership

Quality Assurance / Reliability

Strong Brand and Marketing

Manufacturing Excellence

CAPEX / Balance Sheet (Bankability)

Value Chain Integration

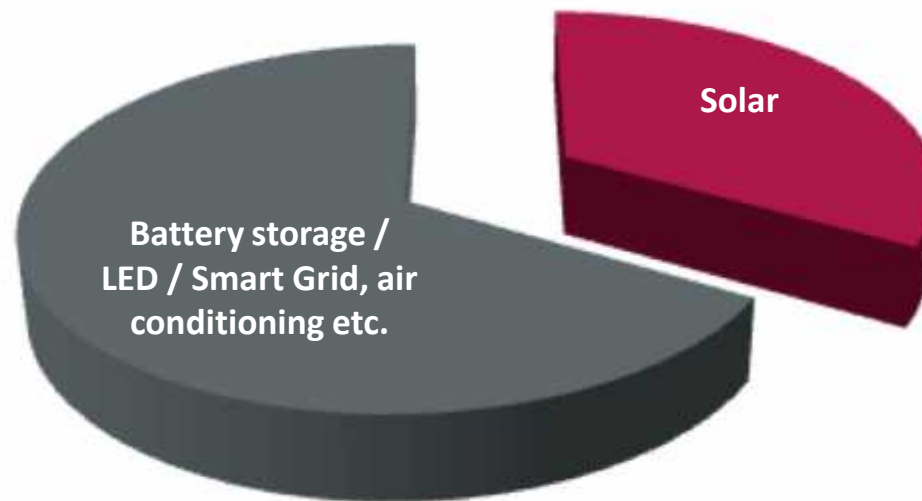


Synergies with other product groups



Energy Solutions is the way to the future. Other LG energy businesses create synergies with **Solar**

Solar is a strategic growth engine for LG



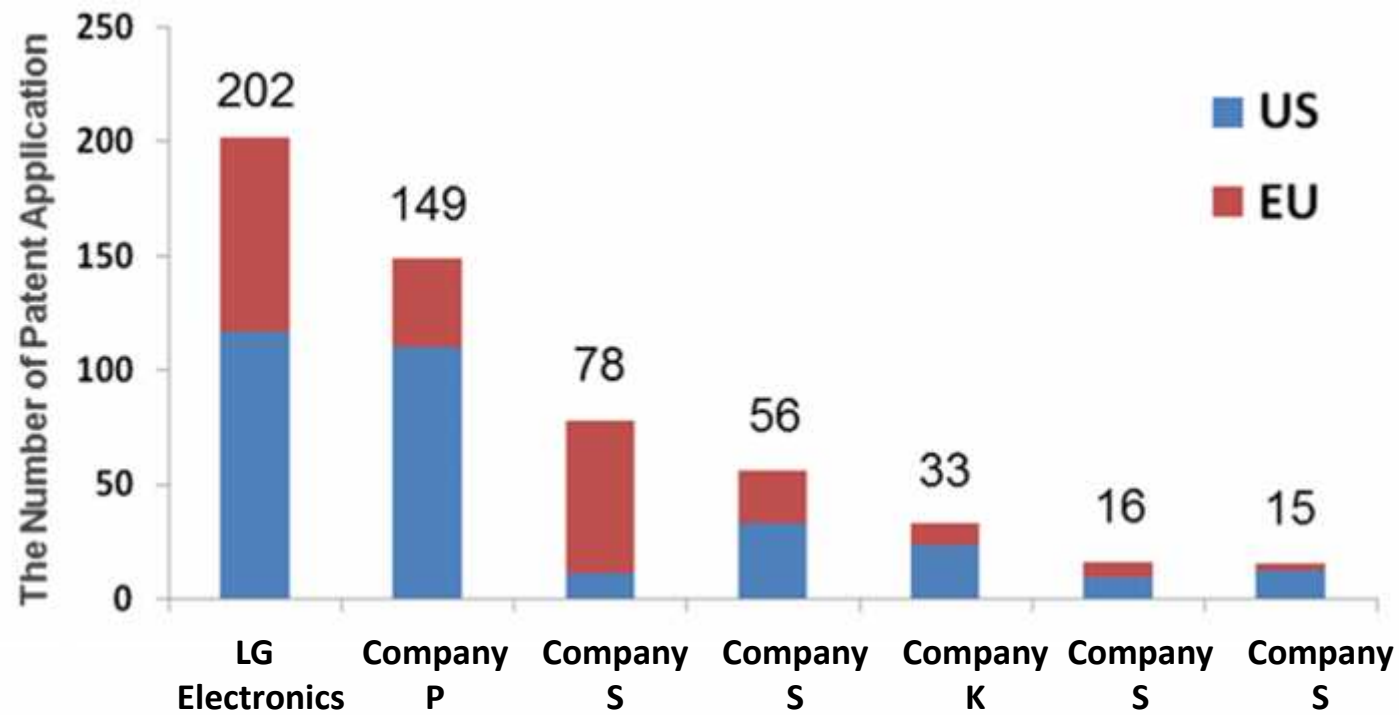
Our \$ 20 billion investment and research pipeline

LG's Own Technology



Technology leader group in the industry

Since 2009 LG has filed a total of 202 patents* in solar-related areas.



* As per July 2013

Our know-how flows towards solar



Technology Leadership

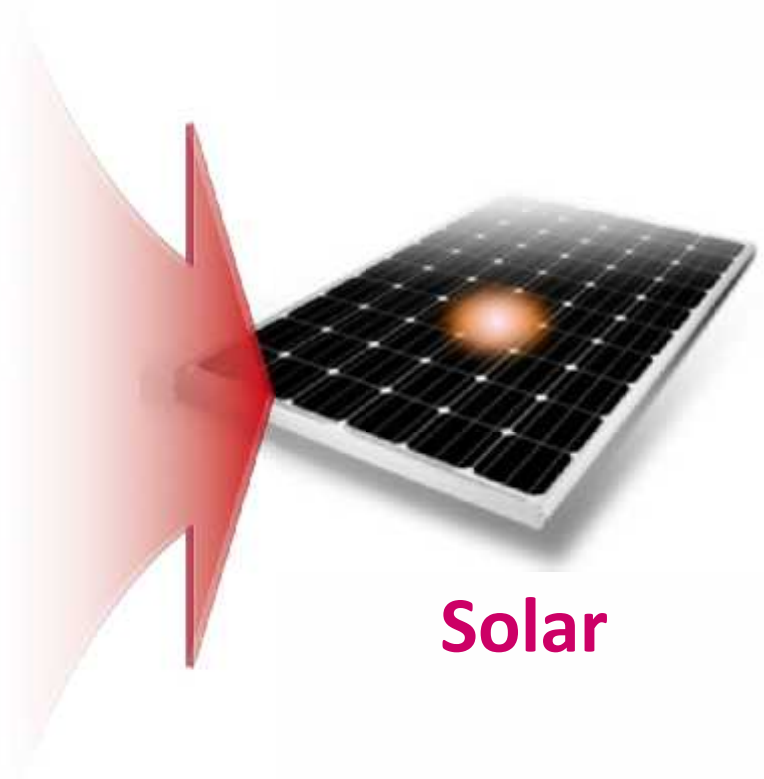
Chemical,
Material Engineering,
Energy Storage



Display Technology
(LCD, OLED, Plasma)



Energy Management,
Smart Grid



Product Range



Mono-X



Mono-X Black



Mono-X NeoN

Models

275W

300W

Why you should choose LG modules



1. Well known consumer electronics brand

2. More than 17 years in solar R &D

3. Vertically integrated production

4. Made in Korea

5. Customer Care Call Centre in Australia open 7 days, 7am to 7pm

6. High quality standards for all input materials and processes

7. Advanced technology eg. dual NeON wafers

8. Well trained dealer network

9. Range of modules/panel styles

10. Aesthetic piano black frame design



Why you should choose LG modules



11. Ultra stable, screwed frame

12. Heavy Static Load Test with 550 kg/m²

13. Ammonia resistance certification

14. Salt mist corrosion certification IEC 61701

15. Passed high stress PID test

16. All modules EL tested for micro cracks by the factory

17. LG product test center certified by TÜV and UL (1st in the world)

18. 0%/+3% positive tolerance with nominal power sorting

19. Mountable on all 4 sides with easy install guide on frame

20. Designed for easy water drainage from frame



Why you should choose LG modules



21. Excellent output performance

22. Lightweight – but strong (17.3 kg)

23. High durability in adverse weather conditions

24. Light absorbent glass for higher efficiency

25. Transferable warranty

26. 10 year manufacturer's warranty on modules

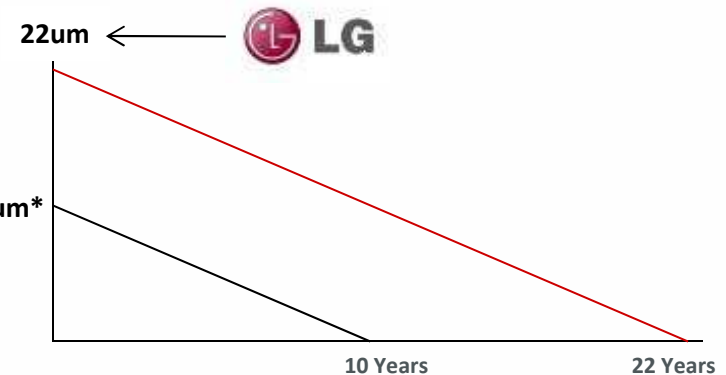
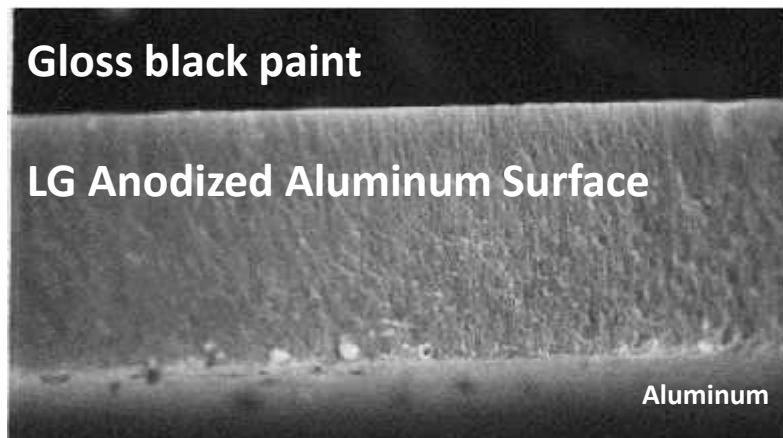
27. 25 year linear output warranty

28. Warranty held in Australia by LG electronics Australia



1. Module advantages -framing

All frames of the Mono X™ are anodised to lengthen the lifecycle of the modules by forming thick and dense oxide(SiO₂) that can help protect the modules from electrochemically detrimental factors.

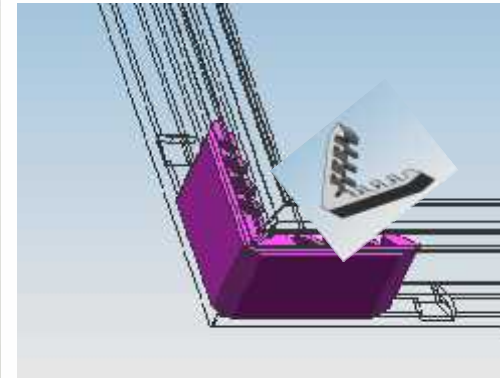


*Average Coating Thickness of competitor module's frames

Reduction rate of coating thickness approx. 1um per year due to weathering

2. Module advantages - framing

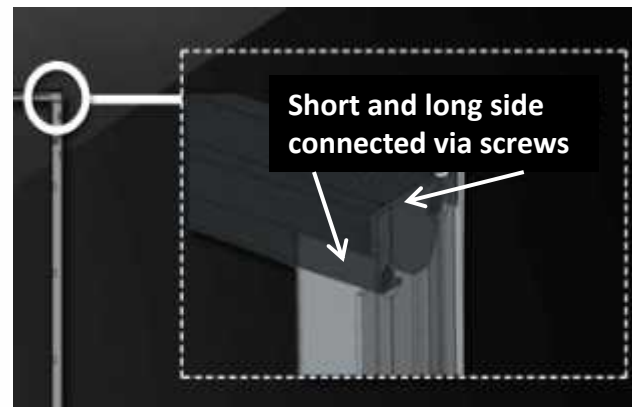
LG modules have a lower risk of physical twisting, by external forces, because corner screws are used in the frames. Many competitor's modules use a corner-key (without screws) that leaves them more prone to future distortion from external forces.



Conventional Corner Key Type



LG Screw Type Frame



Frame profile

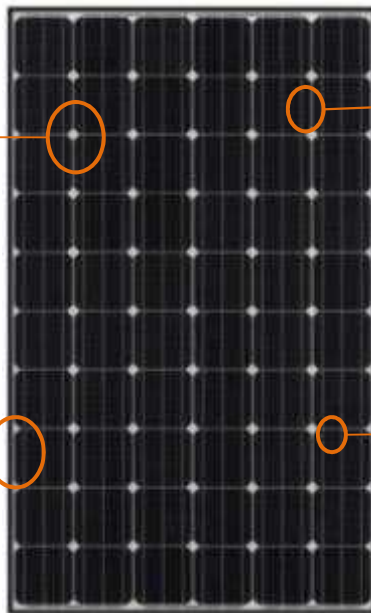
3. Module advantages - precise standards



The manufacturing process of the Mono X™ Module range is tightly managed in regards to μm & mm level tolerances. Every module coming from the production line follows very precise product specifications.



Busbar contact consistency



Overall soldering consistency and quality check



Matrix alignment check



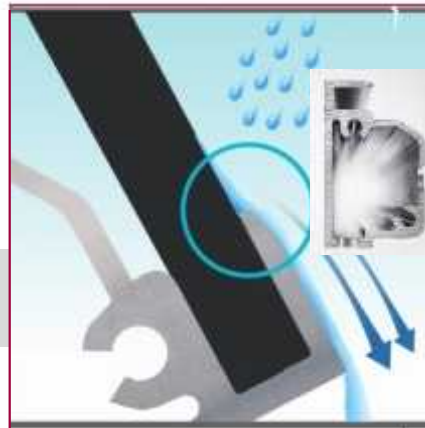
Inter ribbon alignment spot on

4. Module advantages – rain run off

LG modules have a drainage design to minimise micro particle deposits. These deposits can interfere with the performance of a module as they leave remnants on the surface. Over time, these micro particles accumulate more and more and can negatively affect the power output.



12 drain holes on rear



Sliding design for easy run off



Capillary drain on front

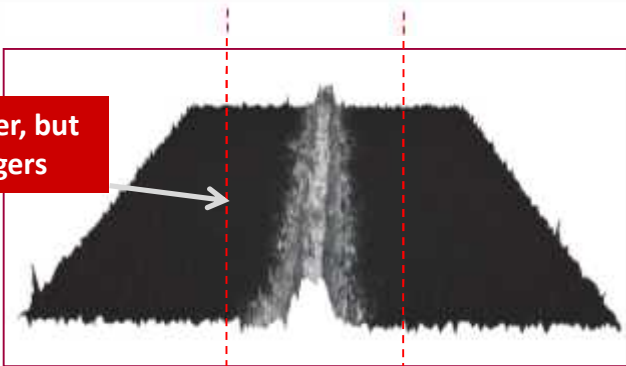
5. Module advantages - soldering



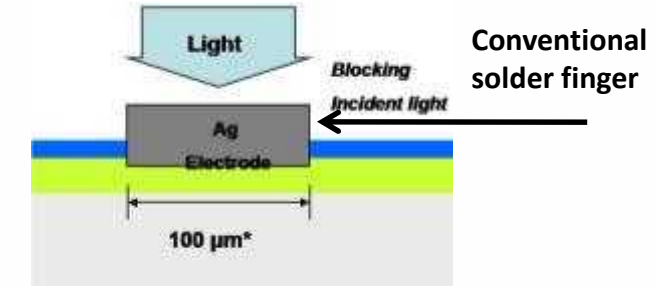
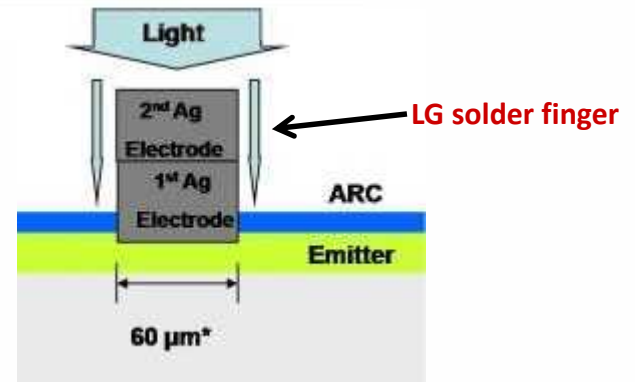
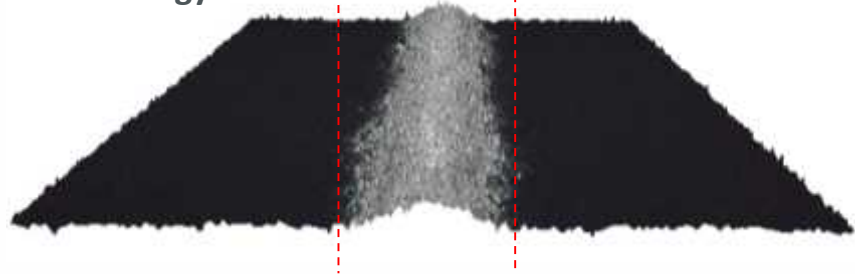
LG uses our Plasma Display Panel double printing technology to create very narrow, but deeper soldered finger contacts. This technique increases the light absorbing area, reduces electrode resistance and maximises current. This innovation increases module output by approximately 3 Watt.

LG's Technology

Resulting in narrower, but deeper solder fingers



Conventional Technology



6. Module advantages - manufacturing



LG's Solar Cells are produced under a "Class 100" production environment, a close to "dust-free" environment and is comparable to the production line for semi-conductors. This is far above solar industry standards and ensures fine production particles do not find their way into the modules.

Semiconductor-level manufacturing environment

Ambient Air	35,000,000	Particle level
LG Module Production	10,000	Particle level
LG Cell Production	100	Particle level

1ft

Dust

LG Cell Production



Cell Chipping



Cell Debris



Lead Debris

Particle waste created during module production

7. Module advantages - EL testing

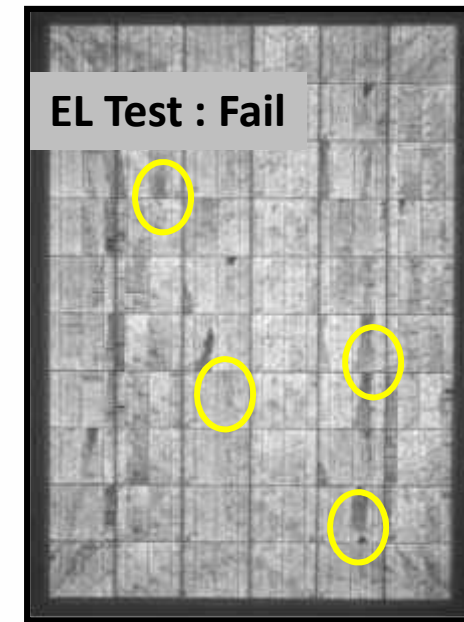
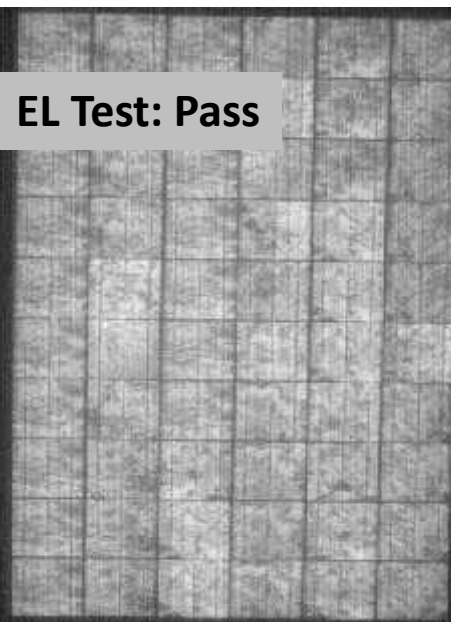


All LG modules undergo EL inspections to detect any micro cracks prior to shipment. The EL tests is a type of x-ray screening of the module and allows LG quality control staff to identify “invisible” cracks that are difficult to detect via the naked eye. Only products without micro cracks are sold.

Conventional X-Ray



EL Test



8. Module advantages - positive tolerance

The nominal power of all LG modules is sorted according to the flash results. All modules are delivered with a higher power than indicated on the nameplate, because our LG's plus 3% tolerance delivers up to 7.5W more power than the stated nominal power. All electric measurements for the modules are based upon the Standard of the German Fraunhofer Institute.

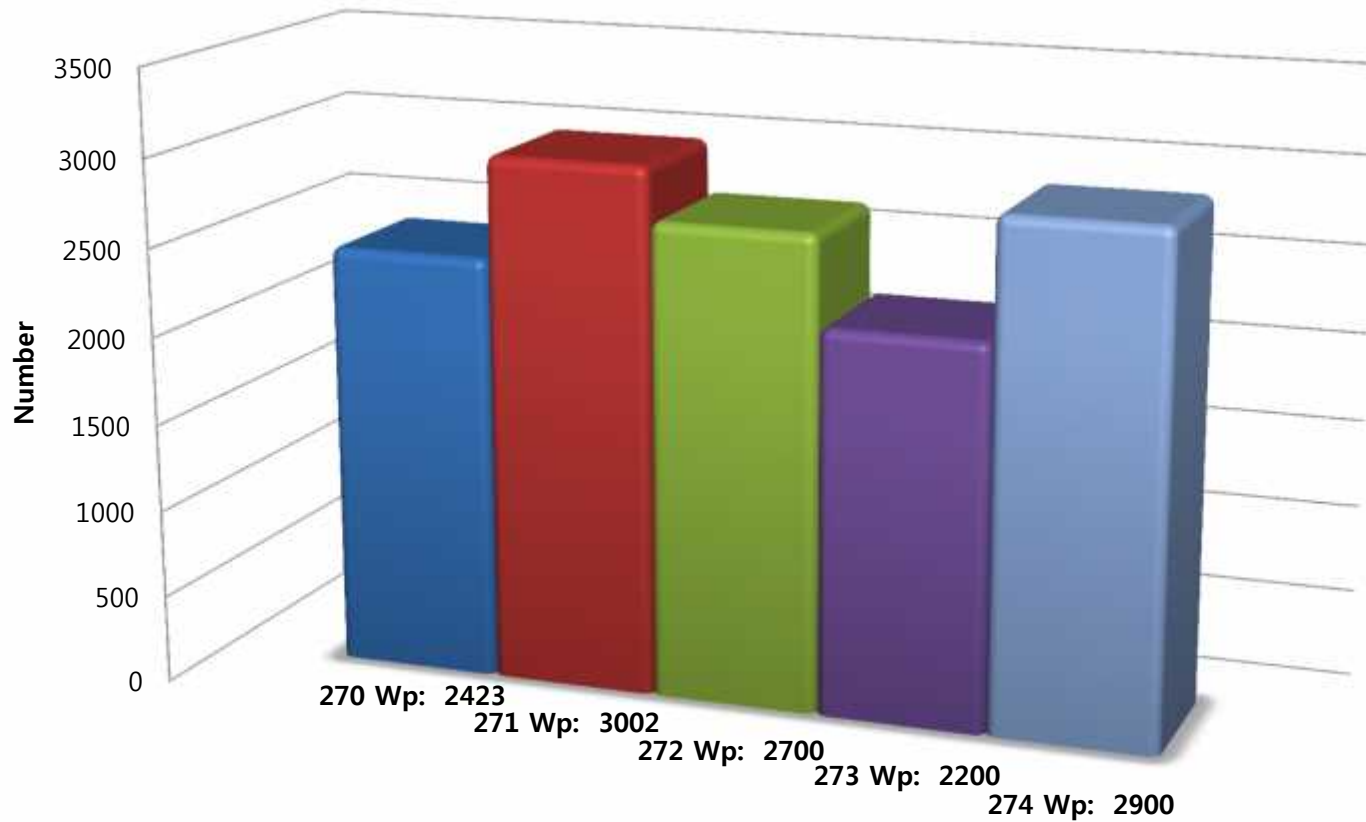
Typical LG pallet sample



Container No	Model	Serial number	PMAX
MSKU9828970	LG270S1C-B3	K21128222345	273.685
MSKU9828970	LG270S1C-B3	K21128222348	274.524
MSKU9828970	LG270S1C-B3	K21128222350	273.452
MSKU9828970	LG270S1C-B3	K21128222353	274.588
MSKU9828970	LG270S1C-B3	K21128222357	275.777
MSKU9828970	LG270S1C-B3	K21128222359	272.211
MSKU9828970	LG270S1C-B3	K21128222360	273.997
MSKU9828970	LG270S1C-B3	K21128222366	273.653
MSKU9828970	LG270S1C-B3	K21128222372	274.774
MSKU9828970	LG270S1C-B3	K21128222386	274.851

9. Module advantages - positive tolerance

Distribution of Flash Data for LG260S1C
 n = 13,000 Modules $\emptyset = 272,5$ Wp



10. Module advantages in detail



In order to ensure our modules last at least 25 years, LG Solar conducts “Accelerated Lifecycle Tests”. Aggressive test conditions include extreme rates of environmental change including temperature, humidity and salinity. LG’s internal reliability tests are twice as harsh (eg 400 cycle, 2000hours) than the industry standard, to make sure we manufacture high quality durable modules.

Reliability Test	IEC 61215	LG
Thermal Cycling Test	-40 °C ~ 85 °C, 200 cycles	-40 °C ~ 90 °C , 200 cycles Pmax degradation check EL inspection after TC checking for microcrack in module
Damp Heat Test	85 °C / 85%, 1,000 hrs	85 °C / 85%, 2,000 hrs Pmax degradation check
Salty Water Spray Test	No	Yes
Combi Test	No	Mechanical Load Test, Thermal Cycle Test, Damp Heat Test

11. Module advantages in detail



LG solar conducts outdoor module testing through internationally recognised testing organisations such as ATLAS (USA), in 25 different locations representing a wide range of climates. Sample modules are tested outdoor for at least a year. Our modules have gained the highest recognition from ATLAS for their durability in challenging outdoor environments.



Phönix, Arizona



Miami, Florida



Arizona dessert

12. Many Additional Tests



LG through its TUV and UL certified testing laboratory undertakes a wide range of tests to ensure our modules stand the test of time.



Hail Impact Test



Brine Spray Test



Outdoors Field Test



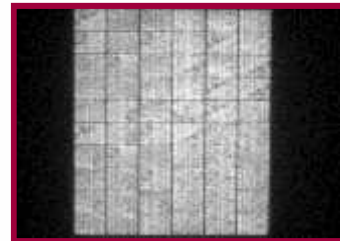
Backing Sheet Stress Test



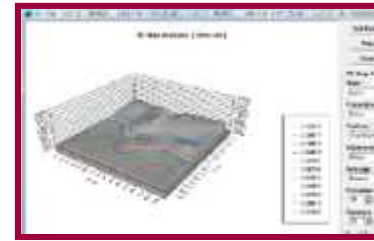
UV Exposure Test



Mechanical Load Test 1



Micro Crack Test



Wafer Resistance Test



**Thermal Cycle /
Damp Heat Test**



Impact Test



Wafer Impurity Test

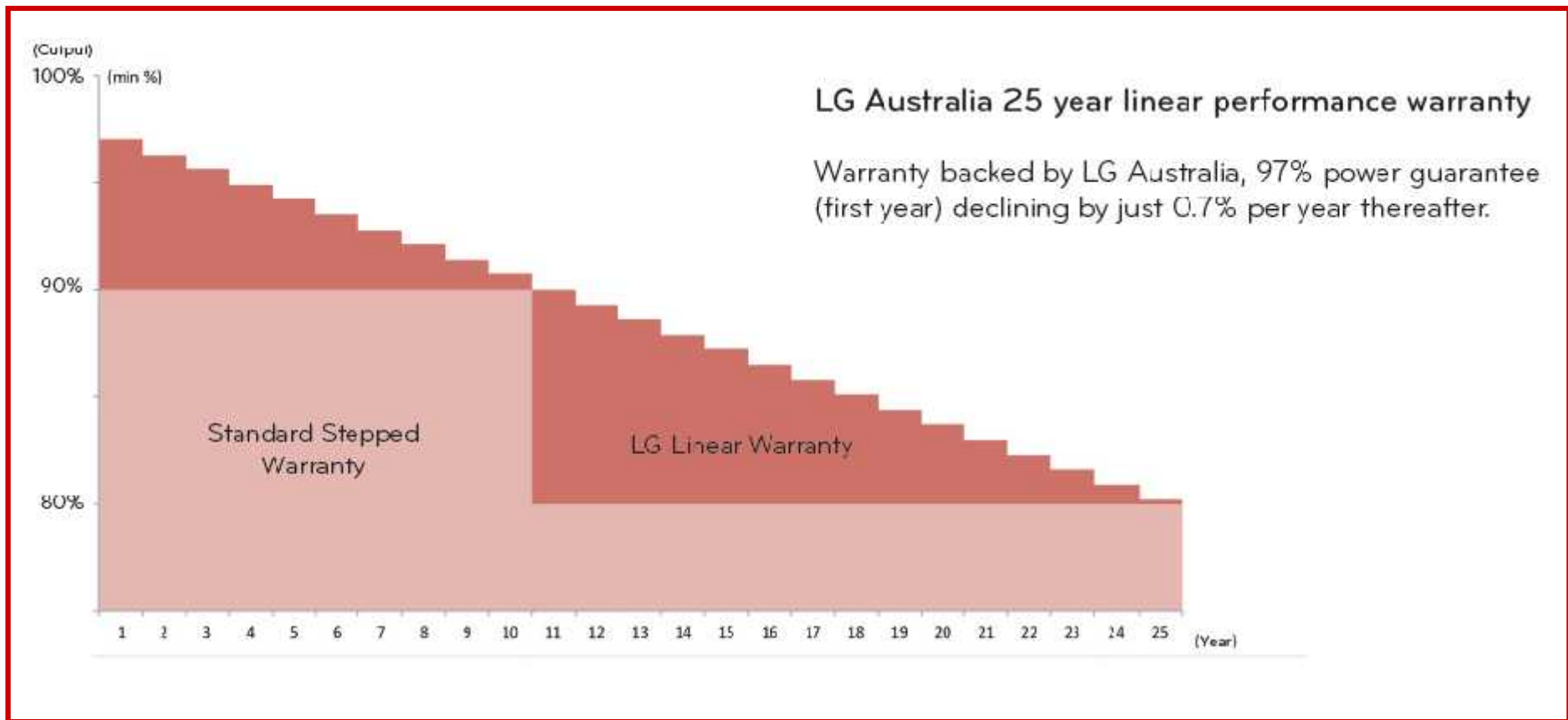


Mechanical Load Test 2

13. Module advantages – linear warranty



Our linear performance warranty is top class and superior to many competitors



14. Local warranty & local advice



Should there ever be the need for a warranty claim, LG Australia is handling all claims locally, as the LG warranty is held by LG Australia.

Our NSW based call centre will take down the details of any warranty claim 7 days a week and will forward the details to the solar unit. **Easy.**



Mono-X NeON – our latest release



- LG introduces a N-type solar module based on our technological leadership.
- NeON offers high efficiency and performance.
- Improved panel quality and less degradation means more power output for longer.
- Only 17.3 kg and 290W and 300W models.



3rd Generation Design

Reference sites



Townsville, Australia



Seoul, Korea



Tamworth airport,
Australia



Galaxy Mine, WA, Australia



San Martin, Malta



Obermeitingen, Germany



Solarfarm, Pajam, Malaysia



Capri, Italy

In summary, LG solar offers ...



 **High quality solar modules**



 **Reliable module supply**



 **World recognised Brand**



 **Product innovation**



 **Professional business ethics**





Thank you