Alternative Energy
Asia Solar Industry

HSBC Global Research

Asia Solar

A cloud in the sky

- **We believe the supply of PV systems will exceed demand in 09; shortage of polysilicon still a bottleneck**
- **Big players with broad customer bases and low cost raw material supplies will expand gross margin**
- **Prefer Suntech to Motech and Yingli due to gross margin potential in 2H08**

Technological advances, government subsidies and increasing global demand for renewable energy are all driving growth in solar power. HSBC forecasts a promising 45% global 2008-12 CAGR for the photovoltaic (PV) industry that makes PV cells for solar panels.

However, in contrast to consensus, we think supply will exceed end-user demand in 2009 for the first time since 2005, as governments in Spain and Germany reassess their subsidy policies. At the same time, we believe the current shortage of polysilicon – a key raw material for making PV cells – will continue for another 18 months, creating bottlenecks.

To succeed in this market, companies will need:
a) diversified customer bases to offset likely lower demand in Spain and Germany; b) leading technology to help lift gross margin; c) a secure supply of low cost raw materials through vertical integration or long term contracts.
We initiate coverage on three companies:

Suntech (OW (V), TP: USD46): Exposure to Spain should drop to 25-30% in 2H08 (vs 58% in 1H); has secured 80% of raw materials in 09, more than Motech and Yingli.

Motech (Neutral (V), TP: TWD255): More exposure to expensive spot wafers in 2H08 and might not meet original capacity expansion plans this year.

Yingli (Neutral (V), TP: USD17): Still highly exposed to Spain (50% in 2H vs. 58% in 2007). Lack of differentiation on technology poses further risk to gross margin in 2H.

	Ticker	Rating	Price (7/15)	Target	Return	08e P/E	09e P/E
Suntech	STP US	O (V)	USD35.16	USD46	30.8%	20.6	11.9
Motech	6244 TT	N (V)	TWD257.0	TWD255	1.6%	22.9	12.6
Yingli	YGE US	N (V)	USD15.34	USD17	10.8%	15.7	8.9

Source: HSBC estimates

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Key differences between Suntech, Motech and Yingli

	Suntech	Motech	Yingli
Bloomberg code	STP US	6244 TT	YGE US
Founded Date	2001	1997	2001
Market Share in 2007	12%	6%	5%
Business	Cell/ Module/ System (China only)	Polysilicon/ Ingot/ Wafer/ Cell/ System	Ingot/ Wafer/ Cell/ Module
Cost competitiveness			
Wafer Thickness(um)	Average	Average	Most efficient
Conversion Rate	15.6% for multi, 17.2% for mono. But will introduce 18% conversion rate Pluto technology	Around 16%	15.7% for multi
Silicon Cost Flexibility	Least flexible. Large long-term contracts.	Most flexible. Target at 50% in-house silicon supply.	Reasonably flexible. Medium term 3-5 yr contracts.
Non-Silicon cost	Lower than average	Lower than average	Lowest
Future Strategy			
Business	Industry cluster: STP encourages partners to co-locate near Suntech's production facilities, helping STP to adopt a "zero inventory" policy.	Experienced in invertors.	Most vertical integrated company in China.
New technology	1) Pluto technology to increase conversion efficiency from current 15-16% to 18%+. 2) Thin film technology.	Evaluating thin film technology.	
Upstream	Strategic investment in several polysilicon/ wafer makers.	Investment in AE Polysilicon.	Good relationship with Xinguang, China.
Downstream	Integrated into system level in China.	1) No plan to step in module level due to conflicts with its current customers. 2) Integrated into system level in Taiwan.	System level in Tibet, China.
Customer Relationship			
Sales Breakdown by Geography	35% Spain, 51% Germany, 6% US in 2007	30% Europe, 62% Asia, 8% US in 2007	58% Spain, 11% Germany, 21% Asia, 6% America in 2007
Operating Performance			
Capacity (year end; MW) in 08	1020	420	400
Output (MW) in 08	528	288	249
Capacity expansion	89% growth in 08, 35% growth in 09	50% growth in 08, 52% growth in 09	100% growth in 08, 50% growth in 09
Output growth	45% growth in 08, 91% growth in 09	67% growth in 08, 51% growth in 10	81% growth in 08, 71% growth in 09
Valuation			
Price (as of 15 July 08)	USD35.16	TWD257	USD15.34
Outstanding shares (m)	169	206	134
Market cap (USD)	5.2bn	1.7bn	1.9bn
Rating	Overweight (V)	Neutral (V)	Neutral (V)
52-week high-low price	90.00 - 28.19	399.50 - 167.50	41.50 - 11.44
DCF-based target price	USD46	TWD255	USD17
Target PE	20x (historical 17-50x)	16x (historical 15-45x)	13x (historical 15-35x)
Potential total return (incl. div)	30.8%	1.6%	10.8%
08 EPS	1.70	11.2	1.0
09 EPS	2.95	20.4	1.7
08 P/E	20.6	22.9	15.7
09 P/E	11.9	12.6	8.9

Source: Company data, HSBC estimates

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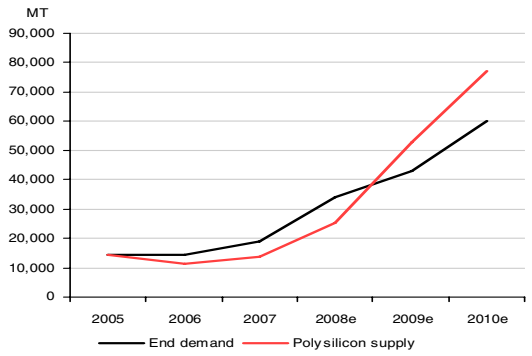
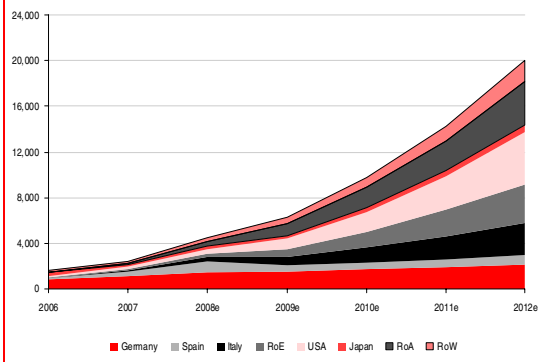
Headwind in 2009: end-market demand < supply

Supply will exceed end market demand from 2009...



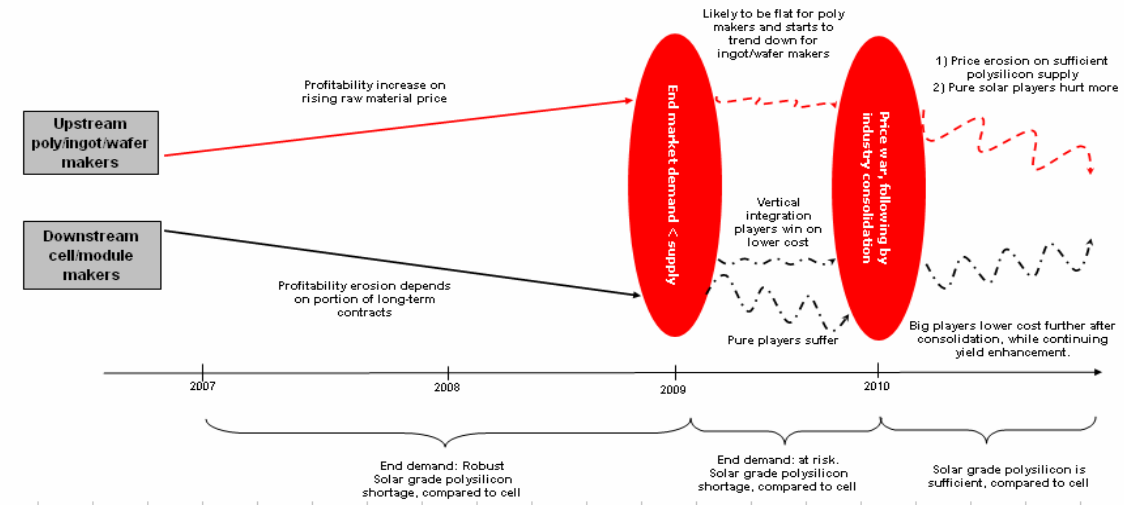
Source: HSBC estimates

...although PV demand strong long term (45% CAGR 08-12)



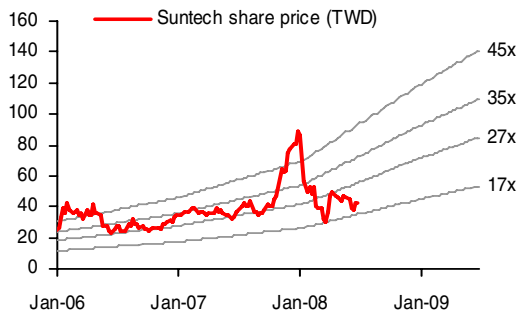
Source: HSBC estimates

Pure cell/module suffers most next year; however, big players with vertical integration and low cost materials are positioned well



Source: HSBC Research

Suntech's forward PE band



Source: TEJ, HSBC estimates

Investment view for Suntech (Overweight, TP USD46)

- **Spain exposure drops significantly.** Potential slowing demand from Spain should not be a big concern to Suntech. Suntech guides that it will successfully reduce exposure to Spain from as high as 58% in 1H08 to only 25-30% in 2H08, as the company is expanding its customer base.
- **Secured 80% of raw materials it needs for 2009 already**. We believe that there will be a polysilicon shortage in the next 18 months, so securing low cost raw materials is crucial for profitability.
- **Potential upside catalysts** include gross margin upside on the implementation of new Pluto technology, and smaller-than-expected module price erosion.

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Summary

- We expect industry supply to exceed end-user demand by next year; the current shortage remains a key bottleneck
- We are positive on companies with access to low-cost raw materials through vertical integration or long-term contracts
- Also, leading technology and broad customer bases will boost gross margin and offset falling demand from Spain and Germany

In demand

Solar power is "hot". In June this year *The Economist* described the photovoltaic cells that convert sunlight into electricity as the fastest-growing type of alternative energy. Bloomberg reported recently that demand for solar power, driven by government incentives in Germany, Spain and California, has increased 40% annually over the last four years. At the same time, record oil and coal costs, along with fears that fossil fuels are feeding global warming, make solar power an increasingly attractive alternative.

However, there's a cloud on the horizon. Our global view of the photovoltaic industry shows that the supply and demand situation will reverse in 2009. For the first time since 2005, demand will be lower than supply even though the PV market is forecast to expand at a CAGR of 45% between 2008 and 2012 (please refer to *German solar sector: Blue-sky scenario is clouding over*, published 2 July 2008 by Burkhard Weiss and team).

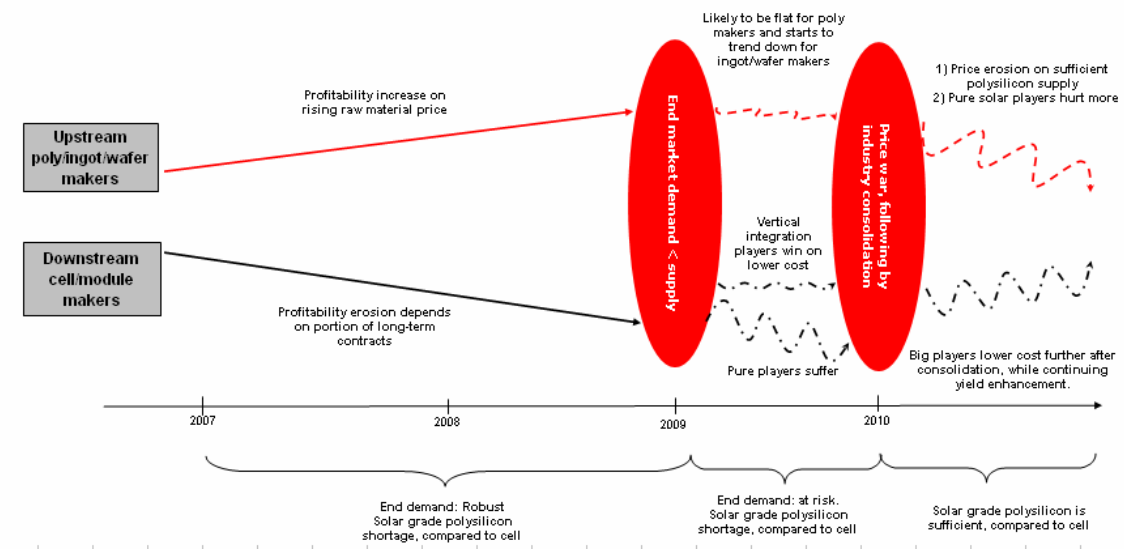
Government subsidies will remain the most important driver for the industry until the PV system reaches grid parity – the point at which photovoltaic electricity is equal to or cheaper than grid power – around 2010-11. But the subsidy landscape is changing. Demand in Germany and Spain, two huge solar power markets, may decline in the next year because of changes in government policy. At the same time, demand in other solar-friendly regions such as Japan and the United States might take time to pick up.

As a result, we think companies in the PV supply chain face increasing uncertainty on the demand side. Price erosion is inevitable and only module companies with strong customer relationships and good product quality will be able to enjoy a pricing premium. We believe that new entrants will suffer the most as they lack brand recognition.

Polysilicon shortage

The current shortage of polysilicon, a key raw material in PV cells, has been the major bottleneck for the crystalline silicon (c-Si) PV industry. (Photovoltaic technology is used to convert photons captured in PV cells to electrons, and the release of these electrons generates an electric current that is then used to supply electricity.)

Investment view at different stages



Source: HSBC Research

Polysilicon accounts for around 85% of the total cost of c-SV-based PV cells. Polysilicon is also used to produce semiconductor wafers, and we estimate that the semiconductor industry uses around 45% of all polysilicon production, down from 68% in 2005. This drop is mainly due to strong demand from the PV industry.

In 2001, there was a substantial oversupply of polysilicon due to the unexpected downturn in the semiconductor industry. With this still fresh in their minds, the largest polysilicon producers such as Hemlock, Wacker Chemie, Tokuyama and MEMC were hesitant to increase capacity in 2005-06 when demand from the PV industry began to increase significantly.

As c-Si PV products account for 90% of the total PV industry, the recent shortage of polysilicon has depressed the PV industry's y-o-y growth rate from 57% in 2007 to 31% in 2008. We think this shortage will remain in place for the next 18 months. We illustrate the situation in the investment view diagram above.

Three-year investment view

Through 2009 – shortage of polysilicon

Polysilicon makers should be the biggest winners during this period due to the high price of polysilicon. Ingot/wafer makers will also be able to pass on the cost to downstream PV cell makers. Margins for the upstream makers are also likely to peak, while cell/module makers will suffer as they struggle to pass on the higher costs to system makers. Assuming that PV cell prices remain flat, margins for the cell/module makers will first decline and then flatten on stable contract prices.

Yingli, Suntech and Motech are cell/module makers. From 2006 to 2008, Yingli's gross margin dropped from 27.5% to 21.8%. From 2005 to 2008, Suntech's gross margin dropped from 30.3% to 21.9% while Motech's fell from 33.1% to 15.8%.

As we think polysilicon will remain in short supply for the next 18 months, we believe gross margin for the PV cell/module companies might continue to suffer. The companies that can secure low-cost raw materials and establish technology

leadership have the best chance of expanding their gross margins.

Suntech is well positioned as it has already secured as much as 80% of the raw materials it needs for 2009, compared to Yingli's 30% and Motech's 45%. Also, implementation of Pluto technology in 4Q08, which increases conversion efficiency from 15-16% to 18%+, should help lift its gross margin.

2009 – PV market end-demand lower than supply + shortage of polysilicon

Polysilicon & ingot/wafer makers are still protected by various long- and short-term contracts. As such, margins should be stable for the leading players as they sell almost all of their output on contract. As demand falls, the cell/module selling price should drop. At the same time, the companies' costs are locked into long-term contracts with poly/wafer suppliers. This means margins for pure cell/module makers should decline as they are unable to pass on rising costs upstream.

Long-term view – pure competition leads to industry consolidation

In the long run, polysilicon companies with relatively high production costs might have trouble surviving if newcomers price their polysilicon below production cost. We believe a price war is likely to break out among cell/module makers.

Companies with high material costs (large portion of inputs on long-term contracts at unfavourable prices signed during 2H06-1Q08) and high non-silicon manufacturing costs might not be able to compete.

We think big players with economies of scale and the technology to reduce costs will grow through industry consolidation. We think Yingli, Suntech and Motech are all positioned to be long-term winners, given their size, business strategy and competitive non-silicon manufacturing costs.

Company picks

Suntech Power (STP US) - We initiate coverage with an Overweight (V) rating and a DCF-based target price of USD46. This translates to a PE of 20x 12-month forward earnings, compared to its historical PE range of 17-50x. We believe that in one year's time the market will partly be valuing the stock on anticipated 2009 earnings. We therefore use a blended 08/09e EPS of USD1.7 and USD2.95, respectively. Potential return from the current level is 30.8%.

Potential slowing demand from Spain should not be a big concern for Suntech. The company guides that it will reduce exposure to Spain from as high as 58% in 1H08 to 25-30% in 2H08 by expanding its customer base to other high growth regions such as Italy and Korea. We think Suntech is positioned well in this transitional stage.

As we think the polysilicon shortage will exist for 18 months, securing low cost raw materials is crucial for profitability. Suntech has secured as much as 80% of raw materials for 2009 and may also be able to obtain extra raw materials from its strategic upstream partners next year (e.g. Asia Silicon, which starts mass production from 3Q08). As such, Suntech stands to benefit from its virtual vertical integration strategy next year.

We estimate that 2H revenues will account for 60% of the full year, with 30% h-o-h growth. Our gross margin forecast is below consensus as we expect lower module prices will hurt profitability while the silicon price remains high.

However, if a higher portion of production based on Pluto technology is achieved this will benefit the gross margin, in our view. Faster-than-expected implementation of Pluto technology would be a catalyst for share price appreciation.

Motech Industrial (6244 TT) - We initiate coverage with a Neutral (V) rating and a DCF-based target price of TWD255. This translates to

16x 12-month forward earnings, compared to its historical PE range of 15-45x. We believe that in one year's time the market will partly be valuing the stock on anticipated 2009 earnings. We therefore use a blended 08/09e EPS of TWD1.24 and TWD20.36, respectively. Potential return is 1.6%, including dividend.

Our 2008 EPS forecast is 20% below consensus, as we are more negative on the gross margin assumption. We expect continuous gross margin erosion for the rest of the year, as it is unlikely that Motech will be able to meet its original capacity expansion plan in 2H 2008 (580MW by year end previously vs. current 420MW+). It also has a relatively high portion of low-margin OEM products and buys a higher ratio of raw materials from the spot market.

Motech is vertically integrated into polysilicon/ingot/wafer, and its long term goal is to produce 50% of total capacity through vertical integration. The company has already secured 45% of its 2009 planned output of 400MW, and probably will secure another 14% from AE Polysilicon (Motech's strategic partner in the upstream polysilicon production). This gives Motech an advantage over its peers during the period of polysilicon shortage.

In addition, we estimate that Motech's exposure to Europe is only around 40% this year, meaning that its business is not over concentrated on Spain or Germany, where demand is weakening. By securing customer orders for 100% of its planned output of 400MW next year, we think the company is well positioned even if supply exceeds demand next year.

We are more positive on its 2009 and 2010 prospects due to a rising ratio of less expensive wafer contracts and the prospect of buying a lower portion of raw materials on the spot market. Our 2009-10 EPS forecasts are 1-9% higher than consensus.

Upside risks to our Neutral (V) rating include better-than-expected gross margins in 2H08 due to higher portion of contract wafers or lower spot wafer pricing. Downside risks include higher-than-expected raw material prices, leading to lower profitability.

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Valuation matrix for our coverage universe

Company		Suntech	Motech	Yingli
Revenue (USDm)	FY07	1,348	15,578	556
	FY08e	1,992	22,410	981
	FY09e	3,405	30,827	1,489
	FY10e	4,015	34,087	1,592
OP margin	FY07	12.7%	15.6%	16.7%
	FY08e	14.2%	12.4%	15.2%
	FY09e	14.3%	14.0%	18.2%
	FY10e	16.8%	16.1%	21.5%
EPS	FY07	1.0	11.8	0.5
	FY08e	1.5	11.3	1.0
	FY09e	2.6	20.4	1.7
	FY10e	3.7	25.9	2.0
PE (x)	FY07	42.8	28.3	84.3
	FY08e	22.4	22.2	15.7
	FY09e	12.9	12.3	8.9
	FY10e	9.4	9.7	7.7
ROE	FY07	19.0%	18.2%	8.2%
	FY08e	22.9%	14.2%	36.2%
	FY09e	28.4%	19.6%	36.9%
	FY10e	28.2%	20.1%	29.7%
Comparison with consensus				
Revenue (m)	FY08e	2,075	23,274	1,021
	FY09e	3,065	31,045	1,745
	FY10e	4,091	36,535	1,998
Difference %	FY08e	-4%	-4%	-4%
	FY09e	11%	-1%	-15%
	FY10e	-2%	-7%	-20%
EPS	FY08e	1.6	14.0	1.0
	FY09e	2.6	20.2	1.8
	FY10e	3.6	23.7	2.4
Difference %	FY08e	-2%	-20%	1%
	FY09e	1%	1%	-2%
	FY10e	2%	9%	-16%

Priced as of July 11, 2008
Source: Company data, HSBC estimates

Yingli Green Energy (YGE US) – We initiate coverage with a Neutral (V) rating and a DCF-based target price of USD17. This translates to 13x forward earnings, compared to its historical PE range of 15-35x. We believe that in one year's time the market will partly be valuing the stock on anticipated 2009 earnings. We therefore use a blended 08/09e EPS of USD0.98 and USD1.73, respectively. Potential return is 10.8%.

Yingli is the most vertically integrated PV company in China but lacks an integrated supply of polysilicon. Raw materials from Xinguang are not available on favourable terms – prices are only 15-20% lower than the current polysilicon spot price which is still much higher than the average long-term contract price. Our gross margin assumption for 2H08 is 19.4%, lower than company guidance of 23-24%.

Spain accounted for as much as 58% of total sales in 2007. Although the company guides that this will fall to 50% in 2H08 and <40% next year, it is likely to be higher than Suntech's 25-30%. As demand from Spain will fall from this September, a high portion of Spanish sales would be a negative catalyst for the stock.

Potential upside catalysts include higher output in 2H 2008 due to expanded capacity, following the halt to capacity expansion in 3Q 2007. Successfully diversifying the customer base would be another positive catalyst.

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Contents

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Headwind in 2009

- We believe supply will exceed market demand in 2009
- Demand from Spain and Germany is likely to fall next year as subsidies and incentives are cut
- US, Korea and Japan the new drivers from 2009, but they might not offset the slowdown in Spain and Germany

Global view

Our global view of the photovoltaic (PV) industry shows that supply and demand will reverse in 2009 (please refer to *German solar sector* dated 2 July). For the first time since 2005, demand will be lower than supply even though the PV market is forecast to expand at a CAGR of 45% between 2008 and 2012.

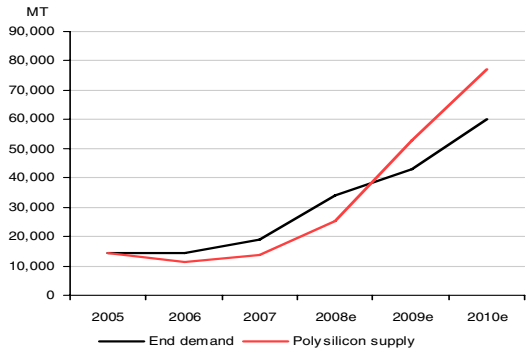
Government subsidy will remain the most important driver for the industry until the PV system reaches grid parity – the point at which photovoltaic electricity is equal to or cheaper than grid power. The key factor is slowing demand from Germany and Spain, the two biggest drivers in the industry this year. At the same time, demand in other promising regions such as Japan and the US might take time to pick up. We think companies in the PV supply chain face increasing uncertainty on the demand side. Price erosion is inevitable and only module companies with strong customer relationships and good product quality will be able to enjoy a pricing premium. We believe that new entrants will suffer the most as they lack brand recognition.

Shifting demand

Germany and Japan were the biggest drivers

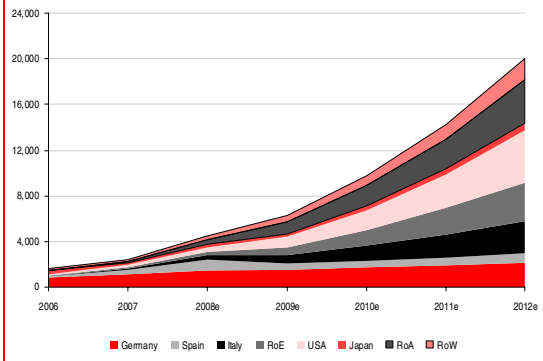
The biggest growth market in recent years has been Western Europe, led by Germany's CAGR of 81% from 2000-05 due to significant feed-in tariffs (FIT). Consumers are able to sell electricity

Supply will exceed demand from 2009



Source: HSBC estimates

PV demand 45% CAGR 2008-12



Source: HSBC estimates

back to the power grid system at a certain rate for a certain period (usually 15-25 years). Japan also has long history in the PV industry and has developed a complete PV industry supply chain. These two countries accounted for the majority of total PV market in 2005 (88% combined; Germany 65.5%, Japan 21.9%).

Spain – strong demand might end after September

In the last 18 months Spain has been the biggest driver in the industry, with a CAGR of 284% from 2005-07. Spain accounted for 13% of the total PV market in 2007, up from only 1.5% in 2005. Strong demand from Spain in 2007 was driven by government clarification of the incentive programme after a period of uncertainty in 2006.

However, according to draft proposals from the Ministry of Industry, the feed-in tariff could be lowered to EUR0.31/kWh from EUR0.42/ kWh from 2H08, with a 5% degression rate from 2009. Based on our calculation, the IRR will drop from 20% this year to only 13% next year if the draft proposal is implemented. As such, we think demand might shrink after September this year.

Germany – the driver for 2H08

If Spain lowers incentives, Germany will be the main driver for 2H08 despite the fact that the German PV market delivered zero growth in 2007.

The other factor to consider is a reduction in government subsidy from next year. The degression rate for the feed-in tariff will be changed from 5% to 8-10% from 2009 (depending on the size of the project), reducing IRR from 13% this year to 6% from 2009.

While demand from Germany should make up the potential loss of demand from Spain in the second half of this year, the average system selling price in Germany might not be as high as in Spain.

Shift of PV subsidy policy in major countries

Country	Shift of subsidy policy
US	Might stop tax refund by Dec 31, 2008, but also cancel the maximum subsidy of USD2,000 for single PV system to USD2,000/KW.
Germany	Degression rate is changed from 5% per year to 8-10% per year.
Japan	2007 stopped PV subsidy policy for residential. However, will restart from 2009 so that the cost of using PV system might drop by 50%.
Spain	Tariffs will be reduced from EUR0.4175 to EUR0.31, although period will be expanded from 20 to 25 years. Tariffs will be reduced by 5% per year.
France	Increase alternative energy portion of total energy consumption from 6.7% to 20% by 2020. PV will increase from 3.2MWp to 3,000MWp.
India	2008 subsidy is 80% of electricity generation cost of PV cells.

Source: PVbuzz, PV news, HSBC research

What to expect from 2009?

Japan – the new growth driver

Japan initiated the New Sunshine Project in 1993 due to its reliance on energy imports, which were as high as 80% of overall consumption. By pushing its PV- generated power to grow 35 fold in 10 years, the average cost of a PV system decreased by 76% and government subsidies dropped by 93%, to USD0.85/W.

Japan's PV market shrunk to only 19% of the total PV market in 2007, from as high as 58% back in 2000. Japan even delivered negative growth last year as the government stopped the PV subsidy policy for residential in 2007.

However, Japan might be one of the most important drivers in the industry from next year. It announced on 23 June 2008 that it would restart the PV incentive programme from 2009 and that the cost of using the PV system might drop by as high as 50%. The Japanese government expects 50% of home electricity could come from PV systems by 2030 and 70% of new homes will install PV systems by 2020. Details about the feed-in tariff and installation subsidy will be disclosed around August. The new incentive programme is critical to the PV industry, especially as Spain and Germany are reducing

IRR and payback period analysis in key countries – before and after changes on incentive programs

	Germany		Spain			Italy		Korea		Japan		CA, USA
	2008	2009	2008	2009*	2009**	2008	2009	2008	2009	2008	2009	
System ASP ($/watt)	6.47	5.82	6.76	6.08	6.08	6.61	5.95	6.43	5.78	6.47	2.91	6.90
Total system cost (3KWp)	19,406	17,466	20,269	18,242	18,242	19,838	17,854	19,277	17,349	13,584	8,733	14,700
Sunlight Hours/year	1,000	1,000	1,600	1,600	1,600	1,600	1,600	1,200	1,200	1,200	1,200	1,600
Annual output (KWh)	3,000	3,000	4,800	4,800	4,800	4,800	4,800	3,600	3,600	3,600	3,600	4,800
Incentive ($/KWh)	0.55	0.5	0.65	0.48	0.56	0.56	0.49	0.712	0.578	0.21	0.21	0.37
Payback period (year)	8.6	12.9	6.5	7.9	6.8	7.4	7.6	7.5	8.3	18.0	11.6	8.3
Life cycle	20	20	25	25	25	20	20	15	20	20	20	20
Degression rate %	5%	8%	0%	5%	5%	2%	2%	0%	0%	0%	0%	0%
IRR %	13%	6%	20%	13%	16%	12%	12%	14%	14%	9%	17%	21%
Interest rate %	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	2.0%	2.0%	0.2%	0.2%	2.4%

* Proposal by Ministry of Industry
** Proposal by ASIF & APPA
Source: EEG (Renewable Energy Source Act), HSBC estimates

government subsidies from 2009. We think the incentive programme might help both c-Si PV system and BIPV system based on thin-film technology.

Our analysis shows that IRR will increase from 9% to 17% (much higher than its interest rate of 0.2%) if we assume the installation cost will be only 50% of the cost today.

Other countries

Demand should grow in South Korea, the US, Italy and China in the next few years.

- **US**: The US government introduced a federal tax credit of 30% of system costs and announced funding of USD168m over 2007-09 for PV research projects. The California state government also signed the PV Homes Bills (SB1) on 21 August 2006 and started to implement a 1m roof project (3,000 MWp equivalent installed by 2017) from 1 January 2007. The California PV Initiative bills offer a choice of investment subsidies or feed-in tariff (FIT) for small and medium-size systems and a FIT for large systems. We estimate the IRR in California is 21%, compared to interest rates of 2.4%.
- **Italy**: In February 2007, the Italian government simplified the funding system for its incentive programme and removed the annual cap on installations of 85MW, leading to rapid expansion of installations, especially in the southern part of the country. The feed-in tariff is limited to a cumulative cap of 1200MW, at which time the tariff will be re-evaluated with a goal of reaching 3000MW of installed capacity by 2016.
- **Korea**: In July 2002, the Korea Ministry of Commerce, Industry and Energy (MOCIE) introduced the PV Land 2010 Program. The target is to install 30,000 rooftop PV systems of 3 kW capacity by 2010. In 2004, Korea established a goal of 1.3 GW of grid-connected PV by 2011. This follows a previously announced target of 100,000 PV homes by 2011, an expected 300MW.

Several important projects are listed in Appendix V.

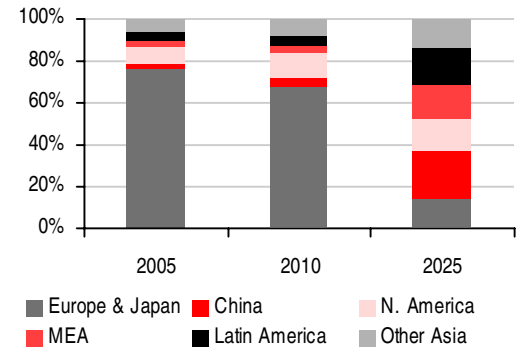
US and China might be the two biggest drivers

As the PV industry is still in its infancy, we believe that short-term drivers will come from developed countries, especially the US, Korea and Japan. After prices of PV systems fall as a result of technological migration and easing raw material prices after 2009, we believe that PV

systems will become cost-competitive with the grid system for more developing countries. In particular, China will be a big market in the long term, in our view.

Interestingly, government subsidies in countries that are keen to control the energy supply, i.e. US and China, are not likely to fall as their PV industry development is based on long-term strategic concerns rather than only environmental issues.

US to be the biggest driver until 2010; China and other developing regions will be the long-term drivers



Source: IEK, EPIA, HSBC Research

Overall, we believe the PV cell market should maintain a 30% annual growth rate through 2010.

Reduction of government subsidies

We believe that a fall in subsidies is reasonable if it is accompanied by technology migration. Usually, government subsidies decline 2-5% annually, which is lower than the PV potential cost reduction of about 10% per year.

Due to growing competition, we think the cost of cell manufacturing will fall more than 10% a year. Therefore, we expect government subsidies may be reduced by more than 5% annually.

HSBC

Transition period

- We forecast a shortage of polysilicon (compared to cell output) for the next 18 months. An ability to secure low-cost raw materials is vital for cell/module makers
- Long term, we believe a price war will lead to consolidation
- Big players with vertical integration, technology leadership and superior manufacturing efficiency will be the long-term winners

The shortage of polysilicon has been the major bottleneck for the c-Si PV industry. Polysilicon is the key raw material for the PV industry (around 85% of total cost for c-Si PV cell), and is also used to produce semiconductor wafers.

We estimate that 45% of polysilicon is currently used for the semiconductor industry, down from 68% in 2005, largely due to strong demand from the PV industry. A downturn in the semiconductor industry around 2001 caused severe polysilicon oversupply. In 2005-06, when demand from the PV industry started to increase significantly, the largest players, including Hemlock, Wacker Chemie, Tokuyama, MEMC, were hesitant to increase capacity. As c-Si based PV products account for 90% of total PV industry, the shortage of polysilicon caused the y-o-y growth rate of the overall industry to decelerate from 57% in 2007 to 31% in 2008.

Currently, the average utilization rate at global PV cell producers is only 55%, as companies seemingly do not want to sacrifice profitability by purchasing materials at high spot prices in order to increase capacity. Therefore, some PV cell makers choose to obtain more OEM orders to occupy their capacity and some PV cell makers have decided to postpone their capacity expansion plans until 2H 2008 or 2009.

Based on the expansion plans of polysilicon makers, our analysis shows the current shortage should continue for the next 18 months, after discounting potential ramp-up issues and yield enhancement problems.

There are, however, risks to our analysis that could result in the shortage lasting longer than expected:

- **Issues on non-Siemens process:** REC's announcement that it will delay its expansion based on a relatively new technology, fluidized bed reactor (FBR), indicates that the market is unlikely to be flooded with new polysilicon supply from players with unproven technologies.
- **New entrants might have trouble scaling up:** Many observers were expecting polysilicon output from Chinese makers to increase significantly from 1H 2008. However, it did not happen. Lack of mass production experience using advanced

Siemens processes might mean it will take longer to ramp up production. In addition, the lack of recycling technology might result in higher costs (USD80-120/kg) than the traditional leading Siemens players (USD40-50). Companies with high costs might face operating issues that will impact capacity expansion plans.

- **Rapid expansion of PV cell capacity could outpace PV supply:** We think an increased supply of cheaper polysilicon in 2010 will stimulate PV cell makers to rapidly increase capacity. Given that it usually takes 9-12 months for the PV cell makers to increase capacity (vs. 24-36 months for polysilicon makers), there could be a continued shortage of polysilicon if cell makers expand too quickly.

Upstream vs. downstream

Please refer to Appendix II for a more detailed explanation of crystalline silicon based PV cell/module manufacturing. Here we give a brief explanation to help readers better understand our investment thesis.

Upstream – downstream for c-Si PV industry

	Entry barrier	Features
Polysilicon	High	Current bottleneck for the industry. High level of knowledge/ experience in chemical engineering is required.
Ingot/ wafer	Low	Many cell/module makers integrate into ingot/ wafer to control quality of wafers.
Cell/module	Medium	Use raw wafers to produce PV cells through simple semiconductor process. Then assemble cells into module sets.
System	High	Build different types of PV systems with modules.

Source: HSBC Research

Investment strategies

We divide the PV industry into three key stages over the next three years:

Through 2009 – Polysilicon shortage

- **Upstream (Polysilicon & ingot/wafer makers):** Given the current shortage, spot polysilicon prices are around three times higher than the current contract price (spot price of USD380-400/kg vs. contract price of USD100-120/kg). The cost of producing polysilicon is only around USD40-50/kg for leading makers and around USD80-120/kg for the newcomers, so this favours the leading makers. Margins are also peaking for the upstream makers, as ingot/wafer makers can also pass on higher costs to downstream cell makers.

- **Downstream (cell/module makers):** Cell/module makers suffering from shortages of raw materials have to choose between maximizing revenues but sacrificing profitability by purchasing spot wafers at sky-high prices or protecting profitability by postponing expansion plans. Since it is hard for them to pass the increasing cost on to system makers, cell/module makers suffer the most during this period. Margins for the cell/modules makers will likely come down first and remain flat on stable contract prices if the cell price remains flat.

- **Downstream (system makers):** System makers are less affected by the raw material shortage and therefore can enjoy stable margins. This is mainly because system makers require highly skilled labour, especially to set up high level systems. Experience is critical for system makers since the projects use a more sophisticated financial system to process computer modelling for their payback period calculations. In addition,

it is a challenge to run a large project (50MW), compared to average project size of 3-5MW in the past. As such, we think system makers will not suffer from margin erosion during this period.

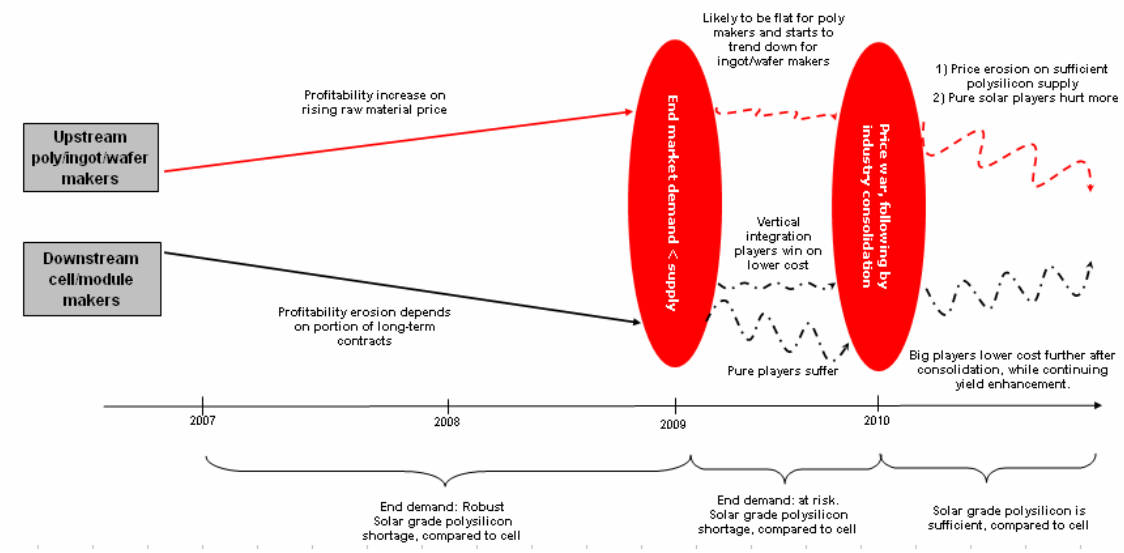
2009 – PV market demand lower than supply + polysilicon shortage

- **Upstream (Polysilicon & ingot/wafer makers)**: Polysilicon supply still in shortage compared to cell capacity, however, PV market end demand is at risk. Polysilicon & ingot/wafer makers are still protected by various long term/short term contracts. As such, margins should be stable for the leading players since they sell almost all of their output on contracts.
- **Downstream (cell/module makers)**: Pure cell/module makers suffer most in this period. The cell/module selling price should drop due to end demand being below the overall PV industry supply. Meanwhile, cost is relatively locked in by long term contracts with poly/ wafer suppliers. Margin for pure cell/module makers should decline as they are unable to transfer loss to the upstream makers.
- **Downstream (system makers)**: Given the unique business model and higher barriers to entry (along with increasing project scale), we think system makers will be able to pass on decreasing system price to the cell/module makers in this period.

Long term – pure competition leads to industry consolidation

- **Upstream (Polysilicon & ingot/wafer makers)**: Oversupply will likely trigger industry consolidation among the upstream makers. New entries with high production costs (around USD80-120 vs. leading makers of USD40-50) might find it hard to survive as we think polysilicon prices will likely stabilise at around USD70/kg, which would be below production costs for some newcomers. Leading players will still enjoy stable margins since most of their output will be sold on contracts.
- **Downstream (cell/module makers)**: Competition among cell/module makers will likely increase. A price war could take place among cell/module makers. Companies with higher material cost (large portion on long term contracts with unfavourable price signed during 2H06-1Q08), and higher non-silicon manufacturing cost might not be able to survive. Big players with economies of scale and technologies to reduce costs will likely grow even further through industry consolidation.
- **Downstream (system makers)**: System makers benefit when the PV cell/module makers suffer from a price war and industry consolidation, since they are able to get even better products at cheaper prices. At the same time, their revenues and profits will both increase as lower prices should accelerate demand further.

Investment view in different stages



Source: HSBC research

New pure cell/module makers

New entrants face difficulties obtaining the same level of profitability as more established cell/module makers due to the difficulty of obtaining sufficient supplies of wafers at competitive prices. Lack of experience in manufacturing and marketing could make it hard for new players to generate consistent cash flow. Terms for new players in short- and long-term contracts might not be as good as those for the market leaders due to lack of economies of scale.

In addition, many new cell makers lack their own technologies, so they have to rely on turnkey solutions from the equipment makers. As such, it is hard to differentiate themselves on lowering non-silicon manufacturing cost when polysilicon supply is greater than demand. New cell makers will suffer regardless of the stage, in our view.

Risks to our investment view

- Capacity ramp-up for polysilicon players is longer than expected, which could result in longer margin contraction among the PV cell makers that hesitate to secure a large portion of raw materials on long term contracts. These players have to obtain a certain portion of their raw materials for their capacity from the spot market, which increases cost significantly when polysilicon supply is in shortage.
- Demand is weaker-than-expected due to insufficient government subsidies in developing countries. Also, reduced subsidies in Spain and Germany plus policy uncertainty in the US might cause weaker demand.
- Lower-than-expected selling price for the PV cells makers, probably due to higher demand from the emerging markets or fewer government subsidies, would cause further profitability erosion for the PV cell makers.
- Less disciplined capacity expansion among the PV cell makers could result in more severe competition that drives the selling price down further. This might accelerate industry consolidation when polysilicon is sufficient.
- Research development and production ramp-up for the next generation PV cell is faster than expected, which might impact the demand for c-Si based PV cell if price is much lower than the c-Si based PV cell at that time.

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Vertical integration

- Vertical integration is crucial when polysilicon is in short supply
- Integration into downstream is also important when polysilicon supply is greater than the end market demand
- We believe fully integrated players will be the long-term winners

We believe that vertical integration into upstream processes is critical, especially when polysilicon is in short supply, compared to the cell output. We expect there will continue to be a shortage of polysilicon in the next 18 months. Thus it is critical for the PV cell/module makers to control their own destiny in the long run. A key strategic advantage is to control supply of raw materials and to accurately control output schedules.

Vertical integration into downstream processes is more important when polysilicon supply is greater than the end market demand, which we might see in 2009. Customers will have more choices, thus allowing them to select higher quality and lower cost products in the future. Companies able to provide high quality and large modules will enjoy pricing premium, especially if a price war breaks out in the future.

Vertical integration

As mentioned, we believe that vertical integration into upstream processes is critical, especially when polysilicon is in short supply, since ensuring a stable supply of polysilicon at a reasonable price is crucial for PV cell module makers. This can be done through long-term supply contracts or vertical integration. However, long-term contracts are generally based on take-or-pay agreements for 3 to 10 years, and customers have to pay 10% to 25% of total amount for the contract period in advance, meaning PV cell makers are subsidising the construction of new polysilicon capacity. We summarize the pros and cons of each strategy below.

Two levels of vertical integration

There are two levels of vertical integration into the upstream for PV cell/module makers: ingot/wafer manufacturing and polysilicon production.

- **Ingot/wafer manufacturing**: Moving one level upstream into ingot/wafer manufacturing should improve conversion efficiency, as the PV cell/module makers will be able to have greater control over quality of wafers. Higher conversion efficiency increases the selling price per wafer without increasing costs. Technological barriers for ingot/wafer manufacturing is relatively low compared to polysilicon production. As such, moving a step upward to ingot/wafer manufacturing should not be difficult as long as cash is not an issue.
- **Polysilicon production**: Moving farther into polysilicon production gives PV cell/module makers more control over cost reduction (polysilicon accounts for around 80-85% of PV cell/module makers' total cost). We believe that vertical integration from polysilicon to

cell/module gives a company a strategic advantage. Currently, the leading vertical integrated players are SolarWorld, REC and Motech. Motech wants to control 50% of their raw material needs, and is building in-house ingot/wafer capacity as well as making a strategic investment into AE Polysilicon to secure polysilicon supply. Barriers to entry in terms of both technology and capex for polysilicon production is the highest among the whole c-Si PV food chain, and as such we are more conservative on the newcomers, especially ones with smaller scale, unproven experience in raising capacity, or with less experience in implementing new technologies.

Profits distribution comparisons

From the charts below, we can see that the ROIC for both polysilicon manufacturers and ingot/wafer makers increased significantly after 2005, when the shortage of polysilicon supply began.

For ingot/wafer makers, ROIC approached 30% in 2006. For wafer works, ROIC reached 50% in 2007. However, we think an increase in the polysilicon supply should drive down price and the ROIC should fall to around 10-15% in the long term. Although this number is much lower than Motech's current ROIC of 33%, it is above the company's cost of capital (11.1%) and therefore should be value-accretive. The number is also higher than Suntech's cost of capital of 11.2% and Yingli's cost of capital of 10.9%.

For polysilicon makers, ROIC surged above 60% in 2005-06 for the leading players largely due to:

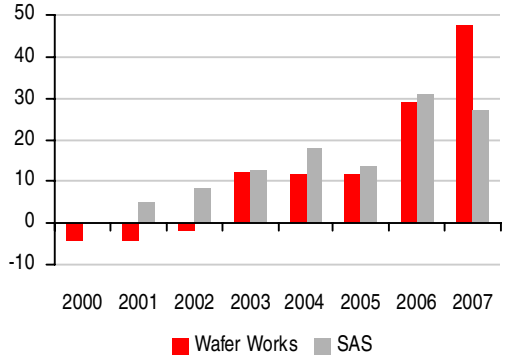
1) PV demand increased suddenly due to government incentives and low entry barrier;

2) Building new capacity takes 24-36 months and the leading players were hesitant to build capacity after suffering in the previous downturn;

3) Demand for semiconductors also increased, especially 300mm wafers, during this period.

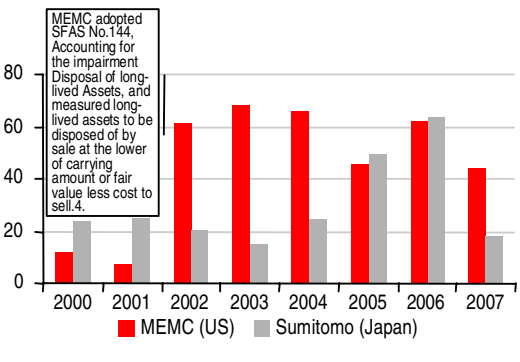
High demand growth in the PV industry, high ROIC in 2006 should be the main reasons for new entrants to join. ROIC might shrink to 20-25% in the long run for these players when polysilicon supply is no longer an issue. Note that ROIC for polysilicon players is still higher than ingot/wafer players in the long run.

ROIC for wafer makers is around 30% 06-07



Source: Company data

ROIC for polysilicon makers is around 60% in 2006



Source: Company data

HSBC

Two ways to secure low-cost raw materials when polysilicon is shortage: Vertical integration into upstream vs. long term contracts

	Long term contracts		Vertical integration	
	Pros	Cons	Pros	Cons
Technology	+ no technology risk			- patents on polysilicon tightly held - low yields could negate cost advantages
Wafer costs		- vulnerable to cost declines	+ cost reduction around 10-15%	
Capex	+ no capex	- total expenditure could be higher than moving upstream		- capex is needed in the initial stage
Return		- contracts longer than five years is not cost effective	+ Payback period is around 1.5-5 years after mass production	
Flexibility		- lack of flexibility on pricing and quantity	+ flexible on raw material sourcing	
Utilization rate	+ higher utilization rate in stage I	- hard to maintain stable utilization rate	+ better to maintain certain utilization rate	
Customer relationship		- might not be able to fulfil customer's need	+ better control on output can build better customer relationship, which is important during the price war	
Quality improvement		- no controls on wafer quality	+ able to improve wafer quality through vertical integration	

Source: HSBC Research

Downstream integration

As mentioned, vertical integration into downstream processes is more important when polysilicon supply is greater than the end market demand. Customers will have more choices, allowing them to select higher quality and lower cost products in the future. Companies able to provide high quality and large modules will enjoy a pricing premium, especially when there is a price war going on in the future. As we forecast that end market demand will be lower than supply in 2009, we believe that in these circumstances downstream vertical integration is more important than upstream.

The customer comes first

The PV industry is not yet commoditised and segmentation will continue to exist. Customisation is still needed for different kinds of projects. We think the industry will be segmented into different categories: 1) high power/high efficiency PV system, which is largely for residential; 2) medium power module; 3) thin film PV system (low power, but can be applied on large areas of land).

Also, as certification requirements will generally be more strict product quality is key in terms of pricing premium.

As such, it is important to be close to the customer to meet their individual needs, especially at times when the supply of PV modules exceeds demand.

In addition, we believe customers prefer to buy from large module companies because:

- A warranty of 20-25 years means customers prefer companies with strong balance sheets that will not disappear.
- Project size is an entry barrier. 50MW projects for delivery within one year are quite common nowadays, compared to only 3-5MW in the past. Large module companies with ample production capacity are in a better position to fulfil the needs of numerous customers at the same time.

Vertical integration among Asian PV names

	Polysilicon	Ingots	Wafers	Cell	Module	System
Canadian Solar		x	x	x	x	x
China Sunergy				x		
E-Ton		x	x	x	x	
Gintech	x	x	x	x	x	
JASO				x		
LDK	x	x	x			
Motech	**x**	**x**	**x**	**x**		**x**
Renesola	x	x	x			
Solarfun		x		x	x	
Suntech				**x**	**x**	**x**
Trina		x	x	x	x	
Yingli		**x**	**x**	**x**	**x**	**x**

Source: Company data

Integration at system level?

System makers usually enjoy gross margin as high as 40% as entry barriers are high. However, we think integrating at system level is not necessary as system makers have to be localized. It is impossible for PV cell makers to have close relationships with local end-users in every country.

Key elements for system makers:

- Closer to construction business in nature.
- Highly skilled labour required, especially for setting up high-level systems. Experience is critical to complete a project efficiently (financial models, programming for payback period calculation, etc.)
- Obtain financing is difficult because PV system projects are relatively long (~20 years). In addition, establishing a relationship with local banks is difficult for overseas PV cell makers, while bank loans/ convertible bonds might still be needed to finance projects.

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Be selective

- Highly vertical integrated players enjoy higher valuation
- Each company has a different approach to polysilicon oversupply and demand uncertainty next year
- Suntech is our top pick; it has up to 80% of the raw materials it needs in 2009 and has reduced its exposure to Spain

Valuation comparison

Our analysis below shows that highly vertical integrated players, such as REC (REC NO) and SolarWorld (SWV GR) enjoy higher valuation than others in general. They are trading at an average of 25x 2008 and 16x 2009 consensus EPS estimates currently, compared to 14x 2008 and 12x 2009 consensus EPS estimates on average in the PV supply chain.

We believe vertical integration is value accretive

PV peer comparison across supply chain

Company	Ticker	Mkt cap (USDbn)	PER			PBR			ROE %		
			08F	09F	10F	08F	09F	10F	08F	09F	10F
Integrated players											
REC (Norway)	REC NO	12.9	27.5	14.9	10.8	4.6	3.5	2.9	17.8	25.2	29.9
SolarWorld (Germany)	SWV GR	5.4	23.4	16.7	13.1	4.2	3.3	2.8	20.1	23.5	24.5
Weighted Average			**25.4**	**15.8**	**11.9**	**4.4**	**3.4**	**2.9**	**18.9**	**24.4**	**27.2**
PV Cells & Modules											
Ersol (Germany)	ES6 GR	1.6	25.1	19.0	17.5	4.0	3.3	3.0	16.0	17.8	15.9
E-ton (Taiwan)	3452 TT	0.6	17.1	11.3	9.4	4.0	3.3	2.8	27.5	30.2	24.4
Firstsolar (US)	FSLR US	21.9	138.9	59.4	33.2	18.7	11.8	9.0	14.7	25.2	30.5
Gintech (Taiwan)	3514 TT	1.1	10.2	5.2	8.6	3.1	2.1	1.7	35.7	47.1	21.4
KANEKA (Japan)	4118 JP	2.4	10.4	9.2	12.6	0.8	0.8	0.9	8.4	8.6	7.3
Kyocera (Japan)	6971 JP	19.0	19.7	18.3	19.9	1.2	1.1	1.3	6.6	6.8	6.5
***Motech (Taiwan)**	**6244 TT**	**1.7**	**22.2**	**12.3**	**9.7**	**3.0**	**2.3**	**1.8**	**14.2**	**19.6**	**20.1**
Q-Cells (Germany)	QCE GR	11.9	33.4	20.5	15.5	3.8	3.2	2.5	12.6	18.3	19.2
Sanyo (Japan)	6764 JP	4.7	24.5	24.4	56.8	4.7	4.5	4.4	7.6	7.4	7.2
Sharp (Japan)	6753 JP	17.9	16.0	14.4	15.8	1.4	1.3	1.3	9.4	9.5	8.9
Solon (Germany)	SOO1 GR	1.0	16.3	11.8	11.0	2.5	2.1	1.4	15.8	20.5	14.2
SunPower (US)	SPWR US	6.6	37.8	23.8	17.8	6.6	5.3	4.0	12.9	24.0	26.5
***Suntech (China)**	**STP US**	**5.8**	**22.4**	**12.9**	**9.4**	**4.6**	**3.6**	**2.3**	**22.9**	**28.4**	**28.2**
Sunways (Germany)	SWW GR	0.2	17.4	8.5	6.1	2.1	1.6	1.2	12.0	22.5	26.8
Trina Solar (China)	TSL US	1.0	15.2	9.8	6.2	2.0	1.6	1.2	14.6	17.8	19.3
***Yingli (China)**	**YGE US**	**2.1**	**15.7**	**8.9**	**7.7**	**4.5**	**2.7**	**1.8**	**40.2**	**39.7**	**32.6**
Weighted Average			**22.6**	**16.6**	**15.5**	**3.3**	**2.6**	**2.1**	**16.4**	**19.4**	**18.1**
Subsector Weighted Average											
Integrated players			25.4	15.8	11.9	4.4	3.4	2.9	18.9	24.4	27.2
Polysilicon			12.8	11.0	11.1	2.7	2.2	1.8	22.8	20.5	16.9
Ingots & Wafers			15.8	12.7	12.1	3.0	2.4	2.0	21.8	23.6	20.5
PV Cells & Modules			22.6	16.6	15.5	3.3	2.6	2.1	16.4	19.4	18.1
PV Systems			9.6	13.2	n.a.	1.8	1.5	n.a.	14.9	15.2	n.a.
Total Average			**14.4**	**11.5**	**12.7**	**3.0**	**2.4**	**2.2**	**18.9**	**20.6**	**20.7**

Source: Company data, I/B/E/S consensus, *HSBC estimates

and these players will continue to trade at a premium. The large, highly integrated players are also likely to enjoy higher ROE. Note that ROE for integrated players is expected to be 27% on average in 2010, while the total sector average is expected to be 21% based on consensus estimates. Long term winners should remain big integrated players.

Top tier PV cell/module makers with some degree of vertical/ horizontal integration in the supply chain are also trading at premium. For example, Q-Cells (QCE GR) and Suntech (STP US) are trading at 33x and 27x 2008 earnings, while the overall 2008 PE for PV cell/module makers is only 23%.

Hard to reach previous valuation peak

A year ago, PV stocks were trading at an average of 25-30x forward earnings, much higher than current 14x. Integrated players even traded at 47x forward earnings a year ago, compared to the current 25x. We think it will be hard to return to those levels due to the potential for industry consolidation and a price war.

We believe it is more reasonable to compare the companies we cover with Q-Cells, the No.1 PV cell maker worldwide. Q-Cells should be able to enjoy the highest PE (current 33x 2008 earnings) in the sector give its scale and extensive investment into different types of thin film PV technology for the next generation applications, in our view. The success of this new technology is critical to its future growth prospects.

We initiate coverage on Suntech, Motech, and Yingli

We initiate coverage on the PV cell/modules makers. The three companies are similar in they are all vertically integrated to some degree and they all enjoy competitive non-silicon manufacturing cost. However, their strategies are different (see table on next page).

Key differences between Suntech, Motech and Yingli

	Suntech	Motech	Yingli
Founded	2001	1997	2001
Market Share in 2007	12%	6%	5%
Business	Cell/ Module/ System (China only)	Polysilicon/ Ingot/ Wafer/ Cell/ System	Ingot/ Wafer/ Cell/ Module
Raw material status in 09			
Vertical integration	Some portion from strategic polysilicon partners	14% of planned output	
Long term contract	80% of planned output	45% of planned output	30% of planned output
Cost competitiveness			
Wafer Thickness(um)	Average	Average	Most efficient
Conversion Rate	Introducing 18% (target at 20% 09/10 for Pluto)	Average	Average
Silicon Cost Flexibility	Least flexible. Large long term contracts.	Most flexible. Target at 50% in-house silicon supply.	Reasonable flexible. Only sign relatively short term contracts from this year.
Non-Silicon cost	Lower than average	Lower than average	Lowest
Future Strategy			
Business	Industry cluster: STP encourages partners to co-locate near Suntech's production facilities, helping STP to adopt a "zero inventory" policy.	Experienced in invertors.	Most vertical integrated company in China.
New technology	1) Pluto technology to increase conversion efficiency from current 15-16% to 18%+. 2) Thin film technology.	Evaluating thin film technology.	
Upstream	Strategic investment in several polysilicon/ wafer makers.	Investment in AE Polysilicon.	Good relationship with Xinguang, China.
Downstream	Integrated into system level in China.	1) No plan to step in module level due to conflicts with its current customers. 2) Integrated into system level in Taiwan.	System level in Tibet, China.
Customer Relationship			
Special Applications	Building Integrated Photovoltaic (BIPV)		
Sales Breakdown by Geography	35% Spain, 51% Germany, 6% USA in 2007	30% Europe, 62% Asia, 8% USA in 2007	58% Spain, 11% Germany, 21% Asia, 6% America in 2007
Operating Performance			
Capacity expansion	89% growth in 08, 35% growth in 09	50% growth in 08, 52% growth in 09	100% growth in 08, 50% growth in 09
Output growth	45% growth in 08, 91% growth in 09	67% growth in 08, 51% growth in 10	81% growth in 08, 71% growth in 09
Margin	GM expansion in the next two years	GM expansion in the next two years	GM expansion in the next two years

Source: Company data, HSBC estimates

Suntech (STP US, Overweight (V), TP USD46)

We initiate coverage with an Overweight (V) rating and a DCF-based target price of USD46. This translates to a PE of 20x forward earnings, compared to its historical PE range of 17-50x.

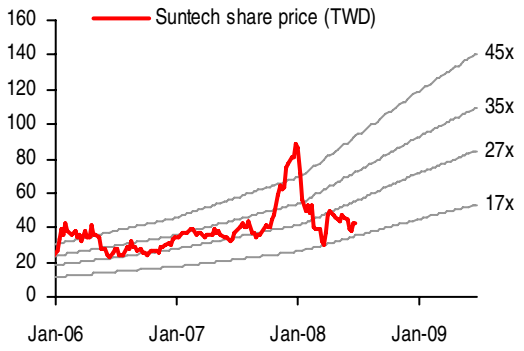
Potential slowing demand from Spain should not be a big concern to Suntech. Suntech guides that it will reduce exposure to Spain from as high as 58% in 1H08 to 25-30% in 2H08. It is expanding its customer base to other high growth regions, such as Italy and Korea. We think Suntech is positioned well in what can be termed a transition stage.

As we believe the polysilicon shortage will remain in place for the next 18 months, securing low cost raw materials is crucial for profitability. Suntech has secured as much as 80% raw material of its planned output of around 1GW in 2009. In addition, Suntech may also be able to obtain extra raw materials from its strategic upstream partners next year (e.g., Asia Silicon, where mass production starts from 3Q08). As such, Suntech should benefit from its virtual vertical integration strategy next year.

We estimate that 2H revenues will account for 60% of the full year, with 30% h-o-h growth. Our gross margin forecast is below consensus as we expect lower module prices will hurt profitability while silicon prices remain high. However, in our view there is potential upside if a higher portion of production is based on Pluto technology.

An increase in gross margins due to faster-than-expected implementation of Pluto technology will be a catalyst for share price appreciation.

Suntech's forward PE band



Source: Company data, HSBC estimates

Motech (6244 TT, Neutral (V), TP TWD255)

We initiate coverage with a Neutral (V) rating and a DCF-based target price of TWD255. This translates to 16x forward earnings, compared to its historical PE range of 15-45x.

Our 2008 EPS forecast is 20% below consensus, as we are more negative on the gross margin assumption. We expect continuous gross margin erosion for the rest of the year, as it is unlikely that Motech will be able to meet its original capacity expansion plan in 2H 2008 (580MW by year end previously vs. current 420MW+), has a relatively high portion of low-margin OEM products, and buys a higher ratio of raw materials from the spot market.

Motech is vertically integrated into polysilicon/ ingot/wafer, and its long term goal is to produce 50% its total capacity through vertical integration. The company has already secured 45% of its 2009 planned output of 400MW, and will probably secure another 14% from AE Polysilicon (Motech's strategic partner in the upstream polysilicon production). This should give Motech an advantage during the polysilicon shortage.

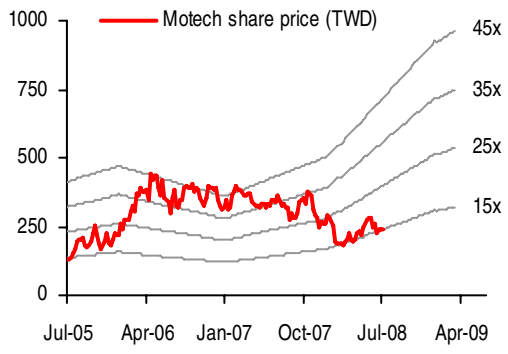
In addition, we estimate that Motech's exposure to Europe is only around 40% this year, pointing to a relatively low exposure to Spain and

Germany. By securing customer orders for 100% of its planned output of 400MW next year, we think the company is well positioned even if demand is lower than supply next year.

This is why we are more positive on its prospects for 2009 and 2010 when it will have a rising percentage of less expensive wafers contracts and the prospect of purchasing fewer raw materials on the spot market. Our 2009-10 EPS forecasts are 1-9% higher than consensus.

Upside risks to our rating include better-than-expected gross margins in 2H 2008 due to higher portion of contract wafers or lower spot wafer pricing. Downside risks include higher-than-expected raw material prices, leading to lower profitability.

Motech's forward PE band



Source: Company data, HSBC estimates

Yingli (YGE US, Neutral (V), TP USD17)

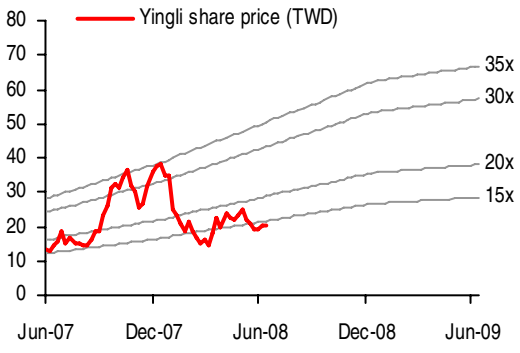
We initiate coverage with a Neutral (V) rating and a DCF-based target price of USD17. This translates to 13x forward earnings, compared to its historical PE range of 15-35x.

Yingli is the most vertically integrated PV company in China but lacks an integrated supply of polysilicon. Raw materials from Xinguang are not available on favourable terms – prices are only 15-20% lower than current polysilicon spot price which is still much higher than average long term contract price. Our gross margin assumption for 2H08 is 19.4%, lower than company guidance of 23-24%.

Spain accounted for as high as 58% of its total sales in 2007. Although the company guides that this will fall to 50% in 2H08 and <40% next year, it is likely to be higher than Suntech's 25-30%. As demand from Spain will fall from this September, a high portion of Spanish sales would be a negative catalyst to the stock.

Potential upside catalysts include higher output in 2H 2008 due to expanded capacity, following the halt to capacity expansion in 3Q 2007. Successfully diversifying its customer base would be another positive catalyst.

Yingli's forward PE band



Source: Company data, HSBC estimates

HSBC

Company profiles

- Suntech (STP US)
- Motech (6244 TT)
- Yingli Green Energy (YGE)

HSBC

Suntech (STP US)

- Exposure to Spain will fall to 25-30% in 2H, from 58% in 1H. The company has also secured 80% of its 2009 raw material needs
- Revenues more backend loaded; 30% h-o-h revenue growth
- Initiate coverage with Overweight (V) rating and TP of USD46

Company overview

Suntech, established in 2001, is the top PV cell/module maker in China and the No.3 worldwide. The company is also the largest provider of PV modules in Spain, and was the second largest in Germany in 2007.

Suntech: No.3 PV cell maker in 2007, up from No. 4 in 2006

Company	Country	07 output plan (MW)	08 capacity plan (MW)	07 ranking	06 ranking
Q-Cells	Germany	389	925	1	2
Sharp	Japan	363	710	2	1
Suntech	China	327	1,000	3	4
Kyocera	Japan	207	300	4	3
Motech	Taiwan	177	420	5	7
Sanyo	Japan	165	350	6	5

Source: Photon International

No turnkey solutions

Unlike most of its competitors, Suntech doesn't use turnkey solutions provided by the equipment makers. Instead, the company uses second hand equipment to construct its PV production lines. This reduces production costs, increases its ability to meet customer requirements and enhances yield rates.

Technology focus

Another key difference is that Suntech holds an annual technology forum for upstream and downstream manufacturers in the industry which helps to establish long term relationships with its customers.

Suntech believes innovative technology is the key to staying ahead of the competition. The company has invested 5% of sales in research and development since 2001.

International standards

Instead of expanding its customer pool by focusing on mass production, the company has made obtaining international quality certification (such as ISO9001, TU, CE, UL, IEC) for its products a high priority. This has helped to eliminate potential problems in the international PV market.

Silicon status

Suntech has not gone down the traditional vertical integration path. Instead, it has opted for "virtual vertical integration" by strategically investing in several polysilicon and wafer companies. The reasons include:

- Suntech doesn't want to have any conflicts with its suppliers;
- It is focusing on increasing PV cell/module production scale to gain market share. The company believes bigger scale is more important than vertical integration.

Although Suntech failed to secure polysilicon from Luoyang Zhonggui due to severe competition from other companies, the company recently invested a total of USD200m in Nitol Solar (a Russian based company) and Hoku Materials to secure polysilicon supply, as well as Glory Silicon for wafer supply.

Suntech has also increased the number of long-term contracts in the belief that polysilicon will soon be in short supply again. Currently, Suntech sources polysilicon and wafers from around 40 different parties to reduce concentration risks.

The contract with Asia Silicon (a Qinghai polysilicon maker using advanced Siemens method) is favourable to Suntech, with the contract price dropping to USD40/kg in the seventh year of the contract This is considerably lower than the forecast spot price of USD50-60/kg the company would expect to pay. Asia Silicon will start mass production around July/August this year.

Suntech's major long-term raw material supply

Company	Signed	Duration	Amount
MEMC (USA)	2006 July	10 years	USD6bn
Hoku (USA)	2007 June	10 years	USD 678m
Asia Silicon (CN)	2007 October	7 years	USD1.5bn
Renesola (CN)		4 years	510MW
Nitol Solar (Russia)	2008 May	7 years	USD100m
Shunda (China)	2008 May	13 years	Invested USD98.9m 7GW wafers
Wacker Schott	2008 June	13 years	200MW

Source: Company data

Note that Suntech buys polysilicon directly from the polysilicon makers, not through brokers like some of its competitors. This guarantees polysilicon supply at lower prices than its rivals.

Capacity and output

2Q08 revenues might be flattish q-o-q at USD430-440m as the company hasn't expanded capacity since 4Q07. It plans to increase capacity from the current 540MW from 3Q08 to 1GW by year end. Further expansion to 1.9GW is possible by 2010, which would represent 38% CAGR in 2008-10.

With 1GW capacity, we forecast output next year will increase by 91%. The company has already secured around 80% of raw material it needs for production next year. We forecast 65% output growth CAGR in 2008-10.

Annual production data

	2006	2007	2008	2009	2010
Year End Capacity (MW)	270	540	1020	1380	1900
Y-o-y %	80%	100%	89%	35%	41%
Output (MW)	160	364	528	1010	1432
Y-o-y %	135%	127%	45%	91%	42%

Source: Company data, HSBC estimates

Investment view

Exposure to Spain is falling

Potential slowing demand from Spain should not be a big concern for Suntech. Suntech guides that it will successfully reduce exposure to Spain from as high as 58% in 1H08 to 25-30% in 2H08. The company is expanding its customer base to other high growth regions, such as Italy and Korea.

Suntech's customer breakdown by geography

	2006	2007
Europe	70%	89%
Spain	21%	35%
Germany	42%	51%
Others	7%	3%
China	22%	2%
USA	3%	6%
Japan	1%	1%
Others	4%	2%

Source: Company data

Suntech is well positioned in these markets. It has established sales and service offices in Munich, Madrid, San Francisco, Seoul, Sydney and Tokyo. And also plans to open offices in Greece, Italy and Switzerland to increase access to developing solar markets. Major international customers include Atersa, IBC Solar, Ibersolar Energia, Krannich and Phoenix Solar.

HSBC

Secured 80% of raw materials it needs for 09

As we believe that polysilicon will remain in short supply for the next 18 months, securing low cost raw materials is crucial for profitability. Suntech has secured as much as 80% of its raw material needs for its planned output of around 1GW in 2009. Suntech may also be able to obtain extra raw materials from its strategic upstream partners next year. For example, Asia Silicon is starting mass production mass from 3Q08. This shows its virtual vertical integration strategy is working.

Positive on 2H08

We believe 60% of 2008 earnings will come in 2H and forecast quarterly revenue growth of around 20% in both 3Q and 4Q08.

Gross margin should be stable at around 21-22% since ASP and costs should both drop around 3-5% in the second half. Potential upside will be from the implementing Pluto technology in its new production line in 4Q08. This technology will be able to increase conversion efficiency from current 15-16% to 18-19%, increasing gross margin by 3% when the production lines are fully transferred to Pluto technology.

Gross margin expansion in 2009

The management expects module selling prices to drop less than 10% y-o-y in 2009, based on the feedback from customers. Demand is expected to be particularly strong in Italy, France and Korea, replacing Spain and Germany as the key markets. At the same time, polysilicon costs should drop 10% y-o-y in 2009, so gross margin is likely to rise slightly next year.

BIPV market

The new PV application of building integrated photovoltaic (BIPV) will be one of the key drivers for Suntech in the next few years. This is why the company acquired MSK (20 years' experience in PV modules). Japan's PV market shrunk after the government subsidy ceased in 2007. However, demand from Japan will accelerate from next year when new government policies will see the cost of using PV systems fall by 50%.

This fits well with Suntech's view that demand in Japan will rise over the next two years. Its first a-Si thin film production line with capacity of 50MW will be mass manufacturing in 2H09. In addition, Suntech also provides thin film PV cells for BIPV systems to Socovoltaic (JV of Socotherm, Italy and TSNergy).

Financial outlook

2Q08 outlook

We estimate revenues for the second quarter at around USD430-440m, flattish q-o-q due to no capacity expansion in 2Q. Gross margin will be flat q-o-q at around 22%, since module selling prices and the cost of wafers should also be stable q-o-q.

2008 outlook

Revenues guidance is USD1.9-2.1bn vs. our estimate of USD1.99 (up around 50% y-o-y), and gross margin of around 20% for 2008 vs. our estimate of 21.9% (flattish y-o-y). Output guidance is 530MW for the year vs. our estimates of 509MW.

How are we different from consensus?

Our EPS forecasts are generally in line with the consensus from 2008 to 2010. However, we expect higher revenues (11% higher than the consensus) in 2009 and lower gross margin since we are more conservative on the company's ability to cuts manufacturing costs. Upside potential relies on a higher portion of production being based on Pluto technology in 2009.

Versus consensus

EPS (USD)	HSBC	Consensus	% difference
2008f	1.53	1.57	-3%
2009f	2.65	2.63	1%
2010f	3.65	3.59	2%

Source: Reuters, HSBC estimates

HSBC

Valuation and rating

We initiate on Suntech with an Overweight (V) rating and DCF-based target of USD46.

Assuming a terminal growth of 4.2%, WACC of 11% with a cost of equity of 26% (considering company specific corporate tax rate, target hearing and asset beta), our DCF model suggests a value of USD45. Cost of equity of 26% is higher than Motech's 15% because we use the China local risk free rate and market premium as the operations are based in China. Higher gearing also results in a higher cost of equity based on our calculation. The target price translates to 22x forward earnings, compared with the stock's historical range of 17x-50x forward earnings. We believe that in one year's time the market will partly be valuing the stock on anticipated 2009 earnings. We therefore use a blended 08/09e EPS of USD1.7 and USD2.95, respectively. Potential return from the current level is 30.8%.

Under our research model, for stocks with a volatility indicator, the Neutral band is 10% above and below the hurdle rate for US stocks of 11.5%. For Suntech, this translates into a Neutral band of 1.5% to 21.5% around the current share price. Our target price of USD46 for Suntech implies a total return of 30.8%, which is above the Neutral band; thus we have an Overweight (V) rating.

DCF assumptions for Suntech

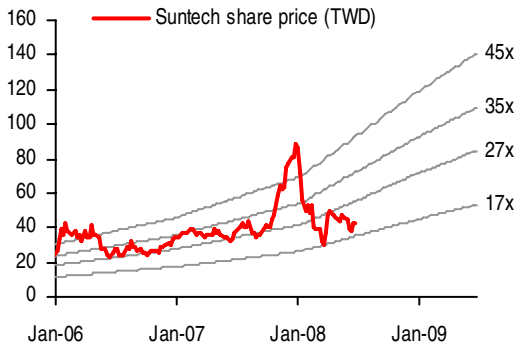
Forecasts	2008	2009	2010	Phase 2 Avg (2011 - 2026)
Invested Capital Growth (%)	25.4	31.6	12.2	9.9
Operating Margin (%)	14.2	14.3	16.8	14.2
Capital Turnover (x)	1.6	2.2	2.0	1.9

Source: HSBC Research

Catalysts

Revenues are back-end loaded this year as the company focused on profitability in 1H. 2H08 revenues should account for 60% of 2008 revenues, with 30% h-o-h growth. Higher than expected revenue from smaller-than-expected sales price erosion should be the upside catalyst. In addition, any upside from current gross margin level due to faster-than-expected implementation of Pluto technology will be a catalyst in 2H.

Suntech's forward PE band



Source: TEJ, HSBC estimates

Risks

- As Nitol Solar and Hoku Materials have not yet started mass production of polysilicon, any delay of production might be a risk to Suntech's operation and output.
- Large long term contract with MEMC at an unfavourable price might be a risk when polysilicon supply is sufficient. Although Suntech doesn't think that the spot price will fall below this contract price, this contract price should be still higher than other contracts they signed this year. We estimate the contract price with MEMC will be 16% higher than the average contract price in 2010.
- Lack of vertical integration into upstream is a concern in the long run. The company has to sign long term contracts with suppliers, but can not enjoy extra financial returns from vertical integration.
- Module price erosion will be higher than expected in 2009 if demand from Italy, US and Korea is below forecasts.

HSBC

Financials & valuation: Suntech Power Holdings

Overweight (V)

Financial statements

Year to	12/2007a	12/2008e	12/2009e	12/2010e
Profit & loss summary (USDm)				
Revenue	1,348	1,992	3,405	4,015
EBITDA	192	336	568	982
Depreciation & amortisation	-20	-53	-79	-101
Operating profit/EBIT	172	284	488	881
Net interest	0	0	0	0
PBT	182	282	488	881
HSBC PBT	182	282	488	674
Taxation	-13	-24	-40	-56
Net profit	172	258	448	825
HSBC net profit	172	258	448	618
Cash flow summary (USDm)				
Cash flow from operations	94	173	203	835
Capex	-163	-200	-200	-200
Cash flow from investment	235	-200	-200	-200
Dividends	0	0	0	0
Change in net debt	239	-468	-483	-893
FCF equity	-82	-51	-37	579
Balance sheet summary (USDm)				
Intangible fixed assets	407	407	407	407
Tangible fixed assets	293	440	561	660
Current assets	1,257	1,918	2,831	3,893
Cash & others	521	989	1,472	2,365
Total assets	1,957	2,765	3,798	4,959
Operating liabilities	209	238	303	325
Gross debt	842	842	842	842
Net debt	321	-147	-630	-1,523
Shareholders funds	906	1,128	1,576	2,194
Invested capital	1,227	1,538	2,023	2,269

Ratio, growth and per share analysis

Year to	12/2007a	12/2008e	12/2009e	12/2010e
Y-o-y % change				
Revenue	125.1	47.8	70.9	17.9
EBITDA	67.6	75.2	68.7	73.0
Operating profit	66.2	65.4	72.1	80.4
PBT	64.7	54.6	73.2	80.4
HSBC EPS	60.6	50.3	73.3	38.0
Ratios (%)				
Revenue/IC (x)	1.4	1.4	1.9	1.9
ROIC	16.1	18.8	25.2	38.4
ROE	21.8	25.4	33.1	32.8
ROA	11.1	10.9	13.7	18.8
EBITDA margin	14.2	16.9	16.7	24.5
Operating profit margin	12.7	14.2	14.3	21.9
EBITDA/net interest (x)				
Net debt/equity	35.4	-13.0	-40.0	-69.4
Net debt/EBITDA (x)	1.7	-0.4	-1.1	-1.6
CF from operations/net debt	29.2			
Per share data (USD)				
EPS Rep (fully diluted)	1.13	1.70	2.95	5.44
HSBC EPS (fully diluted)	1.13	1.70	2.95	4.07
DPS	0.00	0.00	0.00	0.00
NAV	5.97	7.43	10.39	14.46

Key forecast drivers

Year to	12/2007a	12/2008e	12/2009e	12/2010e
Wafer to module	1,177	1,914	3,334	3,954
Cell to module	156	71	64	53
Others	15	7	7	7

Valuation data

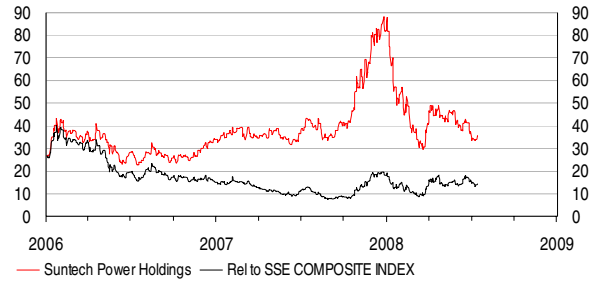
Year to	12/2007a	12/2008e	12/2009e	12/2010e
EV/sales	4.1	2.5	1.3	0.9
EV/EBITDA	28.7	15.0	8.0	3.7
EV/IC	4.5	3.3	2.3	1.6
PE*	31.0	20.6	11.9	8.6
P/NAV	5.9	4.7	3.4	2.4
FCF yield (%)	-1.6	-1.0	-0.7	11.2
Dividend yield (%)	0.0	0.0	0.0	0.0

Note: * = Based on HSBC EPS (fully diluted)

Issuer information

Share price (USD)	35.16	Target price (USD)	46.00
Potent'l tot rtn (%)	30.8		
Reuters (Equity)	STP.N	Bloomberg (Equity)	STP US
Market cap (USDm)	5,186	Market cap (USDm)	5,186
Free float (%)	39	Enterprise value (USDm)	5039
Country	China	Sector	ELECTRICAL EQUIPMENT
Analyst	Christine Wang	Contact	+8862 8725 6024

Price relative



Source: HSBC

Note: price at close of 15 Jul 08

HSBC

Motech (6244 TT)

- Gross margin erosion continues in 2H08
- Might not able to meet the original capacity expansion plan this year
- Initiate coverage with Neutral (V) rating and TP of TWD255

Company overview

Motech, listed in 2004, is among the world's top 10 manufacturers of photovoltaic (PV) cells. The company specialises in polysilicon PV cells. Strong demand for PV-related products, we believe, represents high growth potential for Motech. The company is keen on both vertical and horizontal integration in order to stabilise material supply and attain economies of scale, which are the keys to success in the PV industry.

Fifth-largest PV cell maker in 2007

Motech is currently ranked the world's number five PV cell producer and the largest in Taiwan, with 5.9% market share in 2007, according to PV News.

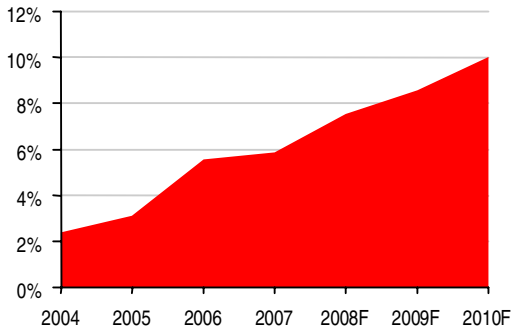
Motech is No.5 PV cell makers in 2007, up from No.7 in 2006

Company	Country	07 output plan (MW)	08 capacity plan (MW)	07 ranking	06 ranking
Q-cells	Germany	389	925	1	2
Sharp	Japan	363	710	2	1
Suntech	China	327	1,000	3	4
Kyocera	Japan	207	300	4	3
Motech	Taiwan	177	420	5	7
Sanyo	Japan	165	350	6	5

Source: Photon International

We estimate Motech will increase its market share to 8.6% by 2009, based on its plans for capacity expansion and our assumption of reasonable ramp-up in production yield.

Market share continues to increase



Source: Company data, Photon International, PV news, HSBC estimates

Strong top and bottom line growth

We expect Motech to deliver 23% revenue CAGR during 2008-10. Motech's quarterly revenues should be highly correlated to the increase in capacity expansion, after factoring in yield enhancement, utilization rate, ASP erosion (around 10% per year from 2009 based on our assumption), and potential change in the OEM – non OEM product mix (assuming the company is able to secure adequate raw material supplies).

We expect Motech to deliver a 51% bottom line CAGR during 2008-10. The number is much higher than the revenue growth because we expect its gross margin will expand on lower raw material cost.

Capacity and output

Motech is aiming for more than 50% y-o-y growth for 2008-09 in terms of both capacity and output, even after the company trimmed down its capacity expansion plan this year.

Capacity vs. output

	2005	2006	2007	2008	2009
Capacity (MW, year end)	86	200	280	420	640
y-o-y %	99%	133%	40%	50%	52%
Output	55	105	177	288	436
y-o-y %	90%	91%	69%	63%	51%

Source: Company data, HSBC estimates

ASP trend

We expect the selling prices of non-OEM PV cells to drop 5-10% y-o-y in 2009-10. We believe the lower ASP will reflect falling wafer prices and increased competition especially when we anticipate that the demand from Germany and Spain might decrease next year on reduced incentives.

Investment thesis

Gross margin is still at risk…

Based on our channel check, the portion of long term raw material procurement contracts is probably lower than expected. Although we think the company will be able to meet its output target of 280MW this year (vs. our estimate of 288MW), we think the long term contracts of raw material should account for less than 30% this year, compared to the expected 40+%. The higher portion of spot wafers is negative for profitability in 2008, and we expect its 2Q gross margin to be lower than 1Q's 16.6%.

At the same time, OEM business is not as profitable as before due to severe competition from other PV cell makers. Many PV cell makers turn to OEM business to increase their utilization rate when they are not able to secure enough raw materials for production. As such, gross margin for OEM business is probably only 10%+ compared to around 30-40% in the past. Therefore, higher OEM portion of 30%+ this year vs. only 10-15% in 2007 will negatively affect its gross margin this year, in our view.

As such, we think the company will still suffer from lower gross margin this year, and the previous expectation of gross margin rebounding in 2H08 might be too aggressive.

Capacity target doubtful…

According to Motech's management team, the company might not be able to reach its original capacity expansion plan of 580MW by the end of 2008. The company might only produce 420MW+ and reach 580MW by 1Q09 and 650MW by 2Q09.

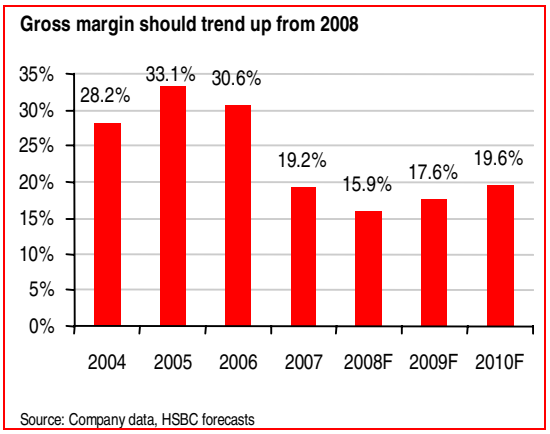
An inability to secure a higher portion of cheaper raw materials through long term contracts might be the reason why the company has postponed its capacity expansion plans for this year. We think it is reasonable considering it is likely that the company will see low utilization rates and possible poor profitability if it does hit the planned capacity targets by year end. However, delayed capacity expansion might affect its 2009 production output. As such, we don't expect its output to exceed 500MW in 2009, which was the company's original plan.

But 2009 should be a good year

Even though 2008 looks like being a disappointing year, we are positive about 2009. We forecast 81% y-o-y increase on the bottom line, with only 38% y-o-y increase on the top line. This is largely due to gross margin expansion from 15.9% in 2008 to 17.6% in 2009 thanks to more long term contracts on raw materials (>40% vs. <30% this year) and more in house polysilicon/ingot/wafer production.

A potential demand slowdown due to reduced demand in Spain and Germany is not a risk to Motech, in our view. According to Motech's management team, the company has already sold out 400MW for 2009 based on current contracts

with downstream customers, which is 92% of total 2009 output, based on our estimates. We believe that the customers will be more selective should the supply-demand situation reverse next year. Companies that provide high quality products (like Motech) should not suffer much from the potential demand slow down in 2009 as demand from Italy, the US and Korea remains strong.



Vertical integration is key

We believe vertical integration into polysilicon manufacturing will give cell makers control over raw material supplies, enabling them to optimise future output in response to changes in demand. As such, vertically integrated cell makers should have a strategic advantage and better growth prospects in the long term.

Motech plans to achieve vertical integration in the c-Si based PV cell industry through a collaboration with AE Polysilicon to secure supply of polysilicon raw material and a new ingot/wafer manufacturing plant in China.

Polysilicon status – on track

AE polysilicon will start to do pilot production in 1Q09, and will begin mass production in 2Q09, according to the management team. This plan is still on track. Motech has signed a seven-year (2009-15) contract with AE to supply 150MW of polysilicon in the initial stage and 240MW in the second stage. Motech has also acquired 12% equity stake in AE. AE is using fluidised-bed reactor (FBR) technology to produce polysilicon, instead of the traditional Siemens or advanced Siemens method, reducing costs by 20-30%. However, since AE has no track record in mass production of polysilicon based on FBR technology, we think the company expects to reach the second stage in 2010, after factoring in potential delays in ramp-up and yield enhancement. We view it is critical for Motech to secure polysilicon as it would give the company some control over raw-material supply and costs in the long run.

Ingot/wafer capacity expansion

In-house wafer capacity will reach 100MW by end 08, which is still on track. Even though the company hasn't finalized its capacity expansion plan in 2009 due to uncertainty from AE Polysilicon, Motech's long term goal is to increase in-house solar wafer capacity to 50% of its cell capacity. As such, we expect its ingot/wafer capacity should reach 200MW+ in 2009 (based on our estimate on output of 436MW).

We believe vertical integration from upstream polysilicon supply, to production of solar-grade ingots/wafers and further to solar-cell manufacturing will make Motech cost-competitive, especially in times of polysilicon supply shortage.

Thin film development

Motech's capacity expansion is focused mainly on the traditional c-Si based wafer technology rather than building manufacturing capacity for thin film based PV cells. However, the company is closely monitoring developments in thin film technology. We think the company might start manufacturing thin film PV cells around 2010 when the conversion rate is improved (currently only 8-10% vs. c-Si based PV cell of 15-16%) and when demand grows.

How are we different from consensus?

Our 2008 EPS is lower than consensus by 20% because we are more negative on the gross margin assumption.

Our view is based on:

- The company's failure to meet the capacity expansion plans in 2H08; the target was 580MW by year end and it is only likely to reach 420MW+;
- Higher percentage of lower-margin OEM business due to severe competition;
- Higher ratio of raw materials from the spot market;
- Higher depreciation cost from 2Q08.

However, we are more positive on its 2009 and 2010 operations due to increasing in-house wafer production and buying a lower percentage of raw materials from the spot market. Our 2009-10 EPS are 1-9% higher than consensus.

Versus consensus

EPS (TWD)	HSBC	Consensus	% difference
2008f	11.3	14.0	-19%
2009f	20.4	20.2	1%
2010f	25.9	23.7	9%

Source: Reuters, HSBC estimates

Valuation and rating

We initiate coverage on Motech (6244 TT) with a Neutral (V) rating and a DCF-based target price of TWD255.

Assuming a terminal growth of 2.4%, WACC of 11% with cost of equity of 15% (considering company specific corporate tax rate, target gearing and asset beta), our DCF model suggests a value of TWD255. This translates to 16x 12-month forward earnings, compared to the stock's historical range of 15-45x forward earnings. We believe that in one year's time the market will partly be valuing the stock on anticipated 2009 earnings. We therefore use a blended 08/09e EPS of TWD1.24 and TWD20.36, respectively. Potential return is 1.6%, including dividend. We think our target price, based on low-range PE ratio, is reasonable as the company will still suffer from raw materials constraint for the rest of this year. Gross margin is likely to shrink in 2H08. As such, it would be hard for the stock to re-rate.

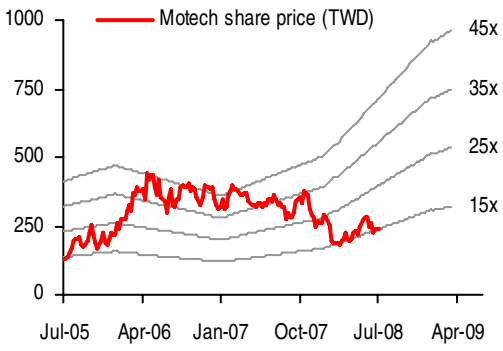
Under our research model, for stocks with a volatility indicator, the Neutral band is 10% above and below the hurdle rat for Taiwan stocks of 10.8%. For Motech, this translates into a Neutral band of 0.8% to 20.8% around the current share price. Our target price of TWD255 for Motech implies a total return of 1.6%, which is within the Neutral band; thus, we have a Neutral rating on Motech.

DCF assumptions for Motech

Forecasts	2008	2009	2010	Phase 2 Avg (2011 - 2026)
Invested Capital Growth (%)	38.3	12.3	6.9	6.3
Operating Margin (%)	12.3	14.0	16.1	14.0
Capital Turnover (x)	2.1	2.1	2.0	2.0

Source: HSBC Research

Motech's forward PE band



Source: TEJ, HSBC forecasts

Risks

Potential upside risks include better-than-expected gross margin in 2H08 due to higher portion of contract wafers or lower spot wafer pricing.

Downside risks include:

- Insufficient raw material supply will continue to be the biggest short-term risk. Unlike some of Motech's competitors, the company is reluctant to secure a large portion of raw material supply on long term contracts, this places a risk on its short-term revenues and margin trend. However, this should enable the company to be more competitive when the raw material supply is sufficient in the future.
- Any potential delay on mass production of AE polysilicon will pose a threat to Motech's profitability next year.
- Lack of exposure on thin film production might be an issue if demand for thin film PV cells increases faster than expected.

HSBC

Financials & valuation: Motech Industries Inc

Neutral (V)

Financial statements

Year to	12/2007a	12/2008e	12/2009e	12/2010e
Profit & loss summary (TWDm)				
Revenue	15,578	22,585	30,827	34,087
EBITDA	2,929	3,333	5,244	6,522
Depreciation & amortisation	-503	-564	-923	-1,035
Operating profit/EBIT	2,426	2,769	4,321	5,488
Net interest	152	0	0	0
PBT	2,596	2,353	4,321	5,488
HSBC PBT	2,596	2,353	4,321	5,488
Taxation	-17	-39	-130	-165
Net profit	2,580	2,314	4,191	5,323
HSBC net profit	2,580	2,314	4,191	5,323
Cash flow summary (TWDm)				
Cash flow from operations	-813	577	3,848	5,665
Capex	-858	-2,426	-1,500	-1,501
Cash flow from investment	-1,300	-2,426	-1,500	-1,501
Dividends	-1,383	-1,441	-1,255	-2,272
Change in net debt	-3,553	1,155	-3,234	-4,033
FCF equity	731	-1,433	2,348	4,164
Balance sheet summary (TWDm)				
Intangible fixed assets	0	0	0	0
Tangible fixed assets	2,921	4,783	5,360	5,826
Current assets	10,136	12,486	17,514	22,200
Cash & others	5,428	4,272	7,507	11,540
Total assets	17,573	21,785	27,390	32,542
Operating liabilities	1,279	2,482	3,009	2,970
Gross debt	2,881	2,881	2,881	2,881
Net debt	-2,546	-1,391	-4,626	-8,659
Shareholders funds	13,413	16,363	21,375	26,501
Invested capital	6,351	10,514	12,357	13,516

Ratio, growth and per share analysis

Year to	12/2007a	12/2008e	12/2009e	12/2010e
Y-o-y % change				
Revenue	92.3	45.0	36.5	10.6
EBITDA	23.0	13.8	57.3	24.4
Operating profit	11.4	14.1	56.0	27.0
PBT	14.7	-9.4	83.6	27.0
HSBC EPS	-20.1	-10.3	81.1	27.0
Ratios (%)				
Revenue/IC (x)	2.8	2.7	2.7	2.6
ROIC	44.0	32.3	36.6	41.1
ROE	27.2	15.5	22.2	22.2
ROA	20.1	11.8	17.0	17.8
EBITDA margin	18.8	14.8	17.0	19.1
Operating profit margin	15.6	12.3	14.0	16.1
EBITDA/net interest (x)				
Net debt/equity	-19.0	-8.5	-21.6	-32.7
Net debt/EBITDA (x)	-0.9	-0.4	-0.9	-1.3
CF from operations/net debt				
Per share data (TWD)				
EPS Rep (fully diluted)	12.53	11.24	20.36	25.86
HSBC EPS (fully diluted)	12.53	11.24	20.36	25.86
DPS	7.00	6.10	11.04	0.00
NAV	65.16	79.49	103.84	128.75

Key forecast drivers

Year to	12/2007a	12/2008e	12/2009e	12/2010e
Sales:Non OEM (NT$m)	15,156	20,658	30,050	32,121
Sales:OEM parts (NT$m)	423	1,752	778	1,966
Gross profit:Non OEM (NT$m)	2,788	3,357	5,333	6,533
Gross profit:OEM parts (NT$m)	198	203	79	164

Valuation data

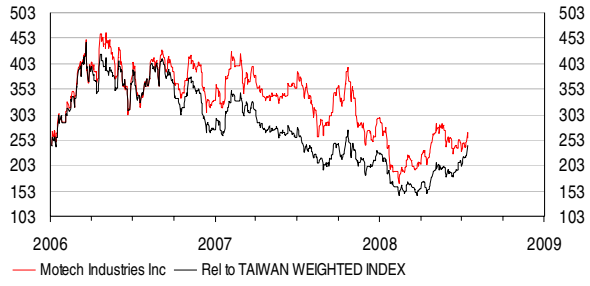
Year to	12/2007a	12/2008e	12/2009e	12/2010e
EV/sales	3.2	2.3	1.6	1.3
EV/EBITDA	17.1	15.4	9.2	6.7
EV/IC	7.9	4.9	3.9	3.3
PE*	20.5	22.9	12.6	9.9
P/NAV	3.9	3.2	2.5	2.0
FCF yield (%)	1.4	-2.7	4.5	7.9
Dividend yield (%)	2.7	2.4	4.3	0.0

Note: * = Based on HSBC EPS (fully diluted)

Issuer information

Share price (TWD)	257.00	Target price (TWD)	255.00
Potent'l tot rtn (%)	1.6		
Reuters (Equity)	6244.TWO	Bloomberg (Equity)	6244 TT
Market cap (USDm)	1,743	Market cap (TWDm)	52,980
Free float (%)	84	Enterprise value (TWDm)	51,283
Country	Taiwan	Sector	Electronic Equipment
Analyst	Christine Wang	Contact	+8862 8725 6024

Price relative



Source: HSBC

Note: price at close of 15 Jul 2008

HSBC

Yingli Green Energy (YGE)

- High concentration in Spain and potential pressure on gross margin in 2H from module price erosion are the key concerns…
- …Even though revenue growth to accelerate in 2H; 20% q-o-q growth in 3Q-4Q
- Initiate coverage with Neutral (V) rating and TP of USD17

Company overview

Yingli Green Energy (Yingli) was founded in 1998. Yingli is the largest vertically integrated PV company in China and is 100% integrated for ingots, wafers, cells, and modules. Its main customers are in Spain, Germany, Italy, China, the US and Korea.

Relationship with upstream/ downstream companies

Strategy into upstream

Boading Tianwei Baoblan Electric (one of the top three transformer providers in China, and Yingli's parent company) invested 36% in Xinguang polysilicon in September 2005 to secure polysilicon supply. Xinguang utilizes the Siemens method to produce high purity polysilicon and has been mass manufacturing since 2007.

Even though Yingli may have priority in terms of purchasing polysilicon from Xinguang, we believe it does not get a discount compared to the market price. This is because Xinguang stated clearly that its polysilicon transactions would follow the market mechanism, i.e., buyers with better prices would be favoured. In the long term, therefore, the investment in Xinguang may not be a differentiating factor for Yingli, as it enjoys no special price benefits.

Strategy into downstream

In terms of end customers, Boading Tianwei Baoblan Electric also acquired Tibet Huaguan Tech, the top PV solution provider in Tibet (it bought a 56.52% stake for RMB45m). Tibet enjoys the highest subsidies in China, as residential electricity is a key issue. Tibet gets six hours of sunlight for 300 days a year, and is the biggest market in China for PV makers currently.

Yingli has already started to secure orders for its 2009 output even though demand might be at risk after Germany and Spain reduce their current incentives.

In our view, Yingli is well positioned both upstream and downstream.

Silicon status

Yingli secures polysilicon largely from Xinguang, Wacker-Chemie and DC Chemical for contracted polysilicon and MEMC Electronic Materials for

spot polysilicon. We believe Yingli has secured 80%+ virgin polysilicon of its planned output (255-265MW) in 2008 and 30% virgin polysilicon of potential output (we estimate this at 438MW) in 2009.

Yingli's policy is to sign medium-term (3-5 years), rather than long term (5-10 years), as management believes that the polysilicon demand-supply situation will reverse in 2010 and spot prices will fall significantly. Management forecasts about the demand-supply situation are in line with ours, and we believe their strategy should continue to contribute to profitability.

Major polysilicon procurement contracts

	Duration	From - to	Value	Amount
DC Chemical	1 yr	2008	$27mn	
DC Chemical	5 yr	2009-2013	$188mn	
DC Chemical	< 1yr	2Q08-4Q08	$39mn	
Wacker	5 yr	2009-2013		50MW
Wacker	9 yr	2010-2018		400MW
Wacker	9 yr	2009-2017		200MW
Sailing	2 yr	4Q08-4Q10		160-200MW
Komex	1 yr	2007-2008		44MW
Xinguang	2 yr	2007-2008		1,200 MT

Source: Company data

Capacity and output

Yingli has not expanded its capacity since 3Q07, so we believe output should stay at around 54.6MW in 2Q08 after its utilization rate reached 109% in 1Q08. However, the company plans to begin capacity expansion again in 3Q08 to reach 400MW by end-2008 and 600MW by mid-2009. We estimate revenues to rise 50% y-o-y in 2H08.

These expansion plans are not finalized yet but we expect Yingli to expand capacity to over 600MW at least in 2009 in order to maintain its market share of 9%. We estimate output CAGR at 60% in 2008-10.

Quarterly production data

	1Q08	2Q08f	3Q08f	4Q08f
Quarterly capacity (MW)	50	50	75	100
Year end capacity (MW)	200.0	200.0	300.0	400.0
Quarterly output (MW)	54.6	54.6	60.9	78.9
Utilization rate %	109%	109%	81%	79%

Source: Company data, HSBC estimates

Annual production data

	2006	2007	2008f	2009f	2010f
Year end capacity (MW)	60	200	400	600	850
y-o-y%		233%	100%	50%	42%
Output (MW)	51	142	249	461	635
y-o-y%		181%	75%	85%	38%

Source: Company data, HSBC estimates

Customers

Customer mix has changed significantly over 2006-07**.** Spain accounted for 50%+ of sales in 2007 and 1H08 but this will fall because of a cut in subsidies this year.

Based on our analysis of Yingli's orders on hand, we believe South Europe (including Spain) should account for just 40% of total sales in 2009. This means Spain will account for less than 40% of revenue next year, compared with the current 50%+. The US and Korea should account for 30-40% of total revenue in 2009, which is a significant increase over 2008.

A balanced customer mix in 2009 should help reduce customer concentration risk. We believe this should benefit Yingli, especially as incentives in certain countries are likely to decline. However, its exposure to Spain might still be higher than that of Suntech next year.

Yingli's customer breakdown by geography

Region	2006	2007
Germany	61%	11%
Spain	14%	58%
China	14%	6%
Others	11%	25%

Source: Company data

Technology development

Thinner wafers

By reducing wafer thickness from 200um in 2007 to 180um we estimate Yingli will be able to cut costs by 8-9%. We expect further cost cuts as the company targets to partly transform to 160um wafers from 4Q08.

At the same time, Yingli's polysilicon usage has been reduced from 12-13g/watt in 2002-03 to 7.2g/watt. One of the advantages of vertical integration is that Yingli needs less polysilicon for the same output.

Low manufacturing cost

Yingli's non-silicon manufacturing cost is only around USD0.8-0.85/watt, which is lower than the industry average of around USD1/watt. This is a result of reducing the breakage rate and enhancing process efficiency and yield rates.

Low manufacturing cost will differentiate PV makers once polysilicon supply is sufficient in the future, assuming all makers obtain raw material at similar prices. This should benefit Yingli.

Investment view

High raw material cost in 2H

Yingli is the most vertically integrated PV company in China but lacks an integrated polysilicon supply. We believe Yingli's 2H08 gross margin could be at risk due to:

- Its high polysilicon price. It got 56% of its polysilicon for 2H08 from Xinguang and while the price was only 10-15% lower than spot it was still significantly higher than the contract price;
- Potential high single-digit price erosion as demand falls in Spain after September 2008.

Our gross margin assumption for 2H08 is 19.4%, lower than company guidance of 23-24%.

Exposure to Spain still high

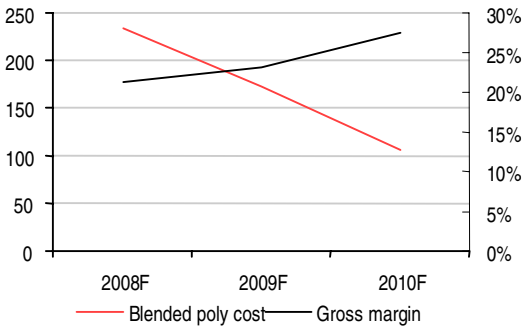
Spain accounted for as much as 58% of its total sales in 2007. Although the company guides that this ratio will fall to 50% in 2H08 and <40% next year, it is likely to be higher than Suntech's 25-30%. The high portion of sales in Spain is a negative catalyst to the stock.

A potential upside catalyst is higher output in 2H 2008 due to expanded capacity, following the halt to capacity expansion in 3Q 2007. Successfully diversifying the customer base will be another positive catalyst.

Margin should trend up from 2009

We expect gross margin to rise from 2009. Yingli has signed several medium-term polysilicon procurement contracts, mainly with Wacker and DC Chemicals, and will start to obtain polysilicon at the contract price from 2009. We expect its blended polysilicon cost will fall by 26% y-o-y in 2009. Potential polysilicon oversupply in 2010 will further help Yingli obtain cheaper polysilicon.

Yingli's gross margin to trend up from 2009



Source: HSBC forecasts

Financial outlook

2Q08 outlook

With potential stable pricing and production output, we expect its 2Q08 revenues to stay flat q-o-q, at USD228m. Gross margin should be stable at 24.5% since we do not expect the polysilicon price to be higher than in 1Q08.

2008 outlook

The company guides for PV module shipment of 255-265MW vs. our estimates of 249MW. Revenue guidance is USD969m to USD1,020m, vs. our estimate of USD981m, which is within the range of company guidance. Gross margin should remain flat y-o-y at 23.5% (vs. our estimate of 22%).

How are we different from consensus?

We differ from consensus on margin assumption. In the light of the increasing portion of virgin silicon in 2009, we are more positive on Yingli's gross margin expansion. However, we are more conservative on ASP, so our revenue estimates are lower than consensus.

Versus consensus

EPS (USD)	HSBC	Consensus	% difference
2008F	0.98	0.97	1%
2009F	1.73	1.77	-2%
2010F	1.99	2.37	-16%

Source: I/B/E/S consensus, HSBC estimates

Valuation and rating

We initiate coverage on Yingli Green Energy (YGE US) with a Neutral (V) rating and a DCF-based target price of USD17.

Assuming a terminal growth of 2.4%, WACC of 10.9% with a cost of equity of 21.2% (considering company specific corporate tax rate, target gearing and asset beta), our DCF model suggests a value of USD17. Cost of equity of 21% is higher than Motech's 15% is because we use the China local risk free rate and market premium (7.5% for China vs. 6% for Taiwan) as the operations are based in China. Higher gearing also results in higher cost of equity.. This translates to 13x forward earnings, compared to its historical PE range of 15-35x. We believe that in one year's time the market will partly be valuing the stock on anticipated 2009 earnings. We therefore use a blended 08/09e EPS of USD0.98 and USD1.73, respectively. Potential return is 10.8%.

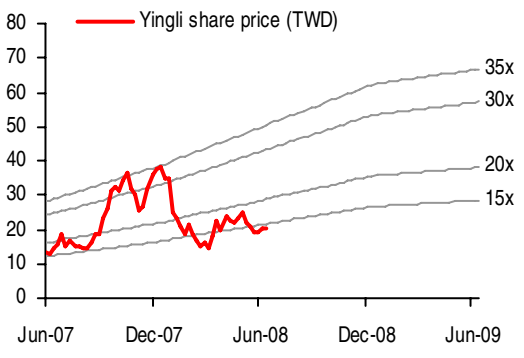
Under our research model, for stocks with a volatility indicator, the Neutral band is 10% above and below the hurdle rate for US stocks of 11.5%. For Yingli, this translates into a Neutral band of 1.5% to 21.5% around the current share price. Our target price of USD17 for Yingli implies a potential total return of 10.8%, which is within the Neutral band; thus, we have a Neutral (V) rating.

DCF assumption for Yingli

Forecasts	2008	2009	2010	Phase 2 Avg (2011 – 2026)
Invested Capital Growth (%)	4.1	26.3	1.7	6.3
Operating Margin (%)	15.2	18.2	21.5	13.8
Capital Turnover (x)	1.4	2.1	1.7	1.3

Source: HSBC Research

Yingli's forward PE band



Source: TEJ, HSBC estimates

Risks

Potential upside risks include higher output in 2H 2008 due to expanded capacity, following the halt to capacity expansion in 3Q 2007. Successfully diversifying the customer base will be another positive upside risk.

Major downside risks:

- If module ASPs fall faster than polysilicon prices, Yingli may be unable to maintain its gross margin at 23-24% for the rest of the year. This is because demand in 2H08 should be largely from Germany, where module prices aren't as high as in Spain.
- Around 56% of polysilicon should still come from Xinguang in 2H08. This polysilicon may have limited discount to the spot price, but should be around 70-100% higher than the contract price, so a higher proportion of

polysilicon from Xinguang in 2H might result in lower gross margin.

- Spain represented 58% of Yingli's total revenues in 2007. It will introduce a lower feed-in tariff in September 2008, so demand is likely to drop significantly. This could hurt Yingli's revenues but the company guides that Spain will represent less than 50% of its total revenues in 2H08, falling to <40% in 2009. Failing to decrease its exposure to Spain will be the key downside risk.

HSBC

Financials & valuation: Yingli Green Energy

Neutral (V)

Financial statements

Year to	12/2007a	12/2008e	12/2009e	12/2010e
Profit & loss summary (USDm)				
Revenue	556	973	1,489	1,592
EBITDA	110	187	326	446
Depreciation & amortisation	-17	-45	-55	-62
Operating profit/EBIT	93	142	272	384
Net interest	0	0	0	0
PBT	82	138	264	376
HSBC PBT	82	138	264	334
Taxation	-2	-6	-32	-67
Net profit	53	132	232	309
HSBC net profit	53	132	232	267
Cash flow summary (USDm)				
Cash flow from operations	-64	206	170	419
Capex	-134	-90	-90	-50
Cash flow from investment	181	-90	-90	-50
Dividends	0	0	0	0
Change in net debt	16	-931	-213	-425
FCF equity	-199	109	48	302
Balance sheet summary (USDm)				
Intangible fixed assets	151	151	151	151
Tangible fixed assets	203	248	284	271
Current assets	698	1,714	2,141	2,598
Cash & others	133	1,063	1,277	1,702
Total assets	1,052	2,114	2,577	3,021
Operating liabilities	227	331	390	394
Gross debt	173	173	173	173
Net debt	40	-890	-1,104	-1,529
Shareholders funds	549	393	625	892
Invested capital	692	719	911	926

Ratio, growth and per share analysis

Year to	12/2007a	12/2008e	12/2009e	12/2010e
Y-o-y % change				
Revenue	469.4	74.9	53.0	6.9
EBITDA	474.3	70.1	74.7	36.8
Operating profit	443.9	52.6	91.1	41.3
PBT	514.8	69.0	91.4	42.5
HSBC EPS	695.8	78.8	76.5	15.2
Ratios (%)				
Revenue/IC (x)	1.2	1.4	1.8	1.7
ROIC	20.1	19.2	29.3	34.4
ROE	15.5	27.9	45.6	35.3
ROA	11.3	8.3	9.9	11.0
EBITDA margin	19.7	19.2	21.9	28.0
Operating profit margin	16.7	14.6	18.2	24.1
EBITDA/net interest (x)				
Net debt/equity	7.3	-226.7	-176.6	-171.4
Net debt/EBITDA (x)	0.4	-4.8	-3.4	-3.4
CF from operations/net debt				
Per share data (USD)				
EPS Rep (fully diluted)	0.55	0.98	1.73	2.30
HSBC EPS (fully diluted)	0.55	0.98	1.73	1.99
DPS	0.00	0.00	0.00	0.00
NAV	5.63	2.92	4.65	6.64

Key forecast drivers

Year to	12/2007a	12/2008e	12/2009e	12/2010e
Year end capacity	200	400	600	850
Total output	142	249	461	635
Net Sales	556	973	1,489	1,592

Valuation data

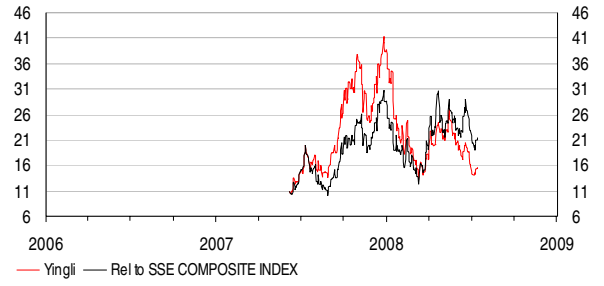
Year to	12/2007a	12/2008e	12/2009e	12/2010e
EV/sales	3.6	1.1	0.6	0.3
EV/EBITDA	18.1	5.7	2.6	0.9
EV/IC	2.9	1.5	0.9	0.5
PE*	28.0	15.7	8.9	7.7
P/NAV	2.7	5.2	3.3	2.3
FCF yield (%)	-10.2	5.6	2.5	15.5
Dividend yield (%)	0.0	0.0	0.0	0.0

Note: * = Based on HSBC EPS (fully diluted)

Issuer information

Share price (USD)	15.34	Target price (USD)	17.00
Potent'l tot rtn (%)	10.8		
Reuters (Equity)	YGE.N	Bloomberg (Equity)	YGE US
Market cap (USDm)	1,947	Market cap (USDm)	1,947
Free float (%)	100	Enterprise value (USDm)	1,057
Country	China	Sector	Electrical Equipment
Analyst	Christine Wang	Contact	+8862 8725 6024

Price relative



Source: HSBC

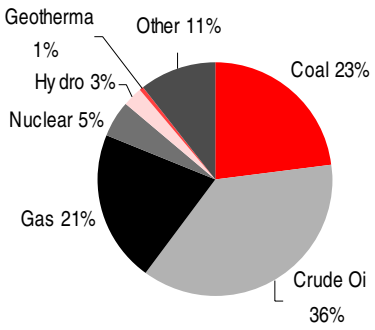
Note: price at close of 15 Jul 2008

HSBC

Appendix I – Why solar?

Crude oil is responsible for 36% of total power generation currently, while renewable energy (wind, PV, biomass and waste) accounts for only 6% according, to the IEA.

Traditional energy source still dominates the market



Source: IEA

However, we have faith in renewable energy for two main reasons.

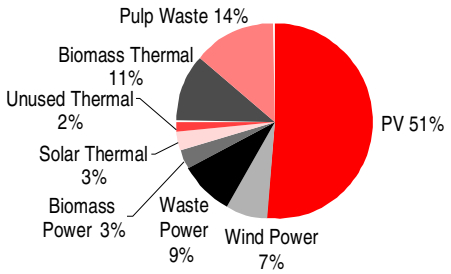
- **Reducing oil resource**: According to British Oil, enough oil is left to meet demand for 41 more years, enough natural gas for 61.9 years, enough coal 230 years and enough uranium for 71 years.
- **Kyoto Protocol vs greenhouse effect**: From 2008 to 2010, developed countries have to reduce CO2 emissions 5.2% from their levels in 1990, according to the Kyoto Protocol. CO2 emission is 530 ton/GWh for the traditional power system, compared to PV system of 5 ton/GWh. Therefore, the PV system is relatively clean and won't have a greenhouse effect.

As such, renewable energy is likely to increase to 9% by 2010, and 16% by 2020, according to the IEA. Among renewable energy, currently wind currently accounts for 38% of the overall renewable energy worldwide, the photovoltaic (PV) system is 24%, PV heating devices comprise 21% and others 17% (including water, biomass and geothermal energy).

Compared to the mature wind energy generating system, the PV system is not limited to certain geographical areas. The PV system can be installed for both industrial and consumer use and in both cities and countries. However, we believe minimum wind speed and noise must be considered when installing a wind energy system. In addition, a PV system is movable and suitable for border applications such as 3C products and automotive systems.

With 970trn KW hours of energy falling from the sky every day, we are positive on PV energy market growth for the long run.

PV power would dominate renewable energy by 2030



Source: JPEA

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Appendix II – What are c-Si PV cells?

C-Si PV cells currently enjoy the majority of share in the global PV cell market (90% in 2007), largely due to its higher efficiency (mass production) and less capital intensive compared to thin film PV technology. We believe that c-Si PV cells will still account for over 70% of the market at least until 2020.

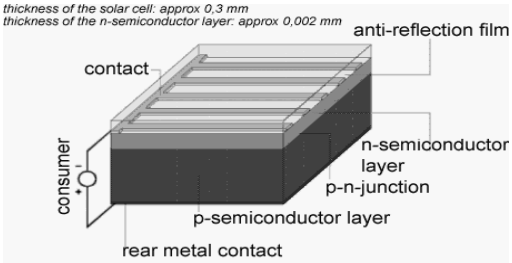
What are c-Si PV cells?

PV cells are composed of various semiconducting materials, which become electrically conductive when supplied with light or heat, but which operate as insulators at low temperatures. To produce a PV cell, the semiconductor is contaminated, or "doped". Doping is the intentional introduction of chemical elements, with which one can obtain a surplus of either positive charge carriers (p-conducting semiconductor layer) or negative charge carriers (n-conducting semiconductor layer) from the semiconductor material. If two differently contaminated semiconductor layers are combined, then a so-called p-n-junction results on the boundary of the layers.

At this junction, an interior electric field is built up, which leads to the separation of the charge carriers that are released by light. Through metal contacts, an electric charge can be tapped. If the outer circuit is closed, meaning a consumer is connected, then direct current flows.

Silicon cells measure about 10cm by 10cm (recently also 15cm by 15cm). A transparent anti-reflection film protects the cell and decreases reflective loss on the cell surface.

Basic structure of c-Si PV cell



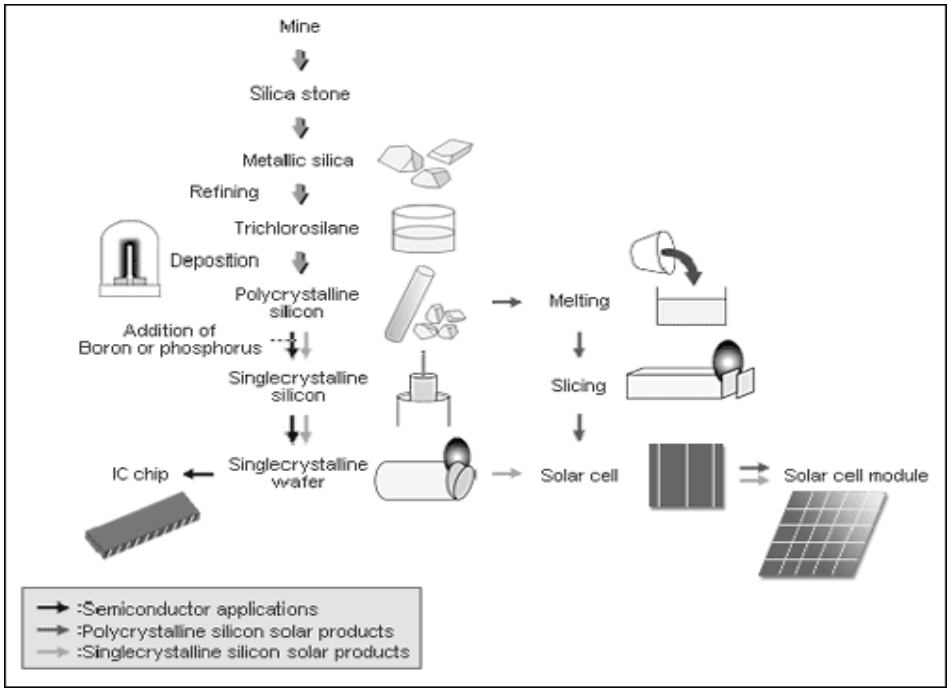
Source: ThePVserver

Manufacturing process

Polysilicon

The first, and most critical step in the manufacturing of silicon wafers, is the 'growth' of single crystal silicon. To begin, the raw material 'polysilicon' is carefully stacked by hand inside a quartz crucible, which in turn rests inside the furnace tank of a Crystal Puller. A small amount of 'dopant' (electrically active elements) such as arsenic, boron, phosphorous or antimony is added to the polysilicon. As the furnace heater rises in temperature, the crucible begins clockwise rotation. After the melt has reached the desired temperature, a counter-clockwise, rotating silicon 'seed' crystal is lowered into the molten polysilicon. The melt is slowly cooled to the

c-Si PV cell module process illustration



Source: Tokuyama

recipe's temperature as crystal growth begins around the seed.

Ingot

The seed is then slowly raised or 'pulled' from the melt – giving the appearance of controlled freezing. After the desired diameter is achieved, the crystal-puller's advanced control systems maintain the diameter throughout the growth stage. A gradual and tapered cone finishes the crystal growing cycle to ensure the crystal's structural integrity. The crystal is allowed to cool before it is extracted from the crystal-puller for further processing.

Wafer

Polycrystalline silicon wafers are made by wire-sawing block-cast silicon ingots into very thin (180-350 micrometer) slices or wafers. The wafers are usually lightly p-type doped. To make a PV cell from the wafer, a surface diffusion of n-type dopants is performed on the front side of the wafer. This forms a p-n junction a few hundred nanometers below the surface.

Cell

Antireflection coatings, which increase the amount of light coupled into the PV cell, are typically applied next. Some PV cells have textured front surfaces that, like antireflection coatings, serve to increase the amount of light coupled into the cell. After antireflecton, the wafer is then metallised, whereby a full area metal contact is made on the back surface, and a grid-like metal contact made up of fine "fingers" and larger "busbars" is screen-printed onto the front surface using a silver paste. The rear contact is also formed by screen-printing a metal paste, typically aluminium. Usually this contact covers the entire rear side of the cell, though in some cell designs it is printed in a grid pattern. The metal electrodes will then require some kind of heat treatment or "sintering" to make Ohmic contact with the silicon.

Module

After the metal contacts are made, the PV cells are interconnected in series (and/or parallel) by flat wires or metal ribbons, and assembled into modules or "PV panels". PV module assembly usually involves soldering cells together to produce a 36-cell string (or longer) and laminating it between toughened glass on the top and a polymeric backing sheet on the rear. Frames are usually applied to allow for mounting in the field, or the laminates may be separately integrated into a mounting system for a specific application such as building integration.

System

The final part of the overall manufacturing process is the PV system assembly and installation, which has two aspects. The first is the mechanical integration of the PV module into its chosen array structure. This array structure will depend on the final location, which could involve retrofitting on to a roof, integration into building materials for roofs or vertical walls, pole-mounting, ground-mounting or attachment to an industrial structure. The second is the electrical integration of the PV module with the other parts of the PV energy system. This will include connection of such elements as inverters, batteries, wiring, disconnects, and regulators (charge controllers). This part also requires matching the equipment to the electrical load required by the customer. The sales company will usually utilise computer software, known as a sizing program, to make this calculation.

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Appendix III – Polysilicon manufacturing process

The current bottleneck in the PV industry is as result of unbalanced polysilicon demand and supply that limits growth and profitability, especially for the downstream makers. As long as polysilicon supply increases significantly, growth in the PV industry should accelerate and approach normal market mechanism (with decreasing government subsidies).

There are currently three common methods commercially employed to produce polysilicon: the Siemens process, metallurgical purifying process and fluidised-bed reactor (FBR) process.

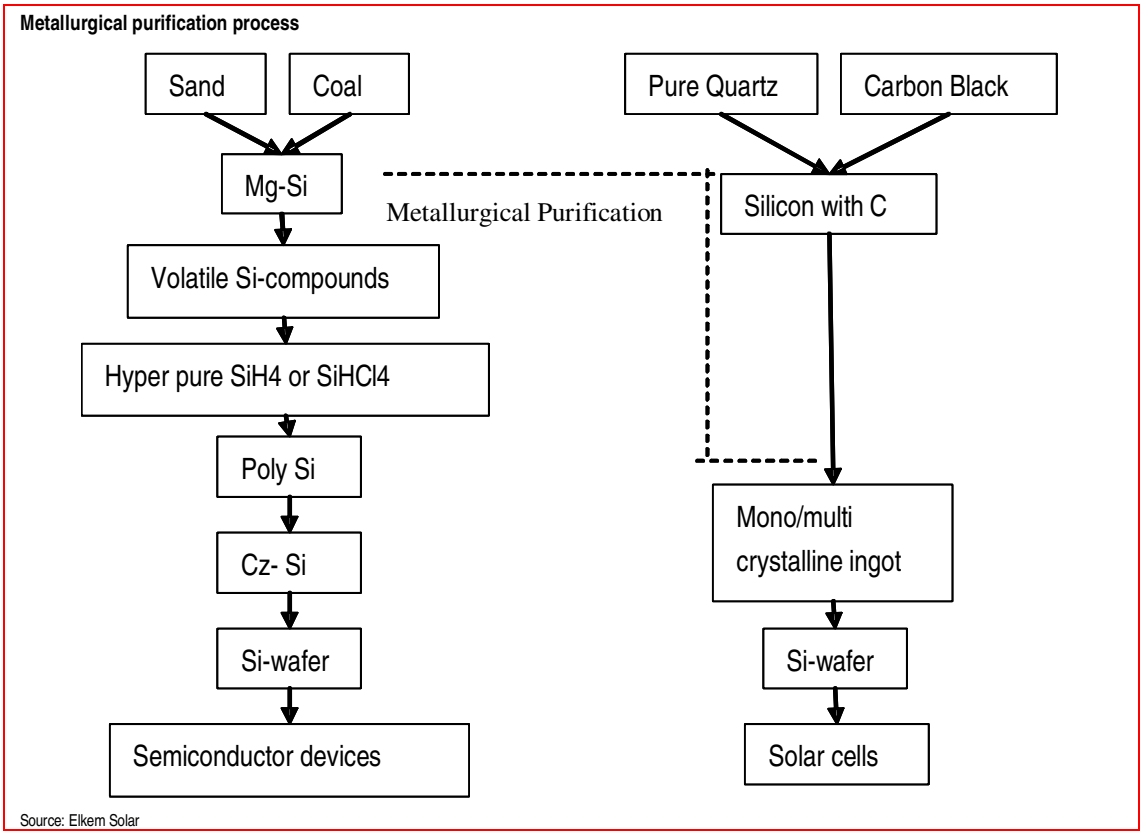
Siemens Process

The oldest method, the "Siemens" process, was the only commercial route to polysilicon prior to 1980. It remains the dominant technology used in the production of prime quality polysilicon chunks. This processes is carried out by depositing silicon onto the surface of electrically heated high-temperature silicon core rods from silicon element-containing gas such as trichlorosilane (SiHCl.sub.3 : referred as TCS hereinafter), dichlorosilane (SiH.sub.2 Cl.sub.2) or monosilane (SiH.sub.4) in a bell-jar type reactor. It is conceivable to heat a silicon core rod with a high-temperature radiation as well as with an electromagnetic wave including high-frequency wave on behalf of the electrical resistance heating via electrode. Therefore, polysilicon can be prepared regardless of the shape of the reactor if the silicon core rod is heated. In the Siemens process, high-purity silicon rods are exposed to trichlorosilane at 1,150°C. The trichlorosilane gas decomposes and deposits additional silicon onto the rods, enlarging them according to chemical reactions like 2 HSiCl3 → Si + 2 HCl + SiCl4.

But when the diameter of the silicon rod reaches a maximum of 10-15 cm, the reaction should be terminated, the reactor is dismantled and the rod-type polysilicon products are separated from the electrodes. Thus, continuous preparation of polysilicon is impossible by using a bell-jar type reactor. Therefore, for reducing the specific electric power consumption and preparation cost, it is essential to maintain the surface temperature of the silicon rod in the limited reactor space as high as possible and to enhance thereby the silicon deposition as much as possible although the yield may be less than that achievable at a thermodynamic equilibrium.

Metallurgical purification process

The direct metallurgical route produces silicon from ultra-high purity raw materials. Silicon is commercially prepared by the reaction of high-purity silica with wood, charcoal, and coal, in an



electric arc furnace using carbon electrodes. At temperatures over 1900 ˚C, the carbon reduces the silica to silicon according to the chemical equation $SiO_2 + C \rightarrow Si + CO_2$ Liquid silicon collects in the bottom of the furnace, and is then drained and cooled. The silicon produced via this process is called metallurgical grade silicon and is at least 98% pure. But the use of silicon in semiconductor devices demands a much greater purity than afforded by metallurgical grade silicon. PV-grade silicon needs to possess a purity of more than 99.999999999%, while silicon for semiconductor applications needs to be even purer, at 99.9999999999%.

Fluidised-bed reactor (FBR)

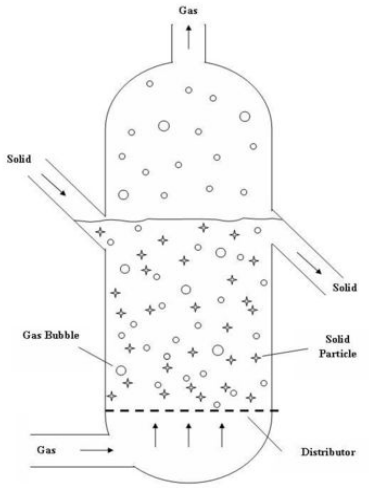
This is the method currently used by MEMC and REC Silicon in its new capacity. According to this process, a fluidised bed of moving silicon particles is formed by the reaction gas supplied from the lower part of the reactor toward its upper part. Elementary silicon is continuously deposited on the hot surfaces of the fluidising silicon particles, which grow into polysilicon product granules. Being enlarged from the smaller seed crystals due to the repeated silicon deposition, the larger particles tend to lose mobility and to settle downward. Here, the seed crystals can be supplied continuously or periodically into the fluidized bed, and the enlarged particles can be withdrawn continuously or periodically from the lower part of the reactor.

MG-Si is reacted with HCl to form trichlorosilane (TCS) in a fluidised-bed reactor (at 300oC) according to the chemical reaction $Si + 3HCl \rightarrow SiHCl_3 + H_2$. TCS is an intermediate compound for polysilicon manufacturing. In the course of converting MG-Si to TCS, impurities such as Fe, Al and B are removed. This ultra-pure TCS is subsequently vaporized (distilling the TCS achieves an even higher level of purity), diluted

with H2, and flowed into a deposition reactor where it is retransformed into elemental silicon. This polysilicon has typical contamination levels of less than .001 ppb.

A method of producing polysilicon using a conventional bell-jar type reactor cannot produce the polisilicon continuously; power consumption is large; and post-treatment is required before use. A fluidised-bed reactor to some extent can solve those problems of the bell-jar type reactor. However, continuous operation of the fluidised-bed reactor is impossible unless the accumulation of silicon deposit on the surfaces of the reaction gas supplying means is prevented.

Fluidised-bed reactor (FBR)



Source: Scientific Electronic Library online

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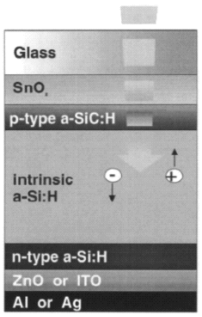
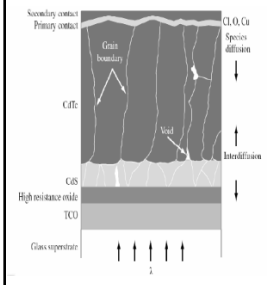
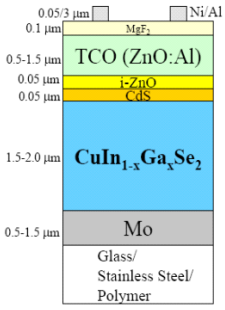
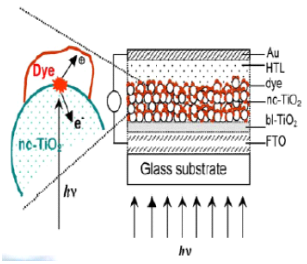
Appendix IV – Types of thin film PV cells

Types of thin film PV cells

	a-Si	CdTe	CIS/CIGS	DSSC
Full Name	Amorphous silicon	Cadmium Telluride	Copper Indium (Gallium) Diselenide	
Illustration				
Efficiency	* Lab:13.2% * Module: 6-8%, triple juction up to 10% * cell: 6.5-10%	* Lab: 16.5% * Module: 8-10% * cell: 9-11%	* Lab: 19.5% * Module: 10-14% * cell: 9-12% * Highest	* Lab: 11% * Module: 5-6% * Lowest
Advantages	* Low cost * Lightweight * can use flexible substrates * development more mature, can be in mass production * similar process to familiar TFT-LCD panels * use 1/100 silicon of crystalline solar cells * Silicon	* Efficiency high in second generation relatively * Lightweight * can use flexible substrates * development more mature, can be in mass production * low in manufacturing cost	* Stable supply of raw material * Highest efficiency among all * Lightweight and thin * can use flexible substrates	* Lowest cost and less raw materials being used among second generation * Lightweight * Easy to make big area component * Easy production process and does not require vacuum equipment * Multi-usage and increases product application * bendable
Disadvantages	* Lower efficiency * Lower stability and durability	* Highest cost in second generation, module and substrates consists 50% of total cost * Highest toxicity (Cadmium) * Tellurium is limited in nature	* Cost relatively high * Complicate production technique not standarized, leading t+E7o higher cost * Indium and Gallium limited in nature * Toxicity of CdS buffer layer	* Can't be commercialized due to immature technology * Packaging process more difficult * will have photodegration effect under UV rays * Convertible efficiency lowest in second generation
Briefing	* applied in calculators * can't be applied to generating electricity when it was first established	* scale prodution in early 90s, but slow market development	* High ray absorption, earliest solar battery to achieve 10% convertible efficiency. * Highest battery efficiency can be as high as 18%	* Convertible efficiency about 10~11% * Commercialized target is 7% in market share

Source: IEK

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Appendix V – Government subsidies

Government subsidy plans among different countries

Country	Plan	Feed-in Tariff	Condition (KWp)	Purchase price (€/kWp)	Limits	Other Incentive Program	Start	Target
Australia	Solar Cities				AUD4000	AUD4/W installation subsidy. The provision of $75 million for Solar Cities trials in urban areas to demonstrate a new energy scenario, bringing together the benefits of solar energy, energy efficiency and vibrant energy markets	2004	Install PV panels on more than 1,700 homes in the northern part of Adelaide, roll out 7,000 "smart meters"
Austria		v	<20 >20	0.6 0.47		Announced a $500 million to be spent on a series of clean energy projects, and a $75 million towards the cost of the 154 MW photovoltaic solar power plant in the first of a series of projects. Supplemented the feed-in tariffs with additional support of over €190 million ($240 million) in investment subsidies through 2012	2006	
Belgium		v		0.15	20 years		2004	
Luxemburg		v		0.45			2002	
China	Light engineering plan	v				Total devices can produce 65KW PV system and invested 5bn RMB to solve electricity supply issue in the distant area for 3m people. Future target is 30bn people.		300MWp by 2010 1800MWp by 2020
Czech Republic		v		0.2	15 years	Adopted a new feed-in law that establishes tariffs for all renewables technologies	2002	
Finland						0.0042 €/kWh tax refund and up to 30% investment subsidy		
France		v		0.225~0.305	20 years	Tax credit: 50% of equipment cost can be reimbursed Reduced VAT of 5.5% A basic tariff of 30 c€/kWh (40 in Corsica and overseas departments) A BIPV (Building Integrated PV) bonus of 25 c€/kWh (15 in Corsica and overseas departments), for a total feed-in tariff of 55 c€/kWh for BIPV	2002	
Germany	100,000 Roofs Solar thermie 2000Plus	v	<30 roof 30~100 roof >100 roof Facade integrated Field installation	0.4921 0.4681 0.4630 0.05 0.3796	20 years	0.518€/kWh for rooftops and 0.406€/kWh for open space in 2006. Will decline by 5% each year for rooftops and 6.5% for open spaces. 2007 Progress Report: 7% degression rate from 2009 and 8% from 2011	2000 2004	100000 roofs program (1999~2003): target capacity of 300MWp vs actual 345.5MWp installed.

Source: Solarbuzz, Solarplaza, HSBC research

Government subsidy plans among different countries (cont'd)

Country	Plan	Feed-in tariff	Condition (kWp)	Purchase price (€/kWp)	Limits	Other incentive programme	Start	Target
Greece		v	Mainland<100 Mainland>100 Island <100 Island>100	0.45 0.4 0.5 0.45	20 years	Tax rebates and grants are available	2006	
India						50% capital subsidy for solar home systems.		
Indonesia						World bank supports and promotes every household installs 50W PV system		100 million household in remote islands installed. 15K solar power stations, power generation for each one is 50-500KW.
Italy		v	1-3 3-20 >20	0.40 0.38 0.36	20 years	Feed-in tariffs of semi-integrated system is 0.44, 0.42, 0.40€/kWh for 1-3, 3-20, and >20kWP system size respectively. And feed-in tariffs of integrated system is 0.49, 0.46, 0.44€/kWh for 1-3, 3-20, and >20kWP system size respectively. Reduce by 2% every year from 2007	2005	
Japan	PV 2030					Government pays 30% expense for the roof-top home PV system. Grants for domestic PV roofs and net metering support provided by utilities.	2002	5000MWp by 2010 28700MWp by 2020 100000MWp by 2030
Korea	Solar Land	v	>30 <30	KRW677.38/KWh KRW711.25/kWh	15 years		2002	1300MWp by 2012
Mexico								100MW by 2010
Netherlands	Solar City	v		0.068	10 years	Revised feed-in tariffs through to 2007		12.5MW by 2000 250 MW by 2010 1500MW by 2020
Norway								5-25TWh by 2030
Poland								
Portugal		v	<5 >5	0.51 0.3		Adopted a new tariff calculation formula that accounts for technology, environmental impacts, and inflation	2002	
Russia								
South Africa								
Spain		v	<100 >100	0.4404 0.2289	25 years	After 25years, the feed-in tariffs will become 0.3523€/kWh and 0.1838€/kWh for <100 and >100kWp system respectively. Require solar PV on new buildings	2004	400MWp by 2010
Switzerland	PV Homes	v		0.095		Additional financial support Already installed 50MWp PV systems before 2000	1991	
Turkey		v		0.05	7 years	0.05 €/kWh feed-in tariff for 7 years		
USA	California - Million Roofs						2006	California: 3000MWp by2017 New Jersey: 1500MWp Maryland: 1500MWp Oregon: 25% of energy by 2025 for large utilities

Source: Solarbuzz, Solarplaza, HSBC research

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Disclosure appendix

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Our ratings are re-calibrated against these bands at the time of any 'material change' (initiation of coverage, change of volatility status or change in price target). Notwithstanding this, and although ratings are subject to ongoing management review, expected returns will be permitted to move outside the bands as a result of normal share price fluctuations without necessarily triggering a rating change.

*A stock will be classified as volatile if its historical volatility has exceeded 40%, if the stock has been listed for less than 12 months (unless it is in an industry or sector where volatility is low) or if the analyst expects significant volatility. However,

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Company	Ticker	Recent price	Price Date	Disclosure
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Source: HSBC

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