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**Global  
Energy/Technology**

Solar power portfolio

- ATS** (ATA Canada)
- Carmanah** (CMH Canada)
- Conergy** (CGY GR)
- Evergreen Solar** (ESLR US)
- Kyocera** (6971 JP)
- MEMC** (WFR US)
- Motech** (6244.TWO)
- QCells** (IPO GR)
- REC** (IPO GR)
- Sekisui Chemical** (4204 JP)
- Sharp** (6753 JP)
- Solartron** (SOLAR Thailand)
- SolarWorld** (SWV GR)
- SunPower** (IPO)
- Tokuyama** (4043 JP)



## Sun screen II

Investment opportunities in solar power

## Contents

**Executive summary..... 3**

**A very good year..... 4**

**Researching risks ..... 8**

**Rapid growth through 2010 .....27**

**Portfolio of solar stocks .....41**

**Company profiles .....47**

**Appendices**

Appendix 1: Our 'Sun screening' process..... 77

Appendix 2: Additional information on Si..... 75

Appendix 3: Key assumptions for sun screen II..... 77

All prices quoted herein are as at close of business 15 June 2005, unless otherwise stated



**Sun screen II – The sequel**  
*This report is the second in a series on the global solar power sector.*

*Please also see the previous report (July 2004) which provides a general overview of the solar power sector.*

**Hot – but not hot air**

**Solar stocks have had a very good year**

**We see five important risks for solar power stocks**

**Our conviction remains strong that rapid, profitable growth will continue**

**We recommend a portfolio with 2-3X upside potential that balances downside risks**

## Sun screen II – The sequel

When we wrote that 'Solar power is hot' last year, we hoped we weren't launching a hot air balloon - but the sector has indeed sizzled and, even if it is ballooning, it looks nothing like a bubble. This is a solid investment target. In the ten months to April 2005, solar stocks rose on average 133%, driven by 33% YoY revenue growth, 85% pretax profit growth and a frenetic energy market. Recent news of feedstock constraints and potential German policy changes has seen the stocks down 6%. But the pullback is just profit-taking in a long-term upcycle and we remain impressed by the sector's modest multiples. The key messages from this year's screen are that:

- 1) Profitable, multiple growth will continue, albeit with more volatility
- 2) Solar stocks have significant upside
- 3) Investors should balance risks with a portfolio approach

### Sun screen II: Investment opportunities in solar power

The solar power sector has had a very good year, with strong stock price appreciation driven by production growing from 1.15GW to 1.5GW, revenue growing from US\$8.3bn to US\$11.1bn and profit growing from US\$1.2bn to US\$2.3bn. After the strong run, many investors are wondering if it is time to walk away from the sector. With stocks down 6% since April peak, investors appear to have been focusing on profit-taking and risks.

We are also highly sensitive to risks that could disrupt fundamentals. These risks include potential shortages in silicon supply, changes in German pro-solar policies, rising interest rates, lower oil prices and backlash against solar by generating companies. We have spent considerable time investigating these risks and come away with the view that they create increased volatility in stock prices and earnings, but do not disrupt the earnings growth profiles for well-positioned players. The recent correction in solar stocks (down 6% since April) suggests the market has discounted these risks.

We have strong conviction that well-positioned players are likely to see enormous growth through at least 2008 and likely 2010. We project sector revenue will grow to at least US\$15bn in 2006 and US\$36bn in 2010, and pretax profit will increase to US\$3.8bn in 2006 and at least US\$6.4bn in 2010. This expansion is driven by demand growth that outstrips capacity, limited pricing competition and impressive cost reductions.

Expectations of huge growth - 4x volume, 3x revenue and 3x profit growth through 2010 - have not led to unrealistic valuations. Typical stocks are trading at 20x 2006 earnings. The result of these modest valuations is a sector with significantly more upside than downside. In the next 2-3 years, we expect at least 2x stock price appreciation for well-positioned companies in the sector, with significantly more in some cases. Yet because volatility is a real issue for every company, we recommend a portfolio approach to reduce exposure. Specifically, we suggest investors consider a portfolio that includes **Conergy, Evergreen Solar, Kyocera, Motech, Q-Cells (IPO), REC (IPO), Sekisui Chem, Sharp, SolarWorld, Sunpower (IPO) and Tokuyama.**

#### Outlook for the solar power sector

	2003	04CL	05CL	06CL	07CL	08CL	09CL	10CL
Production (GW)	0.75	1.15	1.50	2.02	2.62	3.53	4.60	6.00
Production growth (% increase in GW)		50	30	35	30	35	30	30
Average installed price (US\$/Watt)	7.00	7.25	7.42	7.44	7.10	6.77	6.39	6.02
Revenue pool (US\$bn)	5.0	8.3	11.1	15.0	18.6	23.9	29.4	36.1
Industry average pre-tax margin (%)	8	15	21	25	25	21	19	18
Pretax profit pool (US\$bn)	0.4	1.2	2.3	3.8	4.6	5.1	5.6	6.4

Source: CLSA Asia-Pacific Markets

**Strong earnings growth driving rapid stock price appreciation**

## A very good year

### No time to walk away from solar stocks

Investors in the solar sector face a dilemma: walk away after a very strong run or continue investing in a sector with robust growth potential. The logic for walking away is based on the strong gains for solar stocks over the last 12 months. Pure-play solar stocks are up an average of 133% YoY. Within the sector, there are numerous examples of stocks with stunningly steep stock price charts, including Daystar (+519%), Motech (+394%), SolarWorld (+336%), Sunways (+237%) and Evergreen Solar (137%). Among pure-plays, there are 11 stocks that have increased in price and only 4 that have declined. Beyond pure-plays, there are several stocks (e.g. Tokuyama, MEMC, Carmanah) that have been driven higher by solar growth despite solar being only a small portion of revenue.

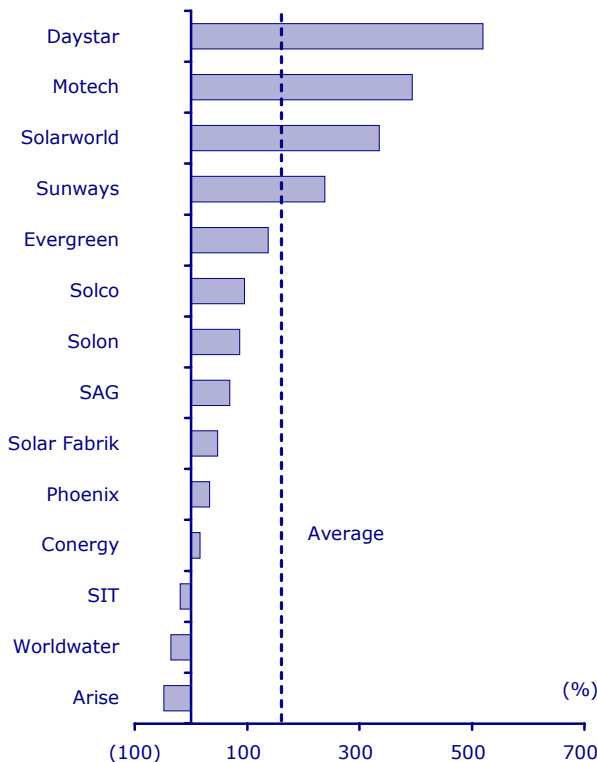
Figure 1

#### Rationale to walk away from solar investments (Section 2)

- 1) Incredible 1-year stock price performance.
- 2) Risks to earnings from:
  - 1) Silicon supply constraints.
  - 2) Changes in German policies.
  - 3) Higher interest rates.
  - 4) Backlash by generating companies.
- 3) Investment climate could turn cold if oil prices fall significantly.

Figure 2

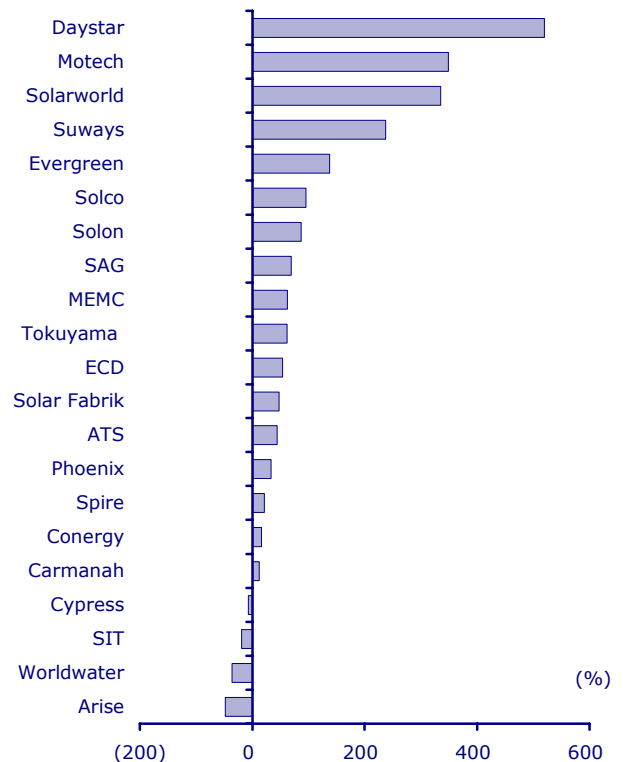
#### 1Y performance of pure-play solar power stocks



Note: "Pure-play solar stocks" include companies whose revenue, earnings and earnings growth is primarily from solar power.  
Source: CLSA Asia-Pacific Markets

Figure 3

#### 1Y performance of solar power stocks



Note: "Solar stocks" include pure-play solar companies and companies for which solar power is a key driver of earnings growth.

**At first glance, price charts for solar stocks are scary**

On the surface, the impressive upward slope for stocks like SolarWorld, Evergreen Solar, Tokuyama and MEMC is worrisome. Our instinct when we see these charts is to provide analysis supporting a pull-out from solar stocks and to emphasize risks to earnings growth.

Figure 4

**SolarWorld stock price**

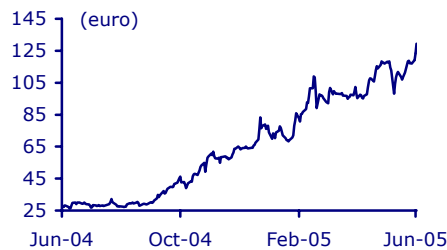


Figure 5

**Evergreen Solar stock price**

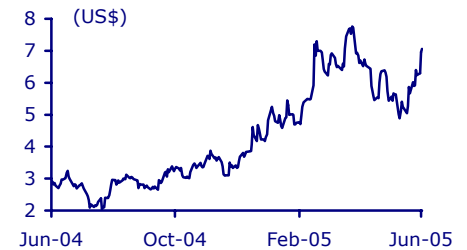


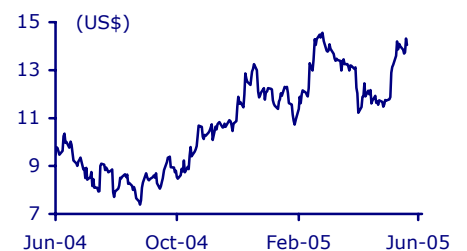
Figure 6

**Tokuyama stock price**



Figure 7

**MEMC stock price**



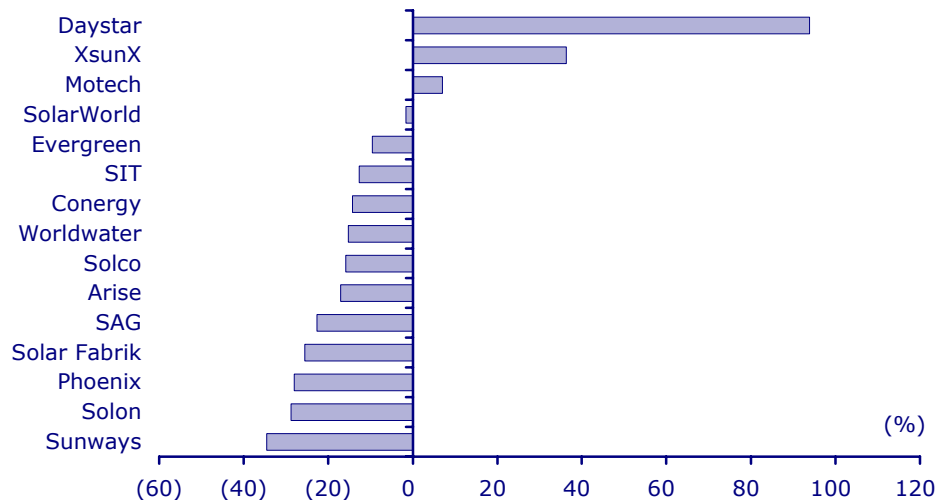
Source: CLSA Asia-Pacific Markets

**Profit-taking and risks have been focus since April**

Since their April peak, solar stocks have slipped slightly, with 12 down and only three up. In conversations with institutional investors, five concerns repeatedly arise: silicon supply constraints, potential changes in Germany's pro-solar policies, vulnerability to interest rate increases, signs of a backlash by generating companies (Gencos) against solar, and impacts on solar stocks if oil prices fall. In Section 2, we investigate these risks in detail.

Figure 8

**Absolute stock price performance of pure-play solar stocks since April peak**



Source: CLSA Asia-Pacific Markets

**Solar power stocks remain very attractive**

**Our view: Keep investing in solar stocks**

Despite our initial reaction, the rationale for pulling out of solar stocks is less than compelling for three reasons.

- 1) The rapid rise in stock prices has been driven by strong fundamentals. Over the last year, companies throughout the solar supply chain have seen very strong increases in revenue and earnings that justify the stock price increases. For example, SolarWorld saw 103% YoY increase in revenue and 404% increase in EPS in 1Q05 versus 1Q04. A similar story holds for Q-Cells, Evergreen Solar, and Solon. In fact, performance across the sector has exceeded our aggressive growth expectations from *Sun screen I*. (See Figure 10.)
- 2) Looking to the future, the earnings growth profile for many of these stocks looks very attractive over the next several years, with the sector's profit pool poised to increase three-fold within the next 5 years. Well-positioned players will exceed even this rapid pace of growth. (Section 3.)
- 3) Solar stocks are trading at reasonable multiples, with pure-plays priced at under 20x consensus 2006 earnings. This includes larger pure-plays such as Conergy (US\$840m market cap; 17.5x consensus 06EPS) and SolarWorld (US\$949m market cap; 19.5x consensus 06EPS). Similarly, stocks whose earnings are largely driven by solar power such as Tokuyama (US\$1.9bn market cap; 18.5x consensus 06EPS) and MEMC (US\$3.2bn market cap; 12x consensus PE06) are not trading at lofty multiples. These multiples compare favourably with other fast growth sectors. For example, each of the following fast growth sectors is trading at significantly higher PE multiples: industrial electrical equipment (177x), semiconductor memory chips (157x), wireless communications (125x), healthcare information services (94x), specialized semiconductors (54x), semiconductor equipment & materials (44x). Given the reasonable multiples of the solar sector, downside risk is limited despite the rapid increase in solar power stock prices over the last year.

Figure 9

**Rationale to continue investing in solar stocks (Section 3)**

- ☐ Stock price performance based on solid fundamentals.
- ☐ Reasonable multiples for earnings growth - often 06PE under 20x.
- ☐ Very strong growth profile with sector increasing volume 4x, revenue 3x, earnings 3x in next 5 years.
- ☐ Potential upside from "greening" policies and corporate initiatives.

Source: CLSA Asia-Pacific Markets

Figure 10

**Sun screen I (July 2004) versus Sun screen II (July 2005)**

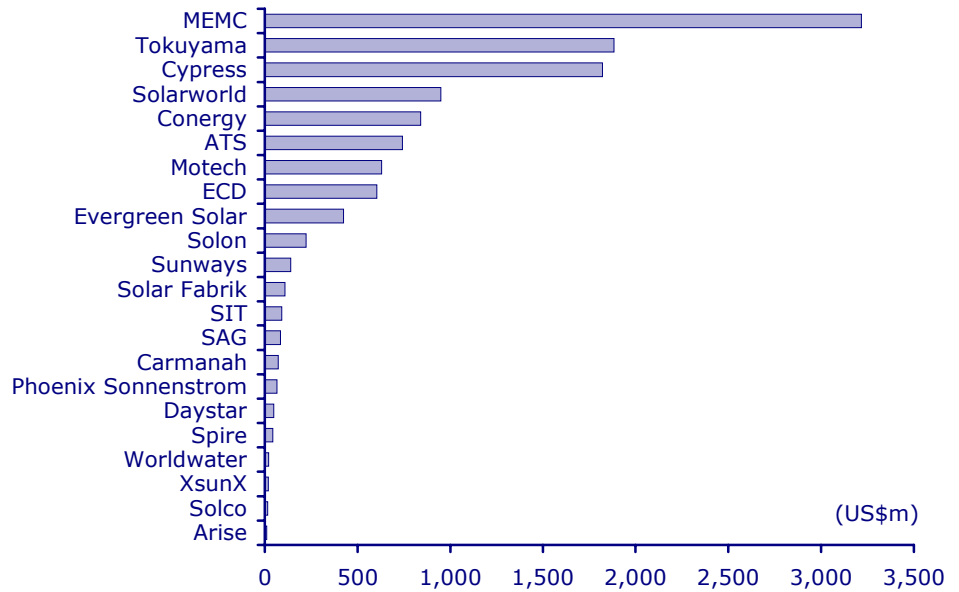
	Sun screen I Jul-04	Sun screen II Jul-05	Change in estimate (%)
Production volume 2004 (GW)	1.00	1.15	15
Production volume 2005 (GW)	1.40	1.50	7
Revenue pool 2004 (US\$bn)	7.1	8.3	17
Revenue pool 2005 (US\$bn)	9.8	11.1	13
Pre-tax profit pool 2004 (US\$bn)	0.8	1.2	55
Pre-tax profit pool 2005 (US\$bn)	1.2	2.2	85

Source: CLSA Asia-Pacific Markets, Sun screen I published July 2004. Sun screen II (this report) published July 2005.

**Our estimates for the sector's growth potential have increased since last year**

Figure 11

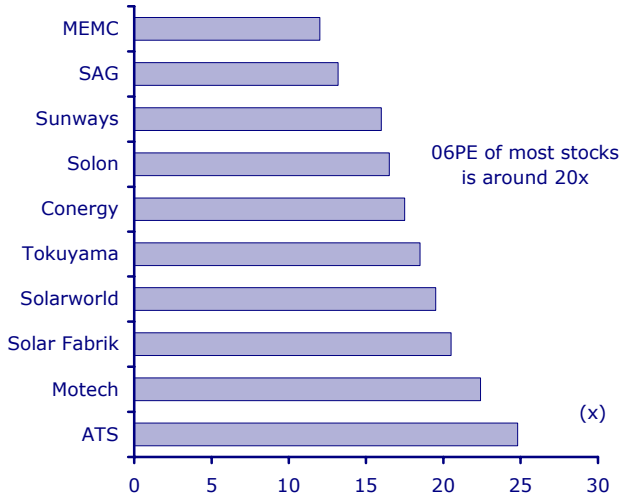
**Market capitalization of solar stocks**



Source: "Solar stocks" include pure-play solar companies and companies for whom solar power is a key driver of earnings growth, CLSA Asia-Pacific Markets

Figure 12

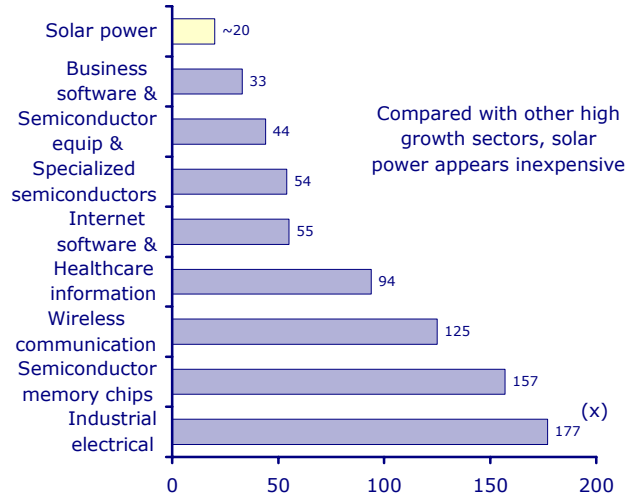
**PE06 of select solar power stocks**



Note: PE06 based on consensus earnings estimates.  
Source: CLSA Asia-Pacific Markets

Figure 13

**PE06 of stocks in select fast growth sectors**



Source: Capital IQ from Yahoo Finance, CLSA Asia-Pacific Markets

**Our main concern is downside, but the data do not support a bearish view**

With the sector's stock prices doubling over such a short period, we are highly sensitive to risks that could disrupt fundamentals in the solar power sector. In Section 2, we turn a spotlight on these risks not to exaggerate or discredit them, but to provide a balanced assessment. Section 3 then explains our rationale for believing there is realistic potential for at least 4x volume growth, 3x revenue growth and 3x profit growth by the end of the decade. Section 4 provides highlights from our screen of 600+ solar power companies and recommends that investors pursue a portfolio of well-positioned solar power stocks. Section 5 provides summaries of 15 solar power stocks we suggest investors include in their solar portfolio.

**We focus on risks before turning to the explosive growth story**

**Five key risks for solar power investments**

**Silicon supply is the most important issue facing the solar power sector**

**Strong silicon consumption growth**

## Researching risks

It may seem strange to begin a positive report about a sector with huge potential with a long discussion of risks. However - given the performance of solar power stocks from July 2004 through April 2005, the plateau of solar stocks since April, and the increased risk-focus of investors - we believe this is a necessary starting point. In this section we delve into key risks facing the sector and their implications. Then, in Section 3, we will explore the massive solar power opportunities.

### An assessment of five key risks to solar power stocks

Running up a steep hill can be exhausting and solar power stocks appear to be tired. Following a strong rise, solar stock prices have flattened. One element of this flattening has certainly been profit taking. But the flattening has also been the result of mounting concerns over industry fundamentals. These risks include:

- 1) Silicon supply constraints (demand exceeds capacity)
- 2) Potential changes in German pro-solar policies<sup>1</sup>
- 3) Impact of possible interest rate increase
- 4) Potential backlash by generating companies against solar power
- 5) Impact on solar stocks if oil prices fall

Overall, our view is that these risks are likely to impact the earnings growth of many companies in the sector but that fundamentals remain quite strong for well-positioned solar players and that stock prices of these well-positioned companies continue to have significant upside potential. The implication of higher levels of volatility and uncertainty is that strategies to balance these risks - such as investing in a balanced portfolio of solar stocks - are necessary.

### Risk #1: Silicon supply constraints

Silicon supply is the most important issue facing the sector today. A year ago, interviews for the first Sun screen report led us to predict that strong demand growth for silicon coupled with limited ability to expand capacity in the short-term would result in significantly higher silicon prices and fast improvements in efficiency of silicon use. This story has played out over the last year. Below is a description of the supply constraints as well as a closer examination of the positive and negative implications of the tight market.

Usage of high purity silicon by the electronics and solar sectors is increasing from approximately 31,000 tons in 2004 to approximately 35,000 tons in 2005. This increase is driven by 5% YoY growth in electronics sector usage and by 20% growth in solar sector usage. Companies with strong ramp in silicon usage include Evergreen Solar, Isofoton, Kycoera, Motech, MSetek, Q-Cells, REC, RWE Schott, Sharp, SolarWorld and SunTech, among others. *The solar sector would surely utilize more silicon feedstock if the feedstock were available* because solar end-customer demand growth significantly exceeds current silicon feedstock availability.<sup>2</sup> Looking to next year, we expect strong growth of silicon usage to continue, reaching at least 39,000 tons, with growth in usage limited only by available supplies.

<sup>1</sup> Potential changes in German pro-nuclear policies (CO2 free) may impact policies supporting solar and other renewables.

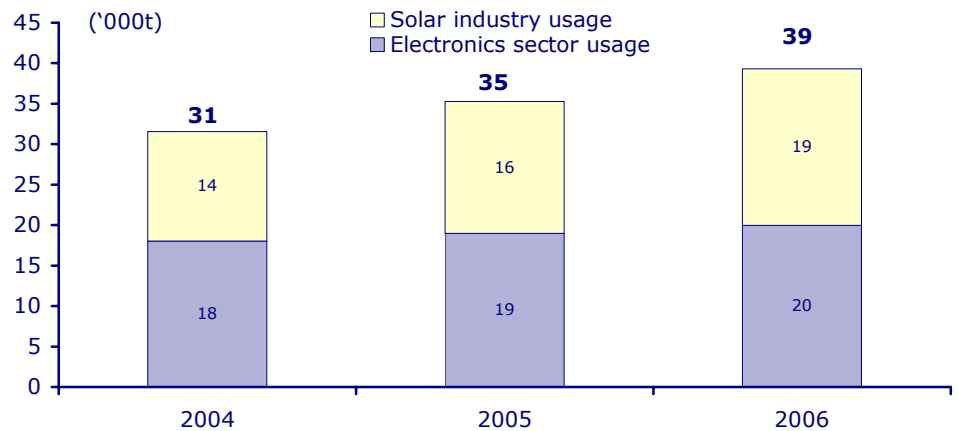
<sup>2</sup> Note: End customer demand significantly exceeds production capacity. Production for 2005 is expected to increase 30% to 1.5GW.

Usage up in 2005 and 2006 . . .

. . . but demand significantly exceeds Si capacity

Figure 14

**Silicon usage by sector 2004 and 2005**



Note: Rough estimate. In addition to usage there is approximately 500-1,000 tons per year of off-spec material that is unable to be used. Source: CLSA Asia-Pacific Markets

The reason supply has been unable to keep up with surging demand is that new silicon production facilities (even brownfield plants) take 18-24 months and US\$250-500m for 5,000 tons capacity. Shorter-term responses are de-bottlenecking, running facilities harder and drawing down inventories. In the last year, all have occurred, but with limited impact. Our interviews indicate that total supply will increase from 32,000 tons in 2004 to 36,000 tons in 2005 and 40,000 tons in 2006.<sup>3</sup> Overall, these shorter-term responses have added only 12% YoY to supply, equivalent to about 300MW if dedicated exclusively to solar.<sup>4</sup> While this response has been notable, it is insufficient to meet the surging demand for silicon from the solar power sector.

Figure 15

**Silicon supply 2005**

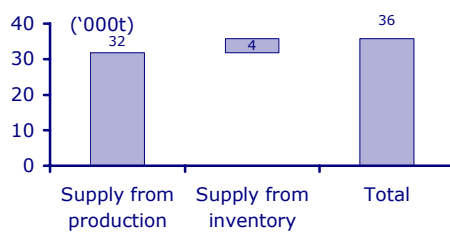
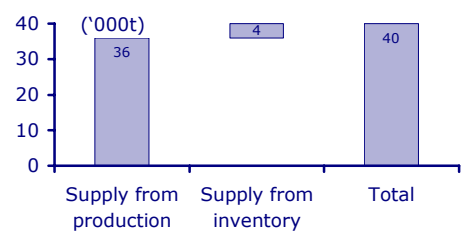


Figure 16

**Silicon supply 2006**



Note: Inventory drawdowns are roughly estimated at 4,000 tons in 2004 and 2005. This estimate is based on a survey of silicon producers and consumers conducted during 1Q05 and reconfirmed with phone calls each month. "Supply from inventory" includes inventories of polycrystalline silicon and wafers. These are very rough estimates, but are consistent with the estimates used by planning departments of silicon producers. It is worth mentioning that use of silicon inventories often requires significant time to locate, ship, clean, evaluate, reprocess/upgrade/recycle and finally use. As a result, even though demand for silicon is quite strong and prices are quite high, drawdown of inventories does not all take place immediately. We estimate there is enough silicon inventory (including polycrystalline silicon and wafers) for at least 4,000 tons of usage by the electronics and solar sectors in 2005 and 2006. Source: CLSA Asia-Pacific Markets

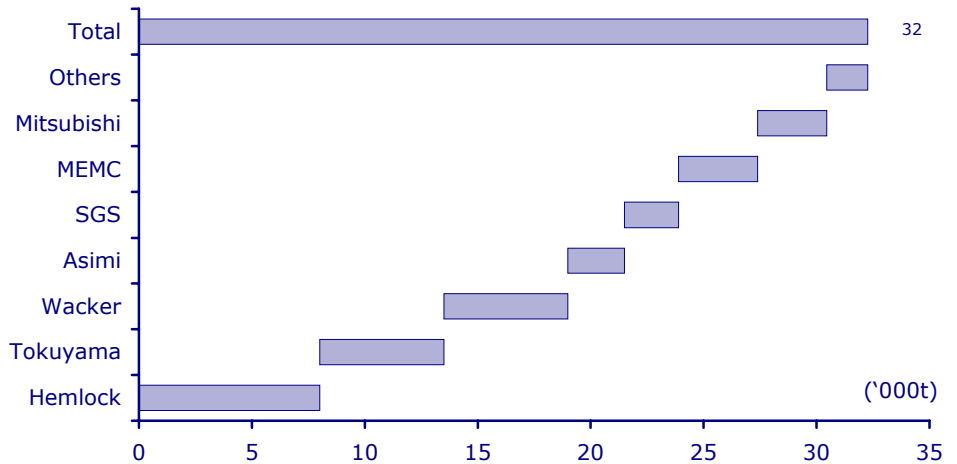
<sup>3</sup> The difference between usage (e.g. 35,000 tons in 2005) and production (e.g. 36,000 tons in 2005) is off-spec/unusable silicon (approximately 1,000 tons in 2005).

<sup>4</sup> Estimating silicon supplied to solar versus electronics sector is difficult due to recycling, cross-sales and losses that take place. We assume increase in production of approximately 3,700 tons in 2005 versus 2004. Of this, we estimate that slightly less than 2,800 tons ends up in solar sector use and slightly less than 900 tons in electronics sector use. The remainder (a small percentage) is off-spec material. If all 3,700 tons were used in the solar sector, this would result in approximately 300MW of additional solar production. If 2,800 tons ends up used in the solar sector, this will result in more than 200MW of additional solar production. For additional details on silicon supply, see Appendix. Anecdotal confirmation of our view that there is significant "capacity creep" and debottlenecking comes from silicon customers who have recently been able to purchase hundreds of tons in spot purchases from large producers.

**Four Si suppliers account for more than 70% of global production**

Figure 17

**Silicon production 2005**



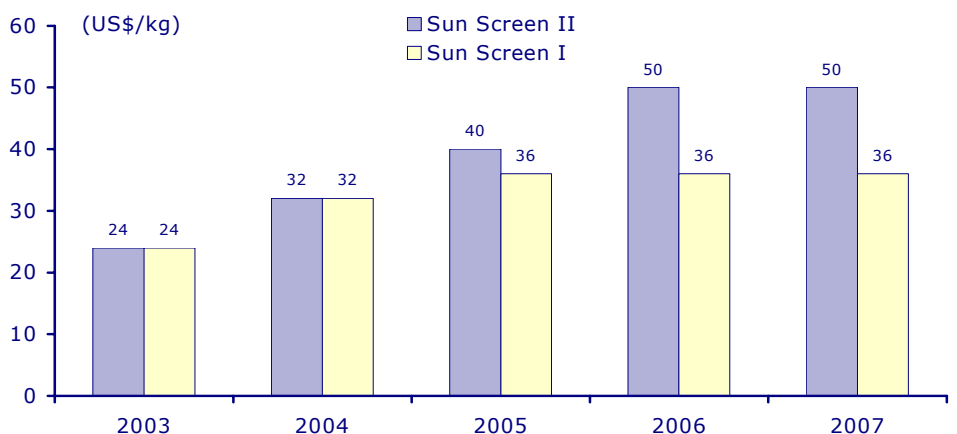
Note: Rough estimates. REC currently owns SGS and is in the process of acquiring ASiMi from Komatsu. Source: CLSA Asia-Pacific Markets

**Significant price increases**

Prices for high purity silicon are up sharply as the result of strong demand growth from the solar sector without an equivalent increase in capacity.<sup>5</sup> Solar-grade prices have risen 67% over the last 2 years from US\$24/kg in 2003 to US\$32/kg in 2004, and US\$40/kg this year. It appears likely that prices will rise further to US\$50/kg in 2006. Electronics-grade prices follow a similar pattern. It is worth highlighting that these price estimates for solar-grade silicon are higher than those made in the first Sun screen report, with our estimate increasing from US\$36/kg to US\$40/kg for 2005 and from US\$40/kg to US\$50/kg for 2006. It is also worth noting that we see upside potential in these prices based on continuing competition for silicon supplies from both solar and electronics players.<sup>6</sup>

Figure 18

**Solar-grade silicon prices**



Note: Rough estimate of global weighted average price. Sun screen I published July 2004. Sun screen II (this report) published July 2005. Source: CLSA Asia-Pacific Markets

**We are raising our estimates for Si prices compared to last year's report**

<sup>5</sup> Because most high purity silicon production capacity is able to produce both solar-grade and electronics-grade silicon, the prices of the two grades are closely linked. Manufacturing costs and prices for electronics-grade silicon are typically US\$10/kg higher than for solar-grade silicon; margins are the same.

<sup>6</sup> Current spot prices are reported at above US\$75/kg for solar-grade and above US\$100/kg for electronics-grade, but these are for small volumes. We expect that weighted average contract prices will continue to be substantially lower than spot prices.

**Tight silicon market is good news for well-positioned players**

**1. Enabling profitable growth for upstream companies**

**2. Reducing price pressure for mid-stream solar players**

**Positive implications of Silicon constraints**

The tight silicon market has positive implications for players in this sector. After years of losses following the crash of the tech bubble, silicon producers such as Hemlock, Wacker, Tokuyama, REC and MEMC are now enjoying a very profitable period. Average silicon prices have risen by approximately US\$15/kg (global weighted average) for both electronics- and solar-grade over the last 2 years. The result has been an increase in typical pretax margins from breakeven to more than 30%. We expect this to expand further to over 40% in 2006. In response to the surging demand and higher prices, nearly all silicon producers are expanding capacity. The longer term outlook for silicon suggests that there will be very significant increases in silicon production through the end of the decade. Based on capacity expansion plans that either have been funded or that have high likelihood of being funded, we estimate silicon production will increase from 32,000 tons in 2005 to 36,000 tons in 2006, 42,000 in 2007, 52,000 tons in 2008, 61,000 tons in 2009 and 65,000 tons in 2010.<sup>7</sup> The 2010 estimate includes approximately 10,000 tons of production in east Asia (China, Taiwan, South Korea).

Figure 19

**Global Si production**

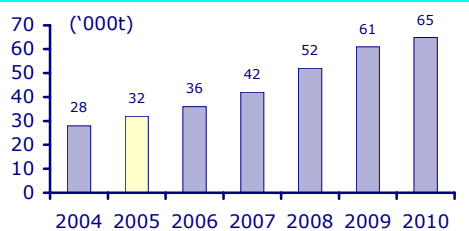
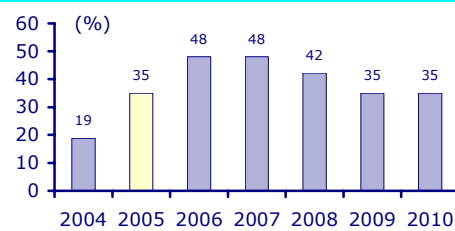


Figure 20

**Typical solar Si pretax margins**



Source: CLSA Asia-Pacific Markets

In contrast to press accounts suggesting that the silicon shortage is bad for many solar companies, we see the price increases as good news for many companies. At the most basic level, the tight silicon market means that downstream pricing competition is reduced because the availability of product is more important than price. The practical implication is that price increases in Si feedstock are passed through the entire supply chain. The price increases can be seen at all levels of the supply chain. We estimate silicon price increase from US\$32/kg last year to US\$40/kg this year and US\$50/kg in 2006. This implies an increase in Si feedstock costs of US\$0.06 per Watt in 2005 and an additional US\$0.07 per Watt in 2006. As shown in Figures 21 and 22, the increase in Si feedstock costs are more than offset by the increases in prices for wafers, cells, and modules. In short, the increase in the price of silicon feedstock is good news for solar many players.<sup>8</sup>

<sup>7</sup> Of course, the earlier estimates have higher probability of being correct, and longer-term projections are subject to considerable uncertainty. The point we want to convey is that a very substantial increase in silicon feedstock is underway that is likely to loosen constraints on solar power growth. Major silicon suppliers have refused to invest in new silicon production capacity without long-term contracts with solar power companies that significantly reduce the risk of their investment. These companies - Hemlock, Wacker, Tokuyama, Komatsu, MEMC, Mitsubishi - invested multiple hundreds of million dollars in the late 1990s in expectation that strong demand growth for silicon from the tech boom would continue. When the tech bubble burst, so too did the attractiveness of their silicon investments. At that time (circa 2000), the solar power sector was a much smaller user of silicon and purchased mostly waste and left-over silicon at significantly lower prices than the electronics industry. Because the solar sector doubles in size every 2-2.5 years, it has rapidly increased silicon usage by ~4X since 2000. Long-term contracts with average prices of US\$35-45/kg (variation depends on terms such as duration, volume, terms of delivery, etc.) have been signed recently and will likely continue to be signed in the coming months as requirements for breaking ground and laying out capital for major capacity additions by the industry leaders.

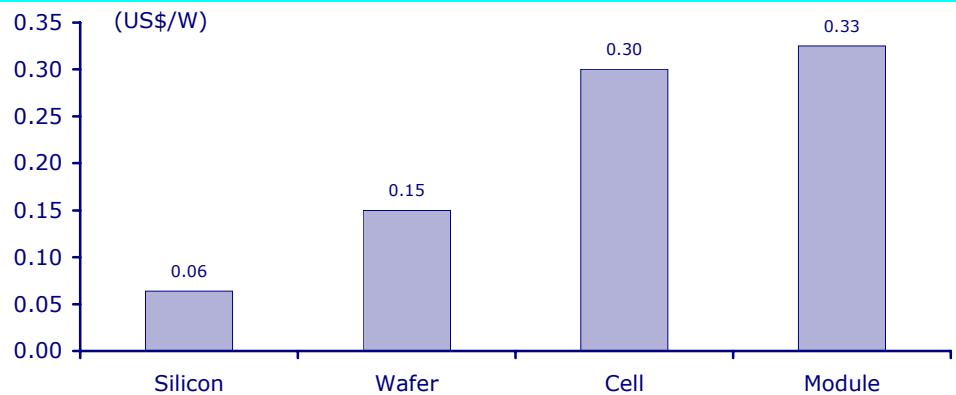
<sup>8</sup> This is not to say that rising silicon prices are not sometimes bad for a downstream players. For example, in 1Q05 rising silicon prices reduced Evergreen Solar's gross profit margins. However, CEO Feldt told the quarterly analyst call that the price increase could be passed on to customers starting in 2Q05.

**3. Passing silicon price increases through the supply chain with slight mark-ups**

**4. Continuing improvements in efficiency of silicon use**

Figure 21

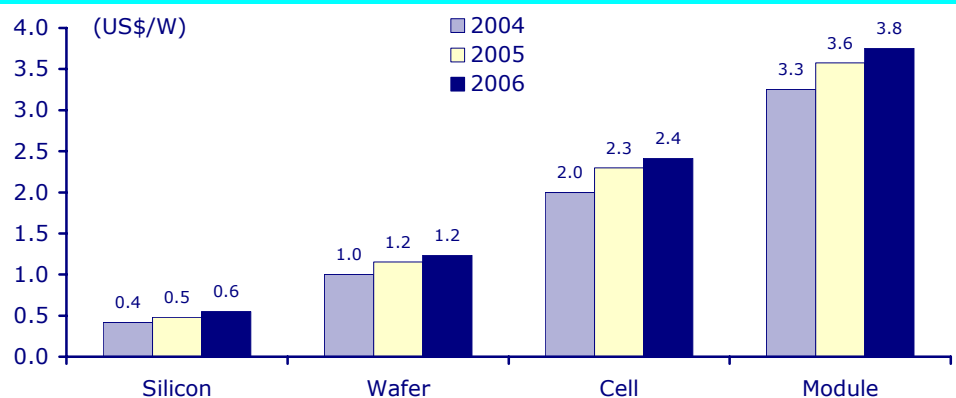
**Average YoY price increases in mid-stream solar power (2005 minus 2004)**



Note: Rough estimate of increase between 2004 and 2005. Also, costs and prices for inverter, other components, installation and other installation are not tied to silicon price.

Figure 22

**Average prices for silicon, wafers, cells and modules**



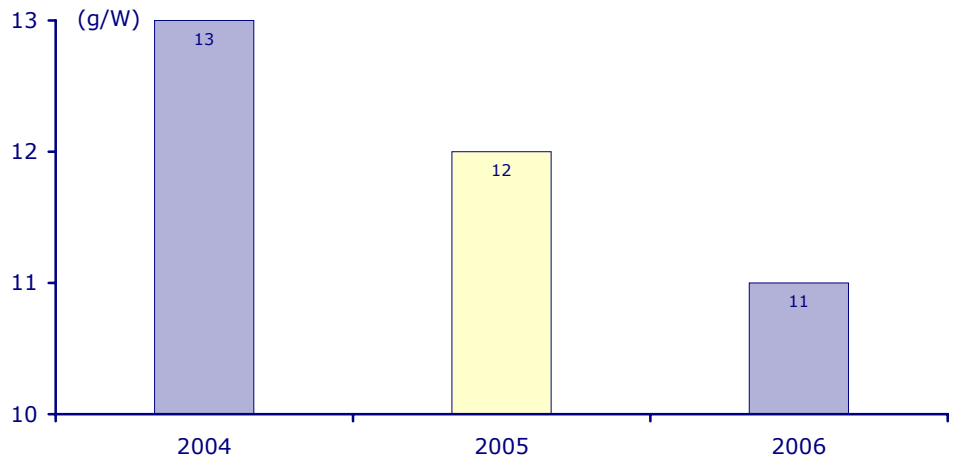
Note: Rough estimates. Source: CLSA Asia-Pacific Markets

With supplies tight and prices rising, both suppliers and downstream customers have had substantial incentive to improve the efficiency with which they use silicon. Improvements have been made at every step of the supply chain. Upstream, silicon producers are producing less off-spec product, with the amount of off-spec material from major silicon producers decreasing from more than 10% of total production a few years ago to approximately 5% in 2005. Similarly, ingot makers are using more recycled material, wafer makers are cutting thinner wafers and reducing kerf loss, and cell manufacturers are making higher efficiency cells. For example, Sharp is now producing some of their cells at thickness under 200 microns compared to an industry average of ~300 microns in 2004, and SunPower is now producing cells with conversion efficiencies of 21% compared with industry average of 16% in 2004. All of these efforts have had a noticeable impact on the amount of silicon feedstock required per Watt. Based on numerous interviews, silicon feedstock requirements are decreasing from 13 grams per Watt in 2004 to 12 grams per Watt in 2005 and will likely fall further to 11 grams per Watt in 2006. This equates to an extra 100MW (equivalent to 9% of 2004 MW output) from the same silicon input in 2005 and 225MW (equivalent to 20% of 2004 MW output) in 2006.<sup>9</sup>

<sup>9</sup> We expect that increasing levels of metallurgical-grade Si will be mixed with higher-purity solar-grade silicon. Adoption of mixing across the industry is likely from 2006, but is likely to commence in small volumes and percentages.

Figure 23

**Average Si feedstock volume requirement**



Note: Rough estimate.

Figure 24

**Cell thickness**

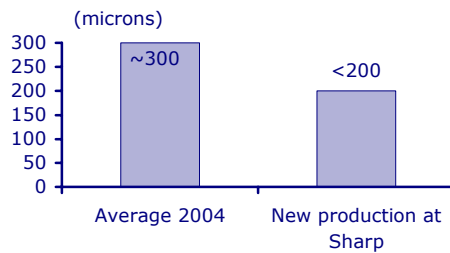
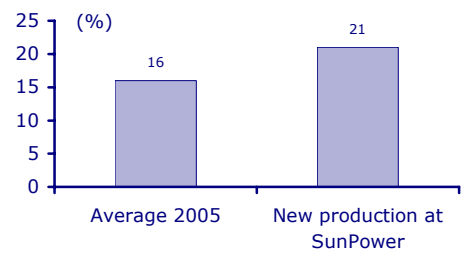


Figure 25

**Cell efficiency**



Note: This is a bit of an apple-and-orange comparison because new production for nearly all companies is superior to industry averages. They are displayed here as examples of the improvements in silicon use that the rest of the sector is quickly following. Sharp's new production cell thickness and SunPower's new production cell efficiency are best-in-class examples for mass production. 2004 and 2005 estimates are for global weighted average. Source: CLSA Asia-Pacific Markets

**5. Encouraging aggressive cost reductions**

**We have been highly impressed by reductions at nearly all players**

Because price competition is limited, *any cost savings go straight to the bottom line*. This creates strong incentive for cutting costs, which often involves improving the efficiency of silicon use. For example, we have observed efforts to reduce kerf loss, to slice thinner wafers and to increase efficiency of solar cells. One example of expanding profitability is REC's subsidiary ScanWafer which is producing 13% of the world's wafers (200MW in 2005). Despite increases in silicon prices (ScanWafer pays market price as part of internal transfer pricing with REC subsidiary SGS), ScanWafer saw EBIT margins triple from 4% to 13%. A similar dynamic exists for cells and modules.<sup>10</sup> Given the substantial cost reductions being pursued by nearly all midstream players, we expect further margin expansion over the next 18-24 months for players not hit by silicon supply constraints.<sup>11</sup>

<sup>10</sup> For example, Chinese production costs for modules are substantially lower than those in more expensive labor markets.

<sup>11</sup> While costs are currently being reduced rapidly throughout the supply chain, it is likely that further cost reductions will be achieved for the next 5 years. As discussed in the previous Sun screen report, we see very large cost reduction potential throughout the supply chain. This is the result of incremental improvements in efficiency, economies of scale, transition to lower cost supplies/labor markets, etc. .

**6. Enabling market share gains**

Figure 26

**ScanWafer 1Q04 versus 1Q05 (Million Norwegian kroner)**

	Revenue			EBITDA			EBIT		
	Q105	Q104	YoY %	Q105	Q104	YoY %	Q105	Q104	YoY %
Solar Grade Silicon	98.3	117.2	(16)	28.0	7.6	271	27.8	7.4	277
ScanWafer	297.8	207.4	44	65.1	28.5	128	37.8	8.9	325
ScanCell	72.2	10.9	560	13.4	(3.9)	(444)	9.7	(6.2)	(256)
ScanModule	72.0	9.3	675	3.7	(2.1)	(279)	2.9	(2.3)	(226)
SolEnergy	1.5	3.3	(54)	(0.3)	1.5	(117)	(1.2)	1.3	(196)
<b>Subtotal</b>	<b>541.8</b>	<b>348.1</b>	<b>56</b>	<b>110.0</b>	<b>31.7</b>	<b>248</b>	<b>77.0</b>	<b>8.9</b>	<b>762</b>
Goodwill/depreciations							(14.1)	(13.7)	
Holding/eliminations	(167.7)	(14.8)	1,031	(20.8)	(4.4)	377	(20.9)	(4.4)	372
<b>Total</b>	<b>374.1</b>	<b>333.3</b>	<b>12</b>	<b>89.2</b>	<b>27.3</b>	<b>227</b>	<b>42.0</b>	<b>(9.2)</b>	<b>(557)</b>

Source: CLSA Asia-Pacific Markets

There are perhaps a dozen mid-stream companies well-positioned to benefit from the tight silicon market. This includes large silicon wafer, cell and module companies who have strong relationships with feedstock suppliers (REC, Sharp, Kyocera, SolarWorld, Q-Cells) and companies that can pay higher prices for silicon because they lead the industry in efficient use of silicon (Evergreen Solar, SunPower, RWE Schott). In addition, companies that have capital to quickly expand non-silicon technologies (ECD, First Solar, Würth) are also able to gain market share. Overall, we estimate that the market share of the top cell manufacturers will increase in 2005 and 2006.

Figure 27

**Examples of players well-positioned to benefit from tight Si market**

**Feedstock suppliers**

- ☐ Tokuyama, Hemlock (Dow Corning), Wacker, MEMC, REC

**Strong relationships with feedstock suppliers**

- ☐ Sharp, Kyocera, SolarWorld, Q-Cells, REC (ScanWafer)

**Efficient users of silicon**

- ☐ Evergreen Solar, SunPower

**Non-crystalline silicon solar power produces**

- ☐ ECD, FirstSolar, Würth, Kaneka

**Players using small amounts of solar in high valued added applications**

- ☐ Carmanah, SolarCentury

Note: Not an exhaustive list. Source: CLSA Asia-Pacific Markets

**7. Enabling expansion of non-c-Si technologies**

In addition, output of non-silicon technologies is rising as the result of tight supply and high prices for silicon. We estimate that production of non-silicon based solar power products will increase from 70MW in 2004 to 140MW in 2005 and 240MW in 2006. This growth will come largely from players like CSG-Solar, First Solar, ECD (United Solar), Kaneka, Mitsubishi Heavy, Fuji Electric, Antec Solar, Shell, Würth, Daystar and others.<sup>12</sup>

<sup>12</sup> We see the current high-price/low-price competition environment in solar power as enabling the growth of non-c-Si technologies. We do not see the rise in non-silicon PV output as a sign that these technologies can compete head-to-head with crystalline silicon (c-Si) technologies. From what we have seen during our plant tours with numerous PV companies, we are skeptical of claims that non-c-Si technologies will be able to match the large-scale manufacturing cost of c-Si anytime before 2010. At present, we are expecting non-c-Si technologies to likely gain marginal market share but we expect these gains to fade once silicon markets begin to loosen with significant capacity expansions from 2008. This view may change in the future if non-c-Si technologies are able to overcome hurdles to large-scale at costs competitive with c-Si technologies. For now, though, we have not seen evidence of this and the history of non-c-Si technologies suggests that ramping production will be harder-than-anticipated.

Figure 28

**Examples of non-crystalline-silicon producers**

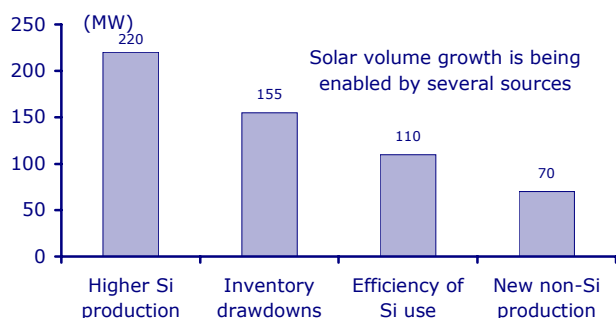
Antec Solar	Free Energy Europe	Mitsubishi Heavy
Bangkok Solar	Fuji Electric	RWE Schott
CSG Solar	Global Solar	Sharp
Daystar	Iowa Thin Film Tech	Shell
ECD (United Solar)	Kaneka	Würth
First Solar	MiaSole	

Note: Examples, not an all-inclusive list. Source: CLSA Asia-Pacific Markets

In summary, our bottom-up assessment of Si supplies suggests that *robust volume growth will continue in the solar power sector in 2005 and 2006 despite the tight silicon market*. We expect the sector to grow at least 0.35GW, from 1.15GW in 2004 to at least 1.5GW of output in 2005. This growth will be enabled by higher silicon production, inventory drawdowns, improvements in usage of Si and new production of non-Si technologies. (See Figure 29.) In 2006, we expect at least 2.0GW of production enabled by similar factors. This represents at least 30% GW volume growth in 2005 and at least 35% in 2006.

Figure 29

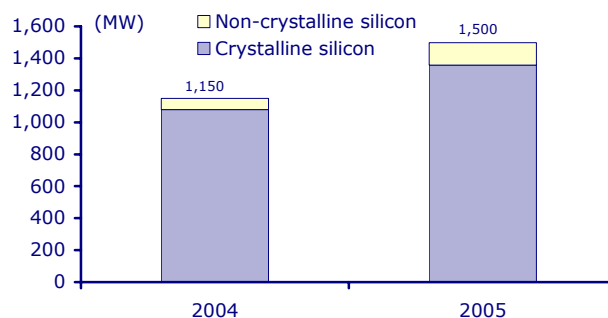
**Sources of potential volume growth for solar sector**



Note: Rough estimates. Numbers add to 520MW in potential, above the 350MW growth we are projecting due to double-counting. Source: CLSA Asia-Pacific Markets

Figure 30

**Estimate of total solar cell production 2004 and 2005**



Note: Rough estimates. It is worth noting that our initial estimate for 2005 production was 1550MW. We have reduced this to 1500MW (30% YoY growth instead of 35%) due to non-c-Si capacity coming online later than previously estimated. Significant non-c-Si capacity will come online in 2006, contributing to 35% annual production growth in 2006.

**Tight market creates risk for all solar players**

**1. Lower inventory levels**

**Negative implications of tight Silicon market**

Of course, the tight Si market also has negative implications. Specifically, it raises volatility and risk for all players. Even players with secure silicon supplies and high utilization rates have potential for significant volatility in earnings from the tight Si market. Some examples of how tight silicon supplies might result in higher volatility and risk include:

Many companies have reduced their inventories of silicon feedstock (meaning polycrystalline silicon and silicon wafers) to bare bones. One major cell/module company has less than 5 inventory-days available, down from more than 50 inventory-days at the start of 2004. Many smaller players have virtually no silicon or wafer inventories.<sup>13</sup> Lower inventory levels mean increasing risk of production (and hence earnings) volatility. This was true in 1Q05 for Motech (6244.TWO), which had negative 9% MoM revenue growth due to undersupply of wafers.<sup>14</sup>

<sup>13</sup> It appears that smaller players face a risk of being "squeezed out" of the market by lack of Si supplies. Si suppliers tend to focus more on larger customers who they regard as having a higher chance of surviving and fulfilling longer-term contracts.

<sup>14</sup> To be fair, the month-on-month comparison ignores impressive 164% YoY revenue growth.

**2. Potential for plant accidents**

Another risk in a tight silicon market comes from the possibility of a plant accident at a silicon manufacturing site. On the surface, this appears to be a realistic possibility given that silicon plants are running harder and having less maintenance in order to keep up with demand. However, interviews with major silicon manufacturers indicate that a major accident is "low probability" given the record of historical performance. For now, though, this is a risk that is worth keeping in mind because it could create production (and hence earnings) volatility for midstream players. For example, shutting down a 5,000 ton p.a. plant for a week due to an accident would remove 100 tons of silicon supply, equivalent to 8MW. While 8MW is only 0.5% of annual production for the total industry, it is 25% of Sharp's monthly production and a much higher percentage of production for smaller players who would be most likely to be cut out of supplies in case of an accident.

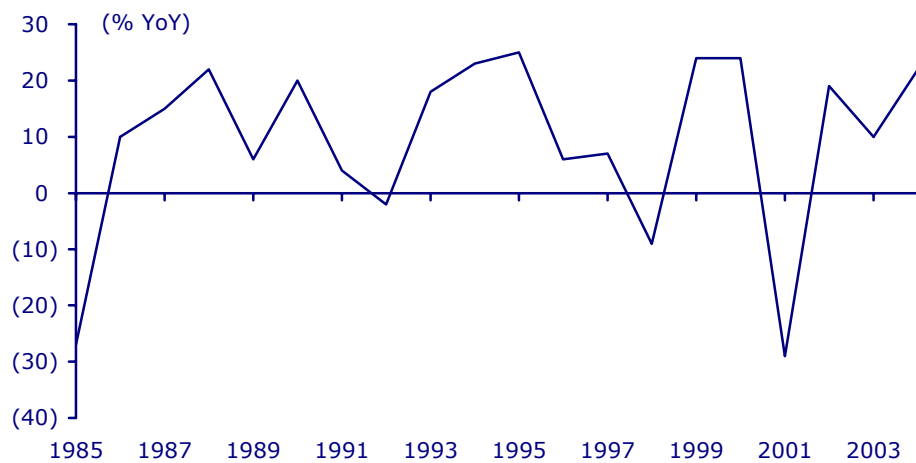
**3. Possible return of electronics demand growth**

Another risk is the potential for a strong increase in the demand growth rate from the electronics sector. We are projecting 5% volume growth for electronics sector Si consumption in 2005 and 2006, which most interviewees say is realistic given current orders and reported growth rates downstream in the electronics sector. However, if electronics demand exceeds this level, it would put a further squeeze on silicon supplies for the solar sector and create more volatility in the solar sector.

**Growth in the electronics sector is a major uncertainty for silicon supply to the solar sector**

Figure 31

**Million square inches of wafer production by electronics sector**



Note: This figure is for MSI of electronics wafer production, not for growth in electronics-sector silicon usage. Source: Datamonitor, CLSA Asia-Pacific Markets

**4. Disturbance of traditional Si supply chain relationships**

Historically, most silicon used in the solar sector was purchased by ingot/wafer companies from silicon producers, silicon recyclers, and electronics-sector ingot/wafer makers. As the silicon market has become tighter, downstream players - cell companies, module manufacturers, and even wholesalers/installers - have been contacting silicon companies directly in hopes of securing silicon feedstock for the wafer/cell/module players upstream of them. The tight market and disturbance of traditional sales channels leads to a huge amount of hype as a rapidly expanding portfolio of customers seek silicon supplies from all potential vendors. The result is a shortage mentality that creates artificial demand and even hoarding.

**5. Low utilization rates**

While this volume growth appears robust on the surface, it is not enough to satisfy the demands from end-customers or from solar power players. Based on interviews, average global utilization rates for ingot, wafer, cell and module

companies are 70-80%. Utilization rates are even lower for many players. For example, the ingot and wafer players in China have typical utilization rates below 50%, with this number likely to come down further as new capacity additions come online during the second half of the year.<sup>15</sup> Of course, lower capacity utilization rates have a dramatic impact on profit margins.<sup>16</sup>

Figure 32

**Schematic overview of silicon supply chain**



Note: Companies listed are for illustrative purposes only. Not intended as a complete listing. Mitsubishi Polysilicon (not Mitsubishi Electric) produces upstream silicon feedstocks. Source: CLSA Asia-Pacific Markets

<sup>15</sup> Several Chinese companies express a preference for owning underutilized equipment than cash because they fear that debt markets may tighten over the next year and reduce their ability to expand.

<sup>16</sup> Very rough estimates. Our methodology for estimating utilization rates was to survey plant managers/operators and to ask them, "At mid-year, what is the average utilization rate of your production lines in terms of hours of full-scale production out of total available production hours?" The answers to this question varied widely, with several plants in Asia reporting utilization below 30% and many plants in Japan/Europe/US reporting utilization rates above 85%. Another way of estimating average utilization rates is to divide annual (full year) production by year-end capacity. Doing this provides a global weighted average of approximately 65-75% for the various segments of the mid-stream, a slight decrease compared with 2004 due to a rapid rise in underutilized ingot, wafer, cell and module capacity in China.

**The major risk**

**Will German pro-solar policies hurt the solar sector? We don't think so**

Figure 33

**Current global midstream capacity**

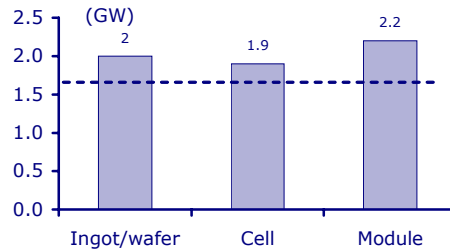
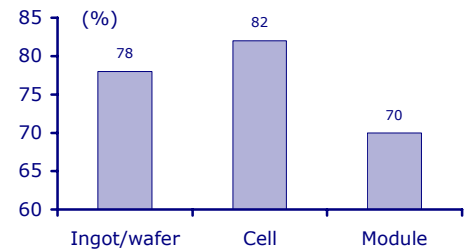


Figure 34

**Current ave. midstream utilization**



Note: Rough estimates. It is worth noting that significant portion of underutilized capacity is in China and, to a lesser extent, India. Estimates of productive capacity in both countries based on on-the-ground interviews and factory tours. Again, these are rough estimates. Please see Footnote 16 above for additional details. Source: CLSA Asia-Pacific Markets

The above is bad news for the sector, but it is only part of the story because the tight silicon market also creates windfalls for better-positioned players.

**Summary on silicon capacity constraints**

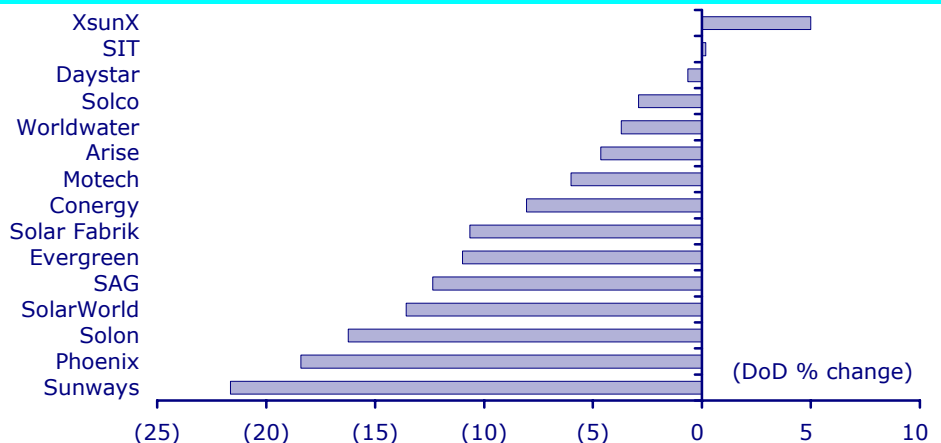
We see constraints over the next two years as the major risk for the solar power sector. The source of this risk is volatility in earnings growth if specific companies are unable to secure necessary silicon supplies. However, the tight silicon market also has very real upside (e.g. high profit margins for upstream companies, reduced price competition for midstream and downstream companies, further margin expansion as result of cost reductions, potential market share gains) for players who successfully secure their silicon. On balance, the constraint on silicon creates upside earnings potential but also introduces significantly higher volatility. To balance the risks of feedstock supplies to any specific player, we recommend investors pursue a *portfolio approach* to solar stocks (see Section 4).

**Risk #2: Changes in German pro-solar policies**

On 23 May, German Chancellor Schroeder announced that he would hold earlier-than-expected national elections. On that day, solar stocks dipped 8%, with Conergy down 8%, SolarWorld down 14% and Evergreen Solar down 11%. The rationale for the price declines was that a change of government in Germany might lead to a change of Germany's very strong pro-solar policies and, in particular, a possible roll-back or elimination of the very strong buyback program for electricity generated from solar power systems.

Figure 35

**Pure-play solar stock price performance on May 23, 2005**



Source: CLSA Asia-Pacific Markets

**Three reasons to be sceptical**

On the surface, it makes sense that any reduction in support for solar power in Germany would have negative implications for solar power companies. After all, Germany is a world leader in solar power, with the most annual installations and the second highest production following Japan. It would make sense that anything that diminishes demand in Germany would be a negative for the solar sector.

We agree that a significant reduction in German policy support would hurt the solar power sector, but believe that it is *highly unlikely that a significant reduction will occur*. More specifically, there are at least three reasons to be sceptical that a significant change will occur in German solar policy.

- 1) First, it is very *difficult to change government subsidy programs* once they have been established, whether they be German programs supporting solar, French programs supporting agriculture or US programs supporting healthcare. The EEG is a full law on the German books and reducing it would require not only the election of a new government but a rescinding of the current law. Interviewees working in German politics tell us that examples of this type of change are rare and politically difficult.
- 2) Second, the solar power sector has become an increasingly *important political constituency* in Germany. The sector has created many new jobs (various sources estimate 25,000 to 65,000 solar jobs created in Germany since 2000), there are now many German homeowners with solar power installations on their roofs (including many in southern Germany, an important constituency for the CDU), and a significant portion of the German population holds strongly "green" views (public opinion polls show that a majority of CDU voters support solar).
- 3) Third, even if other political constituencies (e.g. German generating companies) push for a change in the EEG and are able to reduce German pro-solar policies, it would be most likely that the *changes (if any) would be marginal not thorough*. For example, senior executives in the German solar power market tell us they can envision possible elimination of the EEG for non-rooftop applications or an acceleration of the annual EEG buy-back rate reduction (currently 5% per year for residential systems). However they see these moves as "unlikely", and they see complete elimination or very strong reduction in the EEG as having a very low probability. In the words of one executive, "Pro-solar policies did not emerge randomly out of the German political process. They are the result of a lot of fighting and pushing. While there might be a war of attrition by opponents trying to recapture lost land, it is highly unlikely that there will be much backward movement because there are too many jobs at stake and too many people who already have solar on their roofs."

**Policy support for solar power is increasing around the world**

Even if German pro-solar policies were to change, there is very *substantial "back-up" demand* for solar power around the world. The demand is driven by strong policy support in more than 40 markets that has led to the current "sold out" situation for solar power suppliers. In the coming years, we expect this policy support to continue expanding, with additional support coming from markets such as the United State, China, Italy and perhaps France.

Figure 36

**Examples of markets with strong pro-solar policies**

Arizona	Colorado	Japan	South Korea
Austria	Cyprus	Massachusetts	Spain
California	India	New Jersey	Thailand
China	Italy	Parts of France	Washington state

Source: CLSA Asia-Pacific Markets

**Demand exceeds capacity, creating significant back orders**

To estimate the scale and location of this “back-up” demand, we conducted interviews with executives at major solar cell/module manufacturers. This survey group represents approximately more than 50% market share for cells. Key results from these interviews include:

- ❑ “Real demand” in 2005 is between 1.8GW and 2.4GW at current price levels.<sup>17</sup>
- ❑ There are substantial back-orders in the US, Spain, Italy, South Korea, India, China and other markets.
- ❑ All interviewees (100%) indicate that they see no realistic potential for production to meet end-customer demand before 2008.
- ❑ Key markets that are likely to add significant incremental demand through 2010 include Japan, Germany, California, New Jersey, Spain, Italy, South Korea, China, and Thailand.

**Solar power is part of ongoing trend towards “greener” government and corporate policies**

While these types of bottom-up assessments of demand are useful, we believe it is also important to look at the solar sector from a macro-perspective. We believe that government policies of other nations around the world and corporate investments will continue to “green” through the end of the decade. We expect tightening emission standards and strong government support for renewable energy in nearly all OECD countries. We also expect large companies around the globe - including GE, Sharp, Mitsubishi, BP and Dow Corning - to expand their capex and R&D investments in “green” areas. For example, GE CEO Immelt said his company’s future depends on its ability to, “define the cutting edge in cleaner power and environmental technology.” While there will certainly be anomalies, our view is that the world will become “greener” on average through at least 2010 and that solar power is a very attractive way to play this trend. Without this macro-level outlook for “greening,” we believe many of the specific arguments laid out in this report are less convincing.<sup>18</sup>

**Overall, German policy reversal is unlikely**

In summary, we see changes to Germany’s pro-solar policies as unlikely. Further, we believe that if such changes were to occur, that they would be minor. Finally, if changes were substantial, we see significant back-up demand in other markets that ensures continuing growth for the sector through the end of the decade.<sup>19</sup> The view that there is limited potential for German policy changes to harm the solar sector appears to have been corroborated by stock price movements since May 23. The solar sector has rebounded since then and most stocks have regained their price from prior to the election.

<sup>17</sup> “Real demand” in this case means orders that have been placed or would likely have been placed for end customer installations irrespective of availability of modules to fulfill order.

<sup>18</sup> One concern we have heard is that rising prices for solar power combined with strong but not over-the-top growth rates may lead to diminished policy support or at least a reduction in “PV momentum” among policy makers. We see this as a logical thought process but have yet to see any direct evidence from the policy makers or bureaucrats we interview to support this view. We will be on the lookout for evidence of any loss to “PV momentum.” However, given the diverse set of scenarios that could have positive implications for solar (e.g. a nuclear plant accident to stronger evidence of global warming, increased levels of concern about national security/energy security, substantially higher fossil fuel prices), we believe that policy support is unlikely to weaken in the foreseeable future.

<sup>19</sup> This view is substantiated by interviews with leading equipment manufacturer in Japan, Germany, and the US. Their order books include many orders by companies outside the major markets (Germany, Japan, US) that see very significant local supply and demand potential. In all cases, equipment manufacturers report very strong demand growth and long backlogs of equipment orders. Their estimates for solar sector production in 2010 range from 5GW to 8GW, with the lower end of the spectrum representing a significant softening in German pro-solar policies.

Figure 37

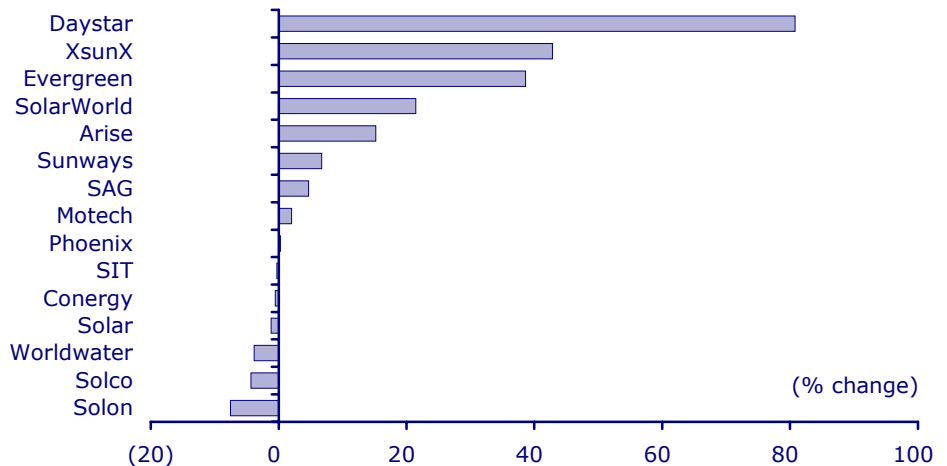
**Chancellor Schroeder meets with CEOs of Evergreen Solar and Q-Cells**



Source: Evergreen Solar website, CLSA Asia-Pacific Markets

Figure 38

**Solar stock price performance since May 23, 2005**



Source: CLSA Asia-Pacific Markets

**Risk of German policy change has been discounted by investors**

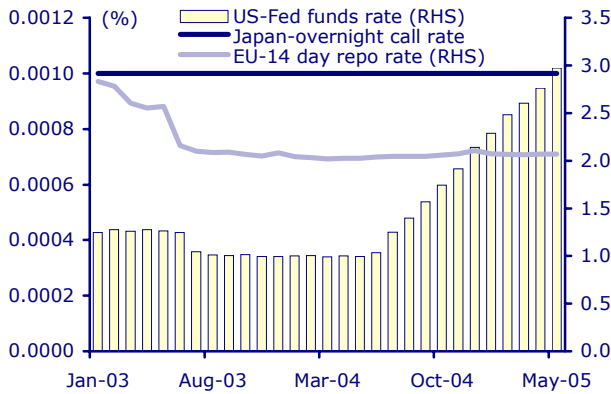
**No evidence yet of 3-5 percentage point increase that would harm the sector**

**Risk #3: Interest rates rising 3-5 percentage points**

In *Sun screen I*, we identified rising interest rates as having potential to disrupt fundamentals and earnings growth for this sector. Interest rates are important because many installations are financed with loans. As a result, a significant rise in interest rates can lead to higher monthly loan payments and a significant increase in the levelized cost (in cents/kWh) of solar power. Over the last year, central bank rates in the US have edged up but residential interest rates have been flat. We maintain the view that higher interest rates could substantially drag solar growth by diminishing end-customer demand. A 3ppt rise in rates in Japan would increase the levelised price of solar sufficient to remove it from a range competitive with grid prices (c. US30¢/kWh at current rates). For now, though, it does not appear that significantly higher interest rates will diminish solar growth.

Figure 39

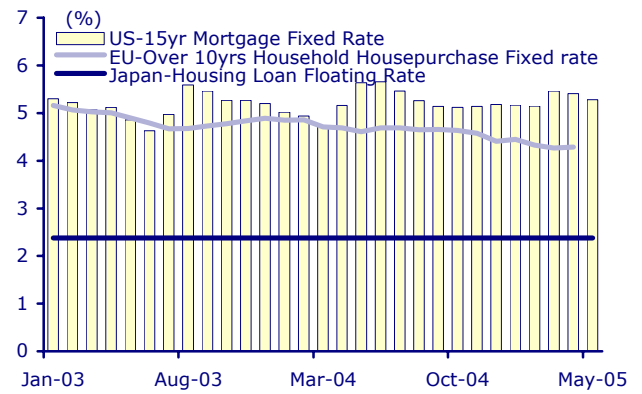
**Central bank interest rates in Japan, Germany and US**



Source: CEIC, CLSA Asia-Pacific Markets

Figure 40

**Residential interest rates in Japan, Germany and US**



**Some anti-solar activities by Genco's but still minor**

**Risk #4: Backlash by Gencos against solar**

When customers install solar power on their roof, they are cutting demand for electricity from the power grid for the lifetime of the system. From a generating company (Genco) perspective, this is a loss of customer volume, revenue and profit for the next 20+ years. Specifically, a typical household installation on a German rooftop will displace US\$10,000 in Genco revenue over its lifetime.<sup>20</sup> As highlighted in the previous Sun screen report, this is not a significant problem for Gencos as long as solar power remains small percentage of total electricity supply. However, as solar power grows, it will become an increasingly noticeable issue for Gencos, largely because of the "peak shaving" nature of solar power. Basically, solar power generates in the middle of the day when the sun is up. This has high correlation in many markets with the peak of demand (i.e. air conditioners running mid-day) and consequently with peak prices that generate a large portion of Genco profits.

**We hear reports of minor anti-solar activities in Germany . . .**

We have heard of initial signs of anti-solar activities among leading Gencos in Germany. This includes activities by RWE, Eon, Veattenfall & EnBW via German Electricity Association (VDEW) seeking to reduce policy support for solar power and increase policy support for nuclear energy. At present, these anti-solar activities remain minor. In the words of one solar industry executive in Germany, they are "rear guard actions" because Gencos are worried about generating negative publicity by being perceived as anti-environment. In the United State and Japan, we do not see signs of any increase in anti-solar activities. In the US, interviewees active in US solar policies tell us that Gencos continue to use connection procedures and rate structures to provide minor barriers to solar adoption, but there has been no significant increase in these activities since last year. Anti-solar activities by Gencos may change in the future if US installations shift from megaWatts to gigaWatts, but this is a problem that would appear only in the long-term.<sup>21</sup>

**. . . but do not expect any significant anti-solar activity before 2008 at the earliest**

For now, we will continue to look for further signs of a Genco backlash, but do not believe that anything aggressive will hit the solar sector before 2008. If and when Gencos begin pushing back against solar expansion, there are good reasons to believe that they may not be alone. Specifically, companies selling

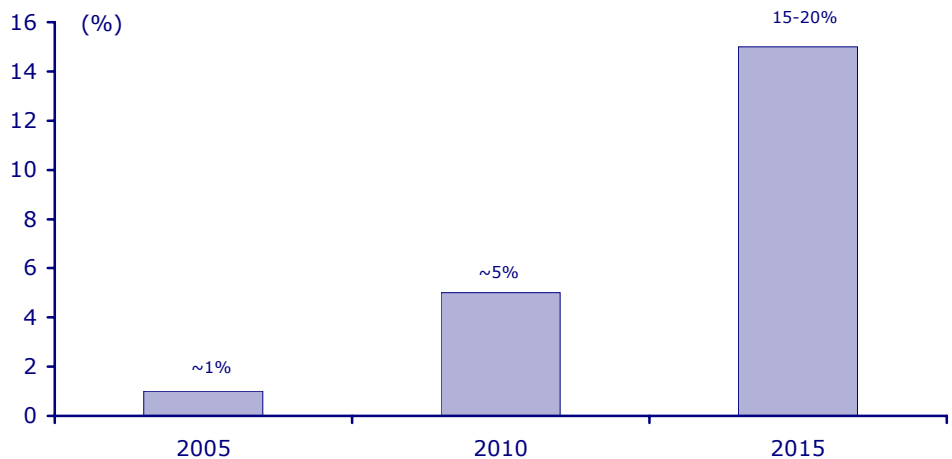
<sup>20</sup> Assumptions: 1kWh DC generates 1MWh DC per year; 20% inverter loss; US\$1.25/euro; 20 year life of system; assumes no decline in output over time but also assumes no output after year 20. Does not account for electricity price increases, time value of money or other factors.

<sup>21</sup>It is worth noting that in areas with particularly strong sunlight (e.g. Arizona), utilities have expressed initial interest in potential for centralized, grid-connected solar concentrator technologies.

turbines for large power plants face a problem similar to that of Gencos: sales of turbines will be increasingly impacted as solar power installations grow. The installation of solar power diminishes end customer demand (especially peak end customer demand), thereby reducing the load for Gencos and diminishing Genco demand for turbines to meet peak demand. Annually there are approximately 100GW of incremental peak capacity installed globally, most of which includes turbines from major suppliers. With the rapid growth of solar power, turbine sales will be increasingly delayed or displaced. While this is not an important factor when solar power installations (1.15GW in 2004) are only 1% of total peak capacity installations, displacement/delay of turbine sales could become increasingly noticeable in some markets as solar grows to 6GW in 2010 (perhaps 5% of global peak capacity additions) with realistic potential for 15-20GW in 2015 (perhaps more than 15% of global peak capacity additions). Again, this is a potentially potent problem for the solar power sector, but one that appears quite far into the future.

Figure 41

**Solar power as percent of global peak generation capacity additions**



Note: Rough estimates. Each year there are roughly 100GW of incremental power generating capacity added globally. Most of this capacity uses coal, natural gas, nuclear or hydro as the energy source. The estimates in this Figure are for the percentage of peak capacity additions from solar power out of total global incremental capacity additions. For example, there will be likely be somewhere between 100GW and 150GW of new peak power capacity installed in 2005 according to US Energy Information Administration. Of this, we expect 1.5GW will be solar, resulting in an estimate of solar accounting for 1-1.5% of total peak capacity installations. It is important to note that solar power only generates 3-6 hours/day compared with other technologies (e.g. baseload coal or nuclear) that operate more than 90% of the time. The result is that the amount of electricity generated from a peak Watt of solar is significantly lower than from a peak Watt of coal or nuclear. Source: CLSA Asia-Pacific Markets

**Backlash unlikely to hurt solar in next few years**

**A fall in oil prices would have a negative impact on solar stocks . . .**

In summary, solar power runs the risk of a backlash from large players in the electricity generating sector, including both Gencos and turbine manufacturers. While there is some recent evidence of anti-solar activities, these appear fairly minor and unlikely to cause noticeable disruptions to solar power growth. However, given the long-term potential for a backlash against solar, this is a trend that we will continue to follow closely.

**Risk #5: Impact on solar stocks if oil prices fall**

Over the past year, there has been strong correlation between the movement of solar stock prices and the movement of oil prices. When oil prices rise, solar stocks tend to rise and when oil prices fall, solar stocks tend to fall. We see oil price movements as creating significant uncertainty for solar stock prices in the future. If oil were to fall below US\$40/bbl and if oil price volatility were to decrease substantially, we believe investor interest in solar

**... but would not harm earnings growth of the solar sector**

stocks would decrease noticeably. At present this is not the case, and we continue to see aggressive interest in solar stocks among both long-term institutional investors and shorter-term hedge funds.

We want to emphasize that the risk of oil prices is based on investor perceptions not on fundamentals. The price of electricity for residential customers is not related to oil price. This is because oil is predominantly a transportation fuel whose use in the electric power sector is limited in most markets and is not a significant factor in setting power prices. Also, oil price tends to have modest mid-term correlation with natural gas (including LNG) and coal prices, both of which are much more important to electric power prices. However, even when prices for natural gas and coal fall, it is rare to see prices for residential power decrease. This is because decreases in costs for generating electricity are generally captured by large industrial and commercial customers, not by residential customers. Because the bulk of solar installations are on residential roofs and because these residential installations compete with residential grid prices which are decoupled from oil prices, we do not see any significant impact on solar industry fundamentals from oil price movements.<sup>22</sup>

With a decrease in oil prices a realistic possibility, we suggest that investors pursuing a portfolio approach to solar stocks should consider hedging oil price risks to solar stocks by shorting oil.

**Beyond 2010, Chinese players are a risk for current industry leaders**

### **Other risks: China and new technologies**

Two other risks deserve brief mention. First, the rapid expansion of capacity in China has captured attention because of concerns that Chinese production could displace existing players, increase pricing competition and/or reduce margins. We spent a week in China investigating the market there and expect that both capacity and installations will continue to increase rapidly. On the supply side we expect:

- ❑ Silicon production to increase from 500-800 tons (approximately 30-50MW assuming 15g/Watt) in 2005 to at least 5,000 tons by 2010.
- ❑ Ingot and wafer production capacity of approximately 250MW in 2005 to double in 2006.
- ❑ Cell capacity of 100-200MW in 2005 to double in 2006.
- ❑ Module production capacity (which is difficult to estimate) to increase from approximately 300MW in 2005 to more than 500MW in 2006.

**In the mid-term, Chinese players are not a significant threat**

Overall, these increases are noteworthy but are *not a major risk for the mid-term growth of the solar sector*. This is because most Chinese players are short of silicon and are operating at very low utilization rates, often under 50%. At such low utilization rates, we expect capacity additions to have limited impact on the overall solar power market. We do not expect the tight silicon market to open up until at least 2008, possibly 2010. As a result, China will remain a largely positive influence on solar power sector earnings (via outsourcing module assembly from higher cost regions to China).

---

<sup>22</sup> The price of oil is tied indirectly to prices for LNG and coal, both of which are larger portions of electricity supply. However, price decreases for both LNG and coal have historically been captured as either profits for generating companies or as price reductions for larger industrial/commercial power consumers.

**New technologies are also a long-term risk . . .**

**. . . but cost reduction in c-Si will ensure that it remains dominant**

**Non-c-Si production on the rise, but unlikely to displace c-Si in the next five years**

In the longer-term - beyond 2008 and perhaps beyond 2010 - we expect that China will emerge as one of the largest solar power producers and that its scale will have potential to drive down global utilization rates and margins. For the mid-term, we believe this is unlikely occur.<sup>23</sup>

The second risk is of new technologies entering the market that displace existing players. We see this as a real challenge for producers of crystalline silicon technologies, but one that is unlikely to impact crystalline silicon players until after 2010. This is because c-Si producers continue to enjoy significant costs advantages relative to non-c-Si producer and because c-Si producer continue to see substantial year-on-year cost reductions, typically 7-10%. We see realistic potential for ingot, wafer, cell and module makers to decrease overall costs by 30-40% or more by 2010, meaning that they are likely to continue being the cost leader in the industry. Rates of cost reduction for c-Si are likely to diminish before 2015 as c-Si hits a number of technical, economic and policy barriers, but this is still quite far in the future.

For the next several years, we expect solar technology to change in two ways. First, we expect continuing incremental innovations that from economies of scale, manufacturing in lower cost regions, higher efficiency of silicon use, and higher efficiency of light conversion. Evergreen Solar and SunPower are companies that are poised to grow rapidly based on their incremental technological innovations. Second, we expect that non-c-Si technologies will expand their production and market share. We estimate that amorphous silicon, CIS, CdTe and other non-c-Si technologies will grow from 70MW (6% market share) in 2004 to 140MW (9% market share) in 2005 and 240MW (12% market share) in 2006.

Beyond 2006, we expect silicon constraints to diminish slightly as new polycrystalline Si capacity comes online, and for the market share for non-c-Si technologies to decrease. In 2010, we expect that production of non-c-Si technologies will be approximately 500MW (8% market share). Historically, non-c-Si technologies have received significant media and investor attention, only to prove to costly or difficult to manufacture at large scale. We expect that current non-c-Si technologies will encounter similar challenges as they attempt to ramp, but will continue researching these new technologies to determine if and when any non-c-Si technology might become competitive with c-Si in terms of cost and large-scale manufacturability.

Figure 42

**Non-crystalline Si production**

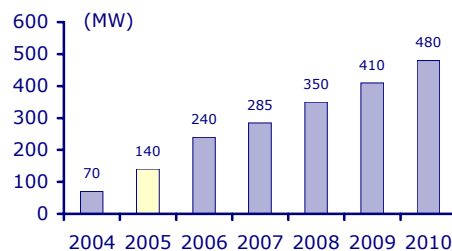
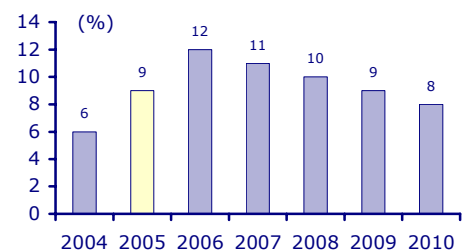


Figure 43

**Non-crystalline Si market share**



Source: CLSA Asia-Pacific Markets based on numerous company interviews.

<sup>23</sup> Between now and 2008, we expect China's largest impact to be seen in the module area. For modules, we expect a continuation of the trend to move module assembly to China because of the low cost of assembly.

After a long discussion of risks, we turn to solar's impressive growth story

### Final comments about risks

In the preceding pages, we focused on risks. Based on this analysis, we have come to believe that:

- These risks (especially the tight silicon market) are putting *a modest governor on growth* for many players in the sector (especially smaller companies), but not for better-positioned players.
- In some cases, the risks actually *create opportunities for leading players* (e.g. decreases in price competition due to silicon constraints help margins for players with access to silicon).
- For all players, there is increasing volatility and uncertainty as a result of these risks. The implication is that *investors should pursue strategies that balance these risks*, such as a portfolio approach to solar stocks.

In the pages that follow, we lay out our logic for why we believe solar power will grow rapidly in the coming years and identify the key companies in the sector that are poised to benefit most from this growth.

**Exponential expansion likely through end of decade**

**Historically, solar sector has grown 30%+ per year**

**We expect strong growth to continue through end of decade**

**Fundamentals remain very attractive**

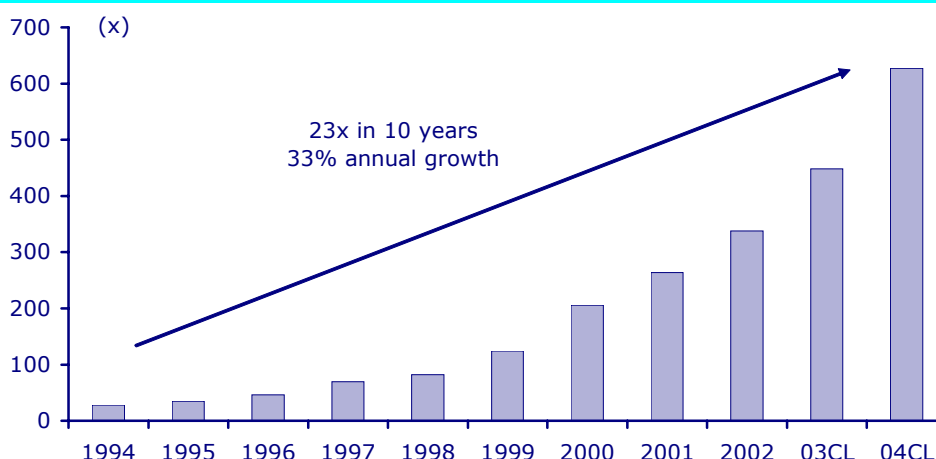
**Strong volume growth rates**

## Rapid growth through 2010

We are convinced that solar power will continue its rapid growth through at least 2010. As mentioned above, we are looking for 4x growth in volume, 3x growth in revenue and 3x growth in pretax profit from 2005 through 2010. This view is based on a screen of 600+ solar power companies and interviews with hundreds of solar power executives, policymakers and technologists. As we conducted this year's screen, we attempted to develop insight into industry-level trends and to identify specific investment opportunities. This section addresses the industry-level growth trends and Section 4 addresses the specific investment opportunities.

Figure 44

### Annual installations of solar power in OECD



Note: Rough estimates. 1.15GW of solar power produced in 2004. this figure shows rough estimate for installation in OECD countries. Remainder are installed during year in non-OECD countries.

Figure 45

### Summary: Volume, revenue and pretax profit growth expectations

	05CL	06CL	07CL	08CL	09CL	10CL	2010 vs 2005 (x)
Production (GW)	1.5	2.0	2.6	3.5	4.6	6.0	4
Revenue pool (US\$bn)	11.1	15.0	18.6	23.9	29.4	36.1	3
Pretax profit pool (US\$bn)	2.3	3.8	4.6	5.1	5.6	6.4	3

Note: Rough estimates. Source: CLSA Asia-Pacific Markets

### Industry trends identified during screening process

Key messages out of this year's screen include:

- Strong volume growth rates.
- Limited pricing pressure.
- Impressive revenue growth.
- Significant cost reductions.
- Robust profit growth.

With aggressive government support in more than 40 markets, end-customer demand for solar power significantly exceeds production capacity. We estimate volume growth of at least 30% in 2005 and at least 30% annually through 2010. The result is a sector poised to grow 4x from 1.5GW in 2005 to at least 6GW in 2010. There is further upside on this growth if silicon feedstock availability exceeds our expectations.

**Limited pricing pressure**

With silicon feedstock availability, pricing pressure for most solar components and feedstock has diminished. In contrast to the historical trend toward lower prices, we see 10% increases in module prices this year, 5% in 2006 and only modest (5-7%) annual price decreases for 2007-2010. We believe pricing support is a safe bet for the next 18-24 months.

**Impressive revenue growth**

With volume growing quickly and only limited pricing pressure, revenue is growing at a fast rate. We estimate industry revenue will grow from US\$8.3bn in 2004 to US\$11.1bn in 2005 to US\$15bn in 2006. By 2010, we estimate US\$36bn in industry revenue, a 3x expansion over the next 5 years.

**Significant cost reductions**

Costs are falling throughout the supply chain. Nearly all of these cost improvement are incremental and based on marginal advances in economies of scale, production efficiency, and lower cost inputs such as labour. While many players are unable to benefit from these cost reductions because they have limited feedstock and are running at low utilization rates, better-positioned players are often seeing cost reductions of 7-10% or more. These cost reductions will enable margin expansion until at least 2008. For 2008-2010, we are projecting a slight decline in margins as prices decline, but this projection may end up being too conservative given the significant cost reduction potential.

**Robust profit growth**

With revenue growing and costs falling, profit is expanding quickly. We estimate that industry pretax profit will grow from US\$1.2bn in 2004 to US\$2.3bn in 2005 to US\$3.8bn in 2006. By 2010, we estimate at least US\$6.4bn in pretax profit, an increase of nearly 3x over the next five years.

**Production growing 30% annually with little pricing pressure**

Figure 46

**Solar cell production volume**

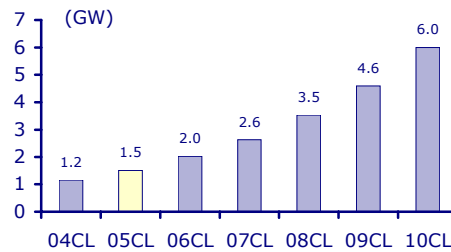


Figure 47

**Average module price**

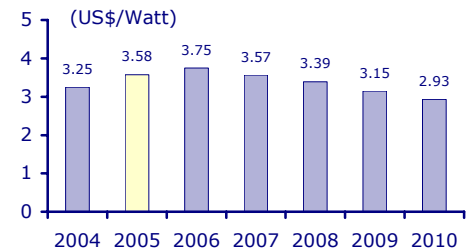


Figure 48

**Average installation price**

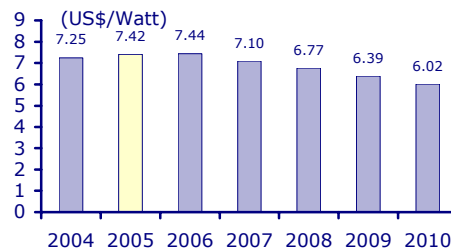
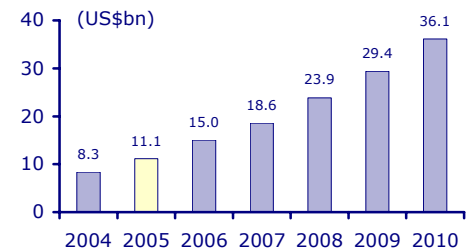


Figure 49

**Solar power revenue pool**



Source: CLSA Asia-Pacific Markets

**Realistic potential for profit pool to expand almost 3x over next 5 years**

**Euphoria for well-positioned players mixes with desperation of companies needing Si**

**30% annual growth likely through 2010**

Figure 50

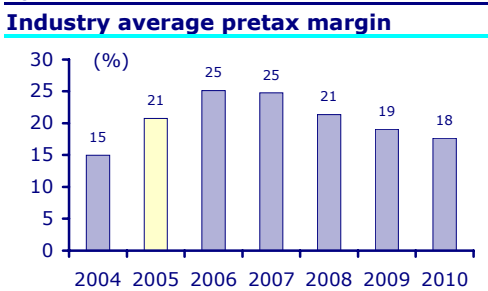
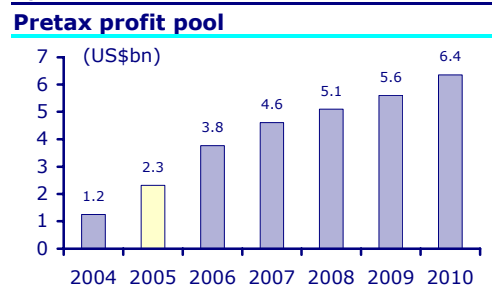


Figure 51



Source: CLSA Asia-Pacific Markets

Of course, any long-term forecast has uncertainty. Factors that could *reduce* volume, revenue and profit growth were discussed in details in Section 2. There are also factors that could significantly *increase* the volume, revenue and profit growth compared with our estimates. These factors include a strengthening of “green” policies beyond our expectations, faster industry consolidation, stronger cost reductions and/or a significant increase in residential electricity prices.<sup>24</sup> The remainder of this section provides additional details on the growth prospects for the sector.

**Strong volume growth rates**

At industry trade shows, the sentiment is a mixture of euphoria and desperation. The euphoria comes from the very strong demand growth in numerous markets. Order books remain oversold and there are waiting lists for silicon, wafers, cells, modules and end-installations. The desperation comes from players who have invested into capacity or committed to deliver products to customers without having enough feedstock. In an environment where feedstock constraints are the key determinant of growth, estimating growth rates is difficult. To address this challenge, we have attempted to triangulate by looking at volume growth from a number of different angles, including end-customer demand, growth guidance provided by a broad group of solar power manufacturers, feedstock production estimates by silicon players and order books for leading equipment manufacturers.<sup>25</sup>

Based on this triangulation, we expect at least 30% volume growth in 2005 and at least 30% volume growth through the end of the decade. This puts the industry at 6GW in 2010. The lowest realistic range we can envision for volume growth is 20% per year, based on very tight silicon feedstock if electronics sector consumption of silicon growth significantly more than 5%. This would put the industry at approximately 3.5GW in 2010. We see this as highly unlikely given that most new silicon capacity that is coming online will be dedicated to specific customers in the solar sector who have signed long-term supply contracts. On the upside, a stronger growth rate is realistic if electronics usage grows less than 5% annually, if new silicon supplies come online faster than anticipated or if efficiency of silicon use improves faster than expected. At a 40% annual growth rate that is seen as viable by some senior industry executives, volume would reach 8.7GW in 2010.

<sup>24</sup> While there are scenarios that lead to diminishing support for solar power, many scenarios favor increasing support for solar power. These include high fossil fuel prices, large-scale power outages or brownouts, a nuclear accident, increased national security concerns and clearer evidence of climate change due to greenhouse gas emissions. In short, many risks that could change the shape of the electric power industry favor solar power. We are not incorporating these potentially positive drivers for solar growth into our outlook.

<sup>25</sup> We believe equipment orders are a good leading indicator for volume growth rates in the solar power sector. When we speak with the largest equipment manufacturers supplying the sector, they tell a consistent story: 100% (or more) year-on-year growth rates and long backlogs on the order books. Based on discussions with equipment manufacturers, we expect these capacities will grow at least 40% for the next 2 years and will be “at least 6GW” in 2010, with “7 or 8GW being a realistic forecast” and “10GW not being out of the question.”

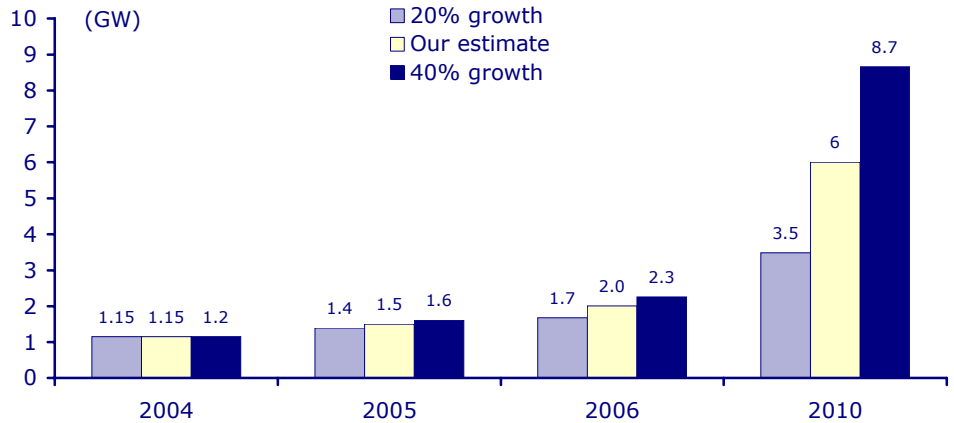
**We expect industry to produce 6GW in 2010, 4X its production in 2005**

**Historical downward trend in prices has reversed**

To summarize our volume expectations, we see a realistic range of growth from 20% to 40% per year, with our estimate being 30% in 2005 followed by 30-35% in 2006-2010. These growth rates will put the industry on a path to expand by 2.5x (20% growth) to 5x (40% growth), with our estimate being 4x growth.<sup>26</sup>

Figure 52

**Realistic range of cell production**



Note: Rough estimates. Source: CLSA Asia-Pacific Markets

**Limited pricing pressure**

Historically, the trend for prices in the solar power sector is on a downward trajectory. As shown in Figures 53 and 54, prices in the three largest markets decreased consistently from 1993-2003. These price decreases were the result of strong pricing competition, often led by the largest Japanese competitors and accentuated by modest manufacturing overcapacity.

Figure 53

**Japanese module prices**

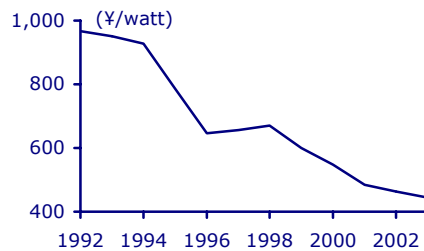
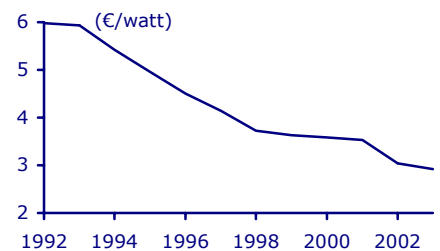


Figure 54

**German module prices**



Source: EIA PVPS, CLSA Asia-Pacific Markets

The downward price trend reversed in mid-2004. This upward shift in prices is continuing, with module prices up 10% in 2005 and end-installation prices up approximately 3%. We expect another 5% increase in module prices in 2006.<sup>27</sup> As described in Section 2, these upward price movements are the result of diminished downward pricing pressure because price has been replaced by feedstock availability as the chief competitive factor. With order books oversold, the pressure on prices is *upward* not *downward*.

<sup>26</sup> This growth in capacity will likely outpace the growth in silicon feedstock availability, meaning that average utilization rates (currently 70-80%) are unlikely to rise and that volume growth rates for the industry will be set by availability of silicon and growth in non-crystalline-silicon technologies.

<sup>27</sup> These estimates are based on regular discussions with wholesalers, modules manufacturers and end installers. We expect end-customer prices to be flat in 2006. This the net result from rising module prices but slight decreases in prices for inverters and other components. Inverters and other components do not have any silicon content and not subject to the feedstock constraints facing wafers, cells and modules.

Figure 55

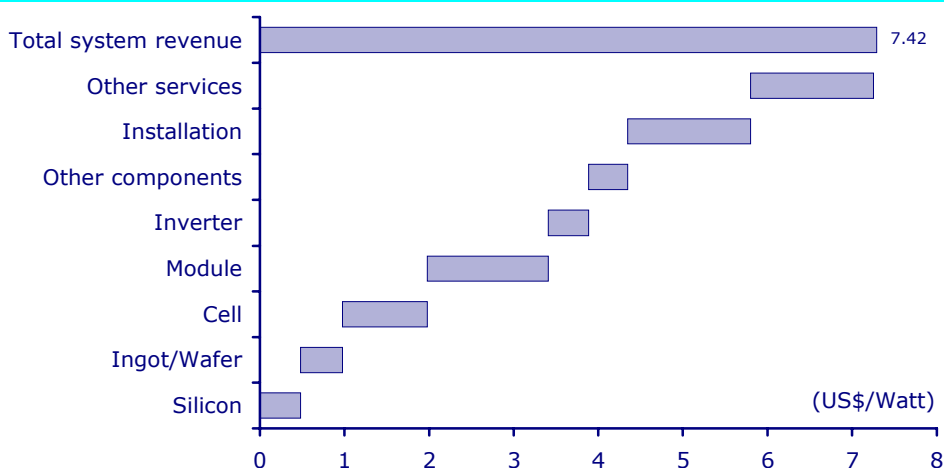
**Global average prices**

(US\$/Watt)	2004	2005	2006	2007	2008	2009	2010
<b>Silicon</b>	<b>0.42</b>	<b>0.48</b>	<b>0.55</b>	<b>0.50</b>	<b>0.405</b>	<b>0.32</b>	<b>0.28</b>
Growth (\$/watt)		0.06	0.07	(0.05)	(0.10)	(0.09)	(0.04)
Growth (% YoY)		15	15	(9)	(19)	(21)	(13)
<b>Wafers</b>	<b>1.00</b>	<b>1.15</b>	<b>1.23</b>	<b>1.18</b>	<b>1.09</b>	<b>1.00</b>	<b>0.96</b>
Growth (\$/watt)		0.15	0.08	(0.05)	(0.10)	(0.09)	(0.04)
Growth (% YoY)		15	7	(4)	(8)	(8)	(4)
<b>Cells</b>	<b>2.0</b>	<b>2.30</b>	<b>2.42</b>	<b>2.29</b>	<b>2.18</b>	<b>2.03</b>	<b>1.89</b>
Growth (\$/watt)		0.30	0.12	(0.12)	(0.11)	(0.15)	(0.14)
Growth (% YoY)		15	5	(5)	(5)	(7)	(7)
<b>Modules</b>	<b>3.25</b>	<b>3.58</b>	<b>3.75</b>	<b>3.57</b>	<b>3.39</b>	<b>3.15</b>	<b>2.93</b>
Growth (\$/watt)		0.33	0.18	(0.19)	(0.18)	(0.24)	(0.22)
Growth (% YoY)		10	5	(5)	(5)	(7)	(7)
<b>Inverters</b>	<b>0.5</b>	<b>0.48</b>	<b>0.45</b>	<b>0.43</b>	<b>0.41</b>	<b>0.39</b>	<b>0.37</b>
Growth (\$/watt)		(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Growth (% YoY)		(5)	(5)	(5)	(5)	(5)	(5)
<b>Other components</b>	<b>0.5</b>	<b>0.47</b>	<b>0.43</b>	<b>0.40</b>	<b>0.37</b>	<b>0.35</b>	<b>0.32</b>
Growth (\$/watt)		(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Growth (% YoY)		(7)	(7)	(7)	(7)	(7)	(7)
<b>Installation</b>	<b>1.50</b>	<b>1.45</b>	<b>1.40</b>	<b>1.35</b>	<b>1.30</b>	<b>1.25</b>	<b>1.20</b>
Growth (\$/watt)		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Growth (% YoY)		(3)	(3)	(4)	(4)	(4)	(4)
<b>Other (services, etc)</b>	<b>1.50</b>	<b>1.45</b>	<b>1.40</b>	<b>1.35</b>	<b>1.30</b>	<b>1.25</b>	<b>1.20</b>
Growth (\$/watt)		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Growth (% YoY)		(3)	(3)	(4)	(4)	(4)	(4)
<b>Total</b>	<b>7.25</b>	<b>7.42</b>	<b>7.44</b>	<b>7.10</b>	<b>6.77</b>	<b>6.39</b>	<b>6.02</b>
Growth (\$/watt)		0.17	0.02	(0.34)	(0.33)	(0.38)	(0.36)
Growth (% YoY)		2	0	(5)	(5)	(6)	(6)

Note: Rough estimates.

Figure 56

**2005 global average prices**



Note: rough estimates. Source: CLSA Asia-Pacific Markets

It is worth noting that the up-tick in prices for silicon, wafers, cells and modules does not apply to other components and services that do not have silicon inputs. For example, inverter prices have decreased approximately 5% YoY according to the largest inverter manufacturers. These price decrease are the result of an increasing number of competitors and significant cost reductions (>7% YoY) for larger manufacturers. We expect this downward trend in price for inverters, other components, installations and other services to continue through the end of the decade. While these prices are decreasing

**Mid-term prices have upside beyond our estimates . . .**

**. . . but longer-term prices have downside**

**With limited pricing pressure, all cost savings increase profits**

as the result of a combination of competition and cost reductions, it would be inaccurate to characterize the pricing environment as high pressure because profit margins remain positive.

We see both upside and downside potential relative to our pricing estimates. In the near-term, we believe there is *significant upside potential for prices*, driven by strong customer demand exceeding capacity. Currently, many companies express reluctance to increase prices substantially for fear of potential backlash among supportive politicians and of upstream suppliers raising prices further. However, all acknowledge that customers are willing to pay substantially higher prices. There is potential that companies who are attempting to recoup investments at low utilization rates by raising prices could increase the 2006 average industry module price by perhaps 10% (instead of 5%) and end-customer prices by perhaps 3% (instead of 0%). For now, though, we are not incorporating this more aggressive price increase into our forecasts.

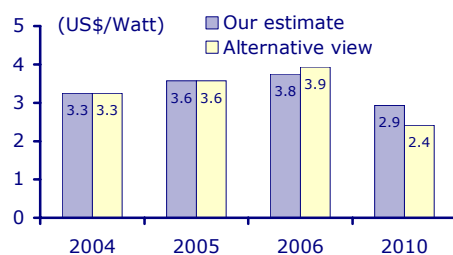
In the longer-term, we see potential downside in prices relative to our estimates. There are three factors that could combine to push down prices in 2007 through 2010 faster than our projections. These three factors are:

- 1) Faster-than-expected annual reductions in specific government subsidies such as the annual 5% decrease in Germany’s buy-back rates;
- 2) Very fast cost reductions which create significant profit margin cushion for companies to cut costs while remaining profitable; and
- 3) Overcapacity from new entrants such as companies in China who are willing to cut prices in order to gain market share.

Taken together, these factors lead us to provide an “alternative view” that prices may increase faster than anticipated in 2006 and fall faster than anticipated through 2010.

Figure 57

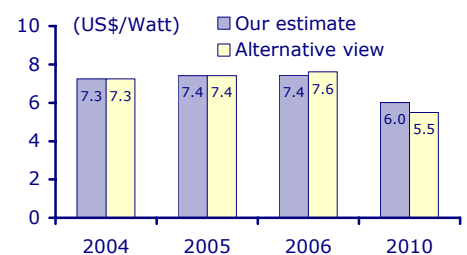
**Module prices**



Source: CLSA Asia-Pacific Markets

Figure 58

**End-customer installation price**



Note: Rough estimates.

Overall, the main point we want to convey is that pricing pressure for the next two years will remain limited and that significant price decreases are unlikely. This creates a very attractive environment for cost reductions because *all decreases in costs fall straight to the bottom line*.

**Impressive revenue growth**

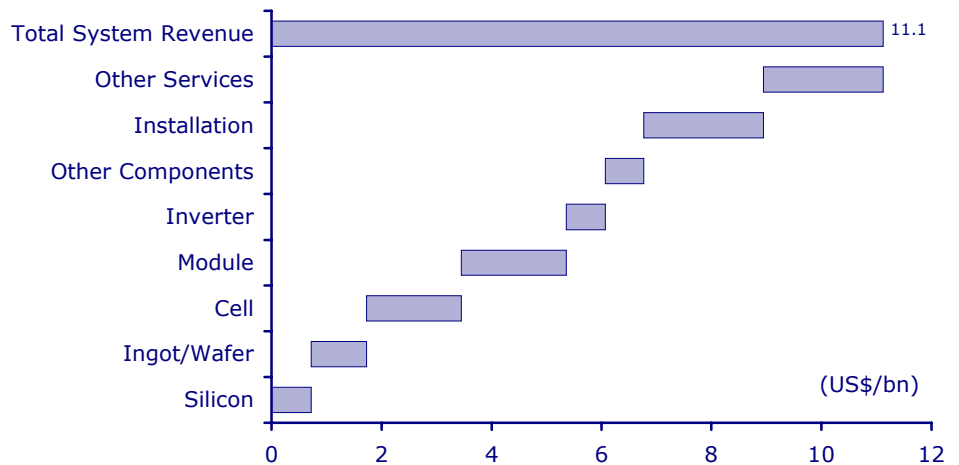
With volume rising and prices firm, revenue is increasing at an impressive rate. We expect revenue for the solar sector to increase from US\$8.3bn in 2004 to US\$11.1bn in 2005, US\$15bn in 2006 and US\$36bn in 2010. This represents roughly 33% revenue growth in 2005, 35% in 2006 and 20-30%

**Most revenue is in cell/module and installation/other services**

or more per year through 2010. Based on the upside and downside potential for volumes and prices (discussed in preceding subsections), we see a realistic range of US\$20bn-US\$52bn in 2010, representing 1.9x to 4.3x increase over the next 5 years, with our estimate of 3.2x.

Figure 59

**2005 solar power revenue pool**



Note: Rough estimates.

Figure 60

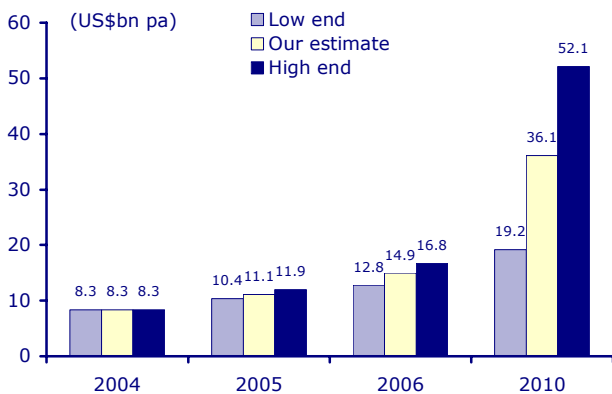
**Solar power revenue pool (US\$bn)**

	2004	2005	2006	2007	2008	2009	2010
Silicon and other feedstocks	0.5	0.7	1.1	1.3	1.4	1.5	1.7
Wafer	1.2	1.7	2.5	3.1	3.8	4.6	5.8
Cell	2.3	3.5	4.9	6.0	7.7	9.3	11.3
Module	3.7	5.4	7.6	9.3	12.0	14.5	17.6
Inverter	0.6	0.7	0.9	1.1	1.4	1.8	2.2
Other components	0.6	0.7	0.9	1.1	1.3	1.6	1.9
Installation	1.7	2.2	2.8	3.5	4.6	5.8	7.2
Other (services, etc.)	1.7	2.2	2.8	3.5	4.6	5.8	7.2
<b>Total</b>	<b>8.3</b>	<b>11.1</b>	<b>15.0</b>	<b>18.6</b>	<b>23.9</b>	<b>29.4</b>	<b>36.1</b>

Note: Rough estimates.

Figure 61

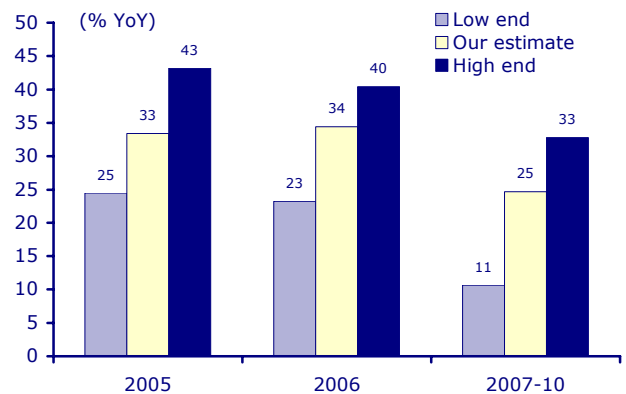
**Range of realistic industry revenue**



Note: Rough estimates. Source: CLSA Asia-Pacific Markets

Figure 62

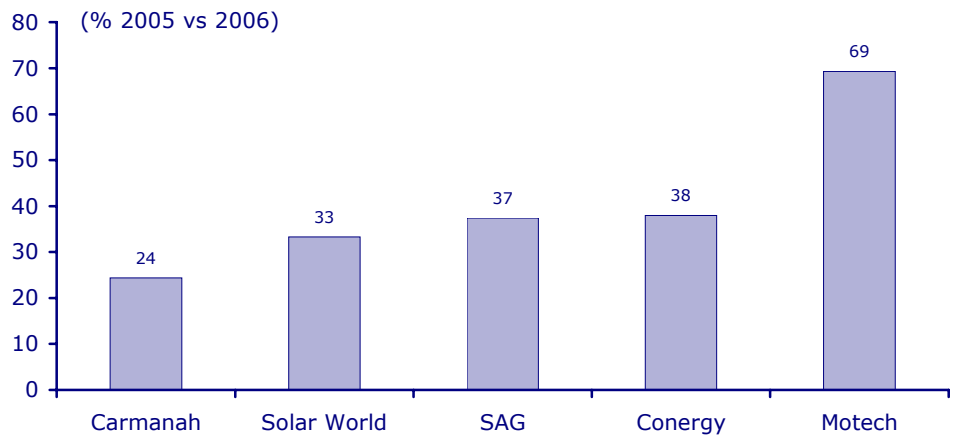
**Range of realistic revenue annual growth rates**



**Aside from Si, costs are falling 7-10% per year**

Figure 63

**Consensus revenue growth expectations for solar companies**



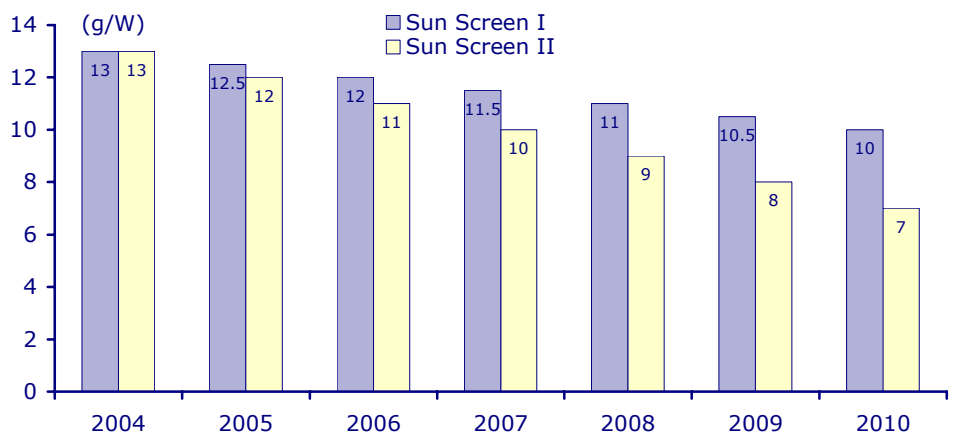
Note: Sample of companies selected based on available data. Source: Bloomberg, Company Annual Reports, CLSA Asia-Pacific Markets

**Significant cost reductions**

Perhaps more impressive than revenue growth are the cost reductions being achieved by players across the industry. Among the companies we have visited, cost reductions of 7-10% are typical (outside silicon feedstock prices). Most notably, silicon usage per Watt is falling much faster than expected due to better sawing, more recycling, less breakage and higher-efficiency cells. As a result, we have revised our estimate through 2010. This has been reviewed by several top executives in the sector, with the bulk saying that it is a realistic picture of the likely improvements over the next five years.

Figure 64

**Usage of silicon feedstock per Watt**



Note: Rough estimates. Source: CLSA Asia-Pacific Markets

In addition to improved silicon usage, several leading companies are benefiting from lower cost module assembly in China and the Philippines, lower cost-per-Watt manufacturing equipment, higher yields/lower breakage from stronger process controls, and marketing/sales budgets that are diminishing as a percentage of sales as the companies grow larger.<sup>28</sup>

<sup>28</sup> The two caveats to this impressive performance are, first, that it does not apply to silicon manufacturers, who are not seeing much improvement in cost structure and, second, the cost reductions are irrelevant to players unable to operate at high utilization rates due to insufficient feedstocks.

**Pretax margins are expanding from 15% in 2004 to 21% in 2005 and 25% in 2006**

With help from leaders in industry, we have attempted to estimate weighted-average profit margins for the industry that account for both the high-performing players that have feedstock and the low-utilization players that do not. On average, we estimate that pretax margins are expanding from 15% in 2004 to 21% in 2005 and 25% in 2006-07. From 2008, we expect average pretax margins to decrease as increasing silicon feedstock begin to reduce the gap between demand and production and allow moderate levels of pricing competition to return.<sup>29</sup>

Our estimate of industry average margins is built-up from margin estimates for each segment of the supply chain. These segment-specific estimates were initially made by bottom-up analysis of specific companies in each segment, and then modified based on feedback from industry leaders in each segment. For example, typical pretax margins for modules are lower than global average for many players, but module makers in China and Japan bring up the global average.

Figure 65

**Industry average pretax margins**

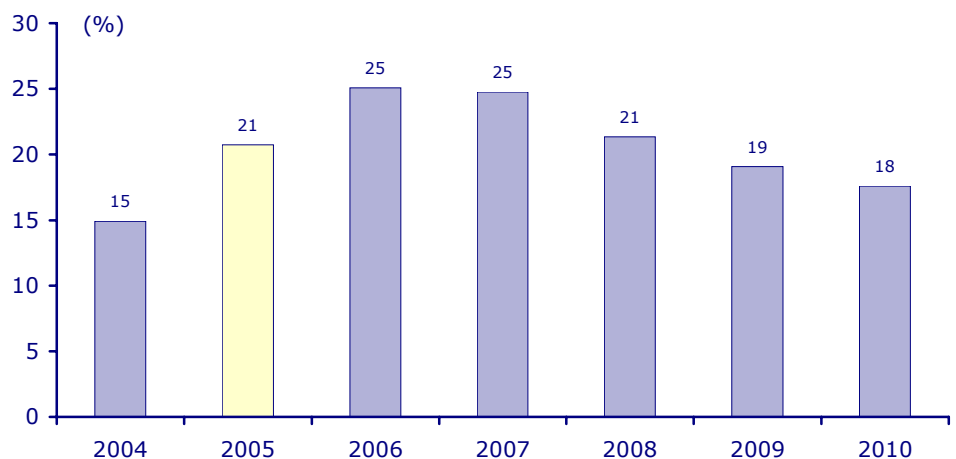


Figure 66

**Silicon pretax margins**

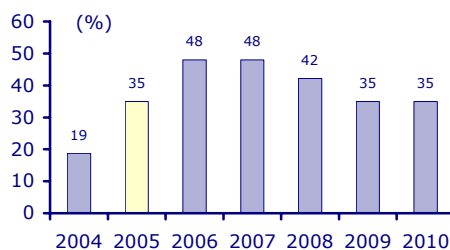
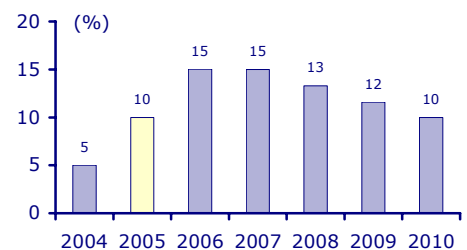


Figure 67

**Wafer pretax margin**



Source: CLSA Asia-Pacific Markets

<sup>29</sup> A minority of interviewees say that their "gut feeling says that industry average numbers are too high." However, these same interviewees also say that cost reduction potential is significant over next 5 years (often 30-40%) and that prices are unlikely to see a rapid drop due to strong demand. The result of bottom-up, segment-by-segment review of margins is that we believe our margin estimates are, if anything, too conservative.

Figure 68

**Cell pretax margin**

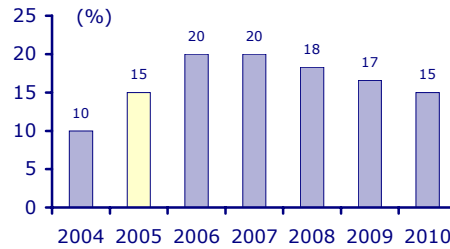


Figure 69

**Module pretax margin**

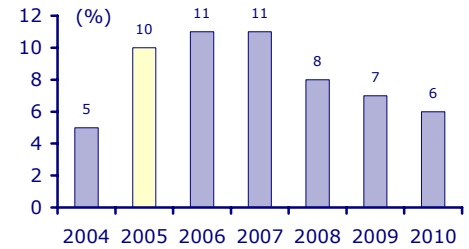


Figure 70

**Inverter pretax margins**

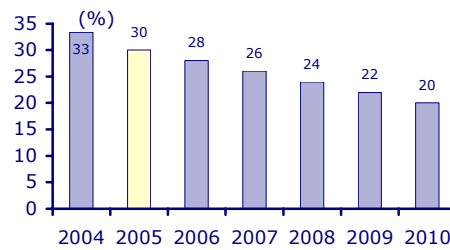


Figure 71

**Installation pretax margin**

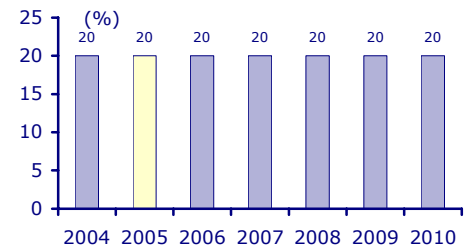


Figure 72

**Global average pretax margins**

(%)	2004	2005	2006	2007	2008	2009	2010
Silicon	19	35	48	48	42	35	35
Wafer	5.0	10.0	15.0	15.0	13.3	11.6	10.0
Cell	10.0	15.0	20.0	20.0	18.3	16.6	15.0
Module	5	10	11	11	8	7	6
Inverter	33.3	30.0	28.0	26.0	24.0	22.0	20.0
Other components	10	10	10	10	10	10	10
Installation	20	20	20	20	20	20	20
Other (services, etc.)	5	5	5	5	5	5	5
Total	15	21	25	25	21	19	18

Note: Rough estimates. Source: CLSA Asia-Pacific Markets

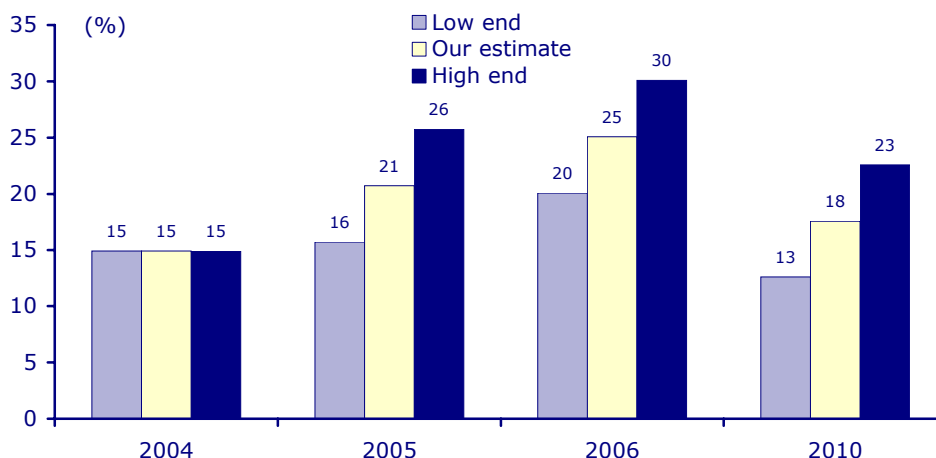
Given the considerable complexity of estimating industry average margins in a sector with overcapacity, a large portion of private companies/subsidiaries and a broad range between leaders and laggards, all of the above should be taken as rough benchmarks that appear to be “reasonable” according to interviewees. Based on feedback, we believe these estimates are accurate within plus- or minus-5 percentage points. As such, Figure 73 present a range of plausible industry average margins.<sup>30</sup>

**Margin expansion likely for next 12-18 months (perhaps longer)**

<sup>30</sup> We want to emphasize that our estimates of pretax margins could end up as significant underestimates for 2007-2010. We have estimated overall margins for the sector as a build-up of margins in each segment of the supply chain. If instead we estimate cost reductions at each step of the supply chain, then project total costs and finally subtract these costs from revenues in order to estimate pretax profit and pretax margins, we end up with margin growth rates that stay a high levels (>13% for modules and >20% for cells) through 2010 instead of starting to dip from 2008. Frankly, the real cost reductions that we have observed in the manufacturing plants (both already captured cost reductions and cost reductions likely to be captured in the next 2-3 years) are often significantly stronger than when we have incorporated into our margin estimates above.

Figure 73

**Range of industry average pretax margins**



Note: Rough estimates. Source: CLSA Asia-Pacific Markets

**Profitable growth likely according to nearly all industry leaders**

**Margin expansion for next 12-18 months, perhaps longer**

**Strong earnings growth over next 5 years**

It is important to emphasize three key points:

- 1) First, regardless the exact margin level, *most industry leaders expect profitable growth to continue through the end of the decade.* While modest margin contraction is anticipated in some areas (e.g. inverters through the end of the decade and modules from 2008 through 2010), we do not expect to see the sector turn unprofitable before the end of the decade.
- 2) While a rapid ramp of capacity in Korea and China is likely, we expect that these *new entrants will not have significant margin impact for the overall sector until after 2010.*
- 3) There will, of course, be exceptions to this view when we look at specific companies. *Identifying winners who are likely to outperform the industry is a major focus of Section 4.*

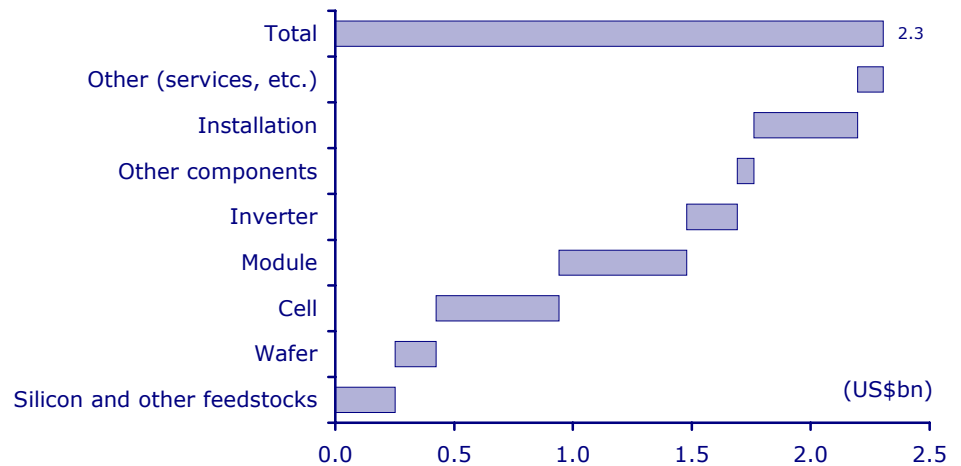
In sum, our outlook is for margin expansion in 2006 followed by slow contraction in 2008-2010. We still see the industry operating at attractive operating margins even in these later years, but expect that loosening feedstock constraints will enable competition that eats into margins. However, we also see potential upside for margins beyond our expectations driven by the very strong cost reductions in the factories.

**Robust profit growth**

With revenue growing quickly and margins expanding for the next 18 months (perhaps longer), we expect the solar sector's earnings growth to continue at a rapid pace. We estimate pretax profit for the sector is expanding from US\$1.2bn in 2004 to US\$2.3bn in 2005, to US\$3.8bn in 2006 and US\$6.4bn in 2010. This represents 2.8x growth in the solar profit pool between 2005 and 2010.

Figure 74

**Solar power pretax profit pool**



Note: Rough estimates.

Figure 75

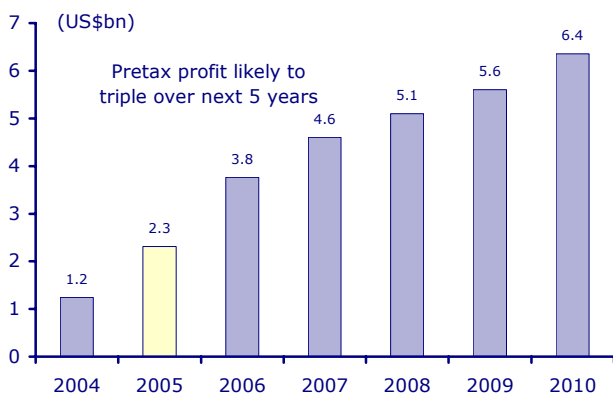
**Solar power pretax profit pool**

(US\$bn)	2004	2005	2006	2007	2008	2009	2010
Silicon and other feedstocks	0.09	0.25	0.53	0.63	0.60	0.52	0.59
Wafer	0.06	0.17	0.37	0.47	0.51	0.54	0.58
Cell	0.23	0.52	0.98	1.20	1.41	1.55	1.70
Module	0.19	0.54	0.83	1.03	0.96	1.01	1.05
Inverter	0.19	0.21	0.26	0.29	0.35	0.39	0.44
Other components	0.06	0.07	0.09	0.11	0.13	0.16	0.19
Installation	0.35	0.44	0.57	0.71	0.92	1.15	1.44
Other (services, etc.)	0.09	0.11	0.14	0.18	0.23	0.29	0.36
<b>Total</b>	<b>1.2</b>	<b>2.3</b>	<b>3.8</b>	<b>4.6</b>	<b>5.1</b>	<b>5.6</b>	<b>6.4</b>

Note: Rough estimates.

Figure 76

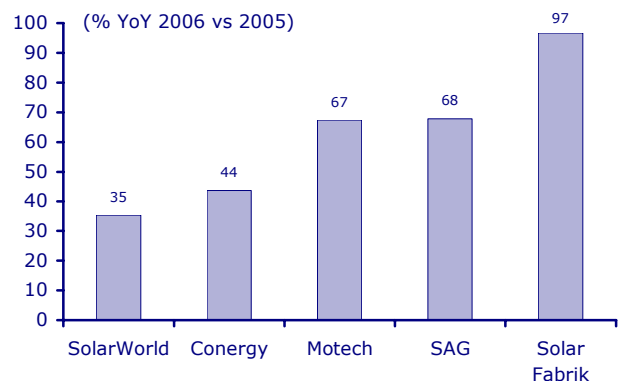
**Solar power pretax profit pool**



Note: Rough estimates. Source: CLSA Asia-Pacific Markets

Figure 77

**Consensus EPS growth estimates**



Note: Examples of growth rates among pure-play solar companies using consensus earnings estimates. Companies in this figure selected based on available data. It is worth noting that these are consensus earnings estimates. Please see write ups on individual companies in Section 4 for CLSA estimates.

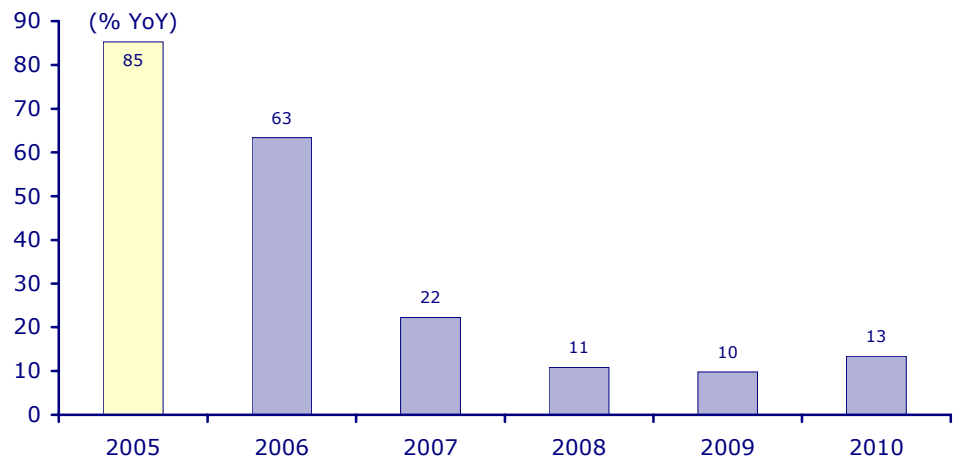
**As industry scale increases, strong growth will continue, but at slower rate than history**

It is worth highlighting that we expect the impressive profit pool growth rate (92% in 2005) will slow in the coming years. We estimate 63% growth in 2006, 22% in 2007 and only 10-13% for 2008-2010. This slowing growth

rate in profit pool is the result of two factors. First, it is based on our expectation that the tight silicon situation will slacken moderately in the coming years, with the result being a modest return in pricing pressure by the end of the decade. Second, we expect low utilization production equipment/machines will continue for many players and will continue to weigh down overall industry average margins. The result is that we expect industry average margins will begin falling slowly from 2007. While the industry remains profitable, the overall growth rate for the profit pool will likely slow.

Figure 78

**Solar power pretax profit pool growth rate**



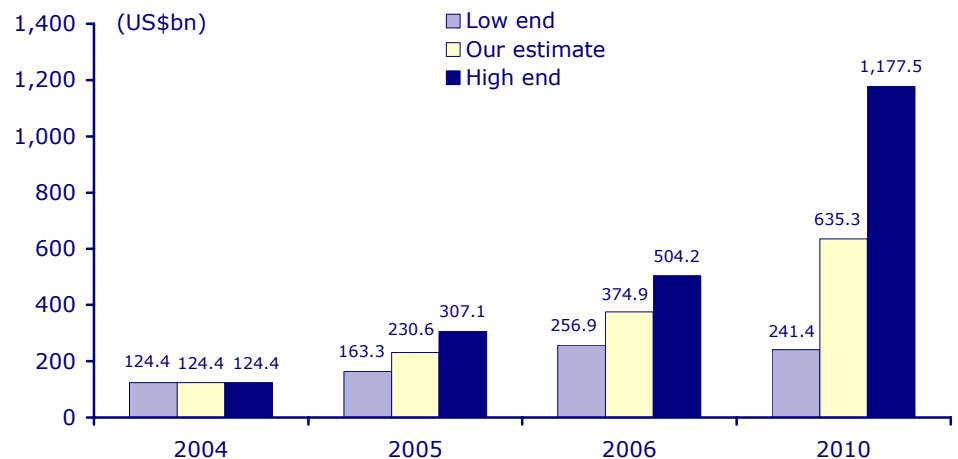
Note: Rough estimates. Source: CLSA Asia-Pacific Markets

**Well-positioned companies will likely expand margins for 2 years or more**

There are two important caveats to this view of decelerating - yet still substantial - earnings growth rates. First, we see realistic potential for well-positioned companies to continue expanding margins for at least the next 2 years, perhaps longer (see Section 4). Second, our estimates of industry average cost reductions are approximate. We see a range of possibilities for coming five years, with pretax profit of US\$1.6 to US\$3.1bn in 2005, US\$2.6 to US\$5.0 bn in 2006 and US\$2.4 to US\$11.8bn in 2010. This corresponds to a range of roughly 1.5x to 4x growth in profit from 2005 to 2010, with our estimate of roughly 3x.

Figure 79

**Range for solar power pretax profit pool**



Note: Rough estimates. Source: CLSA Asia-Pacific Markets

**We recommend a portfolio approach to solar stocks**

### **Rapid ramp ahead**

Section 2 discussed many of the risks facing the solar sector. Section 3 described the solar power sector's realistic potential to grow 4x in volume, 3x in revenue and 3x in profit by the end of the decade. In Section 4, we turn to our core recommendation: *investors should pursue a portfolio approach to solar power stocks that maximizes exposure to this fast growth sector while minimizing risks.*

**Solar stocks will continue to rise based on strong fundamentals**

**We strongly advise investors to pursue a portfolio approach not individual stocks**

**We have identified 15 of the brightest stocks in the sector**

## Portfolio of solar stocks

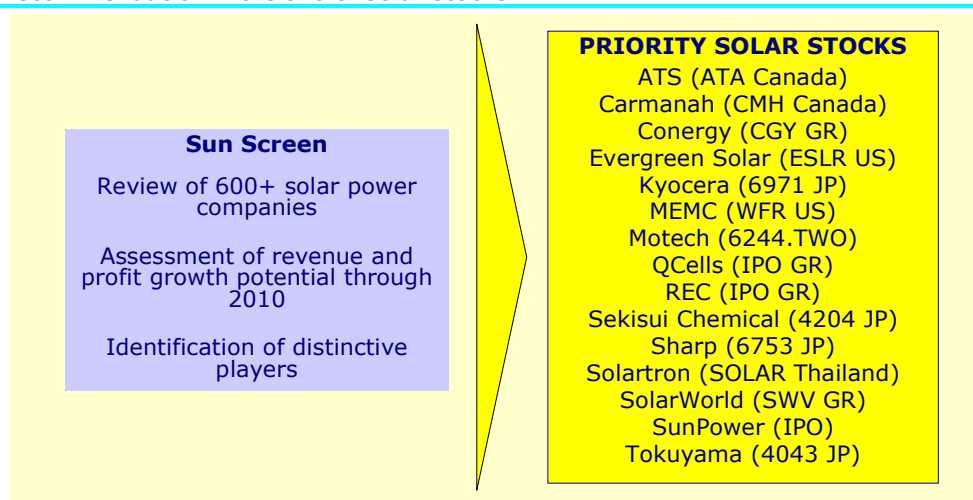
Expectations of multiple growth - 4x volume, 3x revenue and 3x profit growth through 2010 - have not led to unrealistic valuations. Most solar stocks are trading at 20x 2006 earnings despite the sector's very strong growth profile. For the best companies in the sector for whom annual EPS growth of more than 30% is realistic, we see at least 100% upside potential for stock prices over the next 2-3 years. In several cases, we see significantly more upside.

As we screened 600+ solar power companies, we sought to identify the industry leaders who are likely to not only ride the industry wave, but to outpace it. In addition, because we are highly sensitive to the industry's risks (see Section 2), we sought ways to minimize exposure while still investing in rapid growth.

Our recommendation is that investors pursue a *portfolio* of solar power stocks that offers both very significant upside and diversification to manage company-specific risks. The remainder of this section provides an overview of this portfolio and summaries for each stock.

Figure 80

### Recommendation: Portfolio of solar stocks



Source: CLSA Asia-Pacific Markets

### Overview: 15 priority solar power stocks

We suggest that investors carefully consider a portfolio of the following 15 stocks (listed alphabetically):

- 1) **ATS (ATA Canada):** Parent company of the largest solar operator in France. Its solar business accounts for 35% of operating profit and is a key driver of the company's EPS growth.
- 2) **Carmanah (CMH Canada):** Largest Canadian solar power company and manufacturer of the world's best integrated solar products (e.g. streetlights, bus shelters).
- 3) **Conergy (CGY GR):** World's largest solar wholesaler and a leader in German installations. We see realistic potential for at least 60% EPS growth in 2006 and 32% in 2007, and for significant stock price appreciation over next 2 years.

- 4) **Evergreen Solar (ESLR US)**: Owner of distinctive string ribbon wafer manufacturing process that has realistic potential to be the "next generation" for c-Si wafers and grow profitably from 1MW of production in 2005 to 1GW in 2010. We see realistic potential for 3x (or more) stock price appreciation over the next 2-3 years.
- 5) **Kyocera (6971 JP)**: The world's second largest solar company with 105MW in 2004, Kyocera is quickly following Sharp's rapid scaling and will have approximately US\$560m in solar revenue and US\$110m in solar pretax profit this year.
- 6) **MEMC (WFR US)**: One of the world's larger silicon manufacturers, we estimate the rapid rise in silicon prices and corresponding increase in wafer prices will push up silicon-related earnings in 2006.
- 7) **Motech (6244.TWO)**: Leading Taiwanese cell and module player that is aggressively searching for ways to overcome tight silicon supplies in order to meet very aggressive growth targets. We see potential for significant stock price upside over next 2-3 years if it succeeds in securing Si.
- 8) **Q-Cells (IPO GR)**: Germany's largest cell producer with distinct ability to set up new facilities and form partnerships with emerging industry leaders. We expect IPO in the coming months and see initial market cap of US\$1.4-2.8bn, with realistic potential to grow to US\$4.2bn by 2010.
- 9) **REC (IPO GR)**: Among the top silicon producers and wafer makers in the world, REC has very strong margin growth potential due to cost reductions and upstream integration. We expect IPO in the coming months with initial market cap of US\$1-2bn.
- 10) **Sekisui Chemical (4204 JP)**: World leader in highly automated prefab home construction. With 60% of homes manufactured with solar, Sekisui Chem is among the world's top solar installers and has option-value by potentially pursuing other opportunities in domestic and overseas solar markets either directly or in partnership. Based on DCF, we see 30% upside over next 12 months.
- 11) **Sharp (6753 JP)**: World's largest solar power company with US\$1.5bn in solar revenue and US\$150m in solar pretax profit this year. Sharp's solar revenue is expected to grow to approximately US\$5bn by 2010.
- 12) **Solartron (SOLAR Thailand)**: Thailand's leading solar power company with potential for significant scaling as Thailand's pro-solar policies expand the domestic market.
- 13) **SolarWorld (SWV GR)**: SWV is the largest solar stock by market cap (US\$1.1bn) and is one of Germany's leading solar companies (revenue US\$360). We see 35-70% upside potential in stock price over next 12-24 months as EPS increases from US\$4.4/share in 2006 to US\$6.00/share in 2007 and US\$7.7/share in 2008.
- 14) **SunPower (IPO)**: Currently a subsidiary of Cypress Semiconductor, this fast-growing unit has the world's best cell efficiencies, capturing premium prices while keeping costs down by manufacturing in Philippines. We expect an IPO later this year with initial market cap of US\$400-700m and realistic potential to expand to more than US\$2bn by 2010.
- 15) **Tokuyama (4043 JP)**: Japan's largest silicon producer, with silicon accounting for 46% of total operating profit this year. We see the stock Outperforming this year, with potential upside in future years from profitable Si expansion.

**Strong rationale for pursuing portfolio instead of individual stocks**

**Our goal: Highlight stocks that have potential to shape this rapidly expanding space**

A summary of each of these stocks is provided below.

### **Rationale for a portfolio approach to solar stocks**

We see these 15 stocks as an exciting portfolio for five reasons:

- 1) **Best positioned companies to lead industry in 2010.** The stocks in this portfolio represent many of the best-positioned companies in the sector. In 2010, Evergreen, Conergy, Kyocera, MEMC, Q-Cells, REC, Sharp, SolarWorld, SunPower and Tokuyama have realistic potential to hold global market share of 10% or more in their segments of the supply chain.
- 2) **Very strong earnings growth potential through 2010.** All 15 companies have very strong earnings growth potential with realistic potential to significantly outperform industry average earnings growth over the next several years.
- 3) **2x-3x stock price potential for many based on fundamentals.** Based on strong earnings growth and reasonable valuations, we see several stocks - Conergy, Evergreen, Motech, Q-Cells, REC, SolarWorld and SunPower - with realistic potential for 2-3x stock price appreciation over the next 2-3 years.
- 4) **Balances risks.** This portfolio has a number of internal balances that reduces exposure to risks:
  - Because it has a large number of companies, it is less likely to be exposed to significant downside from the tight silicon market.
  - Because it is geographically diversified, it is less exposed to policy changes in any specific geography.
  - Because it is diversified along the supply chain, it provides balance to risks that one segment of the supply chain will falter due to overcapacity or inadequate feedstock.

Overall, we view the reduction of risks from the portfolio as being much more attractive on a risk-reward basis than an investment in any single solar stock.

- 5) **Creates upside.** One off events could have large, positive impacts on solar stock prices. For example, if the Thai or Taiwanese governments passed a new pro-solar policy, Solartron or Motech would benefit. If the Los Angeles city government put out an RFP for a large number of solar bus shelters, Carmanah would benefit. If Tokuyama announced strong performance of its VLD silicon manufacturing process or if Sekisui Chemical entered into an appropriate agreement to jointly manufacture prefabricated solar homes in an international market, their stock prices would likely benefit. These types of one-off events are not guaranteed and are not the basis for investments in any specific stocks, but they do create significant upside potential for the overall portfolio.

### **Summary information on solar stocks**

Solar power is an exciting industry with very strong growth prospects that most industry observers expect will continue. We have made strenuous efforts to identify the best-positioned companies in this sector that are accessible to investors. Our goal has been to highlight the stocks with potential to make a major impact in this rapidly expanding space.

In our view, all of the companies below offer very significant upside. Yet it is certain that the future will not develop as expected for all these stocks. The company-specific details provided below should be taken as our view of the most likely scenario for the future, with the recognition that projecting the future in such a fast-moving space is impossible.

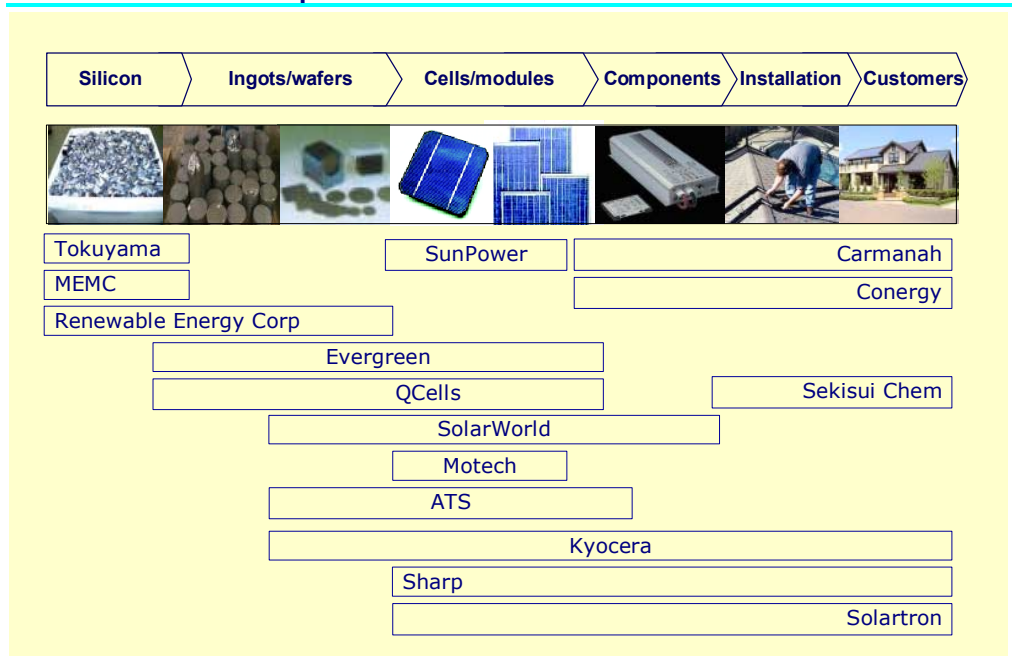
Overall, we see demand surging, prices remaining solid, costs falling, production capacity expanding and government support continuing for the next several years and expect that **the sun will continue to shine for stock in this solar portfolio.**

The remainder of this section provides two-page write-ups on each of these companies.

Figure 81

**Overview of solar stock portfolio**

**A balanced portfolio of solar stocks provides significant upside while reducing risks**



Source: CLSA Asia-Pacific Markets

## Company profiles

Conergy .....	47
Evergreen Solar.....	49
Kyocera.....	51
Motech.....	53
Q-Cells.....	55
REC .....	57
Sekisui Chem.....	59
Sharp .....	61
SolarWorld.....	63
SunPower .....	65
Tokuyama.....	67
Other solar stocks.....	69

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All prices quoted herein are as at close of business 15 June 2005, unless otherwise stated

**Notes**



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**Germany**

**Energy/Electronics**

Reuters 604002  
Bloomberg CGY GR

**Priced on 15 June 2005**

**Market cap** US\$865m  
**Shares in issue** 10m

**3M average daily volume**

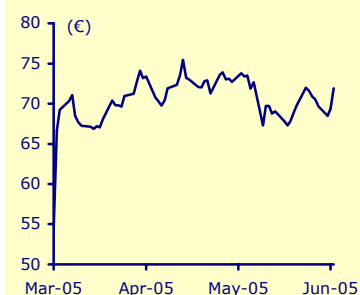
US\$10.4m

**12M high/low**

€75.5/54.4

**Stock performance (%)**

	1M	3M	12M
Absolute	(3)	32	NA(IPO)



Source: Bloomberg

[www.clsa.com](http://www.clsa.com)

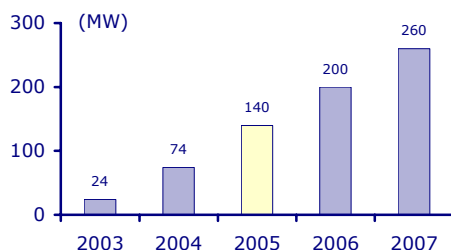
**Downstream dealer**

□ **Overall financial performance:** Conergy is the largest downstream solar company in the world, with some €550m in revenue, €50m in OP and net profit of €30m in 2005 from its wholesale, integration and installation businesses. We see realistic potential for organic growth to enable the company to more than double in revenue, and operating and net profit by 2007. With more than US\$100m in cash, we see further upside from value-added acquisitions.

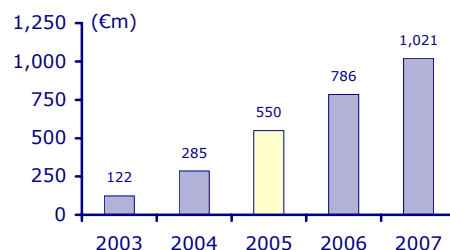
□ **Solar power:** Conergy is a leader in the German market with 140MW in business this year, up from 74MW in 2004 (+89% YoY). Conergy appears likely to more than double its volume by 2007 to 260MW or more. The company is hyper-aggressive and could exceed these expectations via acquisitions. We expect Conergy to focus more attention on growing its higher-margin businesses, expanding operations outside Germany (non-Germany sales were only 5% of revenue in 2004) and pursuing solar thermal opportunities. One risk to earnings growth is a potential shortfall in module supplies, but we believe this risk is being rigorously addressed by the company via its strong supplier relationships.

□ **Stock performance potential:** We expect earnings to double by 2007, with EPS growing 60% in 2006 and at least 32% in 2007. Given this strong growth, we see significant upside in the stock price over the next two years driven by earnings alone. In addition, acquisitions provide potential upside triggers. While risks of new entrants and pricing competition will eventually hit, we do not see these as significant threats before 2008, at the earliest, and perhaps not until after 2010. Currently trading at 15x 2006 earnings, we recommend Conergy be included in any portfolio of solar stocks.

**Volume**



**Revenue**



Note: Rough estimates.

**Preliminary analysis<sup>1</sup>**

	2003A	2004A	2005A	2006C	2007C
Revenue (€m)	122	285	550	786	1,021
Growth (% YoY)	-	133	93	43	30
OP (€m)	1	19	49	79	112
OP margin (%)	1	7	9	10	11
OP growth (% YoY)	-	1,800	160	59	43
Net profit (€m)	0	11	31	49	65
Net margin (%)	0.3	3.9	5.6	6.2	6.4
EPS (€)	0.0	1.1	3.1	4.9	6.5
PE (x)	1,798	65	23	15	11

<sup>1</sup> All estimates are rough estimates. Source: CLSA Asia-Pacific Markets

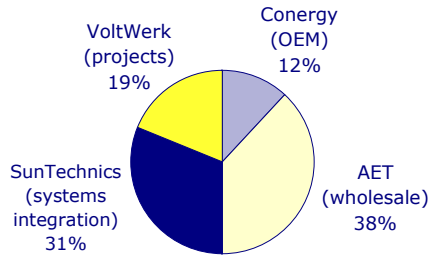
**Conergy is a diversified downstream solar power player**

**Strong earnings growth and continuing margin expansion, with upside beyond our estimates**

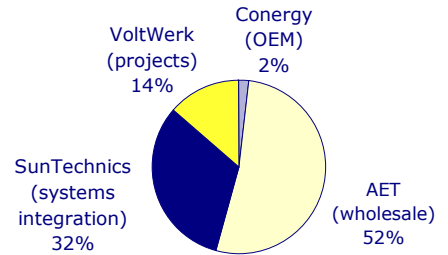
**Conergy is one of the largest solar stocks and its market cap will grow as earnings expand**

**We see significant upside in Conergy's stock price over the next 1-2 years**

**Revenue by business unit - 2004**

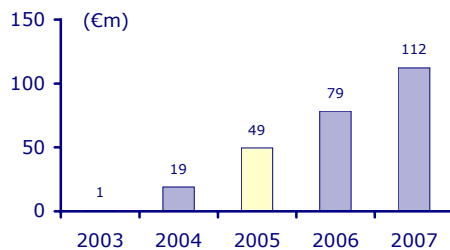


**OP by business unit - 2004**

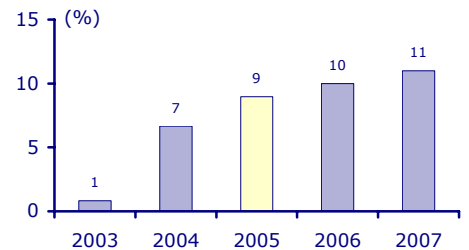


Note: Rough estimates. Does not account for inter-segment activities.

**Operating profit - 2005**

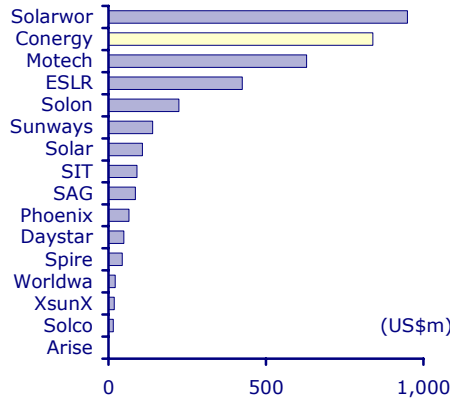


**OP margin - 2005**

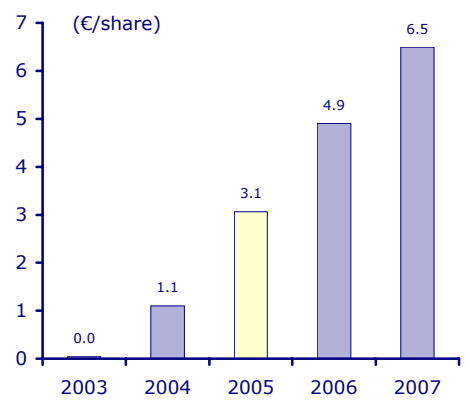


Note: All estimates are rough estimates.

**Market cap of solar stocks**



**EPS**



Note: All estimates are rough estimates.

**Key points about Conergy**

- World's second largest pure play solar stock with market cap more than US\$800m.
- Very strong history of growth (300% top line growth 2002-04).
- IPO in March leaves company with more than US\$100m for acquisitions and growth.
- Even without acquisitions, 60% EPS growth in 2006 is realistic.
- €100/share would put CGYG at 20x 2006 earnings, a 40% premium to current price with further upside on a 12-to 24-month view.

Source: CLSA Asia-Pacific Markets

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### Brent Fisher

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## United States Energy/Electronics

Reuters ESLR.O  
Bloomberg ESLR US

**Priced on 15 June 2005**

**Market cap** US\$430m  
**Shares in issue** 60.9m  
**Free float (est.)** 72%

**12M high/low**  
US\$7.76/2.04

#### Major shareholders

Wellington 4.2%  
Alvdar Partners 2.9%

#### Stock performance (%)

	1M	3M	12M
Absolute	27	7	141



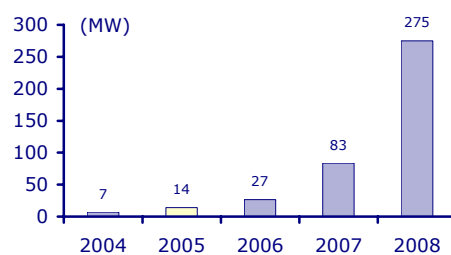
Source: Bloomberg

[www.clsa.com](http://www.clsa.com)

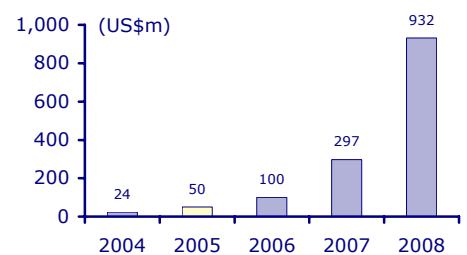
## Profit string

- Overall financial performance:** ESLR is a pure-play solar wafer/cell/module manufacturer using distinctive "String Ribbon" technology. The company is small and not yet profitable, with US\$24m in 2004 revenue and an OP margin of -80%. ESLR is quickly ramping up capacity, growing revenue and approaching profitability (positive OP margins by mid-2006). We believe ESLR (in partnership with Q-Cells) will establish the industry's lowest cost structure for wafers/cells/modules by year-end 2006. By 2008, we see realistic potential for US\$1bn in revenue, growing to US\$2.6bn in 2010. More importantly, we see potential for OP margins sustained above 20% by 2008.
- Solar power:** ESLR's proprietary "String Ribbon" technology uses approximately 65% of the silicon of traditional production methods by avoiding wafer sawing and is working on thin wafers to reduce this to 35%. This process could reduce costs to more than 30% below other production technologies. With capacity increasing 10x from 15MW in 2004 to ~140MW by year-end 2007, ESLR is positioning itself to capture increasing economies of scale necessary to compete with other technologies. We believe ESLR's technology is the "most likely nominee" to replace conventional crystalline Si technologies, and ESLR is taking realistic steps to capture a leadership position by 2007.
- Stock performance potential:** As a small, rapidly growing, but unprofitable company, ESLR is difficult to value. Our DCF analysis using 10-15% discount rates and 0-5% terminal growth provides a range of US\$6.35 to US\$31.05. Given the company's explosive growth potential, we believe the stock has realistic potential to trade above US\$8.00 (20x 2007 earnings) in the next year and above US\$28 (20x 2008 earnings) in the next two years if it hits the realistic milestones laid out by management. We recommend including ESLR in a portfolio of solar stocks.

#### Production



#### Revenue



Note: Rough estimates.

#### Preliminary analysis<sup>1</sup>

	2004A	2005C	2006C	2007C	2008C
Total revenue (US\$m)	24	50	100	297	932
Gross profit (US\$m)	(8)	4	20	89	326
Gross margin (%)	(32)	8	20	30	35
Operating profit (US\$m)	(19)	(19)	(3)	46	191
Operating margin (%)	(80)	(37)	(3)	16	21
Net profit (US\$m)	(29)	(21)	(4)	24	112
Net margin (%)	(119)	(41)	(4)	8	12
EPS (US\$/share)	(0.86)	(0.35)	(0.06)	0.40	1.40
PE (x)	na	na	na	17.8	5.0

<sup>1</sup> All estimates are rough estimates. Estimates based on ESLR meeting the milestones it has established, such as successful operation of 30MW plant in Germany in 2006 expanding to 100MW in 2007. Source: CLSA Asia-Pacific Markets

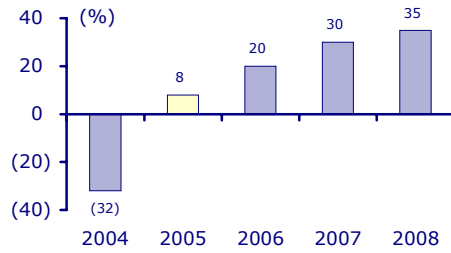
**ESLR is heading quickly toward profitability**

**Realistic potential for impressive earnings growth from mid-2006**

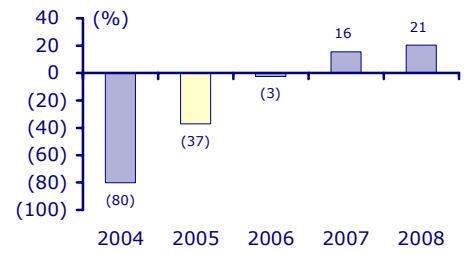
**ESLR is one of the most impressive innovators in the sector with numerous improvements on the way**

**We see significant upside in ESLR's stock price over the next 2-3 years**

**Gross margin**

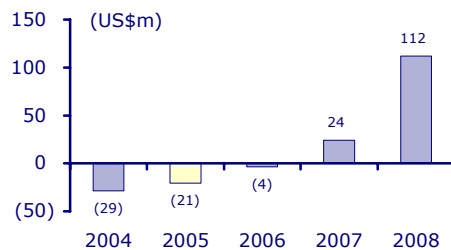


**OP margin**

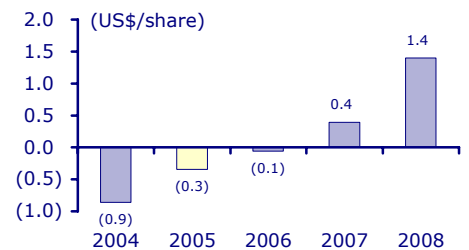


Note: Rough estimates. We expect positive OP margins by mid-2006.

**Net profit**



**EPS**



Note: All estimates are rough estimates.  
Source: CLSA Asia-Pacific Markets

**'Quad' production process**



Source: Evergreen Solar

**Much thinner 'Ribbons'**



**Key points about Evergreen Solar**

- ☐ Small and unprofitable today, but at tipping point for profit and hyper-growth.
- ☐ Most likely candidate for "next generation" technology.
- ☐ Uses same inputs (crystalline silicon) to create same output (wafer) without sawing.
- ☐ Saves 35% of silicon, with potential for higher savings from thin wafer technology.
- ☐ Strong partnership with Q-Cells, best-in-class cell manufacturer.
- ☐ Biggest risk is from slower-than-expected start-up of new plant in Germany.
- ☐ Difficult to value; on DCF appears inexpensive; earnings potential over next 2-3 years.

Note: Estimates assume no change in ownership structure for EverQ joint venture. A change in ownership percentages may occur in the future and affects earnings estimates. We suggest including both ESLR and Q-Cells in solar stock portfolio to address this uncertainty. Source: CLSA Asia-Pacific Markets

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**Japan  
Technology**

Reuters 6971.T  
Bloomberg 6971 JP

**Priced on 15 June 2005**

Topix @ 1,169.2

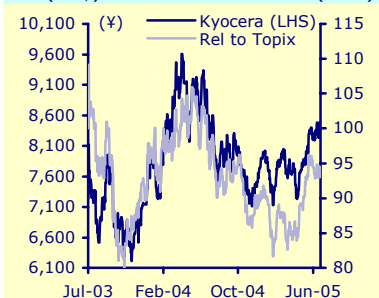
**Market cap** US\$14,710.7m  
**Shares in issue** 186.6m  
**Free float (est.)** 75.5%

**Major shareholders**

Japan Trustee Services Bank 8.5%  
Master Trust Bank of Japan 6.4%

**Stock performance (%)**

	1M	3M	12M
Absolute	3.8	7.7	(9.1)
Relative	(0.6)	9.6	(9.2)
Abs (US\$)	2.9	5.1	(10.3)



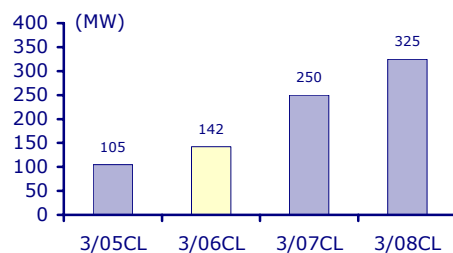
Source: Bloomberg

[www.cls.com](http://www.cls.com)

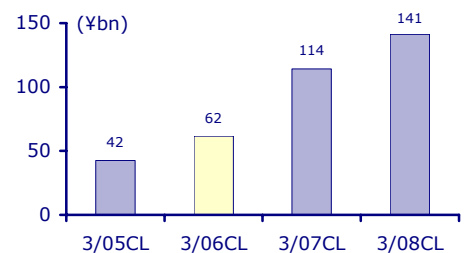
**Integrated solar player**

- **Overall financial performance:** Total revenue is expected to increase ¥1.18tr in FY3/05 to ¥1.24tr in FY3/06 (+5% YoY) and ¥1.28tr in FY3/07 (+3% YoY) and net profit is expected to increase from ¥46bn in FY3/05 to ¥78bn in FY3/06 (+70% YoY) and ¥87bn (+12% YoY) in FY3/07. In FY3/08, revenue is expected to increase 4% to ¥1.33tr and earnings are expected to increase 10% to ¥96bn.
- **Solar power:** Solar is a growth business for Kyocera. This year it accounts for ¥62bn in solar revenue (5% of total) and ¥12bn in OP (8% of total). We expect quick expansion of solar revenue to ¥114bn in FY3/07 (9% of total) and ¥140bn in FY3/08 (10% of total). Operating profit from solar is also expanding quickly, with ¥23bn in solar OP in FY3/07 (14% of total OP) and ¥28bn in OP (16% of total) in FY3/08.
- **Stock performance potential:** Trading at 18x FY3/07 earnings, Kyocera is at a multiple similar to pure play solar stocks. We expect the rapidly expanding solar business to emerge as a more noticeable driver of Kyocera's revenue, earnings and stock price over the next few years.

**Production**



**Solar revenue**



Note: Rough estimates.

**Preliminary analysis<sup>1</sup>**

	3/04A	3/05A	3/06C	3/07C	3/08C
Total revenue (¥bn)	1,141	1,181	1,241	1,280	1,326
Solar revenue (¥bn)	30	42	62	114	141
Solar/total revenue (%)	3	4	5	9	11
Total OP (¥bn)	109	101	120	168	174
Solar OP (¥bn)	1	6	12	23	28
Solar/total OP (%)	1	6	10	14	16
Net profit (¥bn)	68	46	78	87	96
EPS (¥)	365	245	414	464	511
PE (x)	22.96	34.23	20.22	18.05	16.40

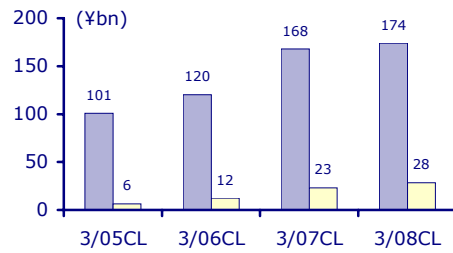
<sup>1</sup> Fiscal year 3/04 is year to March 2004. Estimates based on Conesus estimates from Bloomberg. Solar revenue and profit are rough estimates by CLSA. Source: CLSA Asia-Pacific Markets

**Solar is becoming an increasingly important part of Kyocera's earnings**

**Kyocera is the second largest Japanese maker and has 9% global market share by volume**

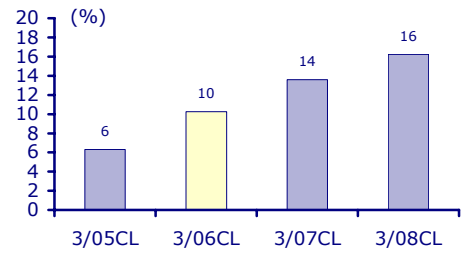
**Kyocera's integrated solar power strategy is paying off with high margins**

**Total OP and solar OP**

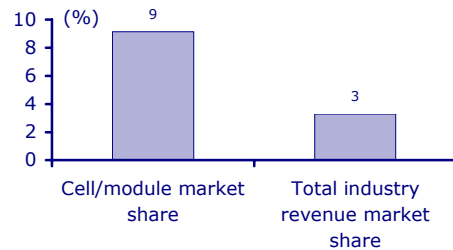


Note: Rough estimates based on Consensus. Source: Bloomberg, CLSA Asia-Pacific Markets

**Solar OP/total OP**

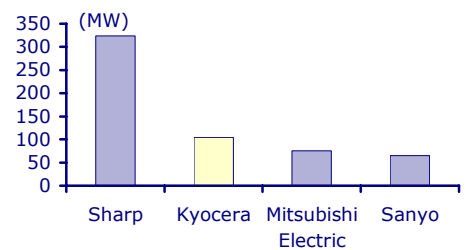


**Kyocera global market share**

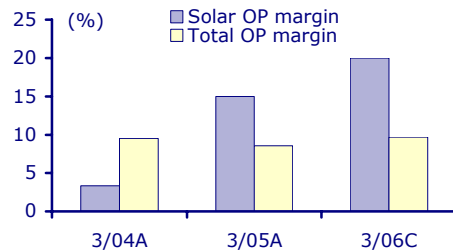


Note: Rough estimates. Cell/module market share based on 1150MW production in 2004. Total industry revenue market share based on US\$8.3bn revenue pool for total industry. Revenue market share lower than cell/module market share because it includes other installation, inverters, other components and services. Source: Companies, Photon International, CLSA Asia-Pacific Markets

**2004 cell/module production**

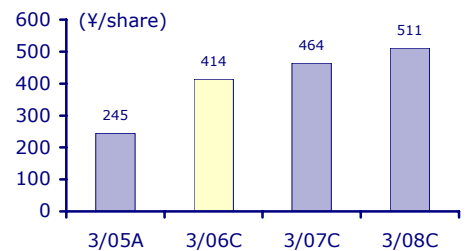


**Total OP and solar OP margin**



Note: Rough estimates. EPS based on Consensus earnings. Source: CLSA Asia-Pacific Markets

**EPS**



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**Energy/Electronics**

Reuters 6244.TWO  
Bloomberg MOEIF TWO

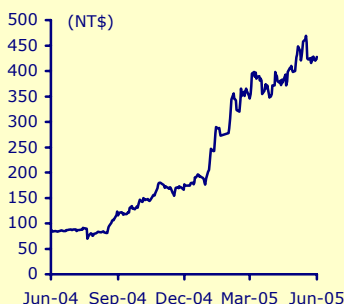
**Priced on 15 June 2005**

**Market cap** US\$629m  
**Shares in issue** 48m

**12M high/low**  
NT\$469/70

**Stock performance (%)**

	1M	3M	12M
Absolute	7	24	394

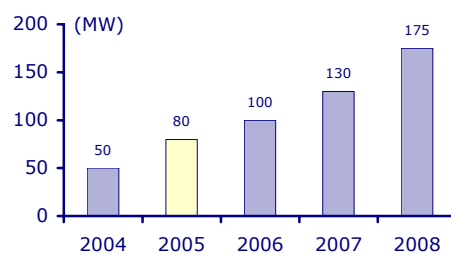


[www.cls.com](http://www.cls.com)

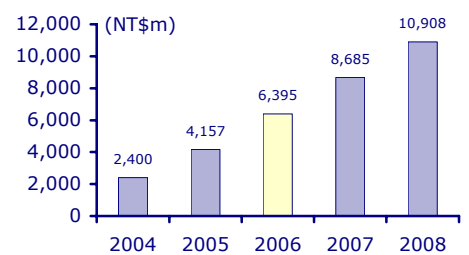
**Taiwan's solar leader**

- Overall financial performance:** Motech is a manufacturer of solar cells and is the largest solar power company in Taiwan. We estimate revenue will increase from NT\$2.4bn in 2004 to NT\$4.2bn in 2005 and NT\$6.4bn in 2006, and for EPS to increase from NT\$6.9/share in 2004 to NT\$12.3 in 2005 and NT\$16.7 in 2006. By 2010, the company has realistic potential to increase revenue 4x (to NT\$16bn) and net profit 2-3x (to NT\$1.4bn).
- Solar power:** As the leader in Taiwan's solar power sector, Motech is poised to continue its rapid expansion. Capacity has realistic potential to increase from 50MW in 2004 to 80MW in 2005 and 100MW in 2006, with production increasing from 35MW in 2004 to 54MW in 2005 and 80MW in 2006. The biggest challenge for Motech is securing silicon to maintain high utilisation. We do not expect this challenge will disappear before 2008, but believe Motech will secure enough Si to enable at least 30% annual volume growth through aggressive purchasing. By 2010, we believe Motech has potential for 300MW of capacity and 265MW of production.
- Stock performance potential:** Motech is trading at 25x 2006 earnings, putting it the higher end of solar stocks around the world. With realistic potential for net profit to triple by 2009 or 2010, we believe the stock has upside in the next two-to-three years. On the downside, the key risk is silicon (wafer) supplies, which creates potential for significant volatility in earnings growth. On the upside, stronger policy support for solar from the Taiwan government could create triggers for significant stock price appreciation. We include Motech in our solar portfolio in order to create exposure to this upside.

**Capacity**



**Revenue**



Note: Rough estimates

**Preliminary analysis<sup>1</sup>**

	2004A	2005C	2006C	2007C	2008C
Revenue (NT\$m)	2,400	4,157	6,395	8,685	10,908
Gross profit (NT\$m)	665	1,172	1,898	2,500	2,941
Gross margin (%)	28	28	30	29	27
OP (NT\$m)	449	798	1,322	1,758	2,055
Operating margin (%)	19	19	21	20	19
Net profit (NT\$m)	329	590	802	1,059	1,208
EPS (NT\$/share)	6.9	12.3	16.7	22.1	25.2
EPS growth (% YoY)		79	36	32	14
PE (x)	62.0	34.6	25.4	19.3	16.9

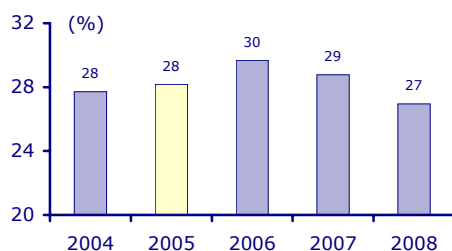
<sup>1</sup> All estimates are rough estimates. Source: CLSA Asia-Pacific Markets

**Motech is likely to maintain attractive margins as long as it is able to secure silicon**

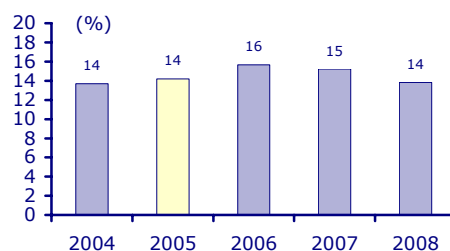
**Over the next two years, stock price has upside if it delivers on earnings expectations**

**Motech is the leader in Taiwan's solar sector**

**Gross margin**

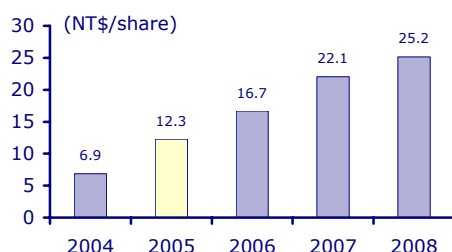


**Pre-tax margin**

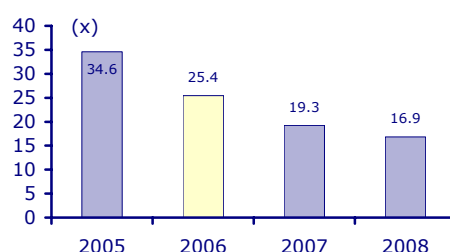


Note: Rough estimates.

**EPS**



**PE**



Note: All estimates are rough estimates.

**Players in Taiwan solar market**

Company nature	Manufacturer	Start up date	Capital (NT\$m)	Annual production	Product
Upstream	Sino-American Silicon Products	2000	1,090	80 tons	Single crystal silicon ingot, wafer
Upstream	Green Energy <sup>1</sup>	2005	1,000	25MW	Poly crystal silicon ingot, wafer
Up/middle/downstream	Motech	2000	610	50MW	Wafer, single/poly crystal silicon cell, installation system
Midstream	Eton	2003	210	8MW	Single/poly crystal silicon cell
Midstream	Del Solar <sup>1</sup>	2005	600	25MW	Single/poly crystal silicon cell
Middle/downstream	Sinonar	1988	900	4MW	Amorphous silicon cell, PV applicant, installation system
Middle/downstream	Ever Bright	2001	120	2MW	PV module, BIPV module, installation system
Middle/downstream	New Core Tech.	2001	200	5MW	PV module, installation system, PVv applicant
Middle/downstream	China Electric	2002	100	2MW	PV module, installation system
Midstream	Lighthouse Solar Power	2002	20	2MW	PV module

<sup>1</sup> MRL/ITRI (2005.04) Source: CLSA Asia-Pacific Markets

**Key points about Motech**

- ❑ Leader in Taiwan's solar industry.
- ❑ Strong growth profile with potential to increase revenue 4x and NP 2-3x by 2010.
- ❑ Biggest risk is earnings volatility from uncertain silicon (wafer) supplies.
- ❑ Upside trigger from stronger Taiwan solar policies

Source: CLSA Asia-Pacific Markets

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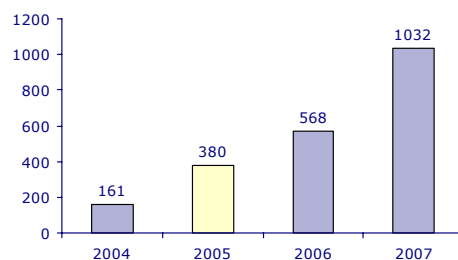
**Energy/Electronics**

**Best buy in cells**

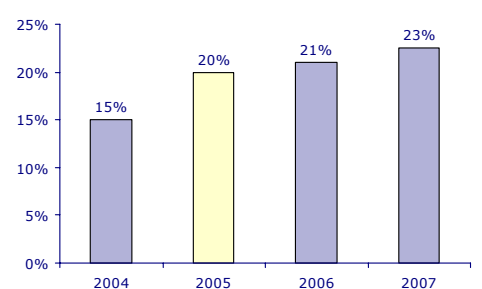
- **Overall financial performance:** Q-Cells is a fast growth company, with estimated revenue increasing from US\$18m in 2002 to US\$161m in 2004 and US\$380m this year. Profits are expanding rapidly as the result of volume growth, price increases and cost reductions. We estimate pre-tax profit of US\$76m in 2005, up 214% from US\$24m in 2004. Looking to 2006, we expect revenue of at least US\$568m (+41% YoY) and pre-tax profit of at least US\$119m (+57% YoY). By 2010, the company has realistic potential for nearly US\$2bn in revenue and US\$350m in pre-tax profit.
- **Solar power:** Q Cells is a star of the solar universe. Its core strength is its ability to quickly ramp cell-manufacturing processes, growing from 28MW of production in 2003 to 165MW in 2005. We believe Q-Cells has realistic potential to grow to 1GW (or more) of production by 2010 and to expand market share (currently 11% by volume for cells) every year. Beyond its manufacturing prowess, Q-Cells has partnerships with impressive innovators (Evergreen, CSG) that augment its core strength.
- **Stock performance potential:** Investors are salivating over Q-Cells. The company has been discussing its IPO for more than a year and has received numerous investment inquiries from private equity players and large companies. Q-Cells appears likely to launch an offering within the next six months. This offering will be big news for the sector, with an initial market cap of approximately US\$1.4-2.8bn, assuming a 20x multiple on either 2006 or 2007 earnings.

*For additional information, please see 2-pager overview of Q-Cells on page 54-55 of last year's Sun Screen report (July 2004).*

**Revenue**



**Pre-tax margin**



Note: Outside-in estimates, not company data.

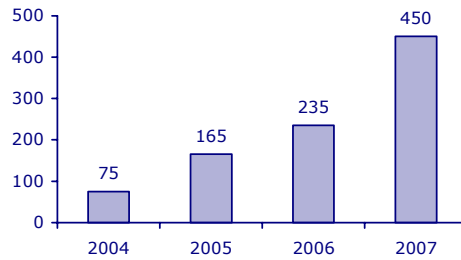
**Preliminary earnings analysis<sup>1</sup>**

	2004C	2005C	2006C	2007C	2008C	2009C	2010C
Production (MW)	75	165	235	450	600	800	1,050
Revenue (US\$m)	161	380	568	1,032	1,308	1,622	1,979
Growth (%)	164	136	50	82	27	24	22
Pre-tax profit (US\$m)	24	76	119	232	272	310	346
Growth (%)	296	214	57	95	17	14	12
Pre-tax profit margin (%)	15	20	21	23	21	19	18
Net profit (assumes 40% tax rate)	14	46	72	139	163	186	208
Implied market cap 20x (US\$m)	290	911	1,430	2,788	3,264	3,717	4,157

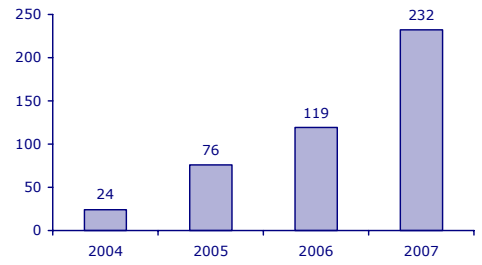
<sup>1</sup> Rough estimates, not based on company data. Production levels in 2007-10 include volume, revenue and earnings from EverQ and CSG. This ignores uncertainty about shareholding structure for these two investments. Source: CLSA Asia-Pacific Markets

**Rapid expansion of production and profit**

**Production**



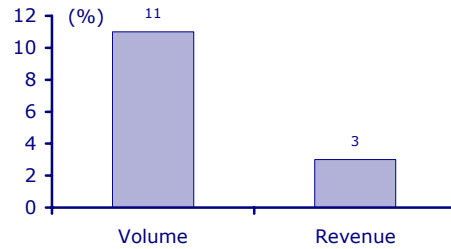
**Pre-tax profit**



Note: Based outside-in estimates. Not based on company data. Source: CLSA Asia-Pacific Markets

**We are highly impressed with Q-Cells and expect that it will continue to gain market share**

**Market share 2005**



**Key points about Q-Cells**

- ❑ World-leader in quickly ramping new cell production facilities.
- ❑ Strong partnership with leading candidates for "next generation" technology (Evergreen Solar).
- ❑ Significant cost savings potential.
- ❑ Strong relationships with silicon (wafer) suppliers.

Note: Based on outside-in estimates. Market share estimates based on overall solar industry producing 1500MW of cells and generating US\$11.1bn revenue. Market share by volume is higher than for revenue because volume estimate is for cells only. Revenue market share is as percentage of end-customer installations. All data based on outside-in estimates. No estimates based on company data. Source: CLSA Asia-Pacific Markets

**Q-Cells partnerships with Evergreen and CSG add to its attractiveness**

**Evergreen's 'String Ribbon' technology**



**CSG's thin-film silicon technology**



Source: Evergreen Solar, CSG, CLSA Asia-Pacific Markets

Note: All estimates are based on our own calculations not on data provided by the company. We are using industry-average estimates for cell revenue per Watt and for pre-tax margins. Estimate of potential market capitalisation at IPO is intended only as a very rough estimate.

**Sun Screen of solar power companies**

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**Norway**

**Energy/Electronics**

**Market cap** Pre-IPO  
**Shares in issue** 14.9m

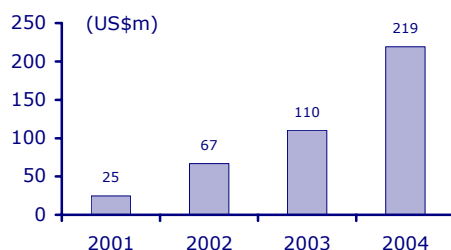
**Major shareholders**

Good Energies 40%  
Elkem 23%  
Hafslund Venture 22%

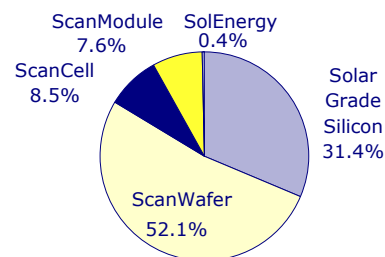
**Silicon and wafer player**

- **Overall financial performance:** REC is a fast growth solar company, with estimated revenue increasing from US\$25m in 2001 to US\$219m in 2004. There was a net loss of US\$10m in 2004, but a net profit is expected in 2005. We expect that revenue will continue to grow faster than the overall solar market, with realistic potential for more than US\$500m by 2007. Profit is expanding rapidly as the result of volume growth, price increases and cost reductions. Acquisition of silicon production capacity from Komatsu and rapidly expanding wafer capacity will likely drive significant earnings growth. With the caveat that earnings are difficult to forecast due to the non-public nature of REC's plans, our outside-in estimate for 2007 net income is US\$80m.
- **Solar power:** REC is a leading player in the upstream solar sector. It owns 70% of Solar Grade Silicon, with production of approximately 2,100 tons in 2004 and 2,300 tons in 2005. Also, it is in the process of acquiring Advanced Silicon Materials (ASiMi) from Komatsu, which will add 2,500 tons of production from late 2005. Together, this will give REC 14% of global silicon production in 2006. In addition, REC is one of the world's leading wafer makers, producing 130MW in 2004 and 200MW in 2005. We see realistic potential for this to double to 400MW by 2007. While REC has other solar activities (e.g., cells, modules), it will increasingly focus on developing even stronger positions as a silicon and wafer producer.
- **Stock performance potential:** REC is tantalising pre-IPO company. The company has been considering its IPO plans and we expect it will go public in the next six months. This offering will be big news for the sector, with an initial market cap of approximately US\$1-2bn, based on 20x rough estimate of 2006 or 2007 earnings.

**Revenue**



**Revenue breakdown - 2004**



Note: 2004 revenue breakdown does not include eliminations. Source: CLSA Asia-Pacific Markets

**Preliminary earnings analysis (US\$m)<sup>1</sup>**

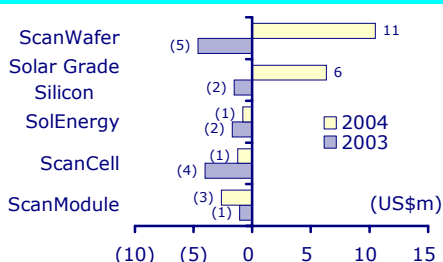
	2003	2004	YoY	1Q04	1Q05	YoY
Silicon revenue	30	83	53	18	15	(3)
Wafer revenue	96	137	41	32	46	14
Other revenue and eliminations	(15)	0	15	1	(3)	(5)
Total revenue	110	219	109	52	58	6
Silicon Ebit	(2)	6	8	1	4	3
Wafer Ebit	(5)	11	15	1	6	4
Other Ebit and eliminations	(19)	(17)	1	(4)	(4)	0
Total Ebit	(25)	(1)	24	(1)	7	8
Pre-tax income	(38)	(8)	30	na	na	-
Net profit	(28)	(10)	18	na	na	-

<sup>1</sup> Assume exchange rate of US\$0.15 per 1 NOK. Source: REC financial reports, CLSA Asia-Pacific Markets

Although net loss in 2004, earnings and cash flow are now positive

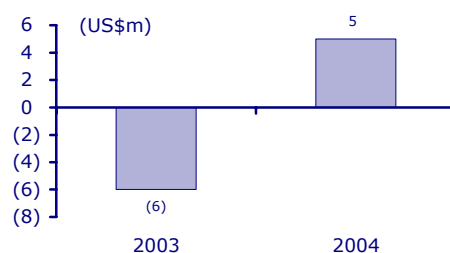
With rapidly expanding Si and wafer production, we expect earnings will growth quickly

**EBIT by business unit 2004**

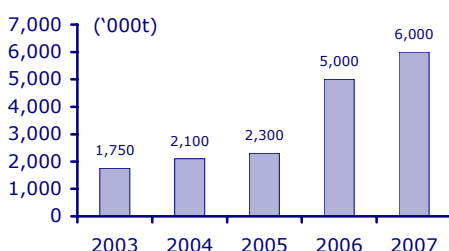


Source: REC financial reports, CLSA Asia-Pacific Markets

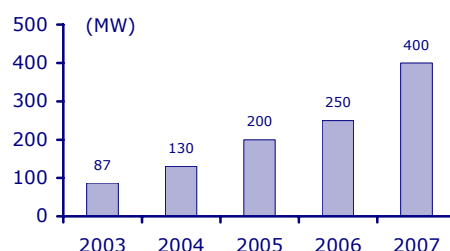
**Operating cash flow**



**Silicon production**



**Wafer production**



Note: Forecasts are rough estimates by CLSA, not based on company data. Assumes successful acquisition of Advanced Silicon Materials from Komatsu in 2005. Source: CLSA Asia-Pacific Markets

**ScanWafer 1Q04 versus 1Q05 (million Norwegian kroner)**

	Revenue						Ebitda					
	Q105	Q104	YoY %	2005	2004	2003	Q105	Q104	YoY %	2005	2004	2003
Solar Grade Silicon	98.3	117.2	(16)	731	534	193	28.0	7.6	271	292	42	(9)
ScanWafer	297.8	207.4	44	1525	884	618	65.1	28.5	128	334	149	39
ScanCell	72.2	10.9	560		144	21	13.4	(3.9)	(444)		7	(18)
ScanModule	72.0	9.3	675		129	7	3.7	(2.1)	(279)		(14)	(6)
SolEnergy	1.5	3.3	(54)		7	3	(0.3)	1.5	(117)		(2)	(7)
<b>Subtotal</b>	<b>541.8</b>	<b>348.1</b>	<b>56</b>	2256	1,698	842	<b>110.0</b>	<b>31.7</b>	<b>248</b>	626	182	(1)
<b>Goodwill/depreciations</b>												
Holding/eliminations	(167.7)	(14.8)	1,031	(372)	(280)	(129)	(20.8)	(4.4)	377	(119)	(27)	(30)
<b>Total</b>	<b>374.1</b>	<b>333.3</b>	<b>12</b>	1884	1418	713	<b>89.2</b>	<b>27.3</b>	<b>227</b>	507	155	(31)

Source: REC, CLSA Asia-Pacific Markets

REC is one of the most attractive companies in the sector

Figure 1

**Key points about REC**

- ☐ Top supplier of wafers with leading edge manufacturing.
- ☐ Integrated silicon supply ensures tight Si market will not impact earnings.
- ☐ Strong cost reductions driving rapid expansion of margins for wafer business.
- ☐ Rapid expansion of silicon and wafer capacity will drive strong earnings growth.
- ☐ Sale of non-core businesses (e.g., cells, modules) will increase focus.
- ☐ Strong management team with deep expertise in solar sector.

Source: CLSA Asia-Pacific Markets

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**Energy/Electronics**

Reuters 4204.T  
Bloomberg 4204 JP

**Priced on 1 July 2005**

Topix @ 1,181.8

**12M price target** ¥1,000

**±% up/downside**

Target set on 1 Jul 05

**Market cap** US\$3,731m

**Shares in issue** 539.5m

**Free float (est.)**

**3M average daily volume**

¥1,582.0m (US\$14.7m)

**12M high/low**

¥899/621

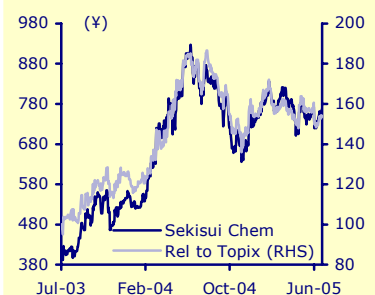
**Major shareholders**

Master Trust Bank 9.3%

Japan Trustee Services 5.9%

**Stock performance (%)**

	1M	3M	12M
Absolute	0.5	(2.5)	(14.2)
Relative	(2.4)	(2.2)	(14.8)
Abs (US\$)	(2.2)	(5.6)	(15.8)



Source: Bloomberg

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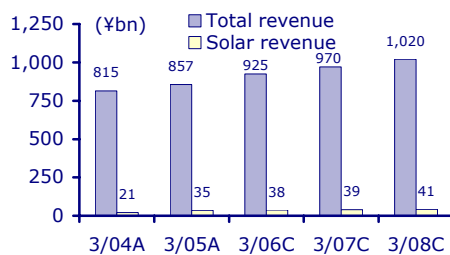
## Solar pre-installer

□ **Overall financial performance:** Sekisui Chemical has a solid core business selling distinctive pre-fab homes and related fittings, accounting for 50% of sales. Total revenue is expected to increase from ¥857bn in FY3/05 to ¥925bn in FY3/06 (+8% YoY) and ¥970bn in FY3/07 (+5% YoY). Net profit is expected to increase from ¥22bn in FY3/05 to ¥29bn in FY3/06 (+29% YoY) and then increase to ¥32bn in FY3/07 (+10% YoY).

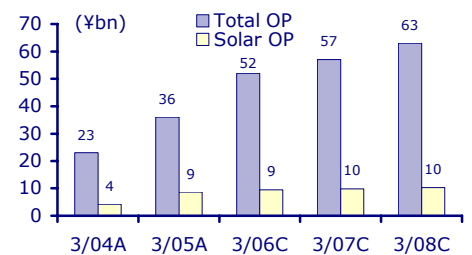
□ **Solar power:** In the current FY approximately 60% of all Sekisui prefab homes will come with solar pre-installed, up from approximately 52% in FY3/05. In addition, the company is active in the add-on market, with approximately 2,600 retrofits this year. With a total of 40MW of installations (30MW pre-installed, 10MW add-on), Sekisui Chemical ranks among the world leaders in solar installations. While these installations only represent around 4% of the company's total revenue, they disproportionately contribute to OP.

□ **Stock performance potential:** Unlike most stocks in the solar sector, Sekisui Chemical has not performed well over the last year (-14% YoY). Frankly, we do not see 4204 as a solar stock because its earnings growth is not being driven primarily by solar. Other factors are likely to drive 29% NP growth in FY3/06 and 10% growth in FY3/07. The stock is not expensive, trading at only 13X FY3/07 earnings. We see option value for Sekisui Chemical to expand on its solar platform, though the timing and strategy for this are unclear. We would nevertheless recommend the stock as a BUY since attractive high margin products in its other business lines are supporting profit growth as well. We believe this positions them as a "green" stock with a slight premium for its multiples.

**Revenue**



**Operating profit**



Note: Solar revenue and OP are rough estimates.

**Preliminary analysis<sup>1</sup>**

	3/04A	3/05A	3/06CL	3/07CL	3/08CL
Total revenue (¥bn)	815	857	925	970	1,020
Solar revenue (¥bn)	21	35	38	39	41
Solar/total revenue (%)	3	4	4	4	4
Total OP (¥bn)	23	36	52	57	63
Solar OP (¥bn)	4	9	9	10	10
Solar/total OP (%)	18	24	18	17	16
Net profit (¥bn)	15	22	29	32	36
EPS (¥)	28	41	53	59	67
PE (x)	28.6	18.6	14.4	13.1	11.5

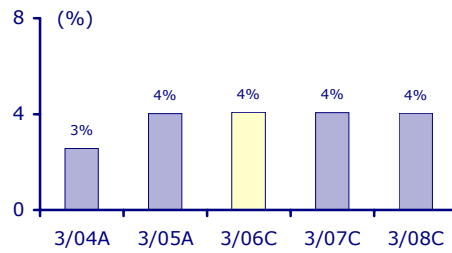
<sup>1</sup> Fiscal year runs April through March. "3/04" runs from April 2003 through March 2004. All estimates of solar revenue and profit are rough estimates. Source: CLSA Asia-Pacific Markets;

**Solar is an important part of earnings**

**Installations are likely to continue growing over the next few years**

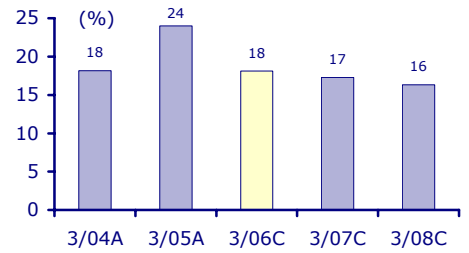
**With fairly strong earnings growth and a modest multiple, we see 30% upside in 4204JP**

**Solar revenue/total revenue**

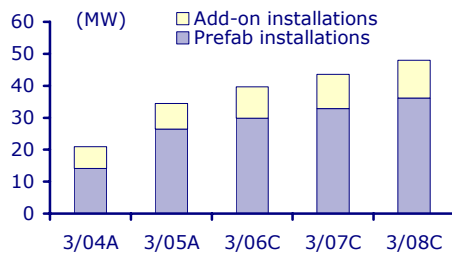


Note: Rough estimates.

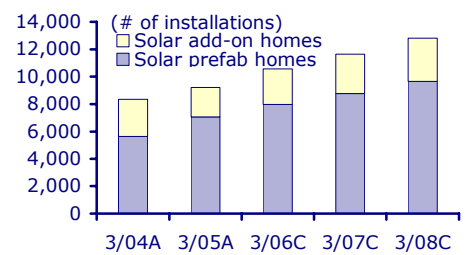
**Solar OP/total OP**



**Installations**

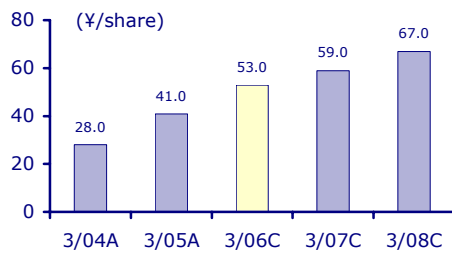


**Installations**

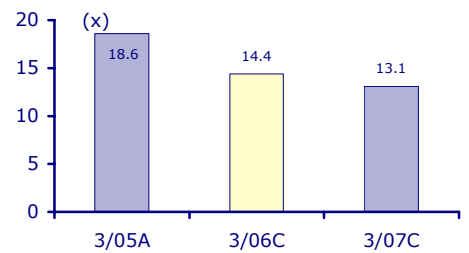


Source: CLSA Asia-Pacific Markets estimates

**EPS**



**PE**



Source: CLSA Asia-Pacific Markets

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**Japan  
Technology**

Reuters 6753.T  
Bloomberg 6753 JP

**Priced on 21 June 2005**

Topix @ 1,169.2

**12M price target** ¥1,900

**±% up/downside**

Target set on 28 Jul 04

**Market cap** US\$400-700m

**Shares in issue** US\$17,334m

**Free float (est.)** 1,110.7m

**3M average daily volume**

¥5,818.2m (US\$54.3m)

**12M high/low**

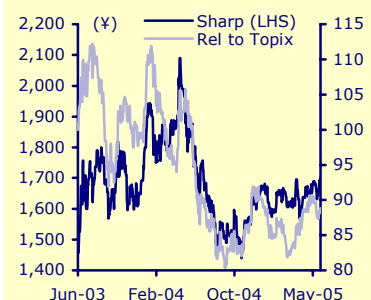
¥1,772/1,437

**Major shareholders**

Nippon Life Insurance 4.7%  
Japan Trustee Services Bank 4.5%

**Stock performance (%)**

	1M	3M	12M
Absolute	2.6	5.3	2.5
Relative	(0.9)	8.4	2.1
Abs (US\$)	1.0	1.1	1.7



Source: Bloomberg

[www.clsa.com](http://www.clsa.com)

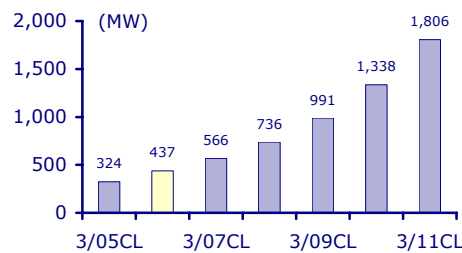
**Sun king**

□ **Overall financial performance:** Despite risk of accelerating pricing pressure, we expect Sharp LCD panel business sales to rise 16% YoY to ¥838bn in FY3/06 on the back of strong LCD TV panel demand and rising revenue for small/medium LCD panels. Based on strong growth in global LCD TV demand (+58% YoY in 2005), we expect Sharp's large LCD TV panel revenues to reach ¥333bn (+15% YoY). Sharp will benefit from strength in small/medium panels, which account for 60% of total LCD business revenues (¥505bn, +17% YoY) where price erosion is lesser and margins superior. For FY3/06 sales we estimate sales and OP in the LCD division reaching ¥838bn and ¥63bn, respectively.

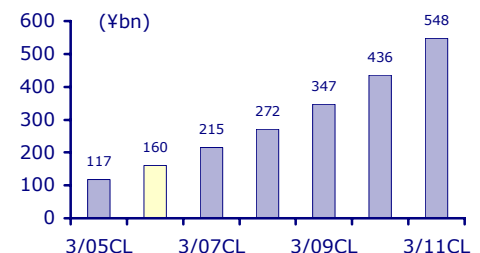
□ **Solar power:** Sharp is the world's largest solar player and we expect its solar business sales and operating revenue to reach ¥160bn (+37% YoY) and ¥17bn (+43% YoY) respectively. Sharp will continue to benefit from growing overseas demand for solar power and further increases in production capacity, which will reach 560MW in 2H05. For FY3/07 we expect solar revenues to grow to ¥215bn and OP to increase to at least ¥21bn. Sharp's goal is to achieve more than ¥500bn yen in solar revenue by the end of the decade and we expect that it will achieve this goal.

□ **Stock performance potential:** Risks remains for the IC business where the company will have a tough time meeting its revenue target of ¥211bn due to a difficult pricing outlook for flash memory. We estimate sales and operating profits in this business reaching ¥203bn and ¥10.9bn, respectively. The weakness in this business should be covered by the strength in the solar and LCD businesses. We confirm our Outperform rating and target price of ¥1,900. Our target price has been calculated based on DCF analysis and values FY3/07 earnings at 21x.

**Production**



**Solar revenue**



Note: Rough estimates.

**Preliminary analysis<sup>1</sup>**

	3/04A	3/05A	3/06CL	3/07CL	3/08CL
Total revenue (¥bn)	2,257	2,540	2,764	2,967	3,182
Solar revenue (¥bn)	73	117	160	215	272
Solar/total revenue (%)	3	5	6	7	9
Total OP (¥bn)	122	151	166	181	194
Solar OP (¥bn)	1	12	17	21	27
Solar/total OP (%)	1	8	10	12	14
Net profit (¥bn)	61	77	90	100	108
EPS (¥)	54.7	69.2	81.2	89.7	96.9
PE (x)	31.19	24.64	21	19	17.59

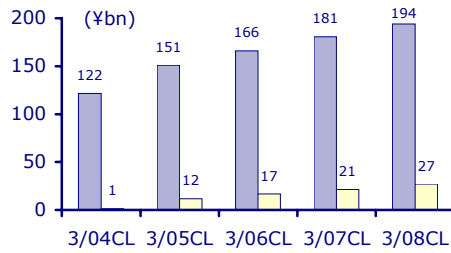
<sup>1</sup> Fiscal year to March. "3/04" is year to March 2004. All estimates of solar revenue and profit are rough estimates. Source: CLSA Asia-Pacific Markets

**Solar is becoming an increasingly important part of Sharp's earnings**

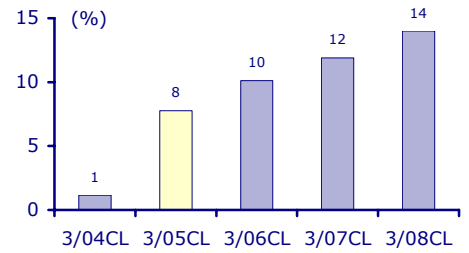
**Sharp is the world's largest solar company and is much larger than other Japanese players**

**Sharp is launching innovative, higher margin products**

**Total OP and solar OP**

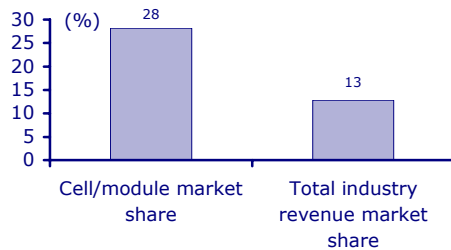


**Solar OP/total OP**

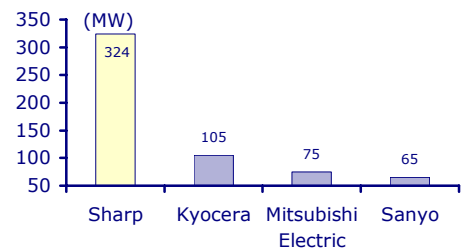


Note: Rough estimates. Source: CLSA Asia-Pacific Markets

**Sharp global market share 2004**



**2004 cell/module production**



Note: Rough estimates. Cell/module market share based on 1150MW production in 2004. Total industry revenue market share based on US\$8.3bn revenue pool for total industry. Revenue market share is lower than cell/module market share because it includes other installation, inverters, other components, services. Sources: Companies, Photon International, CLSA Asia-Pacific Markets.

**Sharp's roofing tile solar panels**



Source: Sharp, CLSA Asia-Pacific Markets

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**Germany**

**Energy/Electronics**

Reuters SWVG.F  
Bloomberg SWV GR

**Priced on 1 July 2005**

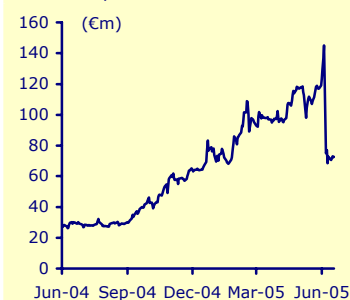
**Market cap** US\$1.10bn  
**Shares in issue** 12.7m  
**Free float (est.)** 59%

**12M high/low**  
€129/26

**Major shareholders**  
Asbeck family 34%  
DWS Investment 7%

**Stock performance (%)**

	1M	3M	12M
Absolute	(33)	(25)	143
Absolute adjusted for stock split	34	50	386



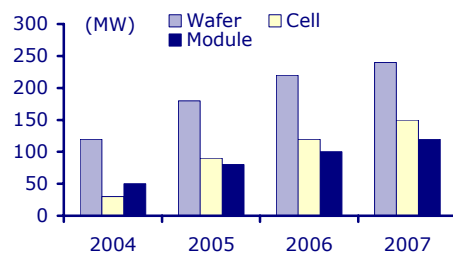
Source: Bloomberg

[www.clsa.com](http://www.clsa.com)

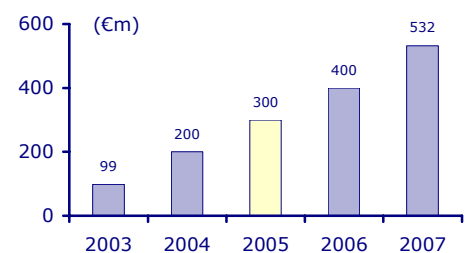
**Steep but still cheap**

- Overall financial performance:** By nearly any measure, SWV is a company running on all cylinders. Revenue is growing from €200m in 2004 to €300m in 2005 and €400m in 2006, and net profit is increasing from €18m in 2004 to €33m in 2005 and €47m in 2006. SWV is generating positive operating cash flow, expanding operations and creating opportunities for further expansion beyond currently announced plans. By 2010, SWV has realistic potential for €1.25bn in revenue and €130m in net profit.
- Solar power:** SolarWorld's bold integration strategy is paying off. With long-term silicon supply contracts and commitment to build its own Si production facility with Degussa, SWV has relatively secure feedstocks. We expect wafer capacity to increase from 120MW in 2004 to 180MW in 2005 and at least 240MW in 2007, and for cell capacity to increase from 30MW in 2004 to 90MW in 2005 and at least 150MW in 2008. Module capacity is also increasing in partnership with low-cost Chinese module player SunTech. With costs decreasing and silicon supply secure, SWV is likely to see margin expansion through at least mid-2007, perhaps longer.
- Stock performance potential:** SWV was the best performing stock in Germany in 2004 and is up 386% (adjusting for June 2005 2:1 split) since July 2004. Despite the strong run and the increase in shares, this stock is trading at only 19.7x 2006 earnings. We expect 42% net profit growth in 2006 and 35% in 2007, giving the stock price plenty of upside. Assuming a multiple of 20x 2007 and 2008 earnings suggests a price of €100-130 over the next 12-24 months. Additional upside for the stock comes from faster-than-modeled capacity increases or cost reductions.

**Capacity**



**Revenue**



Note: Rough estimates.

**Preliminary analysis<sup>1</sup>**

	2003A	2004A	2005CL	2006CL	2007CL
Revenue (€m)	99	200	300	400	532
Growth (% YoY)		103	50	33	33
EbitT (€m)	(3)	33	60	85	115
OP margin (%)	(3)	16	20	21	22
OP growth (% YoY)		(1,161)	82	42	35
Net profit (€m)	(5)	18	33	47	63
Net margin (%)	(5)	9	11	12	12
EPS (€)	(0.9)	3.1	3.6	3.7	5.0
PE (x)		23.2	20.3	19.7	14.6

<sup>1</sup>All estimates are rough estimates. Source: CLSA Asia-Pacific Markets

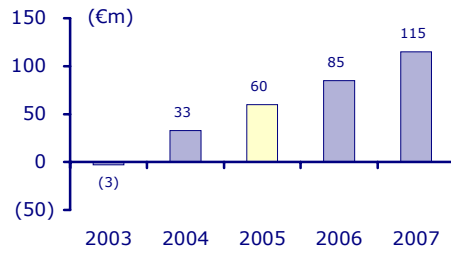
**Earnings are growing quickly driven by fast top-line growth and margin expansion**

**Very strong net profit growth but EPS growth diluted over next year by stock split**

**SWV is the largest pure play stock and is trading at only 20x 2006 earnings and 15x 2007 earnings**

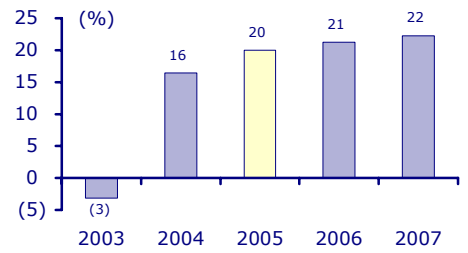
**We see significant upside in SWV's stock price over the next 2-3 years**

**Ebit**

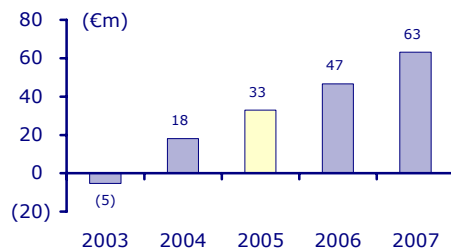


Note: Rough estimates.

**Ebit margin**

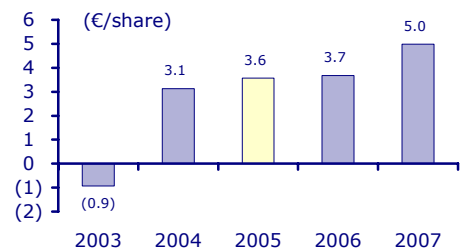


**Net profit**

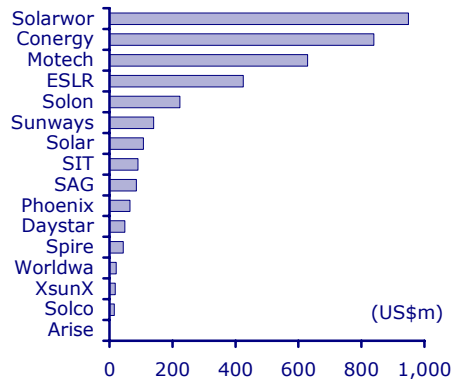


Note: All estimates are rough estimates.

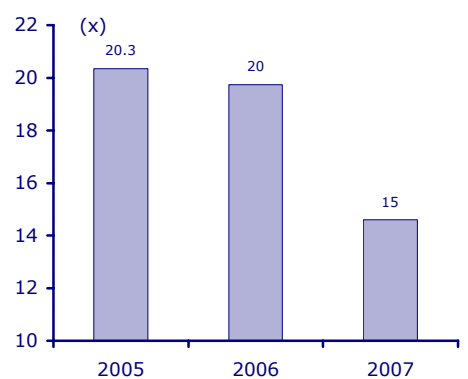
**EPS**



**Market cap of solar stocks**



**PE**



Note: All estimates are rough estimates. Market cap estimate made on 15 June 2005. EPS based on estimates as of 1 July 2005. Source: CLSA Asia-Pacific Markets

**Key points about SolarWorld**

- ❑ Secure silicon supplies through contracts and through JV with Degussa.
- ❑ Strong capacity and revenue growth.
- ❑ Significant cost reductions driving margin expansion.
- ❑ World's largest pure play solar stock by market cap, among top-30 German tech stocks.
- ❑ Trading at PE of only 20x for 2006 earnings, 15x for 2007 and 11x for 2008.
- ❑ Integration strategy pays off while prices are firm and costs are falling, but SWV faces downside risks beyond 2008 (perhaps 2010) if prices begin to fall quickly.

Source: CLSA Asia-Pacific Markets

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**Energy/Electronics**

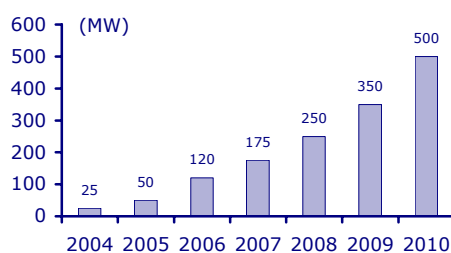
**Market cap** US\$400-700mn  
**Shares in issue** 100m (pre IPO)

**Major shareholder**  
Cypress Semiconductor 100%

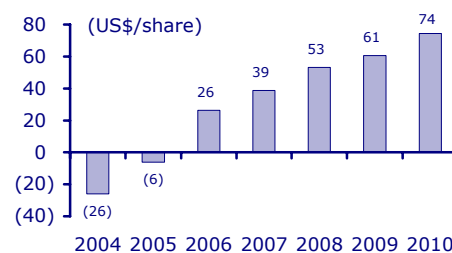
## Efficient IPO

- Overall financial performance:** SunPower is the world leader in high-efficiency solar cell manufacturing. Currently a wholly-owned subsidiary of Cypress Semiconductor (CY US), we anticipate an IPO later this year with initial market cap of US\$400-700m. Today, SunPower is small and unprofitable with US\$80m in revenue and a net loss of US\$8m projected for 2005. We expect a 10x ramp of revenue by the end of the decade, with US\$210m in revenue in 2006, US\$358m in 2007 and nearly US\$800m by 2010. More importantly, we expect a very strong ramp of profit, with net profit potentially rising from US\$33m in 2006 to US\$58m in 2007 and US\$112m in 2010
- Solar power:** SunPower is an innovation leader in high-efficiency solar power cells and modules. At 21% cell efficiency, SunPower is far ahead of the industry average of 16%. With back-sided contacts, SunPower's products look crisper and "more elegant" according to customers. Both of these factors enable SunPower to charge premium prices. On the cost-side, SunPower operates in low-cost Philippines and leverages CY's manufacturing experience to pursue cost reductions as relentlessly as any company we observe. We project SunPower will grow from 50MW in 2005 to 500MW (possibly more) by 2010. We see SunPower as one of the highest profile growth companies in the sector.
- Stock performance potential:** Estimating the value of a pre-IPO US technology company is challenging. At minimum, SunPower's IPO market cap will be US\$400m based on a conservative DCF valuation with 15% discount rate, 0% terminal growth. Realistically, SunPower has potential for US\$700m based on 20x 2006 earnings or a DCF using 15% discount rate and 5% terminal growth. Assuming 125m shares, this sets an IPO price of US\$3.30-6.00/share. We see upside on a two-year view, with realistic potential US\$10/share or more based on 20x forward earnings.

**Year end capacity**



**EPS**



Source: CLSA Asia-Pacific Markets

### Preliminary earnings analysis<sup>1</sup>

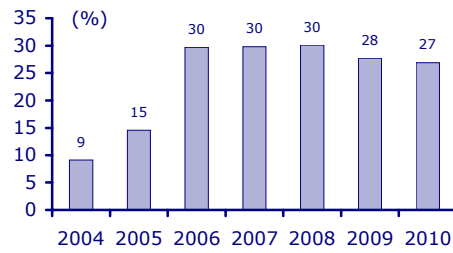
	2004A	2005CL	2006CL	2007CL	2008CL	2009CL	2010CL
Revenue (US\$m)	11	80	210	358	480	618	793
Gross margin (%)	9	15	30	30	30	28	27
Ebit (US\$m)	(23)	(4)	41	71	97	110	134
Ebit margin (%)	(209)	(5)	20	20	20	18	17
Net profit (US\$m)	(26)	(8)	33	58	80	91	112
Net margin (%)	(236)	(10)	16	16	17	15	14
EPS (US\$)	(0.26)	(0.06)	0.26	0.39	0.53	0.61	0.74

<sup>1</sup> Rough estimates based on preliminary modelling. Source: CLSA Asia-Pacific Markets

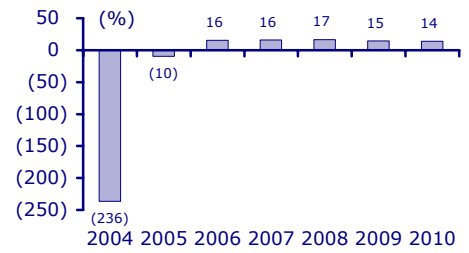
**Rapid margin expansion underway with upside potential beyond what we are modeling**

**SunPower's competitive advantage are its high efficiency, back-contact cells**

**Gross margin<sup>1</sup>**

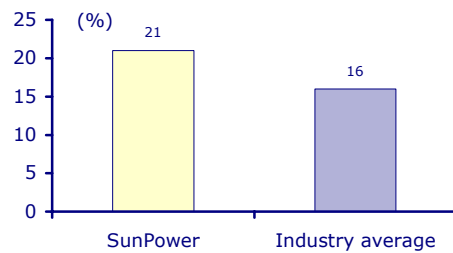


**Net margin<sup>1</sup>**

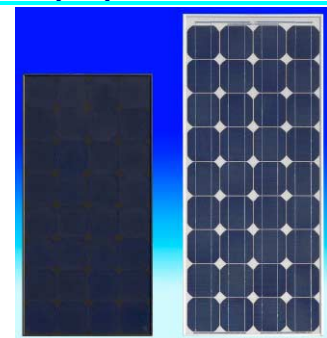


<sup>1</sup> Based on preliminary modelling.

**Average cell efficiency**



**SunPower (left) vs conventional module**



Source: CLSA Asia-Pacific Markets

Note: SunPower module on left is 90W. Conventional module on right is 75W. The conventional module in this picture has front-contacts and as a result loses surface area for sun-to-electricity conversion. In surveys, customers prefer SunPower modules. Source: Company, CLSA Asia-Pacific Markets

**Preliminary financial estimates for SunPower**

	2005	2006	2007	2008	2009	2010
Year end capacity (MW)	50	120	175	250	350	500
Production (MW)	25	73	138	200	283	400
Revenue (US\$m)	80	210	358	480	618	793
Total COGS (US\$m)	68	148	251	336	447	580
Gross profit (US\$m)	12	62	107	145	171	213
Gross margin (%)	15	30	30	30	28	27
SGA (incl R&D) (US\$m)	16	21	36	48	62	79
Operating profit (US\$m)	(4)	41	71	97	110	134
Operating margin (%)	(5)	20	20	20	18	17
Pre-tax profit (US\$m)	(9)	39	68	94	107	131
Tax rate (%)	15	15	15	15	15	15
Taxes (US\$m)	(1)	6	10	14	16	20
Interest (US\$m)	5	3	3	3	3	3
Depreciation (US\$m)	5	8	15	25	34	45
Ebitda (US\$m)	3	57	96	130	154	192
(%)	4	27	27	27	25	24
Ebit (US\$m)	(4)	41	71	97	110	134
%	(5)	20	20	20	18	17
Net profit (US\$m)	(8)	33	58	80	91	112
Net margin (%)	(10)	16	16	17	15	14
Shares (m)	125	125	150	150	150	150
EPS (\$/share)	(0.06)	0.26	0.39	0.53	0.61	0.74
Price/share @ 20x earnings (US\$/share)	(1.24)	5.27	7.74	10.65	12.13	14.89
Market cap @ 20x earnings (US\$/share)	(156)	659	1,161	1,598	1,820	2,233
Price/share @ 2x revenue (US\$/share)	1.28	3.36	4.77	6.40	8.24	10.57
Market cap @ 2x revenue (US\$/share)	160	420	716	960	1,237	1,586
	<b>NPV (US\$)</b>		<b>NPV/share (US\$)</b>			
NPV discount rate 10%, 10 year, 0% terminal growth	804		6.43			
NPV discount rate 15%, 10 year, 0% terminal growth	378		3.03			
NPV discount rate 20%, 10 year, 0% terminal growth	192		1.54			
NPV discount rate 10%, 10 year, 2.5% terminal growth	976		7.80			
NPV discount rate 15%, 10 year, 2.5% terminal growth	417		3.34			
NPV discount rate 20%, 10 year, 2.5% terminal growth	203		1.63			
NPV discount rate 10%, 10 year, 5% terminal growth	1,319		10.55			
NPV discount rate 15%, 10 year, 5% terminal growth	766		6.13			
NPV discount rate 20%, 10 year, 5% terminal growth	430		3.44			

Source: CLSA Asia-Pacific Markets; Modelling based on limited company data and outside-in estimates

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**Japan**

**Energy/Petro Chem**

Reuters 4043.T  
Bloomberg 4043 JP

**Priced on 15 June 2005**

Topix @ 1,169.2

**12M price target** ¥880

**±% up/downside**

Target set on 25 Mar 05

**Market cap** US\$1883.5

**Shares in issue** 225.0m

**Free float (est.)** 70.1%

**12M high/low**

¥848/470

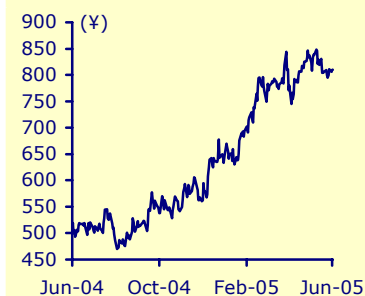
**Foreign shareholding** 25%

**Major shareholder**

Japan Trustee Services Bank

**Stock performance (%)**

	1M	3M	12M
Absolute	(2)	3	62



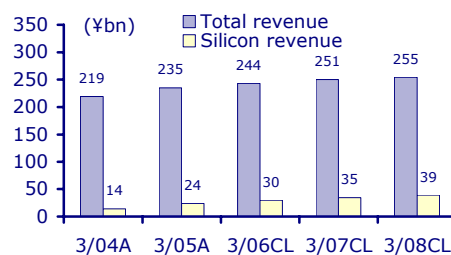
Source: Bloomberg

[www.cls.com](http://www.cls.com)

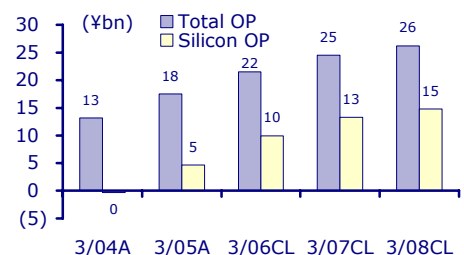
## Silicon stock

- Overall financial performance:** Tokuyama is a Japanese chemical company with a broad base of products, including cement, chemicals and specialty products. While the business environment for Tokuyama remains brisk especially for polycrystalline silicon (PCS), the upside to its earnings is limited as PCS prices have been agreed already for most of FY3/06. Additionally, rising coal costs mitigate the beneficial impact of higher PCS prices. Overall, we expect ¥244bn in revenue (+3% YoY), ¥22bn in operating profit (+18% YoY) and 11bn yen in net profit (+2% YoY) in FY3/06.
- Solar power:** Tokuyama is among the world's largest suppliers of PCS with 17% market share. Prices continue to rise rapidly for both electronics- and solar-grade PCS driven by very strong demand growth from the solar sector. We expect their electronics-grade prices to increase from \$43/kg in FY3/05 to \$52/kg in FY3/06 and \$57/kg in FY3/07 and for solar-grade prices to increase from \$34/kg in FY3/05 to \$43/kg in FY3/06 and \$48/kg in FY3/07. With prices rising and costs remaining fairly flat – with the exception of coal feedstocks – we expect PCS earnings to increase from 5bn yen (26% total OP) in FY3/05 to 11bn yen (50% of total OP) in FY3/06 and 14bn yen (58% total OP) in FY3/07.
- Stock performance potential:** With a large and growing share of earnings growth driven by PCS, 4043 is a stock whose earnings are directly driven by Si. We set a target price of ¥880 (+9%) based on a DCF analysis, which translates into a PE multiple of 20x FY3/06 earnings or 17x FY3/07 earnings. We see further upside in the stock price if Tokuyama's vapour liquid deposition (VLD) process for PCS manufacturing proves that it can deliver substantial cost savings relative to traditional production methods.

**Revenue**



**Operating profit**



Note: Silicon revenue and OP are rough estimates.

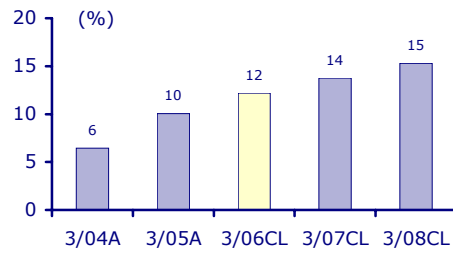
**Preliminary analysis<sup>1</sup>**

	3/04A	3/05A	3/06CL	3/07CL	3/08CL
Total revenue (¥bn)	219	238	244	251	255
Silicon revenue (¥bn)	14	24	30	35	39
Silicon/total revenue (%)	6	10	12	14	15
Total OP (¥bn)	13	18	22	25	26
Silicon OP (¥bn)	0	5	11	14	16
Silicon/total OP (%)	0	26	50	58	62
Net profit (¥bn)	6	11	11	13	14
EPS (¥)	24	43	44	52	56
PE (x)	33.7	18.8	18.4	15.6	14.5

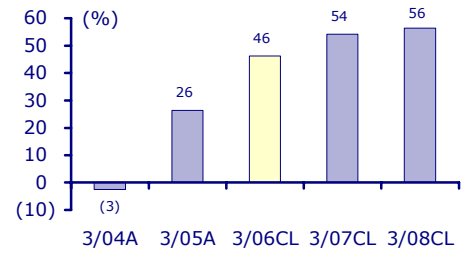
<sup>1</sup> Fiscal year runs April through March. "3/04" runs from April 2003 through March 2004. All estimates of silicon revenue and profit are rough estimates. Source: CLSA Asia-Pacific Markets

**PCS is becoming an increasingly important part of Tokuyama's earnings**

**PCS revenue/total revenue**

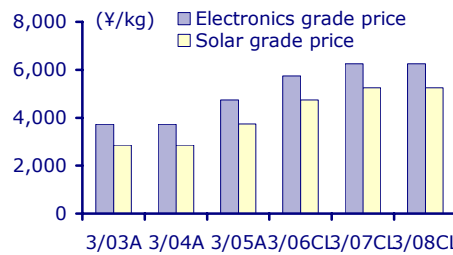


**PCS OP/total OP**

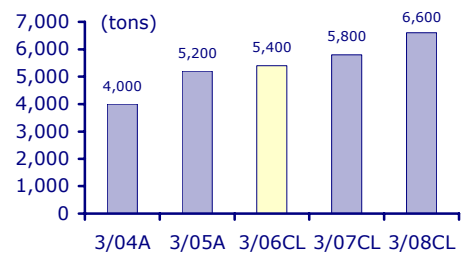


Note: Rough estimates.

**PCS price assumptions**



**PCS production**



Source: CLSA Asia-Pacific Markets

**Tokuyama's VLD process has potential to reduce costs, but is yet-to-be proven**

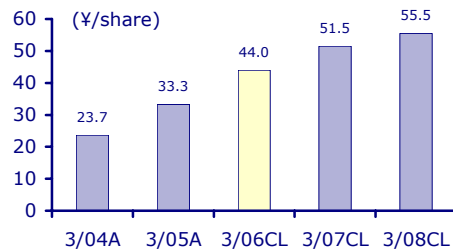
**What is vapour to liquid deposition (VLD)?**

Using trichlorosilane (SiHCl<sub>3</sub>) as the raw material, VLD involves deposition of liquid silicon directly from gas in a tubular reactor, and offers a deposition rate dramatically faster than the current production method, allowing polycrystalline silicon to be manufactured with much greater efficiency. Polycrystalline silicon manufactured using this method is of sufficient quality for solar cells, however at present improving quality further to enable its use in semiconductors as well is believed to be too problematic.

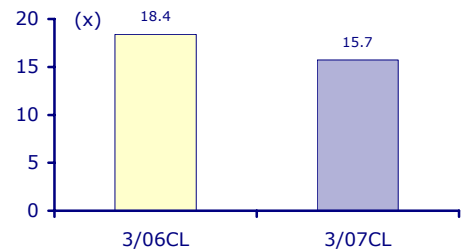
Source: Tokuyama

**Tokuyama's stock price has upside with expectations for 32% EPS growth in FY3/06**

**EPS (yen/share)**



**PE**



Note: Rough estimates.

Source: CLSA Asia-Pacific Markets

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## Global

### Energy/Electronics

#### ATS (ATA Canada)

Market cap: US\$742m

#### Carmanah (CMH Canada)

Market cap: US\$72m

#### MEMC (WFR US)

Market cap: US\$3216m

#### Solartron (SOLAR Thailand)

Market cap: US\$81m

## Upside surprises?

Solar power stocks face numerous uncertainties. Downsides from these uncertainties were explored in detail in Section 2. But there are also upsides that companies may capture from stronger-than-expected policies, larger-than-expected contracts and/or higher-than-expected prices. Of the 600 companies reviewed for *Sun Screen II*, four jump out as being well-positioned to benefit from "upside surprises" – **ATS**, **Carmanah**, **MEMC** and **Solartron**. We believe adding these stocks to the solar portfolio increases upside potential without significantly increasing risk.

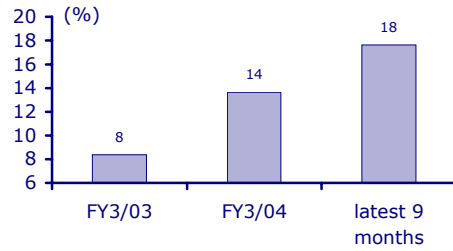
- **ATS.** Solar power has become an increasingly important part of ATS's earnings. In FY02, solar accounted for 9% of revenue and 4% of OP. In the most recent nine months, solar increased to 18% of revenue and 35% of OP. ATS's solar subsidiary, Photowatt, is the largest player in France and is well-positioned to benefit if France pursues stronger pro-solar policies. While the timing, structure and implementation of stronger pro-solar policies is uncertain, we see potential policy support in France as providing strong upside in earnings growth in ATS's solar business.
- **Carmanah.** This one caught our attention with its >50% gross margins, expanding net margins, positive cash flows and distinctive solar products. Its distinctive LED solar streetlights, bouys and bus shelters are the best in the industry and have captured numerous government and large-customer contracts. With the recent acquisition of Soltek Powersource, Carmanah is now the largest solar player in Canada. We see potential upside for Carmanah from rapid growth in its core business (sale of "green" lights to government/other customers), from value-added acquisitions, from potential purchase of the company by a large lighting player and from potential pro-solar policy initiatives in Canada.
- **MEMC.** Rising silicon prices have driven up MEMC's earnings and stock price. We expect silicon prices to continue rising and for MEMC to benefit. If our expectation for silicon prices plays out over the next year, MEMC will see approximately US\$25-35m in incremental revenue with little (if any) additional cost. This alone would provide 11-15% earnings growth for the company compared with 2004. Given the tight silicon supply situation, we expect silicon prices to continue rising for at least the next 12-18 months, with potential for silicon prices even higher than our estimates. All of this is good news for MEMC earnings growth.
- **Solartron.** This is the largest solar power player in Thailand. While small (only US\$25m in revenue in 2004), this company is well-positioned to benefit from increasing Thai government support for solar. With government officials suggesting Thailand will undertake a large-scale program for electrification using solar power, we see potential upside.

### Key points

- **ATS.** Upside if strong pro-solar policies implemented in France.
- **Carmanah.** Upside from organic growth, acquisition of solar/lighting players, purchase by large lighting company and/or strong pro-solar policies implemented in Canada.
- **MEMC.** Upside from rising silicon prices over next 18-36 months.
- **Solartron.** Upside if strong pro-solar policies implemented in Thailand.

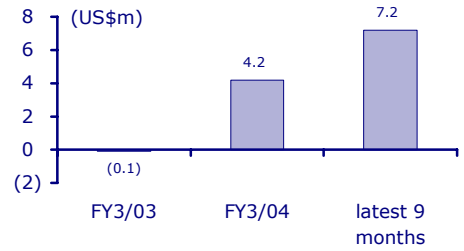
**Solar is a key driver of revenue and earnings growth for ATS**

**Solar as percentage of ATS revenue**



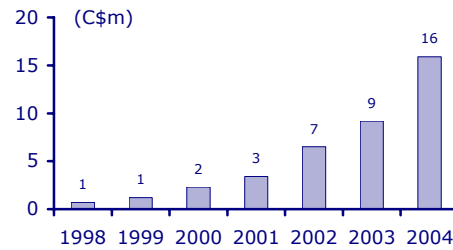
Source: ATS, CLSA Asia-Pacific Markets

**Solar operating profit**



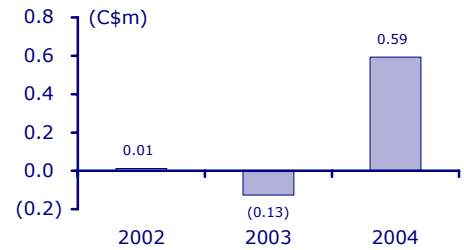
**Carmanah has a history of fast growth and recently turned profitable**

**Revenue**



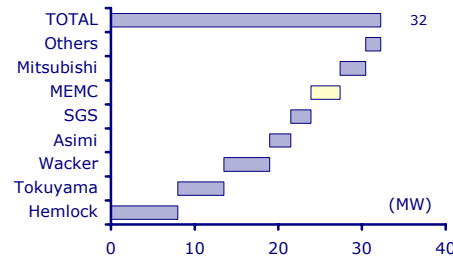
Source: Carmanah, CLSA Asia-Pacific Markets

**Net profit**

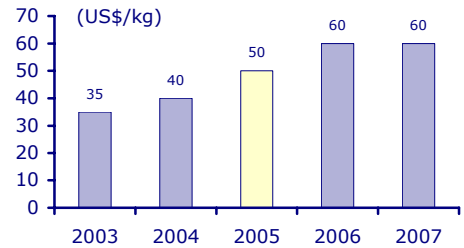


**MEMC's silicon business has profit potential as Si prices continue increasing**

**Si production by player 2005**

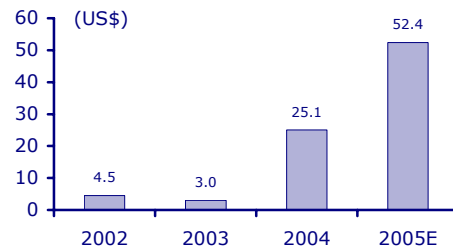


**Estimate of electronics Si price**



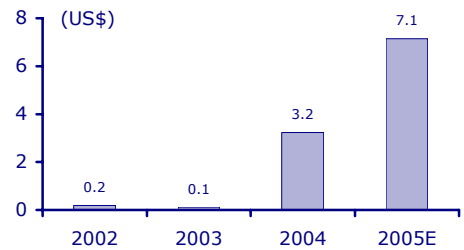
**Solartron's strong growth accelerates if pro-solar policies are implemented**

**Revenue**



Source: CLSA Asia-Pacific Markets

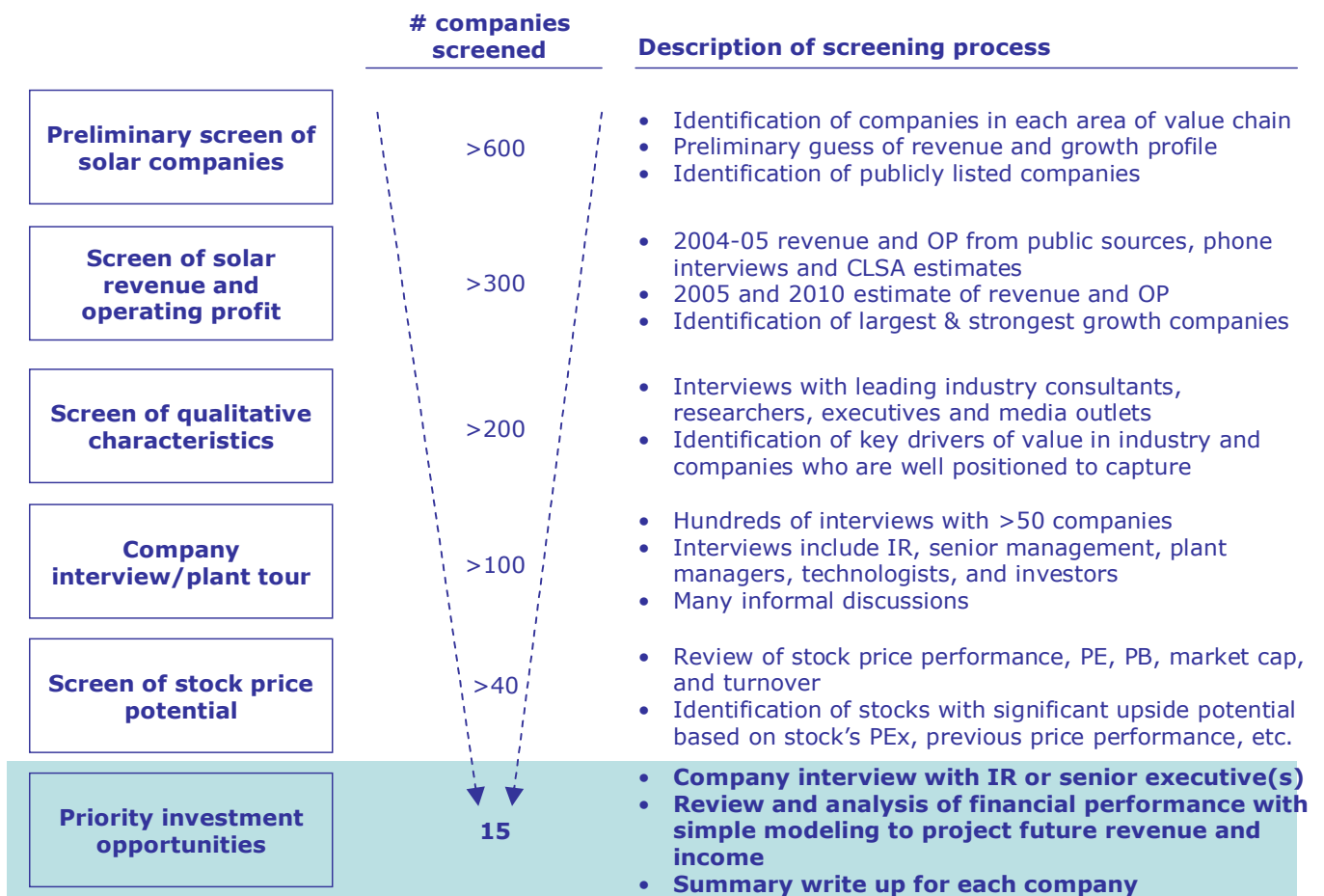
**Net income**



## Appendix 1: Our Sun screening process

We set out to identify attractive investment opportunities in the solar power sector. After compiling a list of 600+ industry players - both public and private - we began a series of 100+ interviews in worlds' three largest solar markets (Germany, Japan, US) and in important emerging markets (Spain, China, South Korea, India). These interviews helped us refine our outlook on the sector and identify attractive listed companies for investments.

### A structured process to identify solar investment opportunities



Source: CLSA Asia-Pacific Markets

**Examples of companies reviewed during our Sun screen process**

Abengoa SA	Conergy	Etimex	JPEA	Noble Energy Solar Technologies Ltd	Rosenthal	Solar Dynamics Inc	Sumitomo Trust & Banking
Acqurahome Corp	ConSol	E-Ton	Kaifeng Solar Cell Factory	Nordisk Solar	RoseStreet Labs	Solar Electrical Systems	Sun Famr Network
Advance Solar Hydro & Wind Power	Conti Corp	Euphoria	Kaneka	Northern Power Systems	Royal Philips Electronics	Solar Electronics Co	Sun Power
Advent Solar	Contrenrix	European Energy Consult Holding	Kiryu	Northpoint Water Pollution Control Plant	RWE Schott	Solar Energy Systems	Sun Power (Taiwan)
AET	Cosmo Oil	Europessedienst	Komatsu	ObjectSoft Corp	S.A.G. Solarstrom	Solar Factory	Sun Power and Geothermal Energy Co.
AET Albasolar	Covell Villiage	Evergreen Solar	Konarka	Oko	Sacred Power	Solar Financial Services	SunPower
Albasolar	CPC Taipei	Evident Technologies	Kubota	Omron	Said PPL Corp	Solar Hydrogen Energy Corporation	Suntech Power
Alcatel Contracting GmbH	Crystal Systems Inc	First Solar	Kyocera	Origin Energy	Samsung	Solar Integrated Tech	SunTechnics
Alternity Power	Cypress Semiconductor	Florida Power & Light (FPL)	La Place System Co	Orionsolar	San Diego Gas & Electric	Solar Kinetics	Suntopway Electronics Co. Ltd
Amonix	Dai Nippon	Free Energy Europe	Landcom	PA.SOL	Sanko Metal Industrial Co.	Solar King Supply	Sunways
Apex-BP Solar	Dankoff	Frimann Juliusson	LEVCO Energy	Pacific Controls	Sanswire	Solar Light Company	SunWize Technologies
Apollo Solar	Davis, Joseph & Negley (DJN)	Fuji Electric	LG	Panahome	Sanyo	Solar Millennium	Superconductive Components Inc (ticker: SCCI)
Applied Films	Day4 Energy	Fuji Electric Systems	LG Industrial System Co.	Pardee Homes	Sarnafil	Solar OCC	Sustainable Energy Enterprises
Applied Solar Energy Corp	Daystar	Fujipream	Lianda Group Co.,Ltd.	People's Power & Light	SatCon	Solar Plaza	Sustainable Energy Finance Initiative
APS	Degussa	Gantan Beauty	Long Island Power Authority	Perfect Power	ScanWafer (REC)	Solar Roofing Systems, Inc.	Sustainable Energy Technologies
AquaSolar	DEP	Garbiel Benmayor SA	M. Setek	PG&E	Scheuten Solar Technology	Solar Satellite Communication	Swiss Wafer
Arise Technologies	Desert Water Agency	GE Consumer Finance	MAAB	Phoenix Sonnenstrom	Schüco	Solar Style, Inc (Subsid of Universal Comm Systems)	SxL
Arizona Public Service (APS)	Deutsche Cell (SolarWorld)	Genesis Worldwide Enterprises PV System	Magnetek	Phoenixtec	SDL Ventures	Solar Traffic Controls	Symphony Energy Co
Arsenal	Deutsche Solar (SolarWorld)	Geothermal	Marine Techno Research	Phoenixtex Power Inc.	SEIA	Solar Verlag GmbH	Taiwan Solar Panel & Engineering Co., Ltd.
ARUP	Direct Global Power	German Solar Federal Industry Association	Marley Roofing	Phönix	Sekisui Chemical	Solara	TATA BP Solar
AS Atmosphaere	Distributed Energy Systems Corp (DESC)	Global Cogenix Industrial Corporation	MEMC	Photon International	Sekisui House	SolarCraft Services	Tatung
ASiMi	Distributed Solar Power Inc	Global Solar Energy	Mesa Environmental Sciences	Photon Semiconductor & Energy	Selco Solar Light Private	Solar-Fabrik	Tatung (Taiwan)
Asirus	Donaher Solartechnik	Global Solar Energy Inc.	Miasole	Photowatt	Semco	SolarGen Solutions	Tenaga Nasional Berhad
Atersa	Donauer	Going Solar	Midwest Optoelectronics	Poly	Semlux	Solargenix	Tenesol
Atlantis Energy Systems	Dow Corning	Good Energies	Millenium Electric	Portech International	Semprea Energy	Solaris Nanosciences	Terion

Note: This is a partial list of companies included in our review. Continued on the next page

**Examples of companies reviewed during our Sun screen process (continued)**

Atmosphaere	Eclipse Solar Gear	GPV	Millennium Electric T.O.U.	Powerlight	S-Energy Co. (formerly Samsung)	Solarmanufaktur Deutschoand (SMD)	Thai Photovoltaics (TPV)
ATS	EGAT	GS Yuasa Power Supply	Mirant Philippines	PowerLight	Senton	SolarMission Technologies	Thai Solartron
ATS Solar Co	Einhorn	Guascor	Mitsubish Heavy Industries	Premier Power	SES21	SolarOne	Tianjin Jinneng Solar Cell Co.,Ltd
Aurex	Electricite de France	Gujarat Electricity Development Agency	Mitsubishi	Presidio Venture Partners	Shanghai Chaori Solar Energy science and Technology Development Co.,LTD	SolarOne Solutions LLC	Titan Energy Systems
Automation Tool Systems	Elkem	Haesung Solar Co	Mitsubishi Electric	Prime New Energy	Sharp	SolarPower Israel	Tokuyama
Auxilia	EMCORE (EMKR)	Hemlock	Morning Star	Progress Energy Florida	Shea Homes	SolarPower Ltd	Total SA
Azur Solar (UK)	E-Mec import & export agency	Hitachi	Motech Industries	Progressive Investor	Shell	SolarTech Co.	TUV
Belval	Emei Semiconductor	Honda	Msetek	Prom Sol Enrg	Shell	Solartron	Ultralite Electronics Co, Ltd
Berbert Arnold	EMMVEE Solar Systems Private Limited	Huamei PV Company	MSK Corp	Proper Field Solar Photovoltaic Mfy. Co. Ltd.	Shenzhen Sunshine Electronics Co Ltd	Solarwatt	Unaxis
Berkeley's Import Tile Company	Endesa	Hydrogen Solar	MVS	Pryon Solar	Shenzhen Topray Solar	SolarWorld	Unisource Energy Corp (UNS)
BK Grundbesitz & Beteiligungs	Enecolo	Hyundai Heavy Industries	Nakhon Ratchasima Solartron	Pump Systems	Shenzhen Topray Solar Co Ltd	SolAsia	Universal Communication Systems
Blitzstrom	Enecsyst	IB Vogt	Nanergy	PV Crystalox	Showa-Shell	Solco	UQM Technologies
Boading Yingli New Energy Resource Co < <a href="http://www.yingligroup.com/">http://www.yingligroup.com/</a> >	Energiekontor	IBC	Nanjing PV-Tech	PV Silicon	Si Bos	Solectria Renewables LLC [Anita Rajan Worden]	Vanguard Ventures
Borrego Solar Systems	Energy Conversion Devices	ICP Solar	NanoHorizons	Qcells	Siene	Solel	Viacom Outdoor JCDecaux
BP	Energy Photovoltaics	Ideal Homes	Nanosolar Inc	Rapier Cs Limited	Sierra Therm	Solland Solar Energy	Voltaix
CalSolar	Energy Valley	Ingeteam	Naturstrom	Rachabun Electricity Generating Holding	Silicon Crystals Inc (SCI)	Solmomma, Inc.	Voltwerk
Cambridge Display Technology Carmanah	Enerpal	Inland Energy	Neskor Solar	REC	Silicon Recycling Services	Solon AG	Wacker
Casio	Enviromission	Innotec	New Enterprises Association	Renetec Co	Sinonar	Soltek Powersource Ltd	Worldwater
Casso Solar	EPIA	Intelligent Perimeter Systems	New Jersey American Water	Renewable Energy Corp	SMA	Solutronic	Wurth Solar
Centrotherm	Ersol	Inverters Unlimited	Nextant	Renewable Hawaii Inc.	SMD	Sompo	Wuxi Suntech Power Co., Ltd
Chinese Electrical Equipment Group	Investment Company Saxony Anholt (IBG)	ITN Energy Systemss	Nextek Power Systems	Renewable Ventures LLC	Soalr Fabrik	Sonnetron,Inc	Xantrex
Citizen Watch	ISG InteriorExterior	Iwasaki Electric Corp	nGimat	Reveo	Solaicx	Southern California Edison	Xi'an REW co., Ltd
CitySolar	Isophoton	JFE Steel	Nighthawk Systems	Rieger Homes	Solar Atmospheres	Specialized Technology Resources	Xingjiang Sunoasis Co Ltd
Clarum Homes	Isovlta	Jiangxi Lianchuang	Ningbo Solar Energy Power Co	Ripro	Solar Communications Inc	Spherical Solar (ATS subsidiary)	XsunX
Concentrix Solar		Johnson & Johnson	Nisshinbo Industries	Romag	Solar Compounds Corp	Spire Corp (SPIR)	Yuhuan Solar Energy Source Co, Ltd
			NJPV Technology		Solar Contractors Inc	SPS Energy Solutions	Yunnan Semiconductor
						Sumitomo Corp	Zephyr Corp

Note: This is a partial list of companies included in our review. Source: CLSA Asia-Pacific Markets

**Examples of publicly traded solar companies**

Arise Technologies	APV (CANADA)	QCells	(IPO GERMANY)
AquaSolar	WKN 550297 (GERMANY)	Renewable Energy Corp	(IPO GERMANY)
Carmanah	CMH (CANADA)	S.A.G. Solarstrom	SAG (GERMANY)
Conergy	WKN 604002 (GERMANY)	Sanyo	6764 (JAPAN)
Cypress Semicon	CY (US)	Sekisui Chemical	4204 (JAPAN)
Daystar Tech.	DSTI (US)	Sharp	6753 (JAPAN)
Elkem	ELK (NORWAY)	Shell	RDA (NETHERLANDS)
Energiekontor	EKT (GERMANY)	Solar Energy Systems	SES (AUSTRALIA)
Energy Conv. Devices	ENER (US)	Solon	SOO1 (GERMANY)
E-Ton	(IPO TAIWAN)	Spire	SPIR (US)
Evergreen Solar	ESLR (US)	Sunways	SWW (GERMANY)
Fujipream	4237 (JAPAN)	Solar-Fabrik	SFX (GERMANY)
Jiangxi Lianchuang	600363.SS (CHINA)	Solar Integrated Tech	SIT (UK)
Kubota	6326 (JAPAN)	Solar Millennium	ISIN DE0007218406 (GERMANY)
Kyocera	6971 (JAPAN)	Solarworld	SWV (GERMANY)
Mitsubishi Electric	6503 (JAPAN)	Solco	SES (AUSTRALIA)
Motech Industries	6244 (TAIWAN)	Sun Power	SJP (GERMANY)
Naturstrom	WKN 685840 (GERMANY)	SxL	1919 (JAPAN)
Omron	6645 (JAPAN)	Thai Solartron	(SOLAR THAILAND)
Panahome	1924 (JAPAN)	Tokuyama	4043 (JAPAN)
Phoenix Sonnenstrom	WKN A0BVU9 (GERMANY)	Worldwater	WWAT (US)
PV Crystalox	(IPO GERMANY)	Xantrex	XTX (CANADA)
		XsunX	XSNX (US)

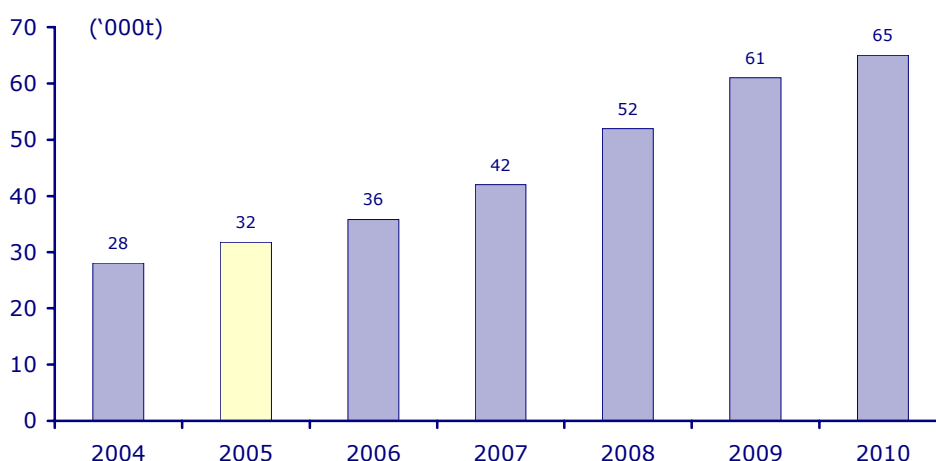
Note: This is a partial list of stocks covered during our review. "Publicly traded solar companies" included any company with publicly traded stock for which solar is a significant portion of revenue, earnings, and/or earnings growth through 2010. Source: CLSA Asia-Pacific Markets

## Appendix 2: Additional information on Si

There is little published data on silicon supply, use and prices. Based on literally hundreds of discussions with silicon producers, we estimate 36,000 tons of silicon supply in 2005, with 31,000 to 32,000 tons of production and 4,000-5,000 tons of inventory draw-downs. When we interviewed silicon executives last year, they told us that global production of silicon would be 28,000 to 29,000 tons in 2005. They emphasized that production beyond this level was unlikely due to the lead long-time required for capacity additions (often 18-24 months or longer). Yet recent interviews with the same executives place production in 2005 at approximately 30,500 to 32,000 tons. The 3,000 ton (>10%) increase in expected output this year is the result of running existing capacity harder, using less stringent quality controls, reducing or delaying maintenance, and instituting incremental projects to quickly debottleneck plants. This extra 3,000 tons is the equivalent of 250 MW of solar cells/modules or approximately 20% of total solar cell production last year.

In 2006, we expect at least 35,000 to 36,000 tons of production, with the increase coming from incremental capacity expansions. From 2007 through 2010, we expect very strong growth in silicon production as major expansion projects at existing sites come on-line. By the end of the decade, we project at least 65,000 tons of production, with realistic potential for more than 70,000 tons. We view capacity expansion to at least 65,000 tons by 2010 as highly likely based on significant capital commitments by existing silicon producers and long-term contracts signed with large solar power players.

### Longer term silicon production estimates

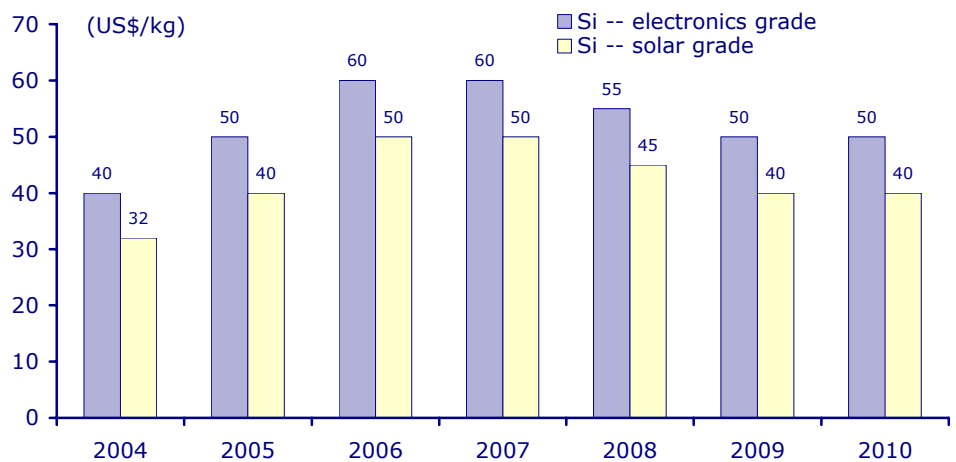


Source: CLSA Asia-Pacific Markets

At first glance, it appears that such a rapid expansion of productive capacity is likely create oversupply and crash prices. In our view, demand from the solar power sector will soak up all new productive capacity thorough the end of the decade. We expect that the new capacity will ease tightness in the silicon market not because silicon supply will catch up with end customer demand, but because silicon users (especially ingot, wafer and cell players) will improve their coordination with silicon suppliers and, as a result, end up with less excess capacity which in turn will reestablish a higher degree of customer constraint in attempting to secure silicon supplies.

This coordination is already apparent, with major customers such as signing long-term contracts for large volumes of silicon. These longer-term contracts are priced in a range of US\$35-45/kg (with varying terms), meaning that they will put pressure on average prices in the sector. We expect that this will drive average price down once significant new capacity comes online in 2008. We project average prices to fall from US\$50 in 2007 to US\$40 in 2008. We expect average prices to remain significantly above historical prices and above fully-loaded Si production costs (typically US\$23-29/kg with a global weighted average of US\$26/kg in 2005) because we project that end-customer demand growth will continue to outpace supply through the end of the decade.

**Longer term price outlook**



Note: Rough estimates. Source: CLSA Asia-Pacific Markets

At the same time, we expect that the tight silicon markets will enable consolidation of the industry to increase. Given the very strong growth profiles for companies like Sharp, Kyocera and Q-Cells, we expect the top 10 players to gain market share through 2008. Tight silicon markets enable this consolidation to continue because smaller players are blocked out of silicon supplies by the larger players.

To summarize our view, there is enough silicon to enable at least 30% MW growth in 2005 and 35% growth in 2006. We believe these to be conservative estimates.

## Appendix 3: Key assumptions for *Sun screen II*

<b>Cell production</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Global Production (GW)	1.15	1.5	2.02	2.62	3.53	4.60	6.00
Growth (%)		30	35	30	35	30	30
% non-silicon	6	9	12	11	10	9	8
<b>Silicon assumptions</b>							
Si -- electronics grade (\$/kg)	40	50	60	60	55	50	50
Si -- solar grade (\$/kg)	32	40	50	50	45	40	40
Si g/W	13	12	11	10	9	8	7
<b>Revenue (\$/watt)</b>							
Silicon	0.42	0.48	0.55	0.50	0.405	0.32	0.28
Wafer	1.00	1.15	1.23	1.18	1.09	1.00	0.96
Cell	2.0	2.30	2.42	2.29	2.18	2.03	1.89
Module	3.25	3.58	3.75	3.57	3.39	3.15	2.93
Growth (%)		10	5	(5)	(5)	(7)	(7)
Inverter	0.5	0.48	0.45	0.43	0.41	0.39	0.37
Other components	0.5	0.47	0.43	0.40	0.37	0.35	0.32
Installation	1.50	1.45	1.40	1.35	1.30	1.25	1.20
Other (services, etc.)	1.50	1.45	1.40	1.35	1.30	1.25	1.20
Total	7.25	7.42	7.44	7.10	6.77	6.39	6.02
Growth (%)		2	0	(5)	(5)	(6)	(6)
<b>Revenue (\$bn)</b>							
Silicon and other feedstocks	0.5	0.7	1.1	1.3	1.4	1.5	1.7
Wafer	1.2	1.7	2.5	3.1	3.8	4.6	5.8
Cell	2.3	3.5	4.9	6.0	7.7	9.3	11.3
Module	3.7	5.4	7.6	9.3	12.0	14.5	17.6
Inverter	0.6	0.7	0.9	1.1	1.4	1.8	2.2
Other components	0.6	0.7	0.9	1.1	1.3	1.6	1.9
Installation	1.7	2.2	2.8	3.5	4.6	5.8	7.2
Other (services, etc.)	1.7	2.2	2.8	3.5	4.6	5.8	7.2
Total	8.3	11.1	15.0	18.6	23.9	29.4	36.1
Growth (%)		33	35	24	29	23	23
<b>Pretax margins (%)</b>							
Silicon	19	35	48	48	42	35	35
Wafer	5	10	15	15	13.3	11.6	10
Cell	10.0	15	20	20	18.3	16.6	15.0
Module	5	10	11	11	8	7	6
Inverter	33.3	30.0	28.0	26.0	24.0	22.0	20.0
Other components	10	10	10	10	10	10	10
Installation	20	20	20	20	20	20	20
Other (services, etc.)	5	5	5	5	5	5	5
Total	15	21	25	25	21	19	18

Continued on the next page

### Appendix 3: Key assumptions for *Sun screen II* (cont.)

<b>Pretax profit (\$bn)</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Silicon and other feedstocks	0.09	0.25	0.53	0.63	0.60	0.52	0.59
Wafer	0.06	0.17	0.37	0.47	0.51	0.54	0.58
Cell	0.23	0.52	0.98	1.20	1.41	1.55	1.70
Module	0.19	0.54	0.83	1.03	0.96	1.01	1.05
Inverter	0.19	0.21	0.26	0.29	0.35	0.39	0.44
Other components	0.06	0.07	0.09	0.11	0.13	0.16	0.19
Installation	0.35	0.44	0.57	0.71	0.92	1.15	1.44
Other (services, etc.)	0.09	0.11	0.14	0.18	0.23	0.29	0.36
<b>Total</b>	<b>1.24</b>	<b>2.31</b>	<b>3.77</b>	<b>4.61</b>	<b>5.10</b>	<b>5.60</b>	<b>6.35</b>
Growth (%)		85	63	22	11	10	13
<b>Pretax unit profit (\$/watt)</b>							
Silicon	0.08	0.17	0.26	0.24	0.17	0.11	0.10
Wafer	0.05	0.12	0.19	0.18	0.14	0.12	0.10
Cell	0.20	0.35	0.48	0.46	0.40	0.34	0.28
Module	0.16	0.36	0.41	0.39	0.27	0.22	0.18
Inverter	0.17	0.14	0.13	0.11	0.10	0.09	0.07
Other components	0.05	0.05	0.04	0.04	0.04	0.03	0.03
Installation	0.30	0.29	0.28	0.27	0.26	0.25	0.24
Other (services, etc.)	0.08	0.07	0.07	0.07	0.07	0.06	0.06
<b>Total</b>	<b>1.08</b>	<b>1.54</b>	<b>1.87</b>	<b>1.76</b>	<b>1.45</b>	<b>1.22</b>	<b>1.06</b>
Growth (%)		42	21	(6)	(18)	(16)	(13)
<b>Growth (%)</b>							
Volume		30	35	30	35	30	30
Revenue		33	35	24	29	23	23
Pretax profit		85	63	22	11	10	13

Source: CLSA Asia-Pacific Markets

Notes

