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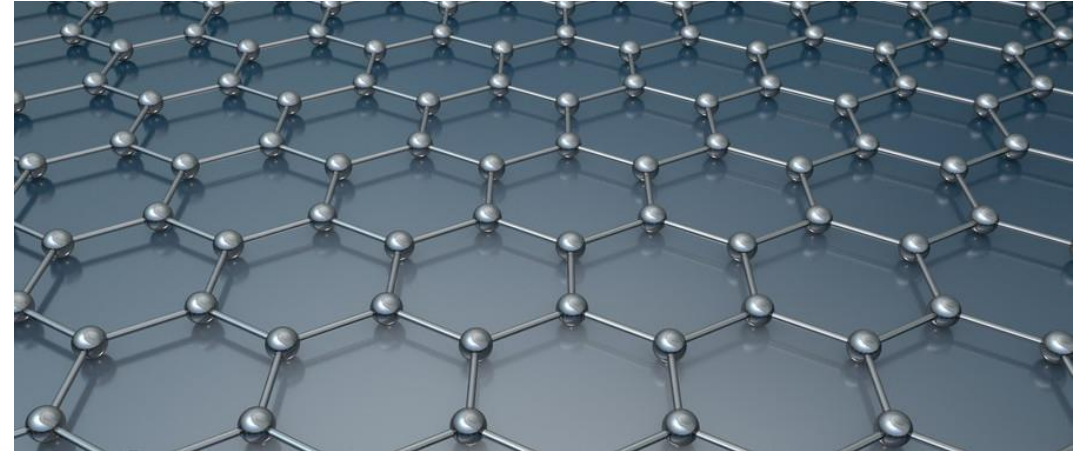


# Graphene technology application



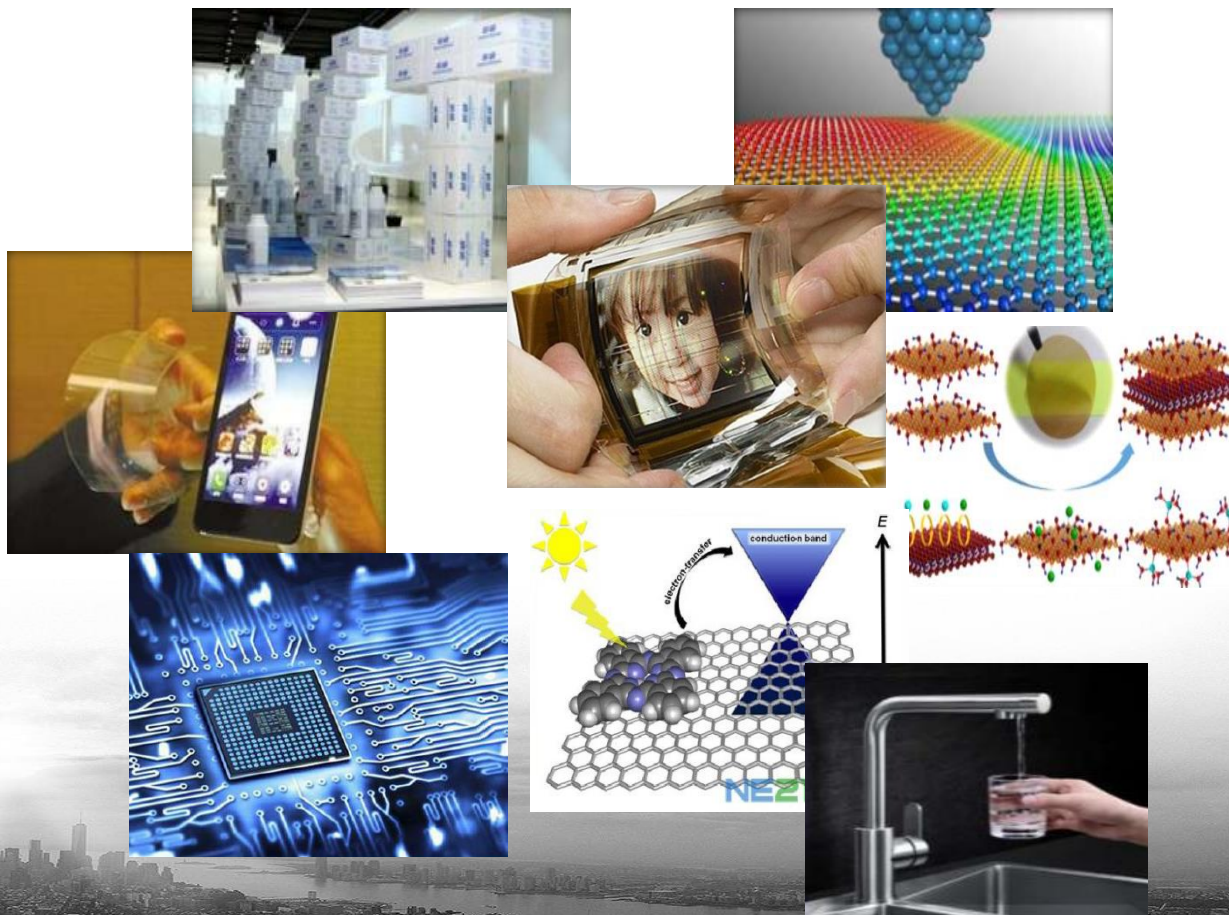
# Graphene technology application

Graphene material is known as the king of new materials. It is the world's thinnest, lightest, most flexible, strongest, and most conductive nano-material. It is recognized as a revolutionary and subversive new material in the 21st century.

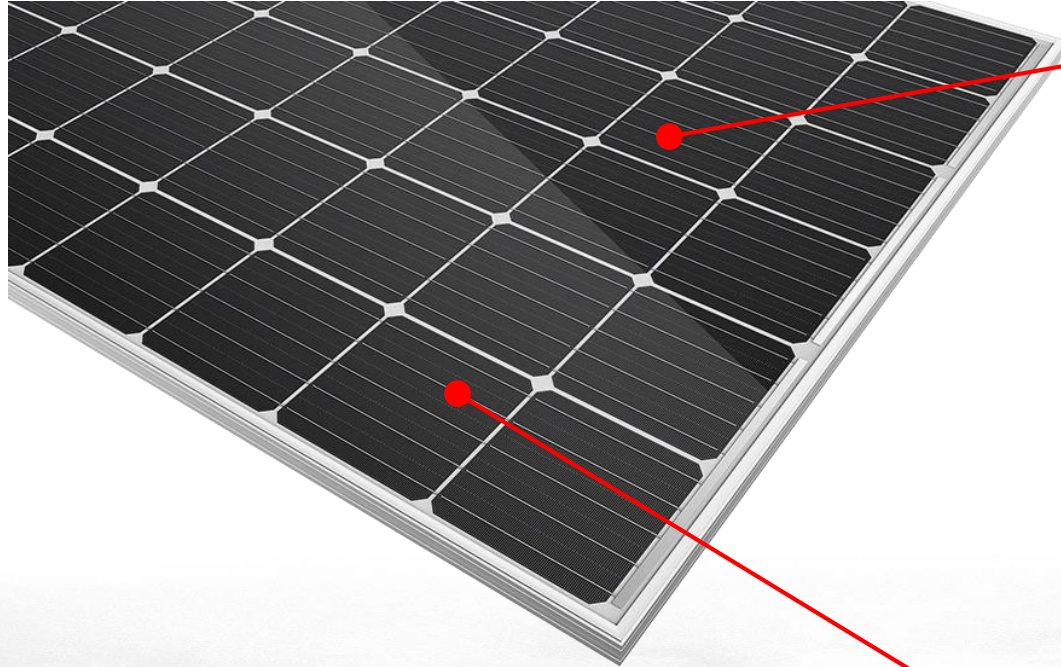


# Graphene material application:

- Filter film market in various fields
- Next generation supercomputer because of its good electrical conductivity
- Cable for making "space elevator"
- Computer, TV, mobile phone display screen
- New generation solar cell
- Photon sensor
- Medical disinfection and food packaging
- New super-strong materials and plastic composites---new plastics
- Transparent touch screen, light transmissive board
- High-performance integrated circuits and new nanoelectronic devices
- Ultra-thin and ultra-light aircraft materials



# Technology introduction of graphene coating solar modules



## Graphene coating glass

- Technical principle: The use of graphene coating layer to enhance penetration, self-cleaning, and photocatalyst to increase solar module power and then increase the power generation capacity.
- I generation products: single sided graphene coating technology
- II generation products: double sided graphene coating technology(under developing)

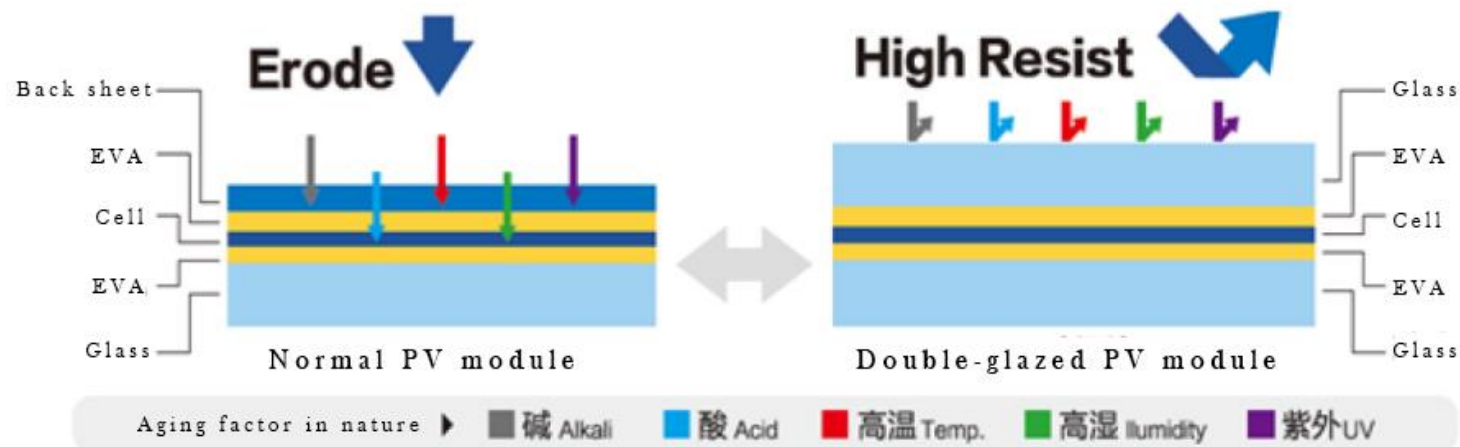
## Graphene solar cell with high efficiency(under developing)

- Technical principle: Improve the photoelectric conversion efficiency of solar cells by using the excellent thermal conductivity of graphene and the excellent transmittance of light.

# Technical Advantages



# Why long life span?



Environment



Radiation(UV)



Acid,alkali,salt and water vapour



Sand and wind

Regular Back Sheet:  
Organic composite



Back sheet aging



Acid,alkali,salt and water vapour will go through the back sheet and then solar cells will be corroded(permeable rate:1-3g/m<sup>2</sup>/day)



Can be gradually damaged by sand and wind

Double glass  
(Tempered glass)



No aging



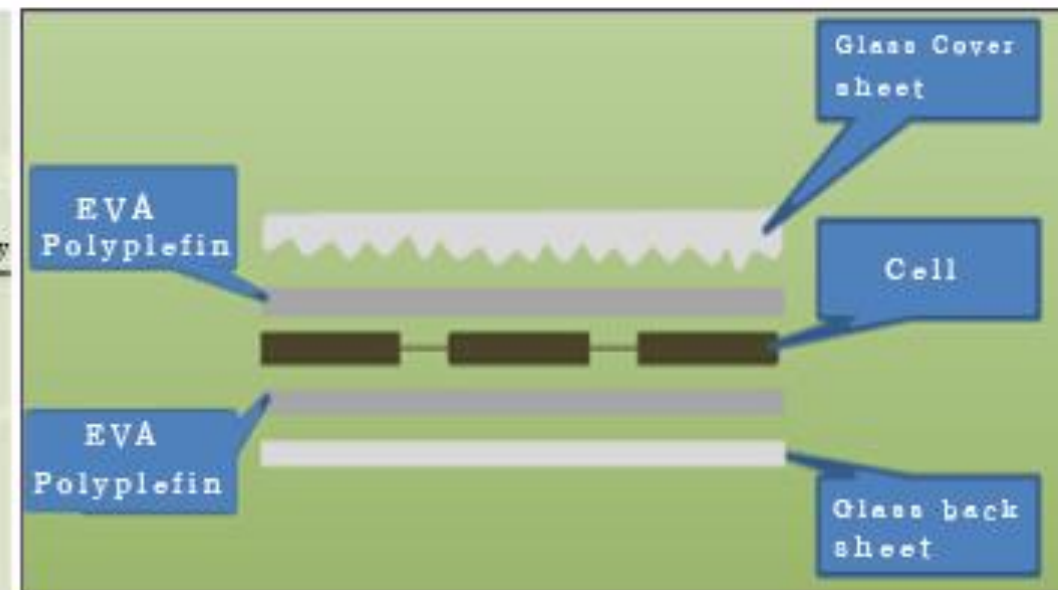
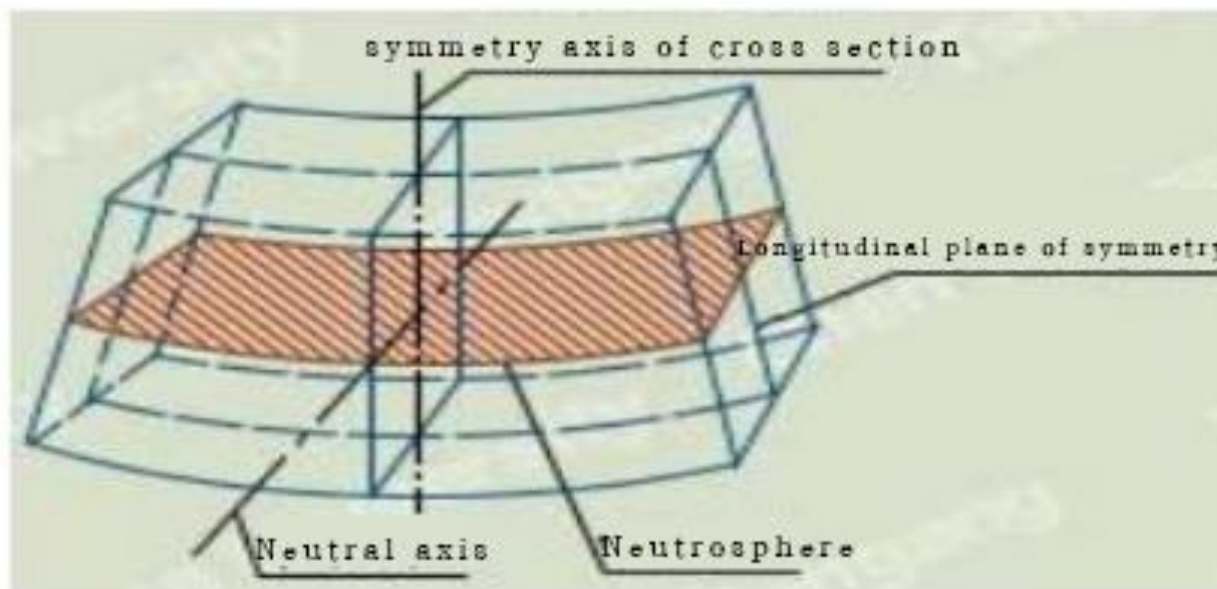
Glass won't be easily corroded by acid,alkali,salt and water vapour (permeable rate:0)



Not easy to be damaged by sand and wind

# Why long life span?

Symmetric “sandwich” structure offers better protection for cells

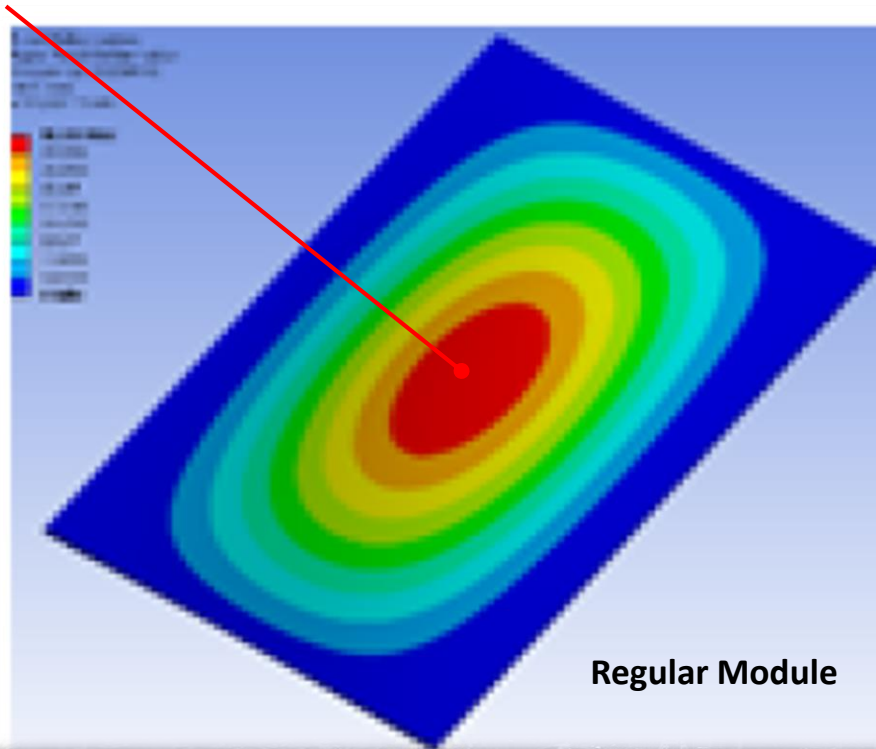




# Why long life span?

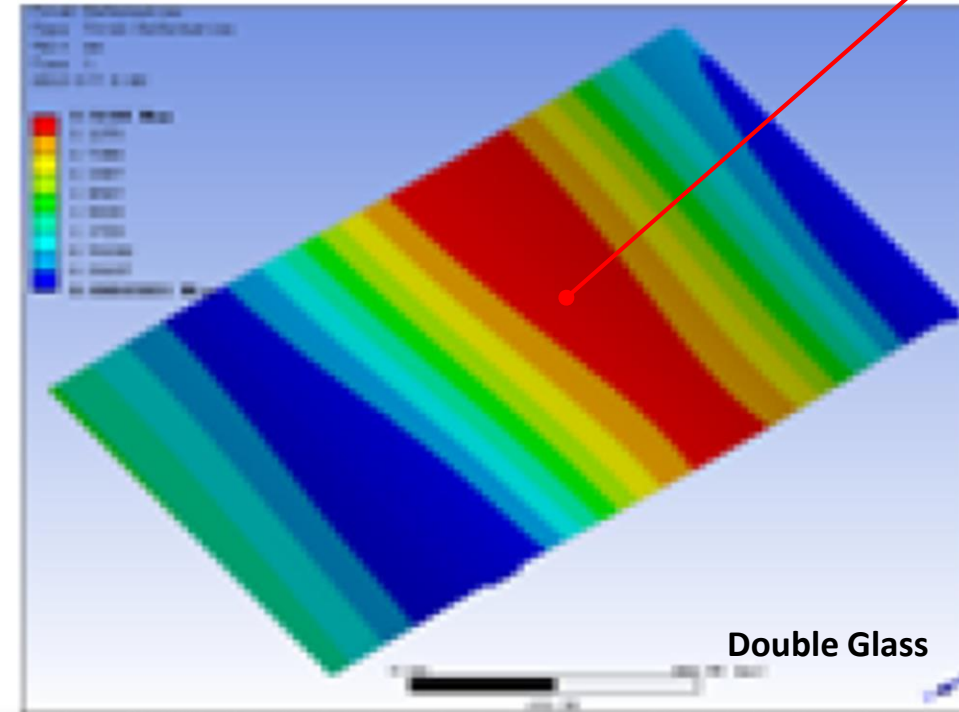
Symmetric “sandwich” structure offers better protection for cells

Max bend 31mm



Regular Module

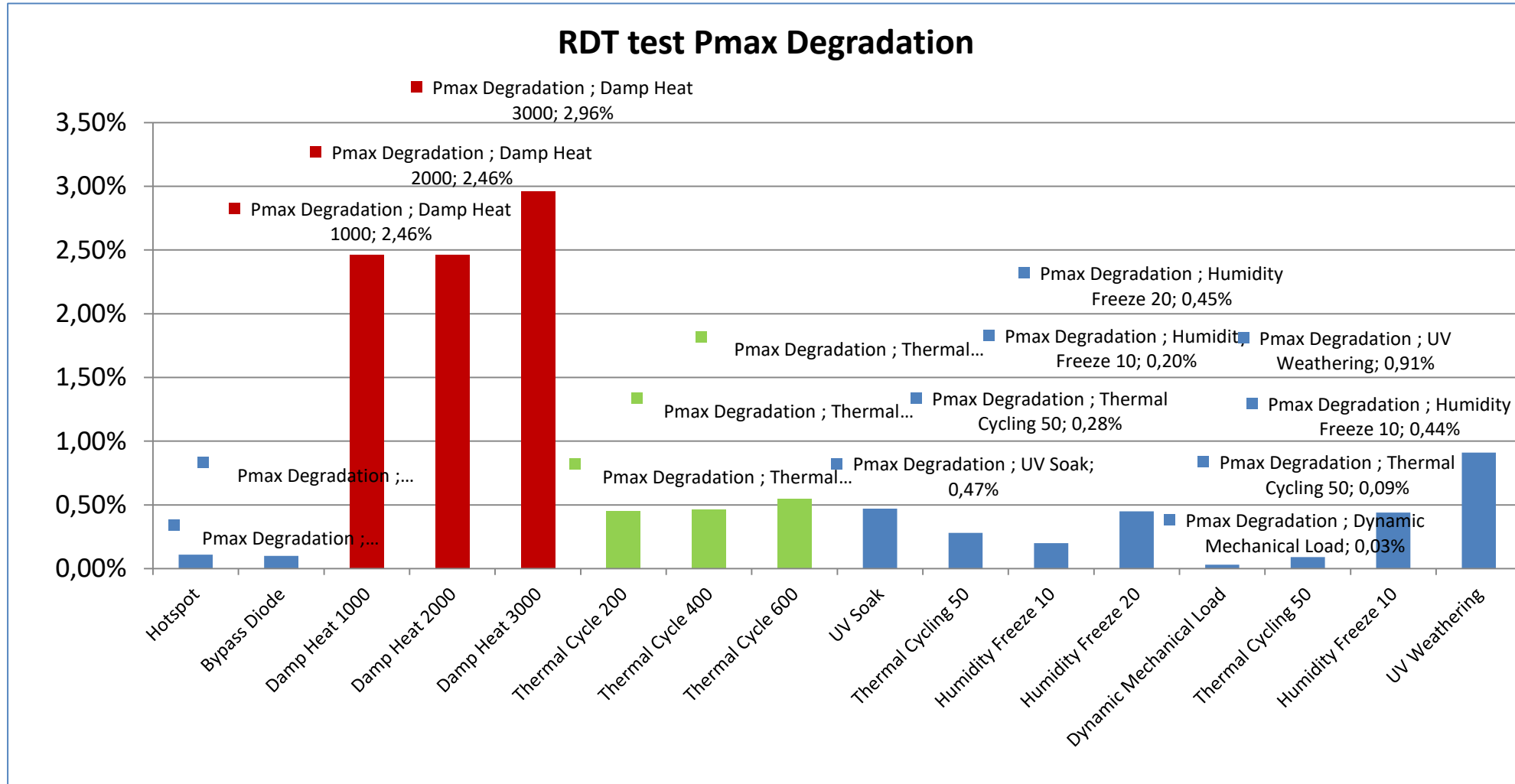
Max bend 16mm



Double Glass

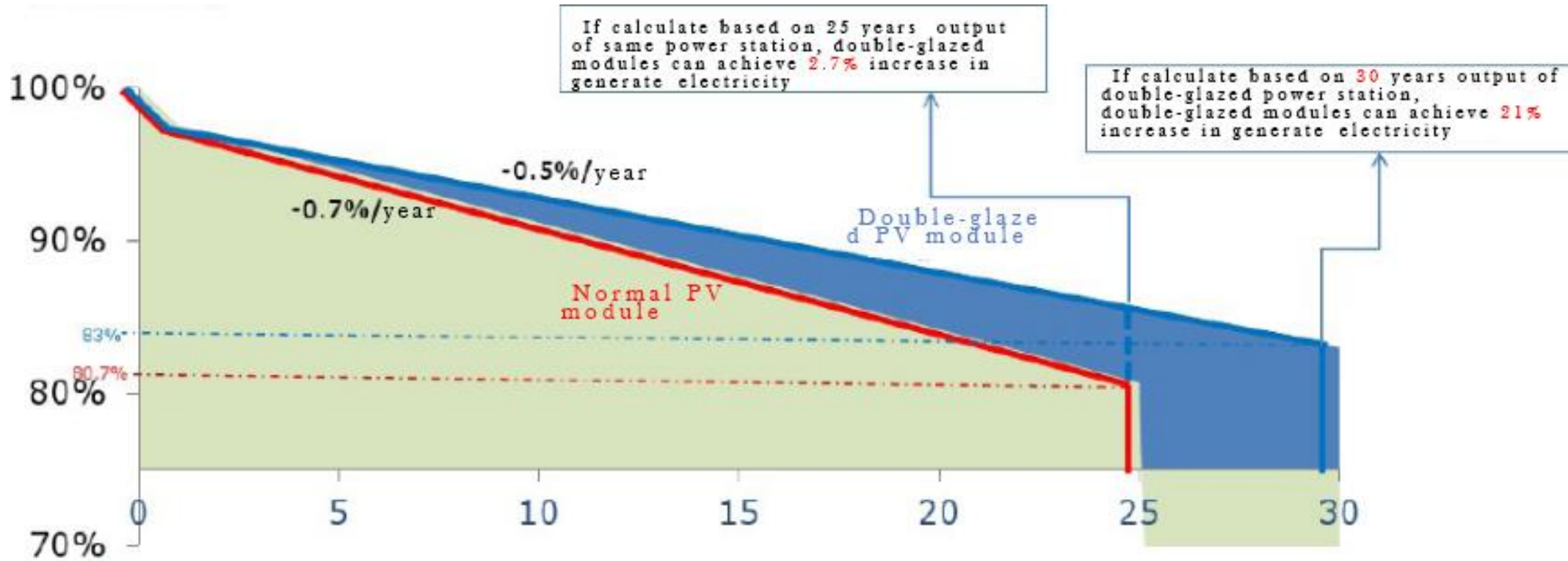
# High reliability

3rd party reliability rest: 3 times strength than normal testing standard



# High power generation

21% more of solar power generation than regular panels with 30 years lifetime for double glass modules



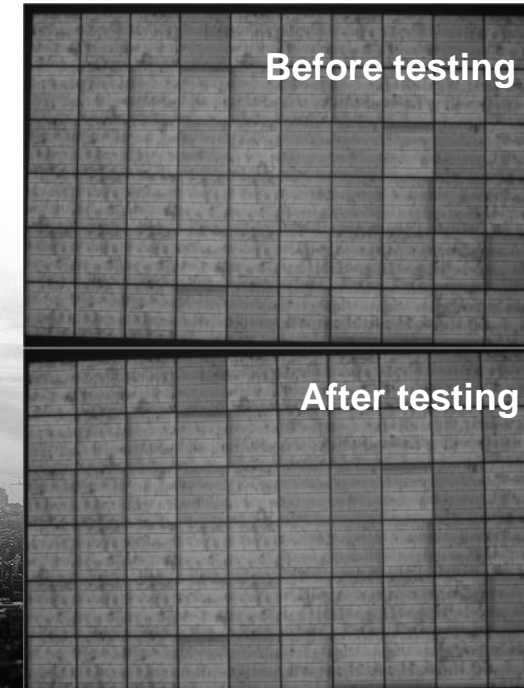
# Anti microcrack

## Load Capacity:

**Static load:** Front: 5400Pa, back side: 3600Pa Equivalent to 2meters snow load plus 140km/h wind load

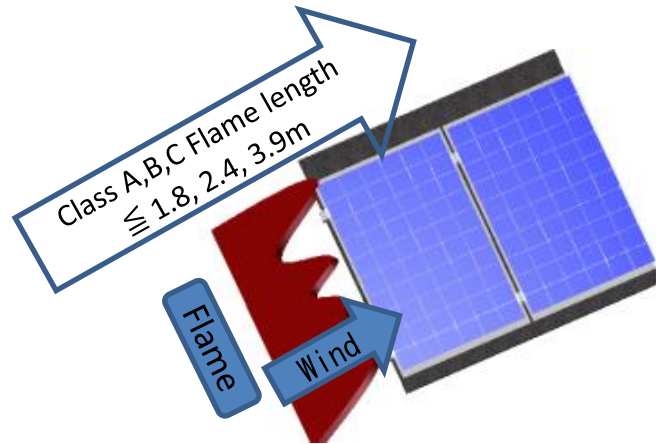
**Dynamic Load:** 1000 times (+1000Pa,-1000Pa) , 1 to 3 cycles per minute

**0% microcrack**

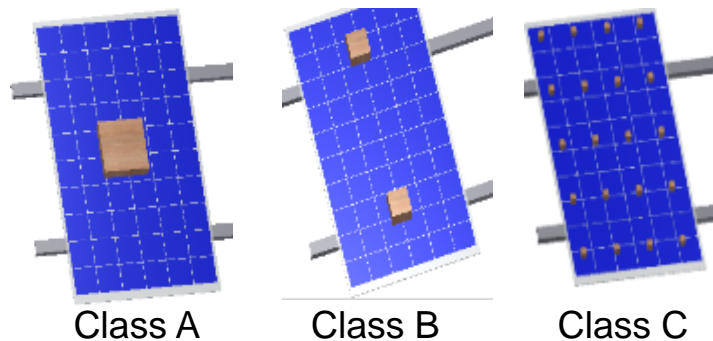


# Class A fire rating

**Flame Spread Test:** Standard flame burns from the side of the module, determining the fire rating by the flame spread area and burning time length.



**Combustion Block Test:** Putting different size of the combustion block on the panel until it burns out, evaluating the fire rating by the damage level from the surface of module



# 1500 Volts

Save 0.2 RMB per Watt for investment

Cable wastage can reduce in 0.27% System efficiency increase in 2%

1500V component applications



Definition of LCOE as below:

**LCOE =**

Total life cycle cost

Total life cycle generated energy

Total initial investment cost+ Total operation and maintenance cost-system salvage value

Total estimated generated energy \* (1-Total decay rate)

# Frameless

## Frameless advantage:

- Lower the risk of PID
- Dust, snow easily falling off, reduce the frequency of cleaning, lower the operational cost;

## Reduce dust and dirt



Normal module

Double Glass frameless module

## Snow falls off easily



# Comprehensive use



Character: anti-vapor, anti-salt spray  
Project: Salt City, floating project



**Lake, Sea, Ocean**

**Utility Scale Project**

Character: anti-polishment, UV resistance  
Project: utility project



Character: anti-vapor, light adjustment and keep warm  
Project: Huazhong Agrecutral



**Agrecutral Project**

**Rooftop Project**

Character: dust resistance, snow resistance, good-looking  
Project: Rooftop



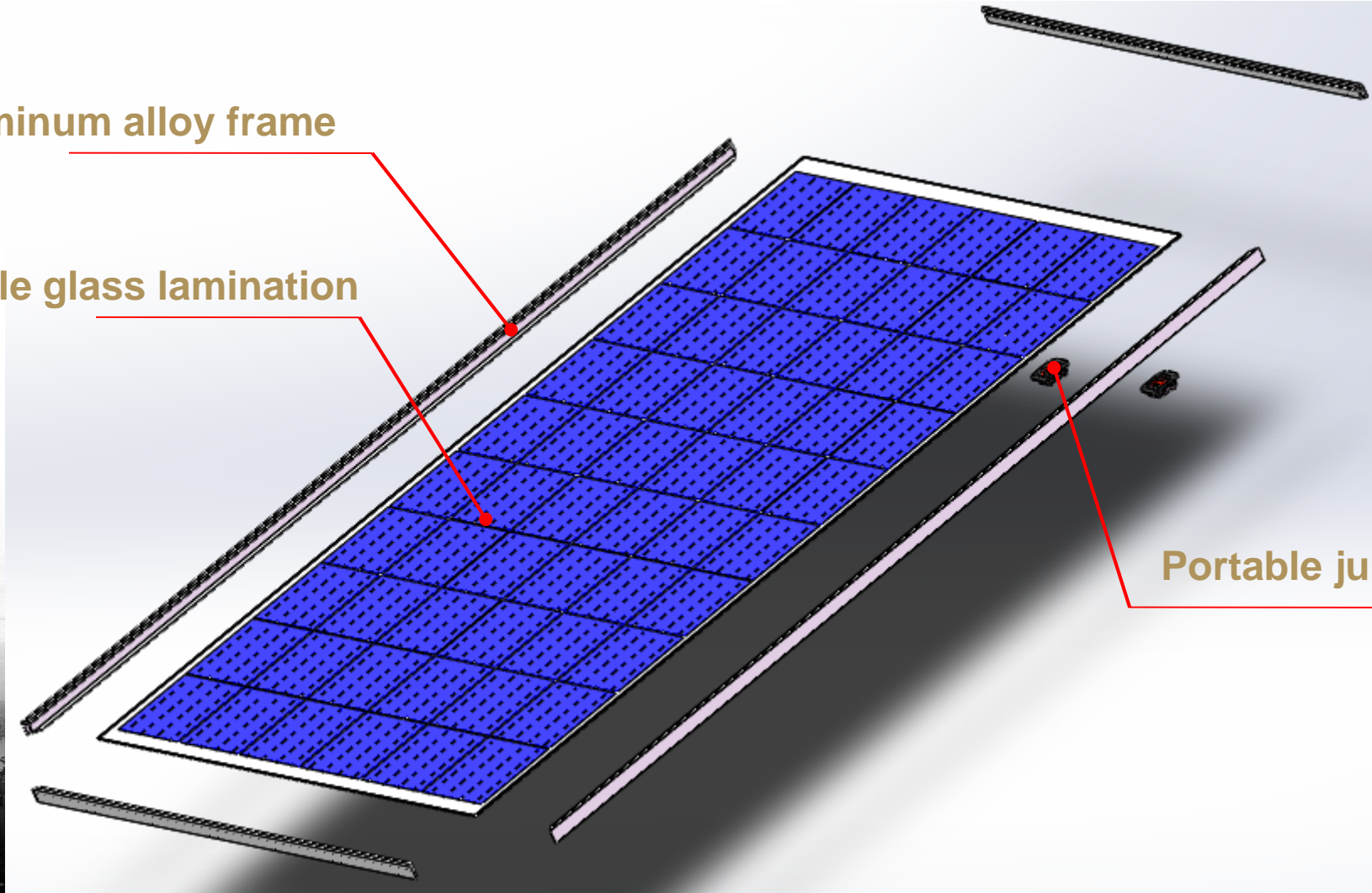


# Structure of double glass

25mm aluminum alloy frame

2mm double glass lamination

Portable junction box



# Light-weight

Module type	Type	Size	Weight
60 cell type	Regular module ( 3.2 glass +35 frame )	1650*992	18.5
	Regular double glass ( 2.5 double glass )	1658*992	22
	1.6mm double glass	1650*992	17.8
72 cell type	Regular module ( 3.2 glass+40 frame )	1956*992	21
	Regular double glass ( 2.5 double glass )	1978*992	28
	1.6mm double glass	1956*992	20.5

**60 cell module, 3.7% lighter than regular module, 21% lighter than regular double glass module;**

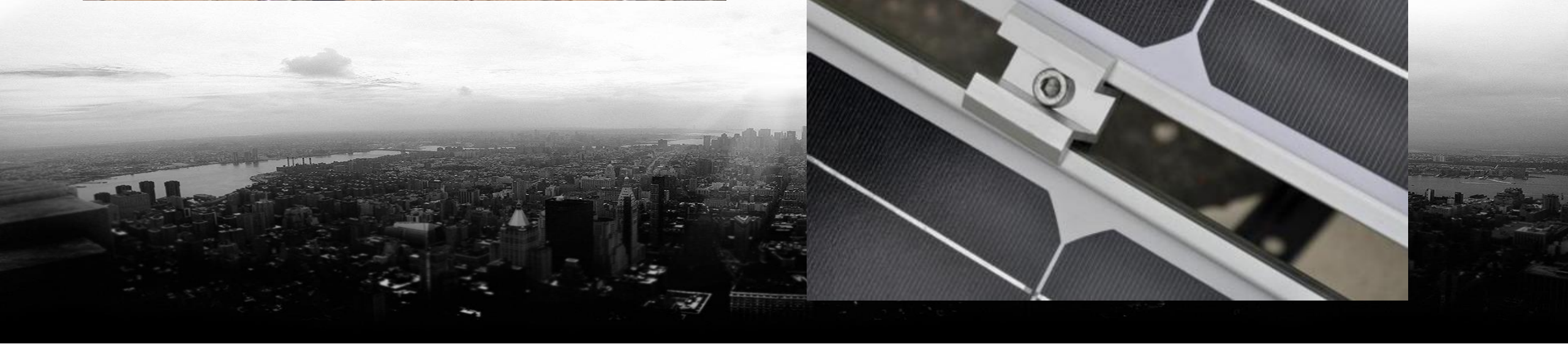
**72 cell module, 2.3% lighter than regular module, 26.7% lighter than regular double glass module;**

# Easy to move and install



Move and install as the same way as the regular module

- **Convenience;**
- **Fast;**
- **Safety;**



# Conclusion

**Lightweight double glass module combines the advantages both from the regular module and regular double glass module, while having some improvement on the disadvantages.**

1. Long lifetime ( 30 years warranty)
2. High reliability, anti-microcrack ( same structure as normal double glass modules )
3. Lightweight, ( weight is similar to regular module )
4. Easy to install, ( similar to the installation method that regular module uses with ballast )
5. 1500V system voltage, ( same as regular double glass module )
6. Load capacity, 2400Pa/5400Pa ( same as regular module )
7. Anti- PID ( same as regular module )





正

Zhèng

***Fairness***

*Do the right thing*

信

Xìn

***Trust***

*Reliability*

**= Z(EN) SHINE**

# Power of Trust



# Thank You!

