



Taiwan Solar Energy Corporation

TSEC in Perspective

December 20, 2015





Agenda

- I. Introduction of TSEC Corporation**
- II. Market Outlook**
- III. TSEC's Comparative Advantages**
- IV. Expansion Plan in 2016 & 2017**



I. Introduction of TSEC Corporation

Date of Establishment : June 24, 2010

Paid-in Capital : NT\$3,518 million

Location of Factory : Hsinchu Industrial Park, Taiwan

Products : PV Cells、 Modules and Solar Power Stations

Annual Capacity : Cells 730 MW、 Modules 45 MW

No. of Employees : 880人 as of November 30 2015

Overseas Offices : Rotterdam、 Tokyo、 Los Angeles

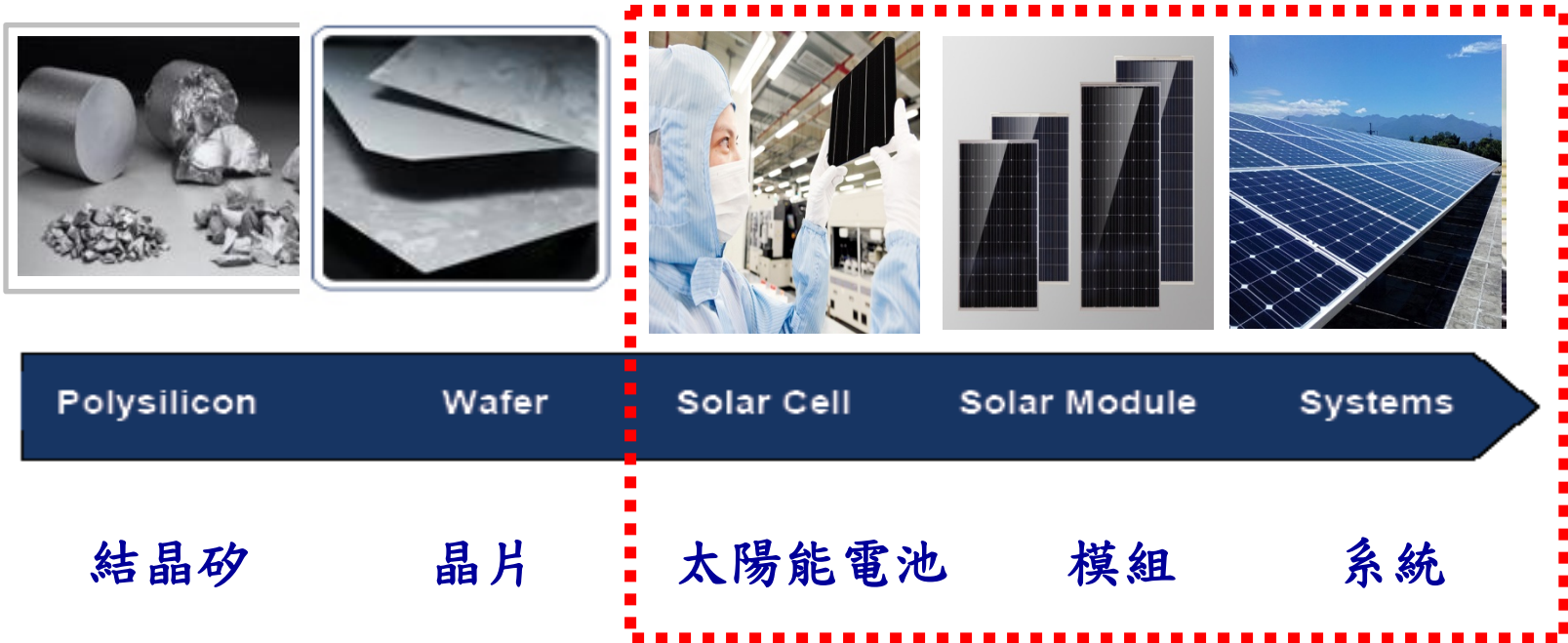
Taiwan Sales Offices : New Taipei City、 Hsinchu、 Changhwa、
Kaohsiung

Main Shareholders : Management Team、 Far East Group、 Aurora
Group and Formosan Rubber Group



Supply Chain Integration

TSEC Business Fields



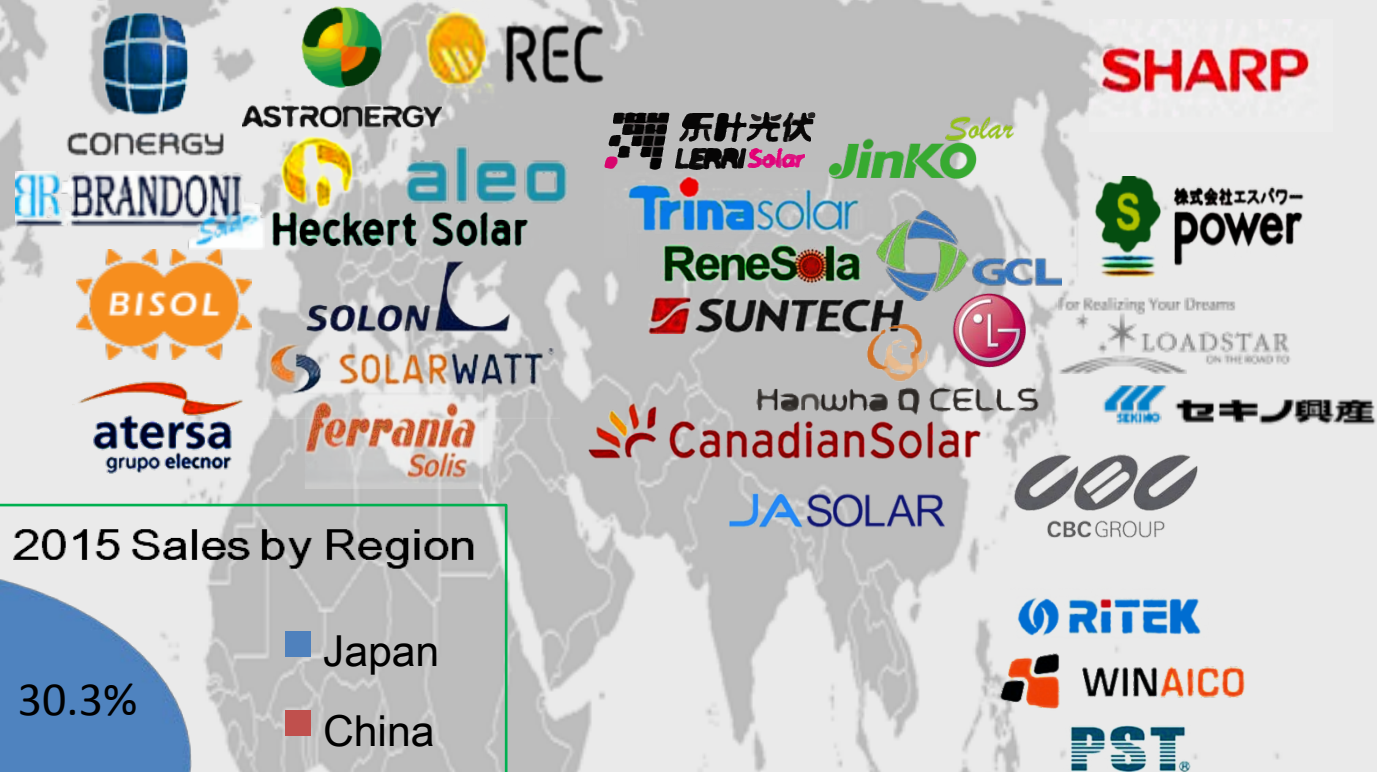
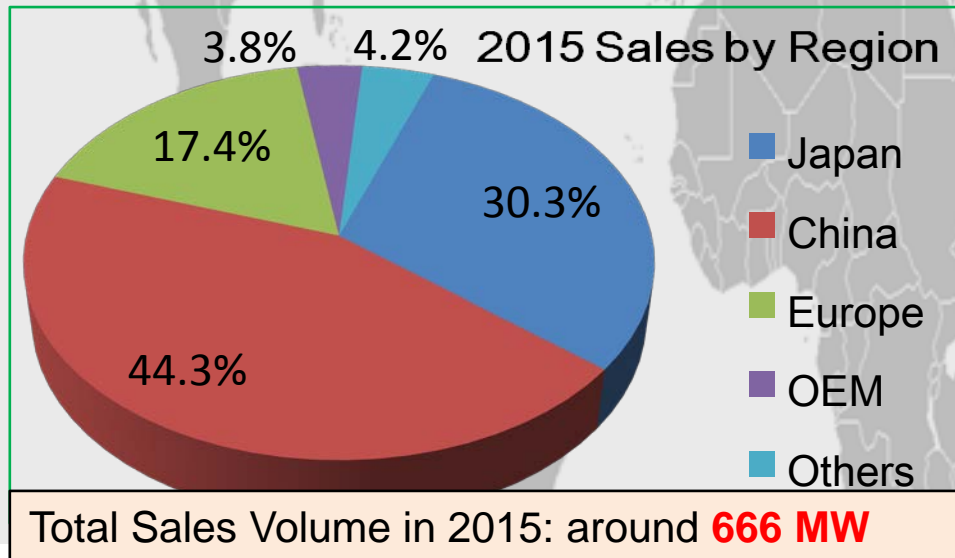
Business Model:

We integrate supply chain from the production of cells and modules to photovoltaic (**PV**) systems installation.

95% of PV cells and modules are exported to global markets.



Customers Spread Over Europe, Japan, China and the US.





Hsinchu Factory- TSEC has led the ranking as the most competitive PV cell producers in Taiwan



Land Area: 21,318 m²

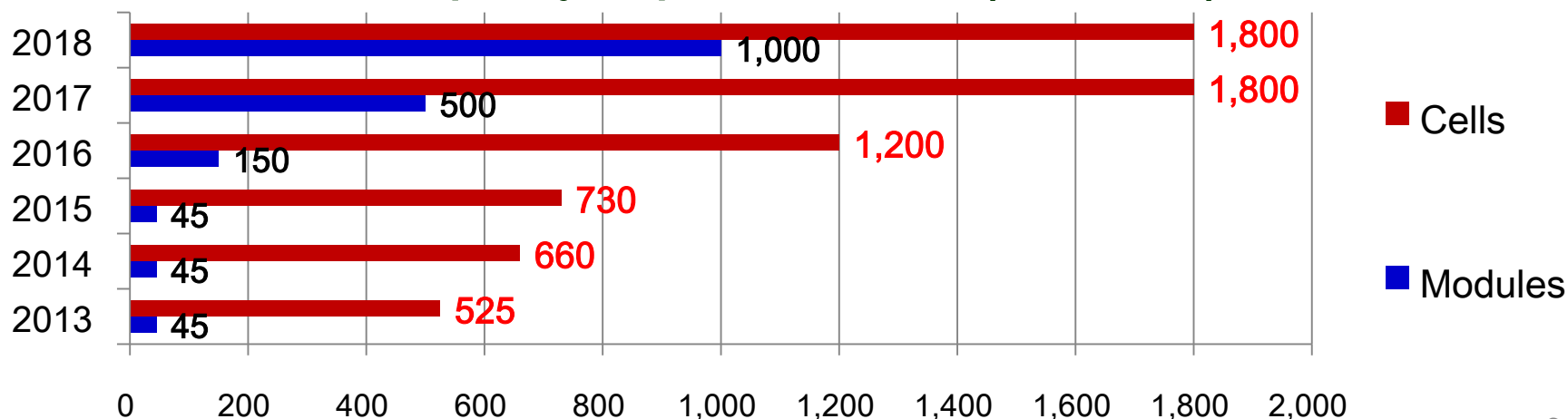
Floor Area: 75,243 m²

Total Capex as of Oct. 2015: NT\$ 6.8Billion

Current Cell Production Capacity: 730MW

(Will be expanded to 1,800MW in 2017.)

Production Capacity Expansion Plan (Unit: MW)





- Install and operate more than 80 PV power stations spread over Taiwan
- Provide EPC services to foreign power stations

嘉義稻江科技管理學院



苗栗客庄國小



Japan- 北上發電



Germany- Heckert Power Stations





Top 20 solar cell producers in the world

Rankings	Country	Company	Name in Chinese	Prod. Capacities
1	China	Trina Solar	天合	4,200
2	Korea	Hanwha SolarOne	韓華	4,000
3	China	Yingli	英利	3,600
4	China	JA Solar	晶澳	3,420
5	China	Jinko Solar	晶科	2,640
6	Taiwan	Motech + Topcell	茂迪 + 聯景	2,500
7	Taiwan	Neo Solar Power	新日光	2,050
8	China	Canadian Solar	阿特斯	1,600
9	China	Hareon Solar	海潤	1,800
10	China	Tongwei(原LDK)	江西通威	1,800
11	Taiwan	Gintech	昱晶	1,680
12	Germany	Solarworld	N.A.	1,500
13	Japan	Kyocera	京瓷	1,245
14	China	Talen Sun	中利騰輝	1,020
15	China	Suntech	尚德	1,000
16	China	Changzhou Eging	常州億晶	960
17	Taiwan	Solartech	昇陽科	900
18	Taiwan	InventecSolar	英穩達	800
19	China	Lerri	樂業光伏	800
20	Taiwan	TSEC	元晶	730

* Exclude thin film, HIT and other non-polysilicon based solar cells.

Outstanding Business Performance

- Factory construction completed in Q3 2011, mass production started from Q2 2012 and operated profitably since March **2013**.
- Received **Golden Energy Awards** 「金能獎」 from the Energy Bureau of the Ministry of Economic Affairs in both 2014 and 2015, only two solar cell producers won the prestigious honor in Taiwan this year .
- Deloitte & Touche evaluated TSEC as one of the **Technology Fast Top 500** companies in 2014. TSEC ranked as the 24th among all the Asia-Pacific companies.
- Allied with US DuPont, TSEC announced its latest PV Cells named **Lightning** in Tokyo PV Expo in February 2015, an extreme high PV convert efficiency of **+21.1%** surpassed the PV industry .



TSEC has led the industry in profitability since 2013

Profitability Comparison among Taiwan Main Competitors in 2013

KPI	Sales	Operating	EBT %	Return on	Return on	Return on
Co. Names	Profits %	Profits %	of Sales	Capital %	Equity %	Assets %
TSEC	12.08%	5.26%	3.93%	6.87%	10.11%	4.11%
Neo Solar	8.51%	1.57%	2.49%	6.63%	2.68%	1.50%
Gintech	2.89%	-1.79%	-3.55%	-14.67%	-4.53%	-2.64%
Motech	7.65%	2.15%	1.57%	5.48%	1.69%	0.81%
Solartech	5.36%	0.34%	-6.04%	-11.49%	-5.22%	-2.90%
Tainerg	8.38%	4.74%	4.08%	9.46%	6.49%	3.21%
TSEC Ranking	1	1	2	2	1	1

資料來源:公開資訊觀測站, 各公司2013年公布之財報。



Profitability Comparison among Taiwan Main Competitors in 2014

KPI	Sales	Operating	EBT %	Return on	Return on	Return on
Co. Names	Profits %	Profits %	of Sales	Capital %	Equity %	Assets %
TSEC	9.41%	3.64%	2.75%	4.91%	6.10%	3.55%
Neo Solar	6.48%	0.90%	0.89%	2.99%	1.19%	1.25%
Gintech	3.78%	-0.69%	-2.43%	-9.33%	-2.93%	-1.24%
Motech	0.85%	-4.60%	-5.29%	-24.05%	-7.73%	-3.24%
Solartech	6.62%	1.99%	1.58%	4.39%	1.97%	1.56%
Tainerg	6.85%	1.73%	2.67%	6.90%	4.47%	3.24%
TSEC Ranking	1	1	1	2	1	1

資料來源:公開資訊觀測站, 各公司2014年公布之財報。



THE UNAUDITED 2015 P & L REPORT

Unit: Amounts in NT\$ Thousand

P&L Items		Jan. ~ Sep.	October	November
Month	Net Sales		607,072	640,200
	Operating Profit		39,459	52,995
	Net Income before Tax		33,397	52,072
Accumulated	Net Sales	5,206,564	5,813,914	6,453,836
	Operating Profit	56,725	96,184	149,179
	Net Income before Tax	10,828	44,225	96,297

NOTE :

(1) Jan.~ Sep. audited by CPA.

(2) October and November are unaudited.



The Best Reasons for Outstanding Performance

1. Competitive Advantage in Production

- TSEC is the first company to incorporate **semiconductor fab design** into solar cell manufacturing plant that acts as the fundamental blueprint for achieving higher quality and lower manufacturing cost.
- New improved machineries with average of 3-year usage, far below the average of industry peers' (5~6 years old).
- TSEC possesses higher automation (**>97%**) and lower production cost compared to the major industry players.



The Best Reasons for Outstanding Performance

2. We innovate product differentiation and quality perfection by adopting cutting-edge R&D technology.
3. We collaborate with multinational enterprises, i.e. Japan **Sharp** and US **DuPont**, to form partnerships in R&D and Supply Chain and to ensure TSEC's product innovation leadership.
4. Our Production capacity is fully booked while utilization ratio has always been above 90% since year 2013.



1st Tier Solar Cell Maker

Main Product: E-Cell

Unique features that differentiate from others:

1. Implementing “thermal process” to modify the interface of solar cell for efficiency gain:

Mono-Cell highest eff. > 19.9%

Multi-Cell highest eff. > 18.5%

2. Achieving PID-free with anti-reflective “ARC” layer design.

Newly Introduced: V-Cell

Passivated emitter and rear contact structure (PERC) based on E-Cell technology, a deviation from the ordinary PERC cells.

Possesses two unique features:

1. Higher Efficiency:

Mono-Cell highest eff. > 21.1%

Monolike highest eff. > 20.4%

Multi-Cell highest eff. > 19.3%

2. High quality PID-free

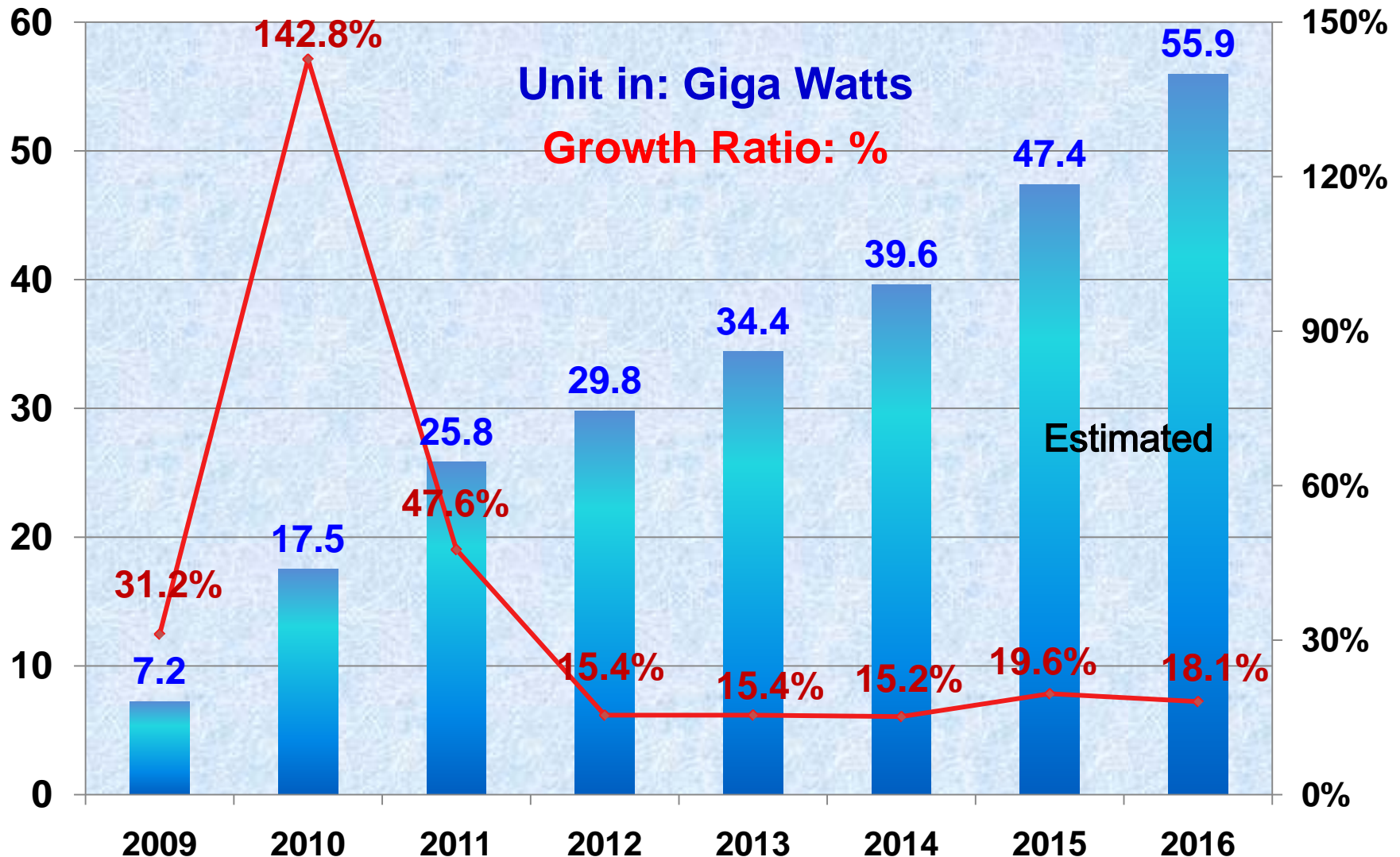
Currently in production, mainly for Japan, Europe and the U.S. markets.

Acquired numerous patent certificates on E-Cell and V-Cell from both domestically and internationally.



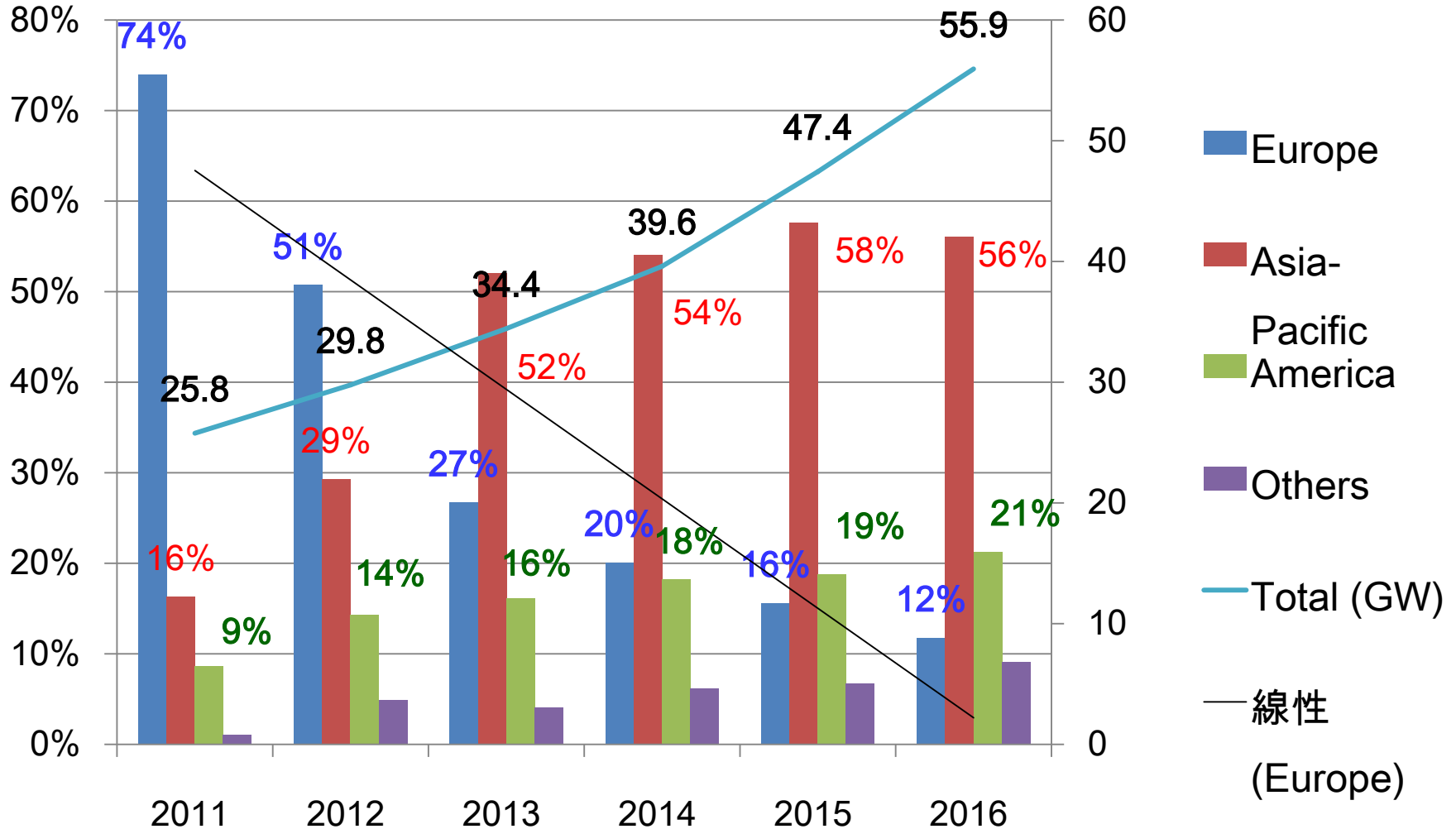
II. Market Outlook

Stable Growth of PV Systems Installation



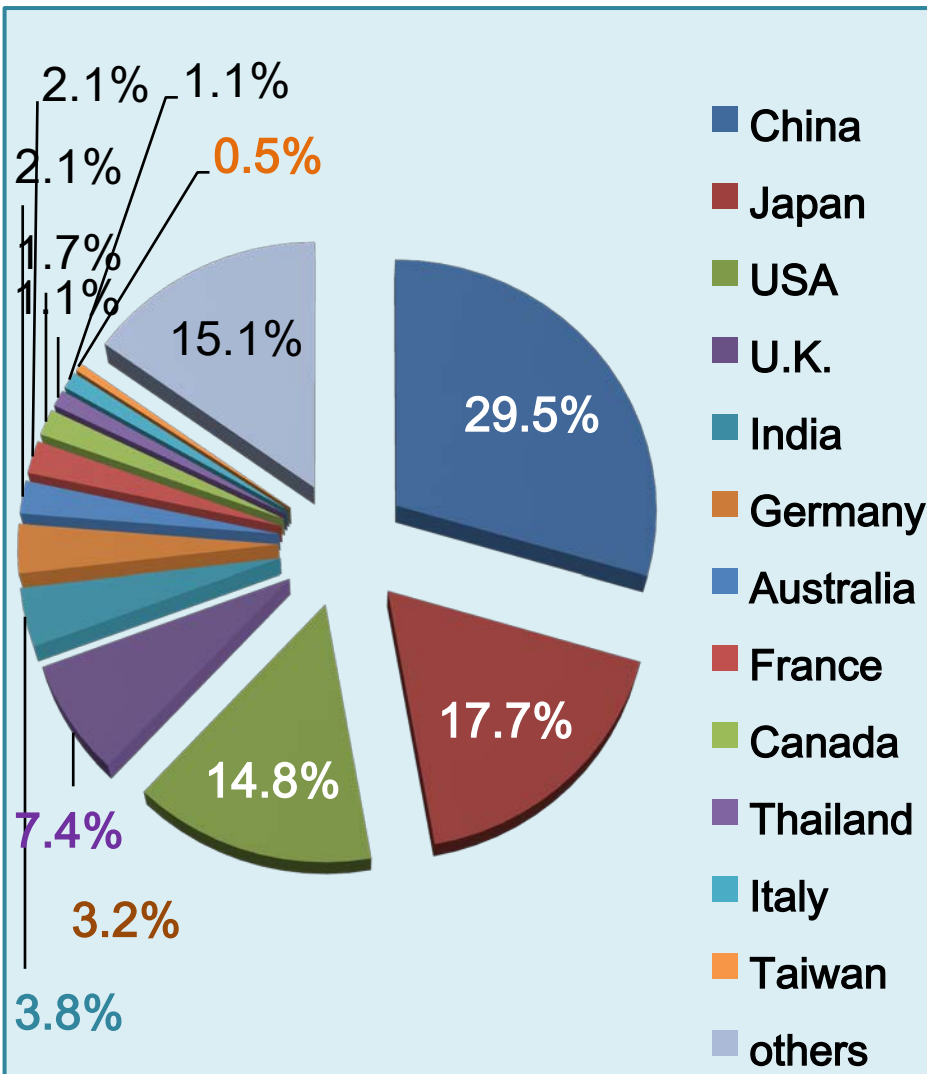


PV Installation by Geographical Distribution

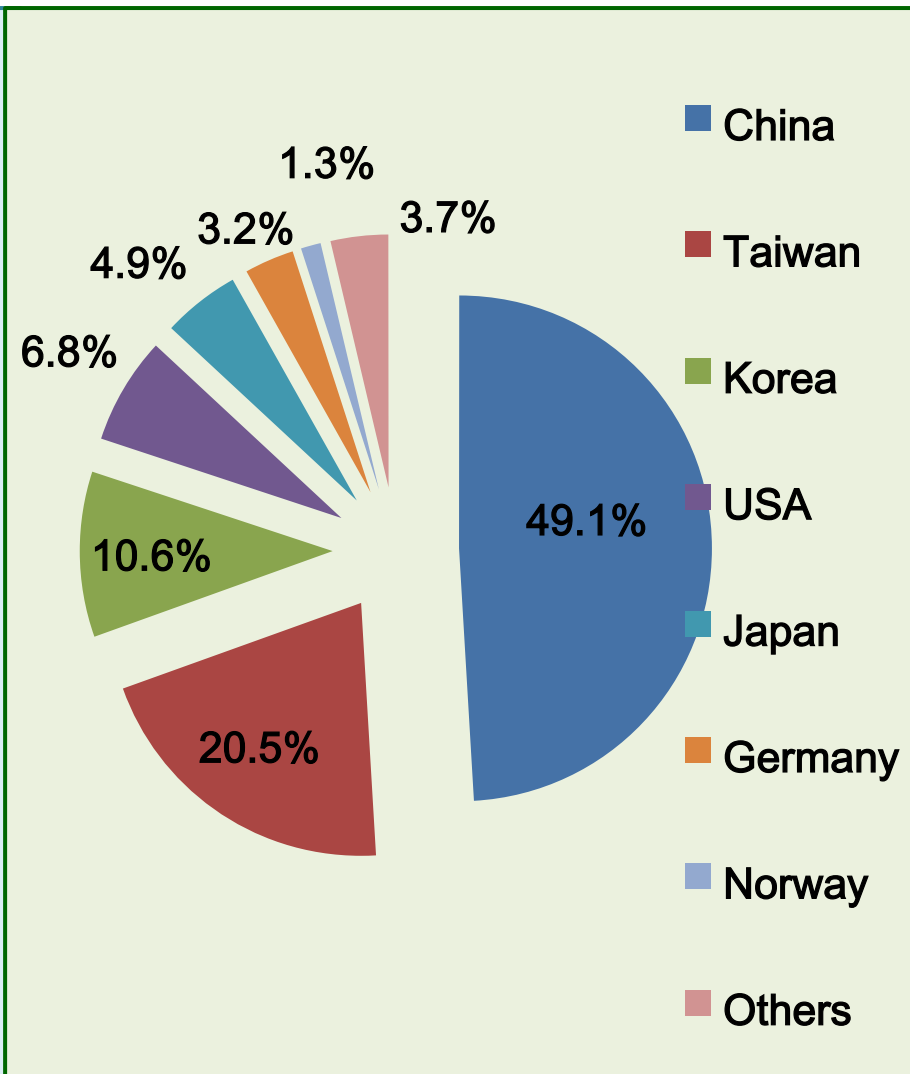




2015 PV Systems Installation and Cell Capacity



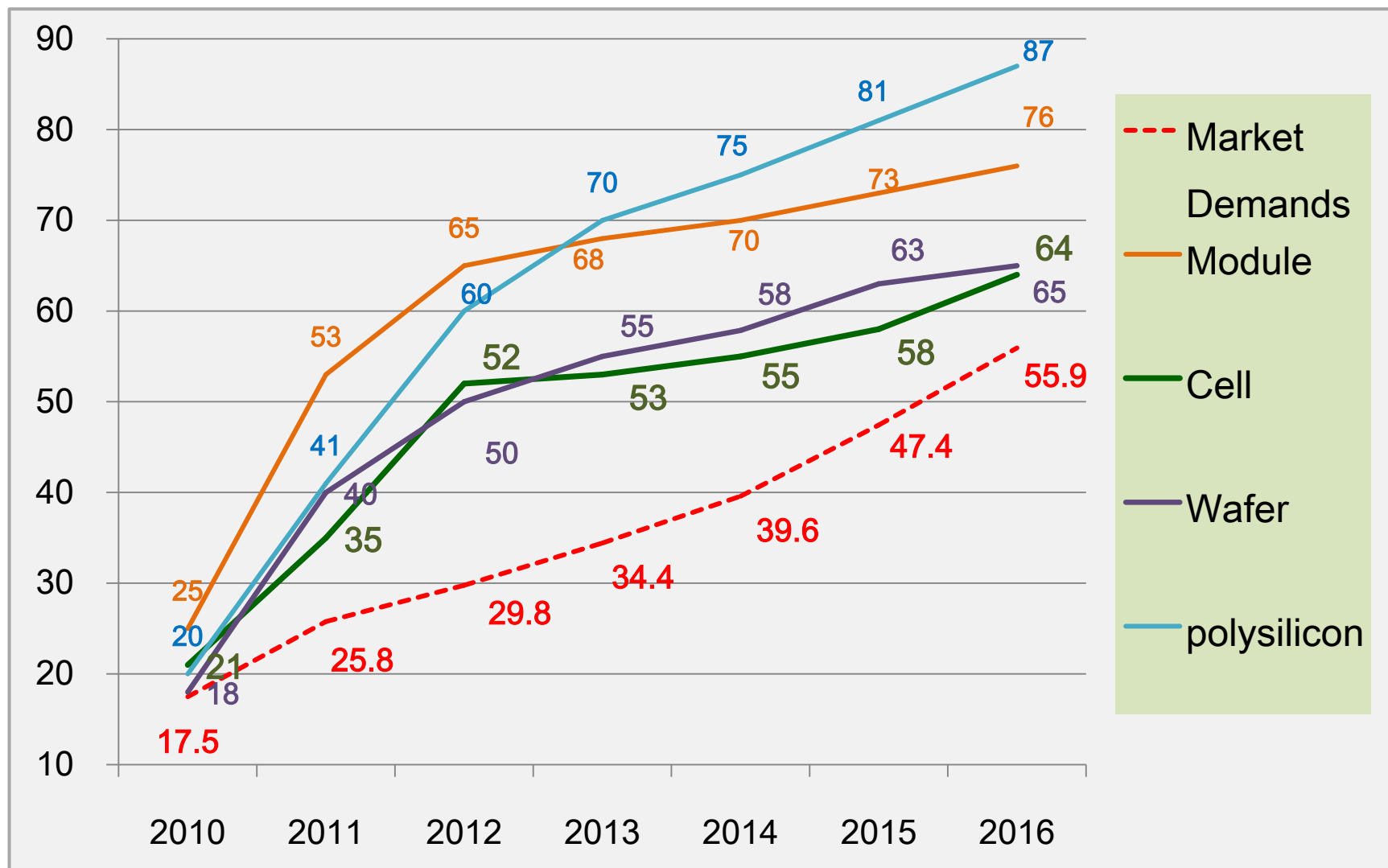
Total Installation: **47.4GW**



Total Cell Capacity: **56.7GW**



Over-capacity situation has been alleviated since Q4 2015





Limit Capacity Expansion in next two years

1. The global cell capacity is 54~58GW. With china's policy to limit financing and leading plan, the possibility of big capacity expansion is low in the next two years.
2. China government regulates 255W module is the lowest standard for compensation in 2015. in 2016, the standard will reach 260W. Most small cell companies will be eliminated.
3. The total capacity is 60~65GW in 2016. The effective capacity is 80~85% . The expected installation is 55.9GW in 2016 so the supply and demand situation is reasonable.



New Effective Cell Capacity in 2016

- Demand will increaase 8GW

- Based on market information, the new capacity is 11GW till the end of 2016. The estimated addition production in 2016 is 6GW.

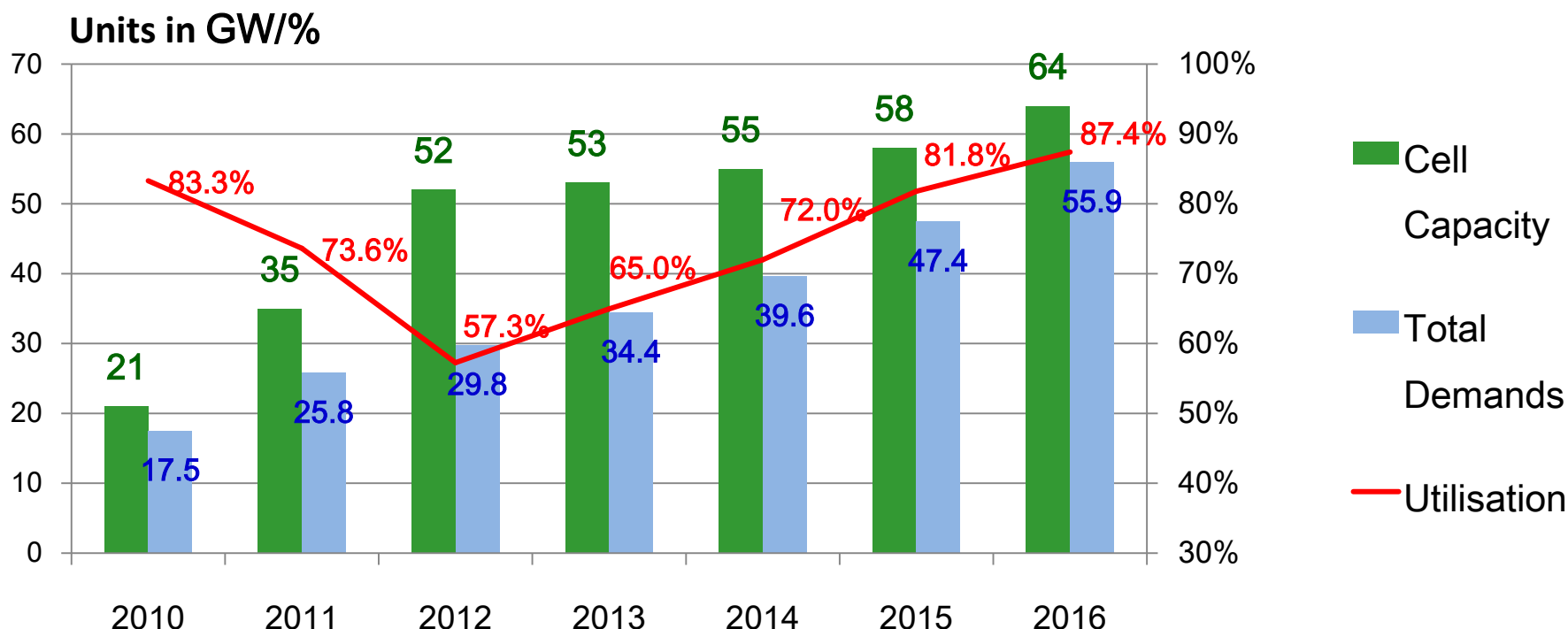
- Supply and demand situation is still reasonable.

產能排名	英文名稱	中文名稱	2015年底 電池產能 (MW)	2016年底 電池產能 (MW)	2016年 電池增加產 能(MW)
1	Trina Solar	天合	4,200	7,000	2800
2	Hanwha Q Cells	韓華	4,000	5,200	1200
3	Yingli	英利	3,600	3,600	0
4	JA Solar	晶澳	3,420	3,800	380
5	Jinko Solar	晶科	2,640	3,040	400
6	Motech	茂迪	2,500	3,300	800
7	Neo Solar	新日光	2,050	2,500	450
8	Tongwei	江西通威	1,800	3,000	1200
9	Hareon Solar	海潤	1,800	1,800	0
10	Gintech	昱晶	1,680	1,800	120
11	Canadian Solar	阿特斯	1,600	2,500	900
12	Solarworld		1,500	1,500	0
13	Kyocera	京瓷	1,245	1,245	0
14	Talen Sun	中利騰輝	1,020	1,500	480
15	Suntech	尚德	1,000	1,200	200
16	Changzhou Eging	常州億晶	960	1,300	340
17	Solartech	昇陽科	900	1,200	300
18	InventecSolar	英穩達(含)	800	1,350	550
19	Lerri	樂葉光伏	800	1,200	400
20	TSEC	元晶	730	1,200	470
總計			38,245	49,235	10,990



Healthy trend in the Utilization of Facilities

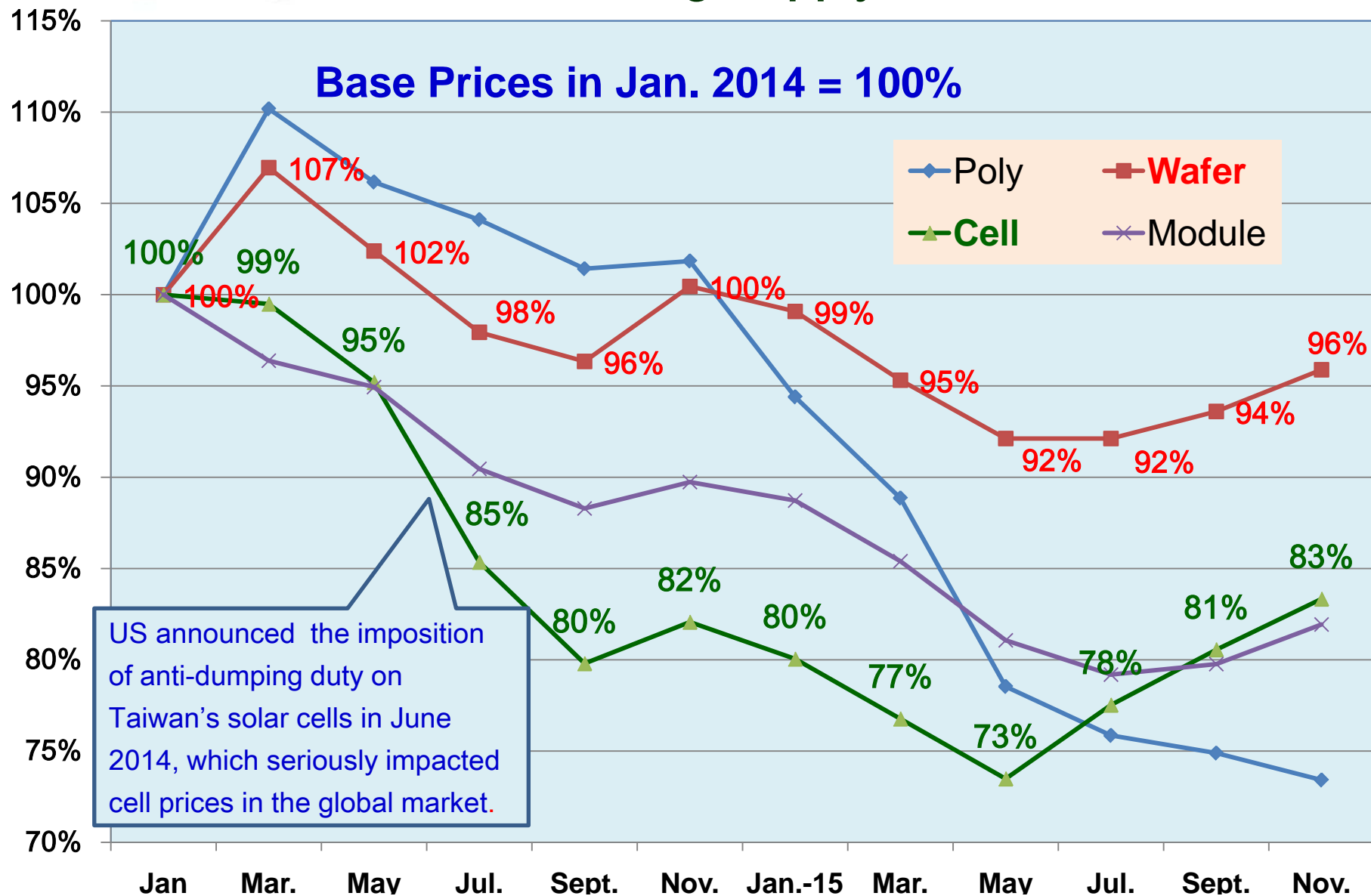
Utilization of global cell capacity has been raised significantly during the past 3 years indicating an healthy trend in the equilibrium of demand and supply, which certainly will enhance the industry's profitability in 2016.





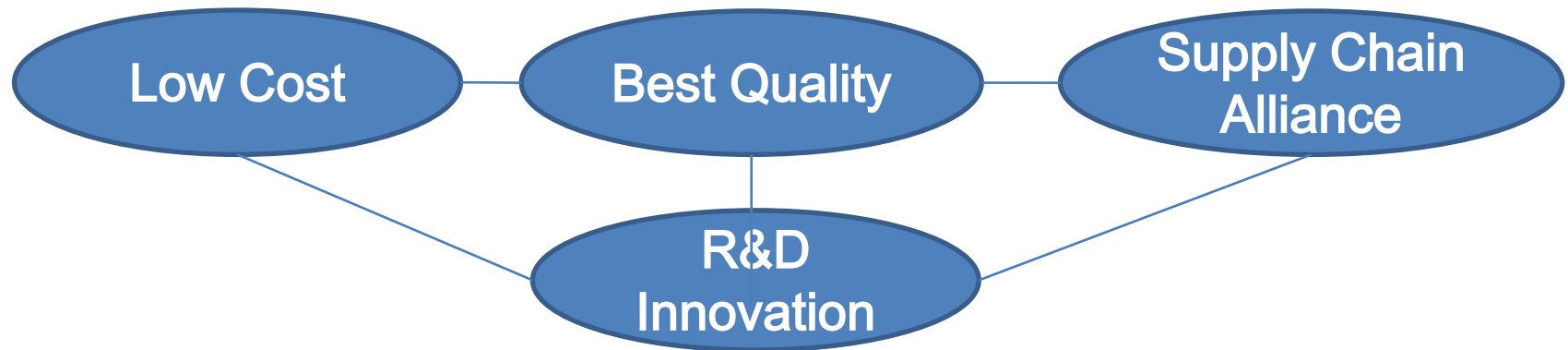
Solar Cell Prices Jump-back among Supply Chain

Base Prices in Jan. 2014 = 100%





III. TSEC's Comparative Advantages



Cell innovation drives quality and cost in two ways: first through increased efficiency characterized by **continuous technology improvements**, and second through normal component cost reduction characterized by production **efficiency increases** and **economies of scale**.

Since PV costs are normalized by watts generated, any increase in cell efficiency gets leveraged through the value chain; i.e. module and system costs. We forward look cell innovation required to drive solar cost to achieve **Grid Parity** in 2016.

TSEC Leads the Industry in Quality and Cost

KPI of competitive strength in PV cell production:

1. PV Convert Efficiency
2. Standard Deviation of Efficiency
3. Product Distribution (multi-cell)
4. Production Yield
5. Cost

Competitive Strength KPI	1 st Tier China Producers	1 st Tier Taiwan Producers	TSEC
Avg. Efficiency-multi	17.70%	17.7% ~ 18.0%	> 18.1%
Avg. Efficiency-mono	19.30%	19.4%~19.6%	> 19.6%
Standard Deviation- 2 σ	0.60%	0.4%~0.5%	0.40%
Product Distribution efficiency of multi-cell $\geq 17.8\%$	75% ~ 85%	80% ~ 90%	96%
Production Yields	97.00%	97%~98%	98.50%
Total cost per watt* exclude wafer cost	US\$0.10~0.125	US\$0.12~0.14	US\$0.114

* Total cost includes production, SG&A and non-operating cost.



Poly-Silicon **Multi-Cell** Dominates the PV market Demand

Market Demand for Cells and TSEC's Product Mix in 2015

Product Category	Global Demand GW	%	TSEC Capacity MW	%	TSEC Product Mix	%
poly-Si multi-cell	35.9	75.6%	380	52.1%	631	93.9%
poly-Si mono-cell	4.0	8.4%	200	27.4%	23	3.4%
poly-Si mono-cell (PERC)	1.7	3.6%	150	20.5%	18	2.7%
Thin-film Cell	3.1	6.5%	0	0.0%	0	0.0%
HIT Cell	0.8	1.7%	0	0.0%	0	0.0%
Back-contact Cell	1.5	3.2%	0	0.0%	0	0.0%
Others	0.5	1.1%	0	0.0%	0	0.0%
Total	47.4	100.0%	730	100.0%	672	100.0%



Historical Trend of Specifications for Multi-Cell & Module

	2010	2011	2012	2013	2014	2015	2016
Mainstream Specs. for multi-module (With 60 pieces of cells)	240W	240W	245W	245W	250W	255W	260~265W
Cell Efficiency Required for multi-modules	16.8%	16.9%	17.0%	17.2%	17.4%	17.6%	17.8%~ 18.2%

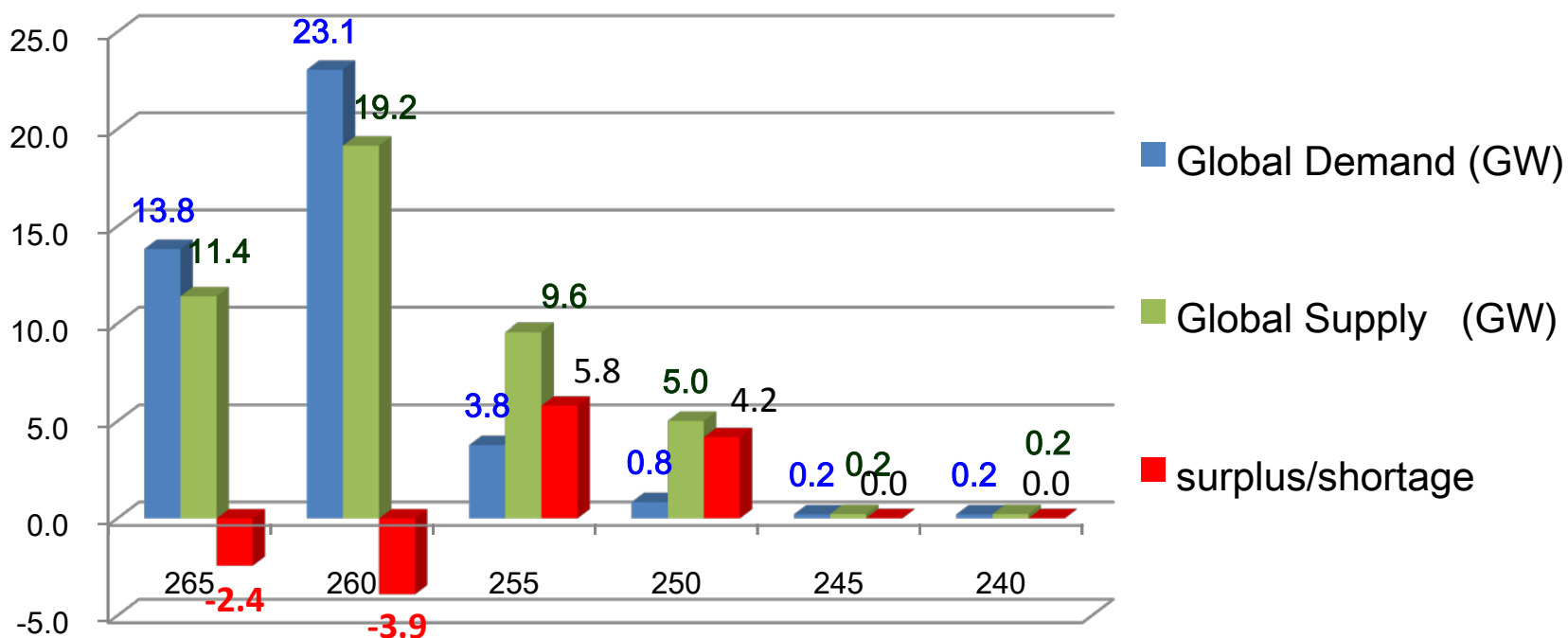
Multi-modules of 260~265 watts (with 60 pieces of cells) will be the mainstream product in the global PV market in 2016, which in turn will require the convert efficiency of multi-cell pertinent to the level of **17.8%~18.2%**.



Multi-cell with efficiency of +17.8% could be short in 2016

Demand for Multi-Cell and module vs. Supply in Product Distribution in 2016

Multi-module Spec.	265	260	255	250	245	240	Total
Required Efficiency for cell	18.2%	17.8%	17.5%	17.1%	16.8%	16.4%	
Global Demand (GW)	13.8	23.1	3.8	0.8	0.2	0.2	41.9
Global Supply (GW)	11.4	19.2	9.6	5.0	0.2	0.2	45.6
surplus/shortage (GW)	-2.4	-3.9	5.8	4.2	0.0	0.0	3.7





Increasing Profitability by high Efficiency Cells

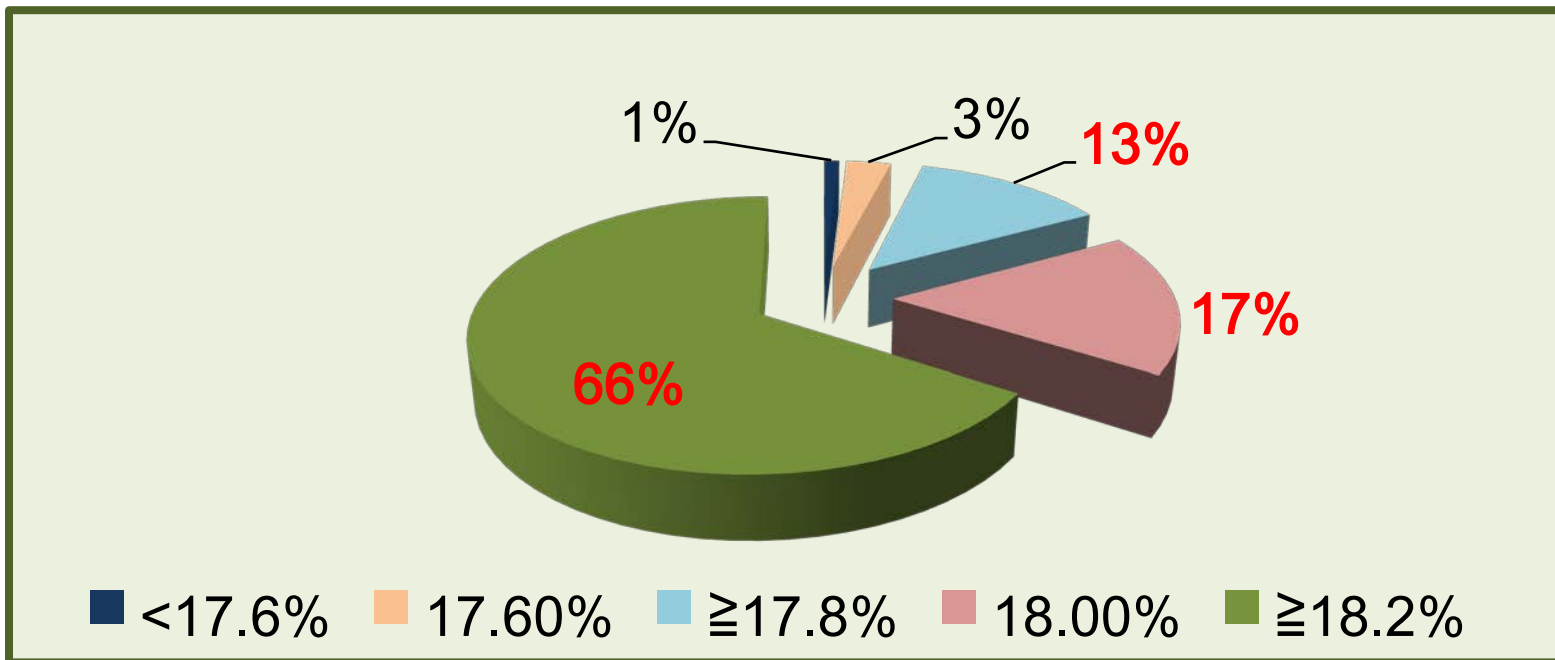
The definition of effective cell capacity:

1. The average efficiency of multi-cell will increase from 17.6 to 17.8% in 2016.
2. Over 90% of the production efficiency must be greater than 17.8%.
3. Commercialized product percentage must be greater than 97% in the production.
4. Only half of global capacity, which is mainly on Taiwan and china's first-tier companies, can reach the standard.



TSEC's better Product Distribution
contributes a solid base for competition

TSEC Product Mix for Poly-Si Multi-Cell



96% of TSEC's multi-cells meet the rigorous market specification of efficiency **at 17.8%~18.2% level** .

96% could be **the highest ratio** among all the PV-Cell producers in the world



IV. Expansion Plan in 2016 & 2017

		2015	2016					2017	
	unit	current	Feb.	May	July	Sept.	Nov.	March	July
Prod. Line		1~7	8	9	10	11	12	13~14	15~16
Daily Capacity	1,000 pieces	440	503	575	647	719	791	935	1,079
Annual Capacity	million pieces	161	184	210	236	262	289	341	394
Convert Efficiency	%	18.7%	18.7%	18.6%	18.7%	18.6%	18.8%	19.2%	19.3%
Annual Capacity	MW	730	830	950	1,050	1,200	1,300	1,600	1,850
Total Capex	NT\$ Million		282	660	400	570	470	920	1,090



The Importance of capacity expansion

1. Steady market growth in global demand **with two-digit growth rates** in coming years
2. Expand production capability to reduce operating costs and increase profitability as well as **EPS to a higher level**
3. Increase global market share and influence
4. Increase **domestic market** share by expanding production capacity for the expectation of huge demand on installation of solar cells, which **Taiwan will install PV capacity reached at 25GW in 10 years**



Company's Positioning & Business Strategy

Company's Positioning:

Win the global **best quality** product at a **lowest cost** in PV industry to sustain competitive advantage and superior long-term profitability

Business Strategy:

1. Upgrade **R&D capability** – Design new generation solar cells with higher convert efficiency
2. Create **TSEC own brand name** to expand the market share in modules and PV power stations
3. Expand Production Capacity to become one of **the top 10 solar cell** manufacturing and marketing company in the world
4. Establish **supply chain relationship** with global leading PV companies to enhance R&D and market influence
5. Increase **EPS** to a higher level in 2 years



Solar Energy Innovation 創新科技拓展太陽能

The Sun is the ultimate source of energy for all creatures on Earth. Through the fast innovation in photovoltaic technology, we strongly believe that solar energy is the prime solution for reducing greenhouse effect and alleviating the depletion of energy resources to our planet. As a PV manufacturer, we set our corporate vision for an eternal prosperity of Earth and vow to protect our planet.

(TSEC Corporate Vision)

謝謝指教!

