

# China Solar Manufacturing

## Changing competitive landscape, finding bottom in 2017

	Ticker	Rec	Mkt cap		Price	EPS growth (%)		PER (x)		PBR (x)		ROE (%)	
			(USD mn)	Ccy		2017E	2018E	2017E	2018E	2017E	2018E	2017E	2018E
<b>GCL Poly</b>	3800 HK	Buy	2,269	HKD	0.94	5%	6%	7.0	6.6	0.7	0.6	11%	10%
<b>Xinyi Solar</b>	968 HK	Buy	2,090	HKD	2.40	15%	15%	7.1	6.2	2.0	1.7	31%	30%

Source: Bloomberg, CSCI Research

- While the dramatic price declines have brought forward grid-parity of solar power in the medium term, we expect solar installation demand to be relatively stable in 2017, counter to aggressive expansions along the solar value chain.
- Domestic polysilicon and PV glass capacity is estimated to increase by over 20% YoY in 2017 with newcomers adding to supply, which came as a big negative surprise given their relatively mature competitive landscapes. Meanwhile, midstream suppliers see extended requirements on efficiency and costs in technological advancements.
- HK-listed solar manufacturers have underperformed the market by c.30% since Sep-2016 and their overall valuation is more than 1SD below the historical average, but as we expect market sentiment to remain weak going forward, we recommend waiting for re-rating catalysts.

**Stable demand for solar installation in 2017.** 2016 witnessed the deepest declines in solar prices amid a downtrend since 2012, which helped boost the economics of solar power. Looking ahead, we expect to see further declines in solar pricing that would lead to an earlier-than-expected grid-parity with other power sources. In view of the high base of solar installation in 2016 and a slowdown in the three major countries, we expect to see sluggish growth in global solar installations in 2017.

**Unexpected expansions in polysilicon and PV glass during 2016-18E** came as a big negative surprise in the solar industry, as the two markets have been dominated with incumbents with high concentration and entry barriers. Domestic poly capacity is expected to increase by over 20% YoY both in 2017 and 2018 (vs. 10% YoY growth in 2016) driven by GCL Poly (3800 HK), East Hope, Tongwei (600438 CH) and Xinte Energy (1799 HK). Meanwhile, for PV glass, major capacity expansions have either commenced in 2016 or scheduled to be launched in 2017 with respective YoY growth rates of 29% and 25%, and a turnaround in ASP will not likely be realized until the industry overhauls takes place (c.20% of existing capacities) and inefficient furnaces cease production.

**Intensifying midstream competition, a race in efficiency and costs:** with respect to wafers and cells, there would be competing trends between mono-Si upgrades on PERC cells and multi-Si adoption of diamond wire sawing technology, respectively led by Longi Silicon (601012 CH) and GCL Poly. But despite the ongoing technology race, the extended requirements on efficiency and costs are in favour of leading suppliers, as we expect the Chinese module suppliers to gain market share with double-digit growth in shipments.

**Weak sentiments since Sep-2016 and wait for re-rating catalysts.** HK-listed solar manufacturers have underperformed the HSI by c.30% since Sep-2016 and their overall valuation is more than 1SD below the historical average. We hold a cautious view on solar manufacturing, given the exacerbated over-supply and technological competition. Meanwhile, as we expect market sentiment to remain weak, we recommend waiting for re-rating catalysts.

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## Valuation: waiting for re-rating catalysts

**Figure 1: Peer valuation**

Company	Ticker	Close (Local\$)	Mkt cap (USD mn)	EPS Growth		PER (x)		PBR (x)		ROE (%)		Yield (%)		Net Gear (%)	
				FY17E	FY18E	FY17E	FY18E	FY17E	FY18E	FY17E	FY18E	FY17E	FY18E	FY17E	FY18E
<b>PV glass manufacturers</b>															
Xinyi Solar	968 HK	2.4	2,090	15%	15%	7.1	6.2	2.0	1.7	31%	30%	6.1%	7.1%	67%	62%
Flat Glass	6865 HK	1.7	391	-11%	26%	4.8	3.8	0.7	0.5	18%	19%	5.1%	6.3%	-	-
<b>Average</b>				<b>2%</b>	<b>20%</b>	<b>6.0</b>	<b>5.0</b>	<b>1.4</b>	<b>1.1</b>	<b>24%</b>	<b>25%</b>	<b>5.6%</b>	<b>6.7%</b>	<b>67%</b>	<b>62%</b>
<b>Poly &amp; Wafer manufacturers</b>															
Longi	601012 CH	16.2	4,887	8%	24%	17.4	14.0	2.8	2.3	17%	18%	0.7%	0.9%	26%	34%
GCL Poly	3800 HK	0.9	2,269	5%	6%	7.0	6.6	0.7	0.6	11%	10%	0.0%	0.2%	135%	135%
Daqo	DQ US	18.5	195	8%	9%	3.4	3.1	0.6	0.5	17%	17%	0.0%	0.0%	81%	57%
<b>Average</b>				<b>7%</b>	<b>13%</b>	<b>9.2</b>	<b>7.9</b>	<b>1.3</b>	<b>1.1</b>	<b>15%</b>	<b>15%</b>	<b>0.2%</b>	<b>0.4%</b>	<b>81%</b>	<b>75%</b>
<b>Module manufacturers</b>															
GCL System	002506 CH	4.3	3,108	-	28%	19.9	15.6	4.1	3.4	21%	23%	0.7%	0.9%	125%	104%
Canadian Solar	CSIQ US	13.7	786	37%	11%	8.9	8.0	0.8	0.7	11%	9%	0.0%	0.0%	156%	131%
Jinko	JKS US	17.2	545	-50%	33%	6.2	4.7	0.6	0.5	9%	8%	0.0%	0.0%	114%	121%
JA Solar	JASO US	6.7	316	-89%	238%	32.0	9.5	1.6	1.6	-9%	2%	0.0%	0.0%	78%	69%
<b>Average</b>				<b>-34%</b>	<b>78%</b>	<b>16.8</b>	<b>9.4</b>	<b>1.8</b>	<b>1.5</b>	<b>8%</b>	<b>10%</b>	<b>0.2%</b>	<b>0.2%</b>	<b>118%</b>	<b>106%</b>
<b>Downstream solar farm</b>															
GCLNE	451 HK	0.4	980	438%	41%	9.0	6.4	1.2	1.0	13%	15%	0.0%	0.3%	272%	235%
Singyes	750 HK	3.4	376	-13%	8%	5.1	4.7	0.5	0.5	12%	11%	1.4%	1.5%	84%	77%
<b>Average</b>				<b>212%</b>	<b>25%</b>	<b>7.1</b>	<b>5.6</b>	<b>0.9</b>	<b>0.7</b>	<b>13%</b>	<b>13%</b>	<b>0.7%</b>	<b>0.9%</b>	<b>178%</b>	<b>156%</b>

Date as of 24-Apr, 2017

Source: Bloomberg, CSCI Research

**Figure 2: Xinyi Solar (968 HK) historical PER band**


Source: Bloomberg, CSCI Research

**Figure 3: Xinyi Solar (968 HK) historical PBR band**


Source: Bloomberg, CSCI Research

**Figure 4: GCL Poly (3800 HK) historical PER band**


Source: Bloomberg, CSCI Research

**Figure 5: GCL Poly (3800 HK) historical PBR band**


Source: Bloomberg, CSCI Research

## Demand: solar economics on the upsurge

### Solar demands: limited installation growth expected in 2017

#### Global solar installations to be largely stable in 2017

2016 saw the most substantial solar power installations in China and the US with China recording 34GW new grid-connections and installations in the US nearly doubling to 14-15GW, making up for c.60% of global installations, beating our expectations and increasing global installations by 44% YoY to 75GW for the year (vs. our estimates of 70GW). For the current year, we expect global installations to remain at close to 70GW, particularly in light of the continuous decline in module prices and record-low global bidding tariffs; and compared with our predictions, we see downside risks to the street's estimates for 2017 solar installations in China as we think it has overlooked the downside risks from quota deficits in utility-scale projects.

#### We maintain conservative on China due to quota deficits

With regard to the Chinese market, we estimate that 15 provinces already have new grid-connections exceeding their respectively installation quota for 2015-16, let alone undisclosed installed capacities that are unable to connect to grid, especially in the northwest regions. Confronting this notable disparity between installed capacity and subsidy quota, we expect existing utility-scale projects to occupy a large proportion of the 2016 quota and also overdraw 2017 quota through the 7GW+ additions. DG installations would be the positive surprise but we would prefer to wait for more clarification on its development pace. Therefore, we conservatively estimate 16-18GW solar installations in China this year (for more details, please see our Feb report, *China Solar Power 2017 outlook: Quota deficit in utility-scale projects, but limited impacts on listcos.*).

### Solar pricing: intensifying requirements on cost competitiveness

#### Lifted solar power economics in 2016 due to sharp costs reduction

While price drops are the norm in the solar industry over the past decade, 2016 witnessed the most dramatic downward pricing trends since 2011-12 in not only module pricing but also the entire BOS hardware ecosystem (balance-of-system, including inverters, trackers and even labour costs). The impressive cost reductions recently have helped brought solar power to a level that can increasingly compete with other technology. The consistent reductions in system costs make the access to low-cost financing playing an increasingly important role; according to a recent study by First Solar, 33% of the current LCOE of solar power comes from financing, accounting for the single largest part, vs. 27% from BOS and 17% from module.

#### Solar pricing continues to drop and be driven by the shift to tender bidding

Consistent reduction in solar pricing has been largely facilitated by the continuous decline in module prices; and despite the price crash last year, according to industry consensus, solar pricing will continue to come down in 2017 given the persistent oversupply situation; and the reduction would also be driven by the wide-spread adoption of tender bidding. Along with the reduction of FiT rates in current major markets, capacity bids have been spreading in the major markets as well as emerging markets. Emerging markets in Latin America, Middle East and Asia Pacific nations, such as Mexico, Israel, Turkey, are adopting auction tenders directly as the way of procuring new capacity.

## Supply: unexpected Poly/PV glass expansion

### Poly and PV glass: cost-driven capacity expansion, positioning for 2019 grid-parity

The aggressive capacity expansions in Poly and PV glass came as the biggest negative surprise along the solar value chain, as the market expected relatively matured competitive landscape in these two segments in light of their highest concentration ratios and entry barriers. And we think it was mainly due to 1) newcomers are motivated by the superb industry profitability (30-40% GPM in 2016) and longer-term positive outlook on solar power, and 2) existing players expand capacity for lower production costs which is for strengthening market share as well as compelled by the steep cost reduction in solar power.

#### Polysilicon: domestic capacity to increase by over 20% YoY both in 2017 and 2018

While Tier 2 suppliers completed technology upgrades in 2015-16, large-scale expansions are planned by leading players in 2017-18, including:

- **GCL Poly (3800 HK):** add 60kt new facilities in Xinjiang by 2020, including 20kt to commence production in 2Q18 and another 20kt by end-2018; its production capacity would increase by 56% from current 72kt to 112kt, maintaining to be the largest polysilicon producer in China and globally;
- **Xinte Energy (1799 HK):** add 8kt new capacity by Jun-2017 from technology upgrades, increasing total capacity by 36% from 22kt to 30kt; it is the second largest poly producer in China with the lowest production cost on a global basis, but might lose its ranking to Tongwei in 2017;
- **Tongwei (600438 CH):** acquired Sichuan Yongxiang in Jan-2016 and became the third largest domestic producer; it plans to expand capacity from 15kt in 2016 to 20kt by end-2017 and increase capacity further to 45kt by end-2018;
- **East Hope:** the newcomer with 30kt new capacity in Xinjiang commencing production in Apr-2017;
- **Daqo (DQ US):** leading low-cost producer and made the domestic Top 5 rankings in 2017; 6kt new capacity commenced production in 1Q17, which is slightly ahead of schedule and increased its total capacity to 18kt from 12kt.

**Figure 6: Domestic polysilicon capacity, 2015-2018E**

(MT/year)	2015	2016	Jun-17E	2017E	Jun-18E	2018E
GCL Poly (3800 HK)	68,000	72,000	72,000	72,000	92,000	112,000
Xinte Energy (1799 HK)	22,000	22,000	30,000	30,000	30,000	30,000
China Silicon	15,000	15,000	15,000	15,000	15,000	15,000
Tongwei (600438 CH)	15,000	15,000	15,000	20,000	20,000	45,000
Asia Silicon	12,000	15,000	15,000	15,000	15,000	15,000
Daqo (DQ US)	12,150	12,150	18,000	18,000	18,000	18,000
East Hope	-	-	30,000	30,000	30,000	30,000
Tier 2 suppliers	44,000	56,500	56,500	56,500	56,500	56,500
<b>Domestic capacity</b>	<b>188,150</b>	<b>207,650</b>	<b>251,500</b>	<b>256,500</b>	<b>276,500</b>	<b>321,500</b>
<i>Period net additions</i>	<i>23,150</i>	<i>19,500</i>	<i>43,850</i>	<i>48,850</i>	<i>20,000</i>	<i>65,000</i>
<i>YoY growth (%)</i>	<i>14%</i>	<i>10%</i>	<i>22%</i>	<i>24%</i>	<i>10%</i>	<i>25%</i>

Source: Company, China Silicon Association, CSCI Research

**PV glass: ASP depressed by massive expansions in 2016, turnaround on overhauls**

Domestic daily glass melting capacity has expanded by 29% YoY to 19,980ton/day as at end-16 and might further expand to c.25kton/day in 2017 if the currently announced expansion plans are delivered and the massive overhauls in the industry do not take place. While there were unexpected expansions from non-tier suppliers in 2016, leading players have retained their expansion plans for 2017-18

- **Xinyi Solar (968 HK):** daily melting capacity increased by 49% from 3,900tons in June to 5,800tons as at end-2016, and further increased to 6,800tons in Feb-2017; and the management indicated to prioritise sales volume from these new production lines, which would weigh on industry ASP;
- **Flat (6865 HK):** the second largest PV glass producer in China; capacity to increase by 1,000tons to 3,290tons/day by end-2017; for 2018; besides the 1,000tons from the Vietnam production line, the company has added another 1,000tons production line in Anhui;
- **IRICO (438 HK):** the newcomer and ranked the third in 2016 with 1,500tons/day capacity, and it guided 3,200tons/day capacity by 2018 with net adds of 800tons in Anhui and 900tons in Shaanxi.

**Figure 7: Domestic PV glass capacity, 2015-2018E**

(Tons/day)	2015	2016	Jun-17E	2017E	Jun-18E	2018E
Xinyi (968 HK)	3,900	4,900	5,900	5,900	5,900	5,900
Flat (6865 HK)	2,290	2,290	2,290	3,290	3,290	4,290
IRICO (438 HK)	750	1,500	2,300	3,200	3,200	3,200
Hebei Jinxin	-	1,400	1,400	1,400	1,400	1,400
CSG (sub. of 000012 CH)	1,300	1,300	1,300	1,300	1,300	1,300
CNBM	950	950	1,230	2,230	2,230	2,230
AVIC Sanxin (002163 CH)	900	900	900	900	900	900
ANCAI Hi-Tech (600207 CH)	750	750	750	750	750	750
Tier 2 suppliers	4,680	5,990	5,990	5,990	5,990	5,990
<b>Domestic capacity</b>	<b>15,520</b>	<b>19,980</b>	<b>22,060</b>	<b>24,960</b>	<b>24,960</b>	<b>25,960</b>
<i>Period net additions</i>	<i>1,970</i>	<i>4,460</i>	<i>2,080</i>	<i>4,980</i>	<i>-</i>	<i>1,000</i>
<i>YoY growth (%)</i>	<i>15%</i>	<i>29%</i>	<i>30%</i>	<i>25%</i>	<i>13%</i>	<i>4%</i>

Source: Company, SCI 99, CSCI Research

**Wafer and Cell: technology competition on multi vs. mono led by GCL Poly and Longi Silicon**

Since 2016, the mono-Si market has witnessed a booming demand, driven by its cost reductions and preference from Top Runner projects. Looking into 2017, two key trends with regard to competition on efficiency and costs have emerged, namely:

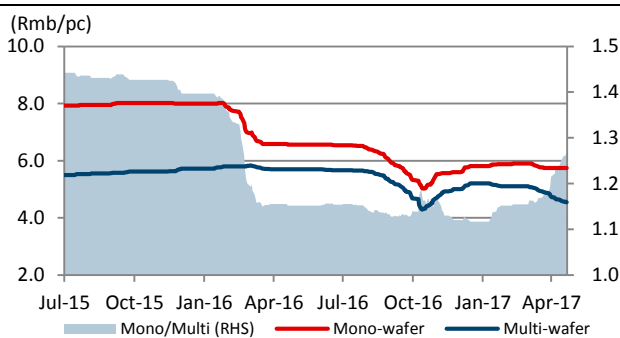
- **Mono-Si upgrades on efficiency gain from PERC cell**, which has been led by the largest mono-wafer supplier Longi Silicon (601012 CH) and collaborated with major module suppliers i.e. Trina, Jinko; 2017 will witness addition of new production lines, the adoption of PERC cell upgrades, and further ingot pulling improvements as GCL Poly commenced commercial production of CCZ;
- **Multi-Si upgrades on cost reductions from diamond wire saws**, which is led by GCL Poly (3800 HK on wafer side and GCL System 002506 CH on cell side) and Canadian Solar. Diamond wire saws could save c.10% in costs on wafer slicing which is applied in mono-wafer production; its adoption in multi-wafer was bottlenecked in the downstream cell stage in 2016 and is expected to gain traction this year.

### The rising popularity of mono-Si wafer since 2016

P-type multi-wafer has dominated the market for years due to a significant pricing advantage and constant efficiency enhancements, whereby GCL Poly has been fully in control. But the dynamics has changed since 2016 when mono-wafer supply was scaled up, which was mainly driven by Longi, and pushed mono prices to within a few percentage points to p-multi wafers. On the supply side, the faster than multi-Si cost reductions in mono-crystalline production in 2016 was mainly attribute to the adoption of diamond wire saw wafer cutting, which not only trims slicing costs, but also reduces polysilicon consumption.

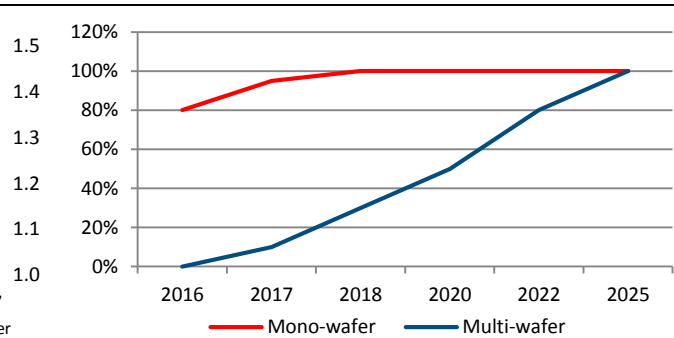
Diamond wire sawing is applicable to both mono- and multi-wafers but has been so far applied to mono-crystalline only. It would help save 10-15% in costs on wafer slicing from higher output ratio from ingot to wafer. Currently, most multi-Si ingots are cut into wafers by steel wires covered with slurry, which turns 50% of the whole ingot volume into useless dust; meanwhile, wires coated by diamonds will trim the loss to 35%, or effectively cutting polysilicon use per watt by 23%. Accordingly, on the cell/module front, the diamond wire sawing is expected to reduce production costs by USD0.02-0.03/watt, as it increases cell efficiency and reduces silicon usage.

**Figure 8: Price comparison of mono and multi-wafer**



Source: Wind, CSCI Research

**Figure 9: Forecasts on adoption rate of diamond wire saw**



Source: CPIA, CSCI Research

### 2017 expects further upgrades and multi-Si to regain cost competitiveness

We expect 2017 to witness multi-wafer to regain cost advantages over mono-wafer by the adoption of diamond wire saw for wafer slicing. Currently, the stumbling block for application on p-multi is at the next stage in cell production. The existing texturisation methods on p-multi (almost all using wet benches) are not compatible with the different surfaces finished from the DWS process, requiring a greater level of surface texturisation that can be achieved by either dry etching (such as RIE) or metal-assisted chemical etching. Therefore, for DWS to gain traction on p-multi, cell changes need to be synched to wafer changes, and the most common enhancement is the black silicon surface treatment; or wafer suppliers could include the front-end cell texturisation themselves to allow cell makers to avoid making this switch.

### Module: Chinese suppliers to gain global market share with distinct cost advantages

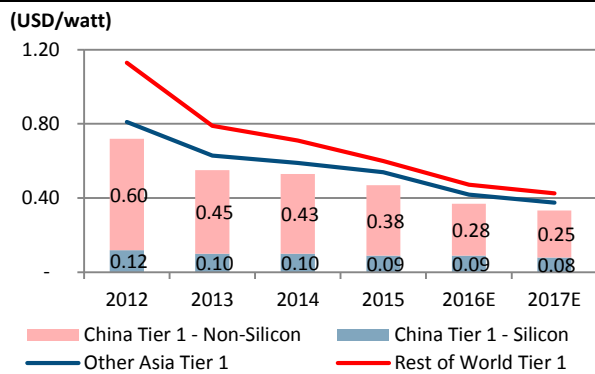
#### Chinese players dominate in terms of both scale and efficiency

Manufacturing costs for Tier 1 Chinese suppliers have been 10-30% lower than overseas peers, which is attributable to 1) economies of scale from the higher production capacities and output, 2) proximity to upstream suppliers to enjoy lower material and shipping costs, 3) focus on standard products for substantial commercial production, according to a recent study by IHS.

Accordingly, leading suppliers would gain market share with strong order book on hand. While we expect relatively stable global installations in 2017, module suppliers guided double-digit shipment growth rates this year and indicated a large proportion of their order book is already occupied. Specifically,

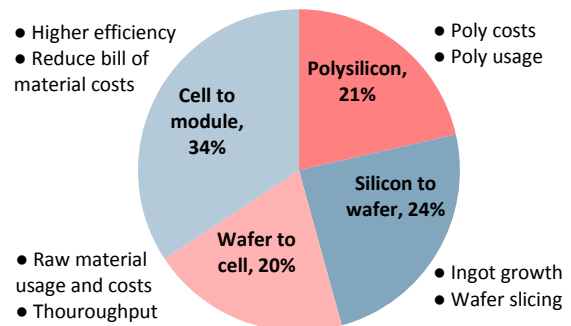
- **Jinko (JKS US)** recorded 6.7GW shipment in 2016 (+47% YoY) and guided 2017 shipments of 8.5-9.0GW (+28-35% YoY);
- **Canadian Solar (CSIQ US)** recorded 5.2GW shipment in 2016 (+11% YoY) and guided 2017 shipments of 6.5-7.0GW (+24-34% YoY);
- **JA Solar (JASO US)** recorded 5.2GW shipment in 2016 (+40% YoY) and guided 2017 shipments of 6.0-6.5GW (+15-25% YoY);
- **Trina (TSL US)** no disclosure as it was privatised in 2016.

**Figure 10: Module production costs, 2012-2017E**



Source: IHS, CSCI Research

**Figure 11: Module costs composition, 2016E**



Source: Company, CSCI Research

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## Company Rating Definition

The Benchmark: Hong Kong Hang Seng Index; Time Horizon: 12 months

<b>Buy</b>	12-month absolute total return: $\geq 10\%$
<b>Hold</b>	12-month absolute total return: $> -10\%$ but $< 10\%$
<b>Sell</b>	12-month absolute total return: $\leq -10\%$

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