

# **JA Solar Company Presentation**

## Company Overview



### Headquarters

- Beijing, China

### Date est. / IPO

- May 2005 / February 2007 (NASDAQ: JASO)

### Annual Capacity

- 5.5 GW solar module
- 5.5 GW solar cell
- 2.5 GW silicon wafer

### Shipments

- 2014: 3.1 GW
- 2015: 4.0 GW
- 2016 guidance: 4.9-5.0 GW

### Employees

- 12,550 as of end of 2015

### Business Highlights

- Industry Leader
- Solid Finance
- Optimized Vertically Integrated Model
- Global Market Coverage and Diversified Customer Base
- Advanced Innovation

### Products Advantages

- High conversion efficiency
- High reliability
- High yield efficiency

## *Advanced Innovation*

### ■ **Global leader of PV cell technologies through innovation and invention**

- PV technology leader with a six-month to twelve-month leading edge ahead of the others
- The first company in the world started mass producing and commercializing selective emitter, MWT, and PERC structured PV cells
- The first company in the world applied double-printing technology to all cell manufacturing lines



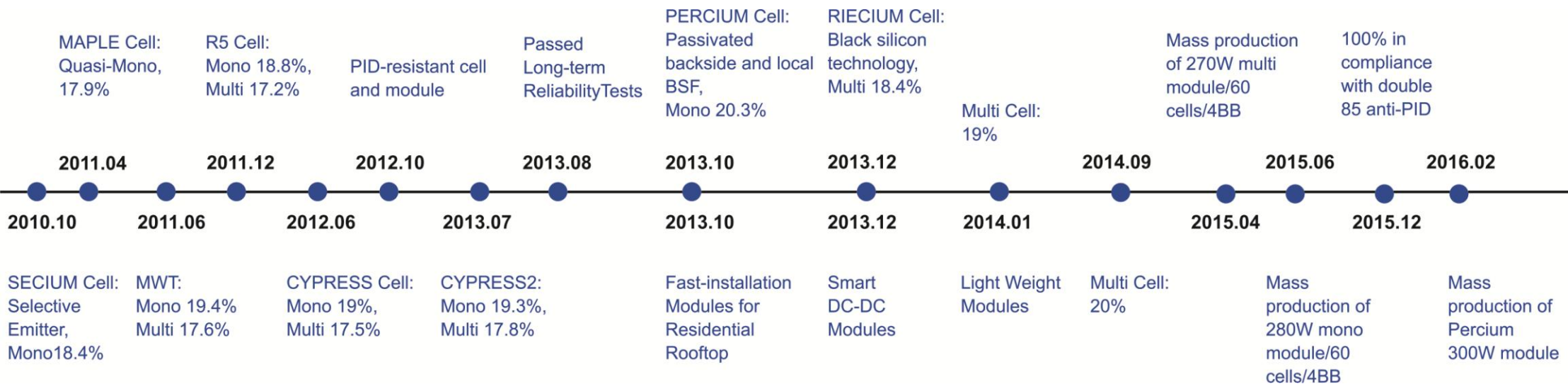
### ■ **Industry front runner of PV module performance based on proprietary technical approaches**

- Pursuing process optimization for PV modules assembly process, improving their performance and reliability, using proprietary technologies and various innovative approaches
- Consistently out-performing competitors' modules by 5-10watts in terms of power rating

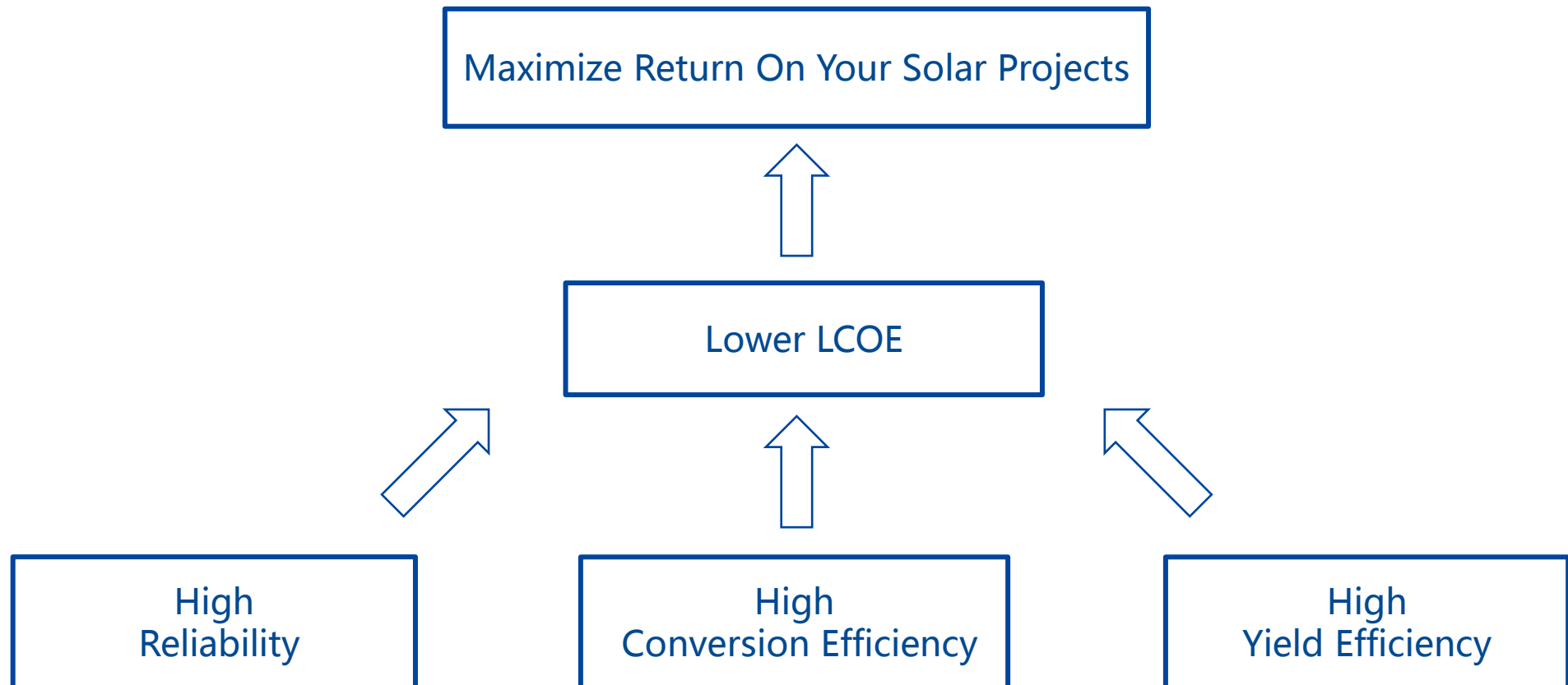


## Advanced Innovation

### —Product and R&D Milestones

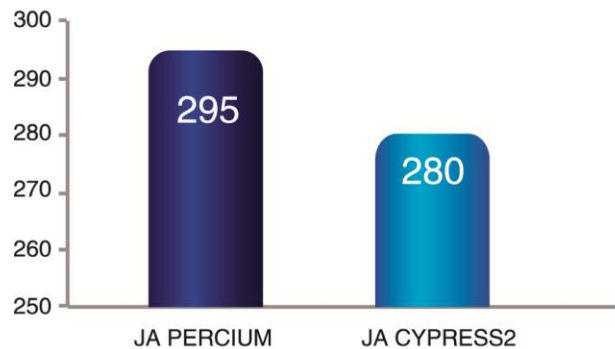


## *Product Advantages*

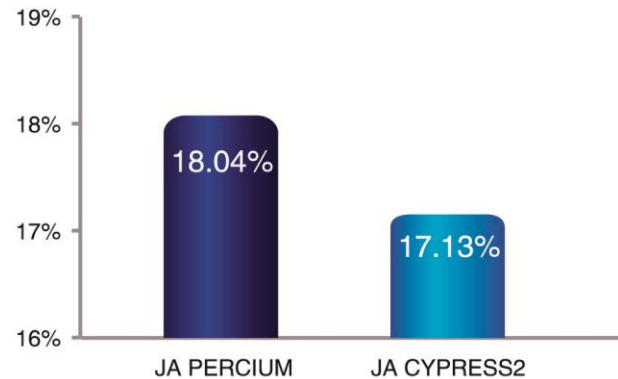


## High Conversion Efficiency

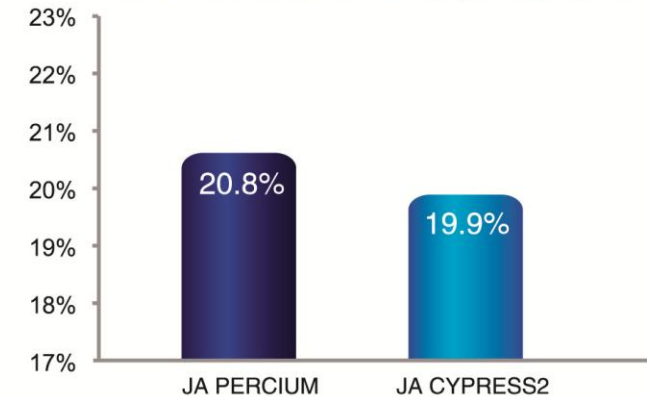
Mono Module Power Comparison (60 Cells/W)



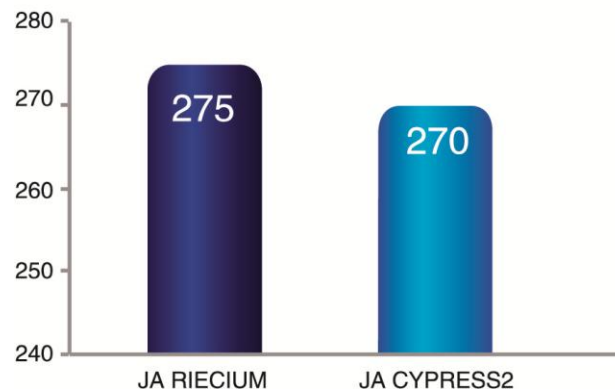
Mono Module Conversion Efficiency Comparison



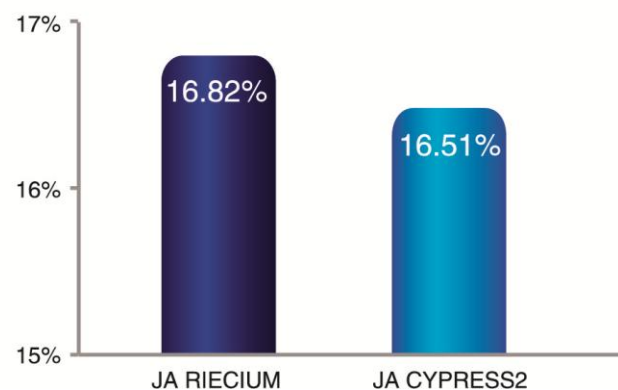
Mono Cell Conversion Efficiency Comparison



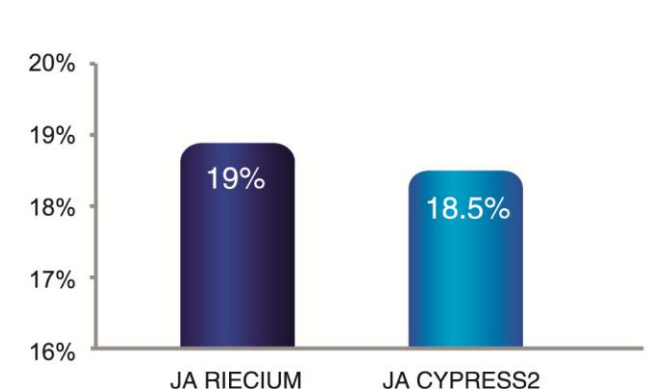
Multi Module Power Comparison (60 Cells/W)



Multi Module Conversion Efficiency Comparison



Multi Cell Conversion Efficiency Comparison



100% Positive Power Tolerance: 0~+5W

## *Product Advantages – High Reliability*

—Industry-leading Cell Technology

- World-class cell R&D staff and facilities, leading other manufacturers by 6-12 months in cell R&D since 2008
- The only company 100% implementing high-aspect-ratio double-printing in the industry
  - ✓ Addresses contact resistance and solderability optimization without compromising one or another
  - ✓ Less finger interruption
- Superior PID-resistance performance



Single Printing



Double Printing

## *Product Advantages – High Reliability*

——High-quality Components from Best Suppliers

### ■ EVA

- ✓ High transparency, reliable quality
- ✓ High durability against PID degradation and UV yellowing

### ■ Back Sheet

- ✓ Fluoride material ensures excellent resistance against harsh environment and low water vapor permeation

### ■ Junction Box

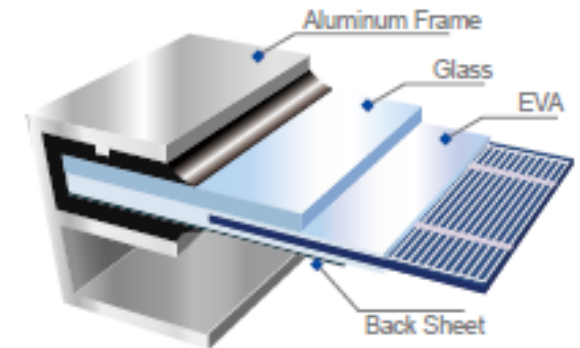
- ✓ Source from reputable tier 1 diode manufacturers to reduce hot spot risks
- ✓ Potted J-Box ensures excellent ingress protection performance

### ■ Glass

- ✓ Closed Nanoscale structure AR-coating ensures excellent reliability and anti-soiling performance
- ✓ High transparency, reliable quality
- ✓ Excellent scratch resistance

### ■ Aluminum Frame

- ✓ Outstanding surface treatment technology and higher line density ensure strong corrosion resistance and mechanical strength
- ✓ High salt & ammonia resistance



## Product Advantages – High Reliability

- **100% in-house automatic module manufacturing to guarantee product quality and performance**
- **Manufacturing Process, Quality, and Facility Certified by TÜV SÜD, CTF and ETL, and Third-Parties Agencies Including PI-Berlin and Solar-IF**

- **Long-term Reliability Tests**

- ✓ Mechanical load test 5400Pa to 10000Pa (about 2×IEC standard)
- ✓ HAST test DH1000 (85°C and 85% RH) to 121°C 3 times atmospheric pressure and 100%RH
- ✓ Thresher test (about 3×IEC standard)

| IEC Standard texts          | Thresher test               |
|-----------------------------|-----------------------------|
| Thermal cycling, 200 cycles | Thermal cycling, 600 cycles |
| Damp heat 1000 hour         | Damp heat 3000 hour         |
| UV 15KWH                    | UV 45KWH                    |
| Humidity freeze 10 cycles   | Humidity freeze 30 cycles   |
| Hot spot endurance 5 hour   | Hot spot endurance 20 hour  |

- **Environment Endurance Tests**

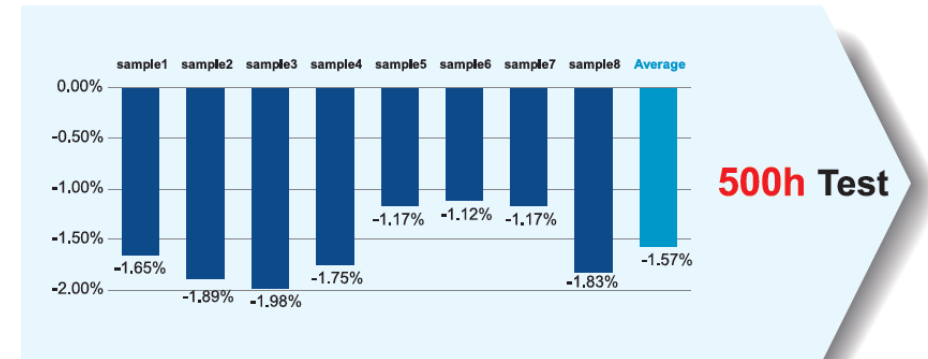
- ✓ Ammonia Resistance Test Salt Mist Spray Test, SO2 Resistance Test, Dust and Sand Test
- ✓ Hot-Dry Climate, Damp-Heat Climate, and Plateau Climate Conditions



## Product Advantages – High Reliability

### ■ 100% Mass-production of PID-resistant Cell and Double 85 Anti-PID for All Modules

- ✓ PID-Resistance Performance:  
Potential Induced Degradation



RIECIUM Module Degradation After 500-hour PID Test  
(Test Condition: 85%RH 85°C -1000V 500Hr)

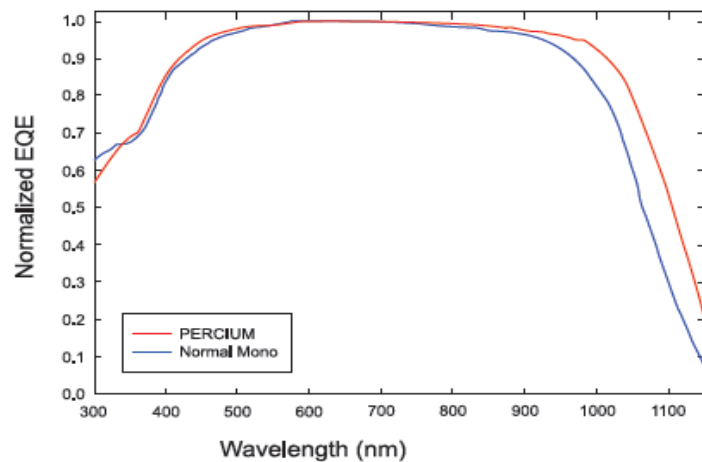


### ■ Excellent Quality Management System and Product Quality Assurance

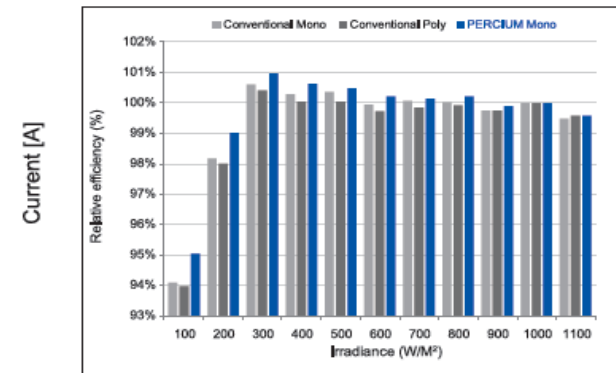


## Product Advantages – High Yield Efficiency

### ■ Outstanding Low-light Performance



EQE—External quantum efficiency



Relative module efficiency comparison under different irradiance

Source: 

### ■ The modules are classified into three current category

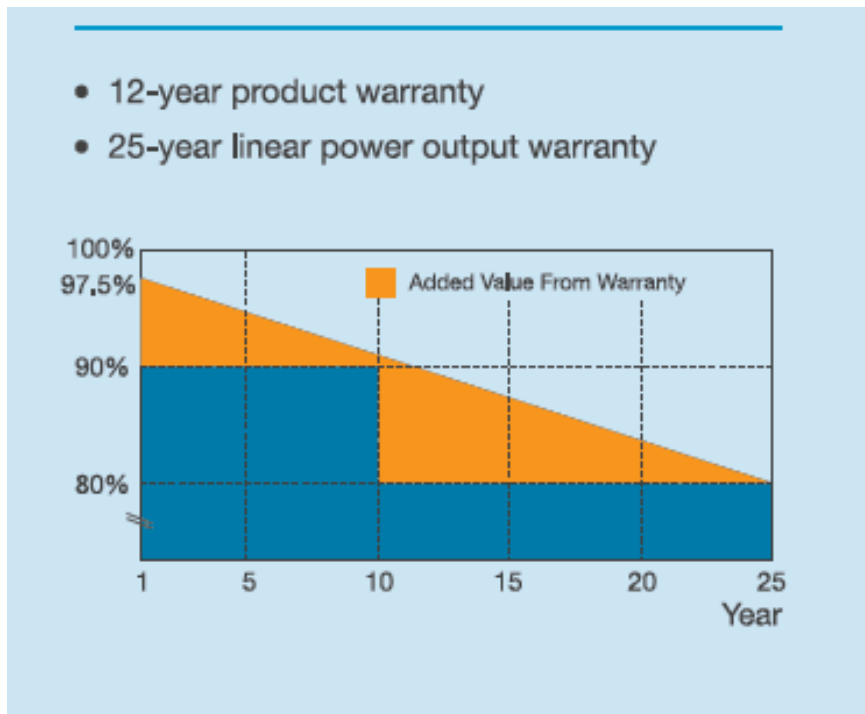
- ✓ Current class—H (high)
- ✓ Current class—M (middle)
- ✓ Current class—L (low)



## *After Sale Service*

### ■ Product Warranty

- ✓ 12-year warranty on materials and workmanship
- ✓ 25-year linear power warranty ( 80% )



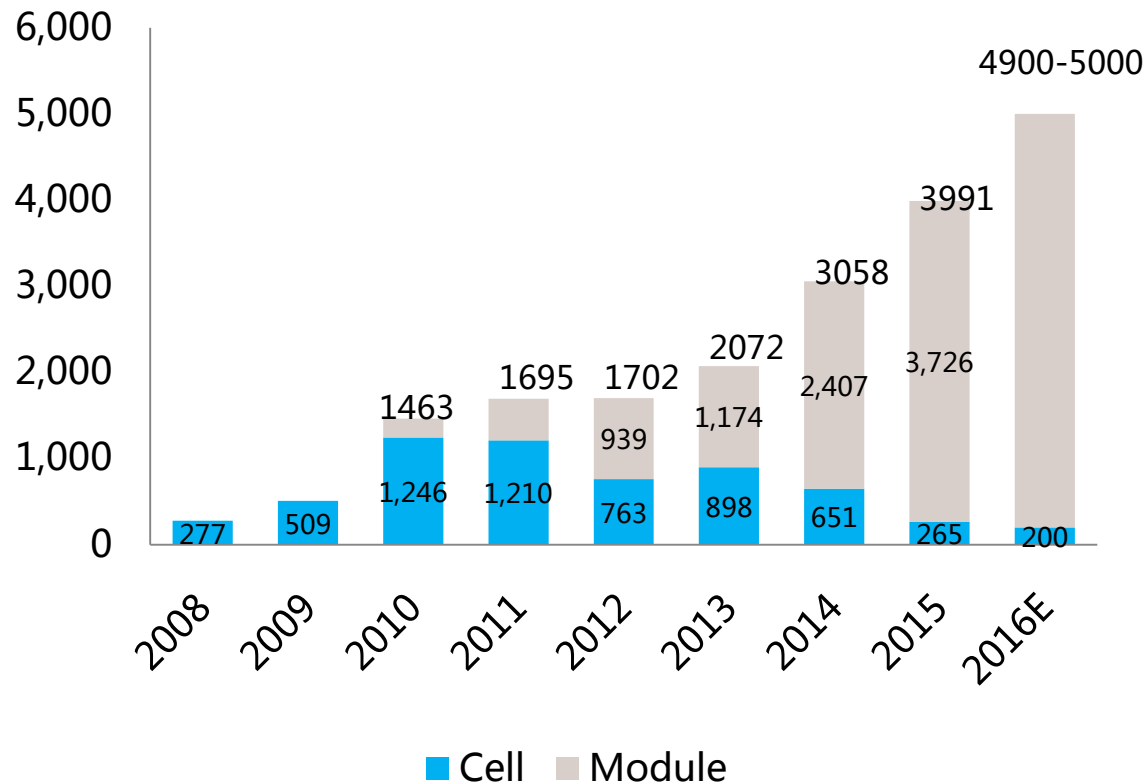
### ■ Additional Insurance Options



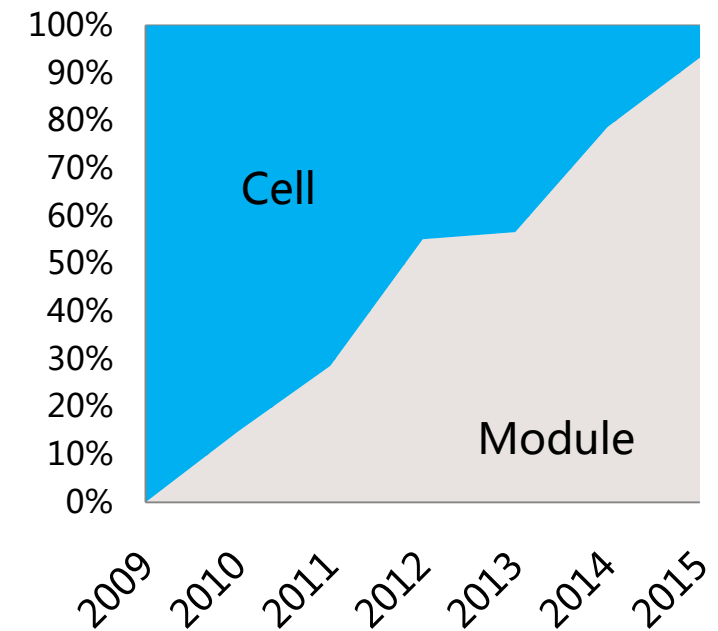
## Industry Leader

—18.7GW cumulative shipments by the end 2016 Q3

### Shipment (MW)



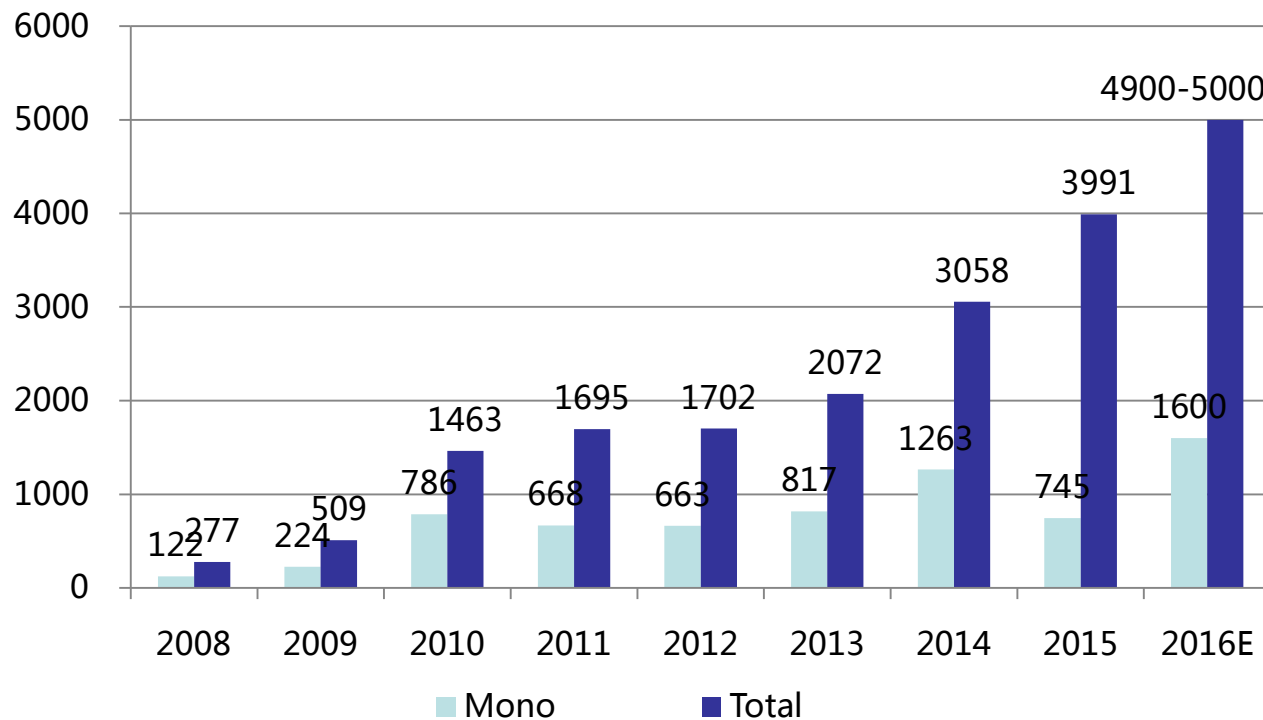
### Shipment Ratio (%)



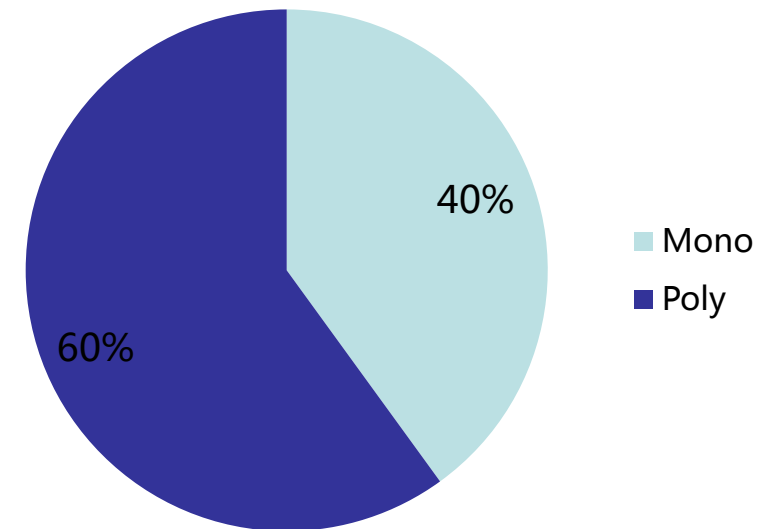
## Industry Leader

—7GW cumulative Mono module shipments by the end of Nov 2016

### Shipment (MW)



### Cumulative shipment ratio(%)



## *Top 4 Module Manufacturer in 2015*

### Top 10 Module Manufacturers by PV-Tech

| 2015     | Module Manufacturer |
|----------|---------------------|
| 1        | Trina               |
| 2        | CanadianSolar       |
| 3        | Jinko               |
| <b>4</b> | <b>JA</b>           |
| 5        | Hanwha Q CELLS      |
| 6        | First Solar         |
| 7        | Yingli              |
| 8        | SFCE                |
| 9        | Renesola            |
| 10       | SunPower Corp       |

Source: PV-Tech

## Global Leading Bankable Module

2014 Top bankable PV module brands by BNEF Survey

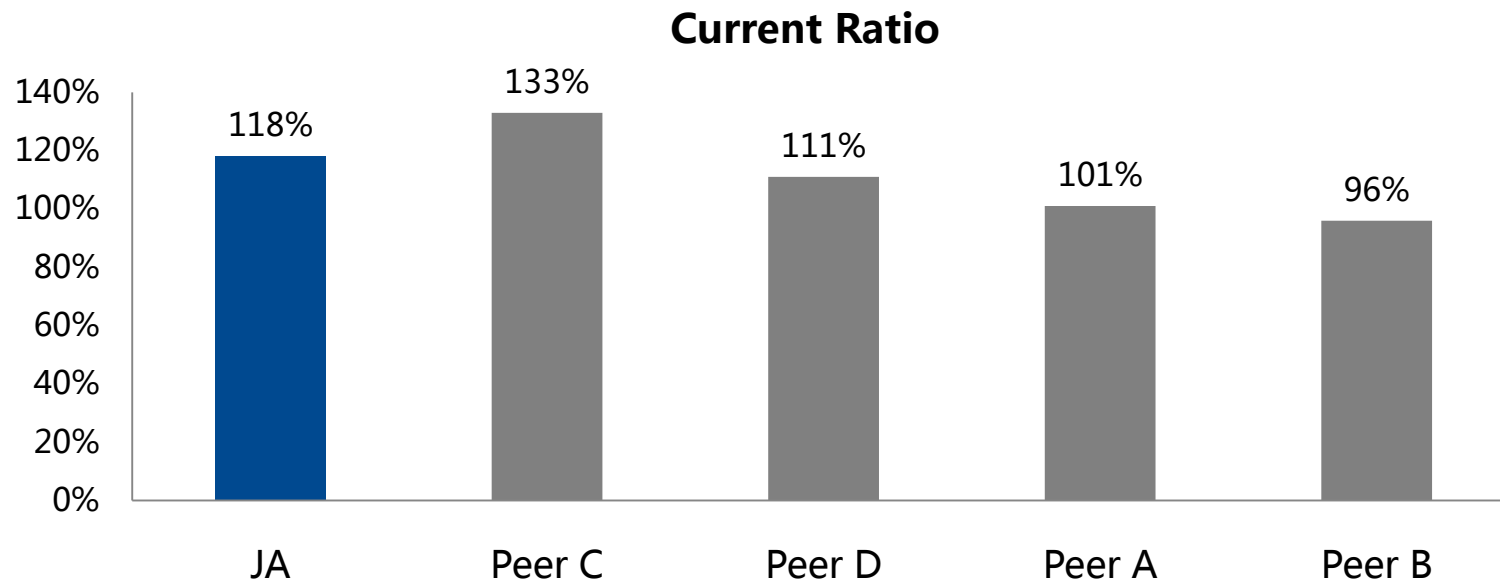
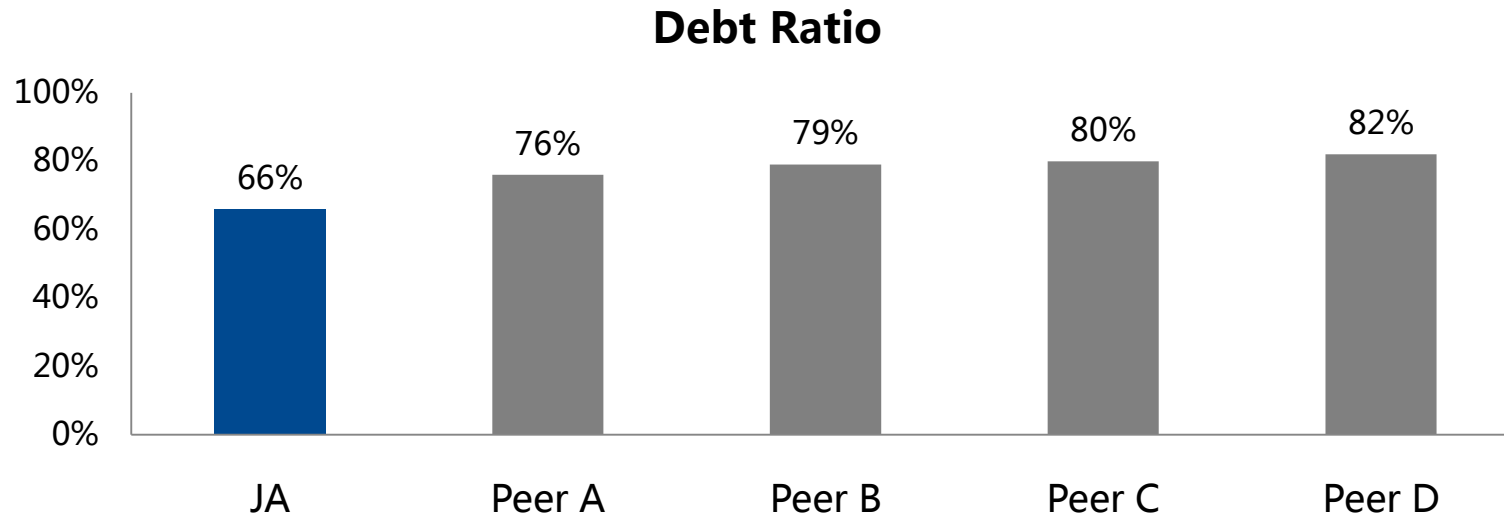
| Rank | PV Module Manufacturer | 'Yes'      | 'No'      | 'Never Heard' |
|------|------------------------|------------|-----------|---------------|
| 1    | First Solar            | 100%       | 0%        | 0%            |
| 2    | Hanwha SolarOne        | 93%        | 7%        | 0%            |
| 3    | <b>JA Solar</b>        | <b>93%</b> | <b>7%</b> | <b>0%</b>     |
| 4    | Trina Solar            | 93%        | 7%        | 0%            |
| 5    | Yingli                 | 93%        | 7%        | 0%            |
| 6    | Hanwha Q-Cells         | 87%        | 13%       | 0%            |
| 7    | Jinko Solar            | 87%        | 13%       | 0%            |
| 8    | Canadian Solar         | 80%        | 20%       | 0%            |
| 9    | Panasonic              | 80%        | 20%       | 0%            |
| 10   | Renesola               | 80%        | 20%       | 0%            |
| 11   | SunPower               | 80%        | 20%       | 0%            |
| 12   | REC Solar              | 80%        | 7%        | 13%           |
| 13   | Sharp                  | 73%        | 27%       | 0%            |
| 14   | Solar Frontier         | 73%        | 7%        | 20%           |
| 15   | Mitsubishi             | 67%        | 33%       | 0%            |
| 16   | Kyocera                | 67%        | 20%       | 13%           |
| 17   | ET Solar               | 60%        | 27%       | 13%           |
| 18   | SunEdison              | 60%        | 33%       | 7%            |
| 19   | China Sunergy          | 53%        | 27%       | 20%           |
| 20   | BYD                    | 47%        | 47%       | 7%            |

2016 Top bankable PV module brands by BNEF Survey

| Rank | PV Module Manufacturer | 'Yes'      | 'No'      | 'Never Heard' |
|------|------------------------|------------|-----------|---------------|
| 1    | Trina                  | 100%       | 0%        | 0%            |
| 2    | Hanwha Q Cells         | 95%        | 5%        | 0%            |
| 3    | SunPower               | 95%        | 5%        | 0%            |
| 4    | First Solar            | 95%        | 5%        | 0%            |
| 5    | Canadian Solar         | 95%        | 0%        | 5%            |
| 6    | <b>JA Solar</b>        | <b>91%</b> | <b>5%</b> | <b>5%</b>     |
| 7    | Kyocera                | 91%        | 9%        | 0%            |
| 8    | Jinko                  | 86%        | 14%       | 0%            |
| 9    | Mitsubishi             | 86%        | 9%        | 5%            |
| 10   | Panasonic              | 77%        | 14%       | 9%            |
| 11   | LG Electronics         | 73%        | 14%       | 14%           |
| 12   | REC Solar              | 73%        | 23%       | 5%            |
| 13   | Samsung                | 73%        | 9%        | 18%           |
| 14   | Sharp                  | 73%        | 27%       | 0%            |
| 15   | Renesola               | 68%        | 32%       | 0%            |
| 16   | Solar Frontier         | 68%        | 18%       | 14%           |
| 17   | SolarWorld             | 64%        | 18%       | 18%           |
| 18   | Chint/ Astronergy      | 59%        | 18%       | 23%           |
| 19   | Hyundai Heavy          | 59%        | 18%       | 23%           |
| 20   | SunEdison              | 59%        | 32%       | 9%            |

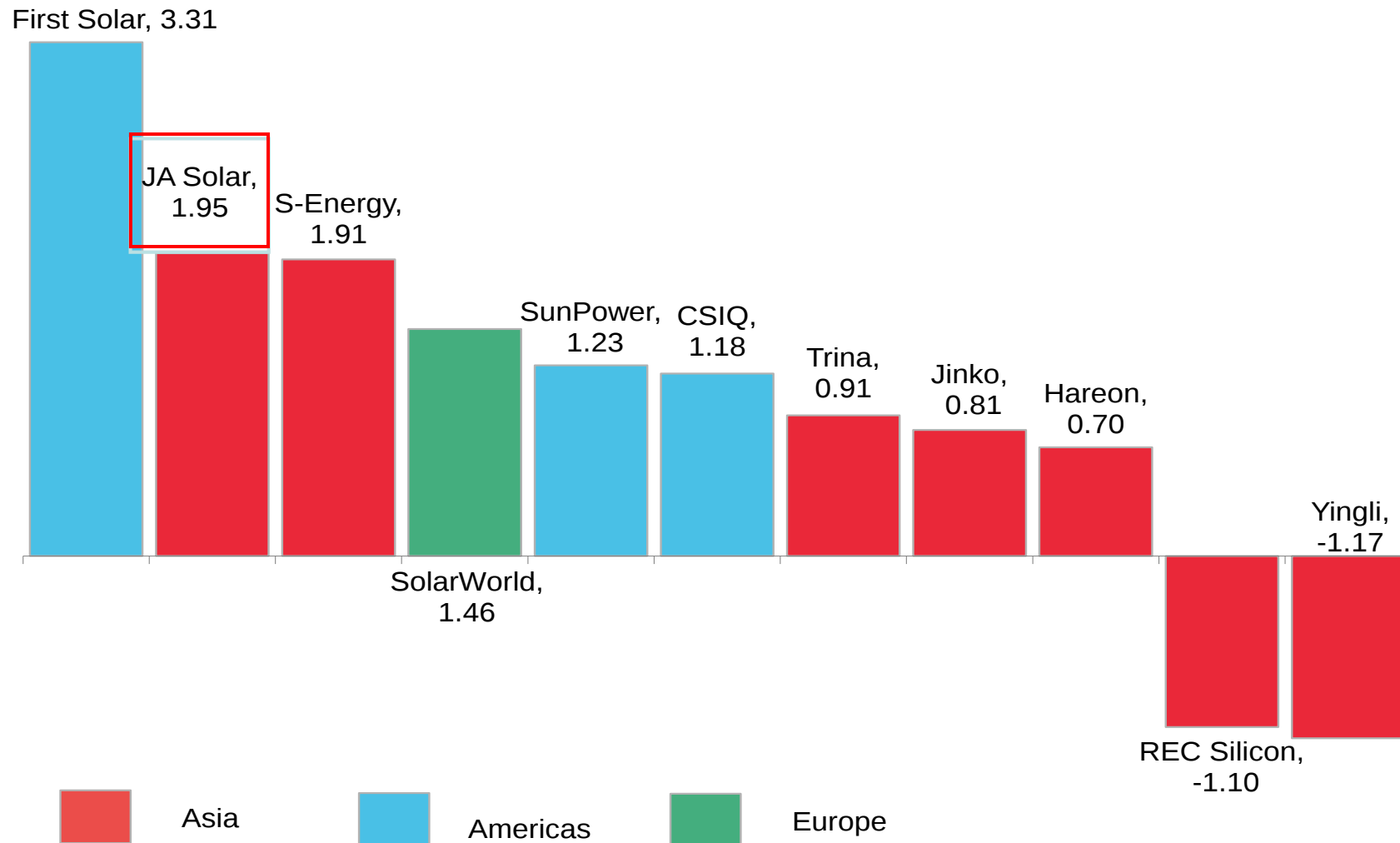
Source: BNEF

## *Solid Finance for Future Growth*



## *Solid Finance for Future Growth*

—Altman-Z scores of pureplay solar companies



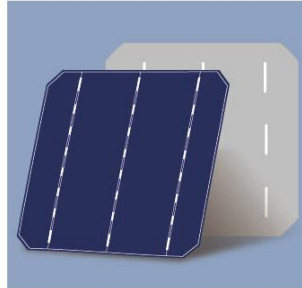
## *Optimized Vertically Integrated*



**Polysilicon**



**Silicon Wafer**  
**2.5 GW**



**Cell**  
**5.5 GW**



**Module**  
**5.5 GW**



**System**

JA SOLAR

## State-of-The-Art Production Facilities



## Global Market Coverage

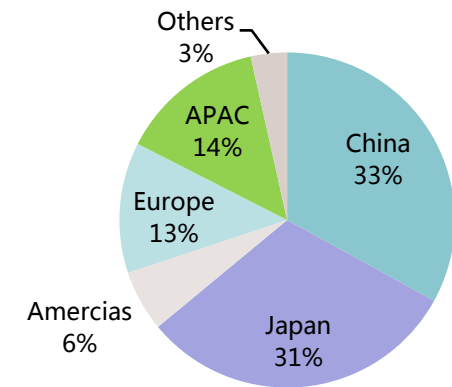
—A global sales network over 90 countries



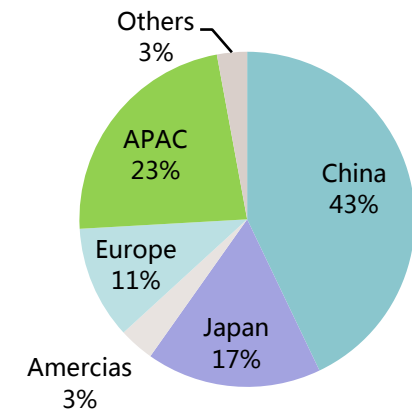
## External shipments by region

(% of total MW shipped)

**2014**



**2015**



## *Top Brand PV Modules 2016 Europe*

JA Solar ranks among the top PV brands in Europe according to the result of survey carried out by EUPD research among installers on brands awareness, customers' choice and distribution



## *Diversified Customer Base*

—partnerships with various global leading corporations



## *Selected Projects*

### **Social Circle Solar Farm**

Bank: Bank of America

Georgia USA

38.7 MW



### **100MW project in Dunhuang, China** Bank: ICBC (Industrial and Commercial Bank of China)

Dunhuang, China

100 MW



### **Utility Ground Mount Project in UK**

Chittering Great Knowles, UK

11.6 MW



### **Pakistan 100MW project in Bahawalpur** Bank: Bank of Punjab / ADB ( Asian Development Bank )

Bahawalpur, Pakistan

100 MW



## *Selected Projects*

### **TSE 30MW in Kanchanaburi** Bank: Bangkok Bank

Kanchanaburi, Thailand

30 MW



### **30MW Project in Japan**

Tomakomai, Japan

30 MW



### **Largest Solar Installation in Israel,**

Arava Desert and Negev Desert, Israel

35 MW



### **Largest Solar Installation in North Africa**

Kenitra, Morocco

2 MW



## CSR – Corporate Activities

- **USA:** Donated modules to Stanford University for its construction of the Bioengineering & Chemical Engineering building.



- **China:** Sponsors Peking University, Tsinghua University, and Tongji University in their participation at the "Solar Decathlon SD" .



- **Haiti:** Following Haiti' s earthquake, JA donated PV modules to the local fish farmers for electricity generation



Harvest the Sunshine  
Premium Cells, Premium Modules

Thank you !

**JA**SOLAR

December 5, 2016