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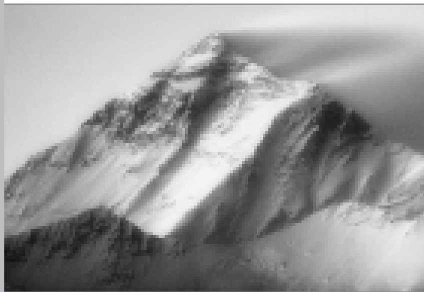

SOLAR POWERED: AN EMERGING GROWTH INDUSTRY FACING SEVERE SUPPLY CONSTRAINTS

Initiation of Coverage: Energy Conversion Devices (ENER - $43.29, 9/29/05) and Evergreen Solar (ESLR - $8.88, 9/29/05) at Outperform.

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Key Points

We expand our coverage of the semiconductor supply chain and alternative energy technology to the solar power industry: A solar cell is a simple semiconductor device with much the same manufacturing materials, equipment, and processes as integrated circuits (ICs) for computing and communications.

- **Why Invest In Alternative Energy?** We believe that alternative energy technology stocks represent a growth play on accelerating worldwide energy demand, rising energy costs, and growing environmental concerns. We believe catalysts for the group abound: 1) growing government subsidies for alternative energy programs worldwide, and 2) spiking energy/oil costs that are beginning to restrict global economic growth.
- **Why Invest In Solar Power Stocks?** Unlike other technologies still in R&D, solar energy is proven, business models have been validated, and the solar industry is enjoying tremendous growth as the prime beneficiary of worldwide alternative energy subsidies. Solar power demand will exceed supply for several years. We peg the solar module market at $4 billion in 2004 (based on 1,256MW of solar cell production) growing to $12 billion in 2010 (4,800MW).
- **But There Is A Severe Supply Limitation Due To Polysilicon Shortage:** Ninety-four percent of all solar modules require polysilicon as a raw ingredient. We estimate a severe polysilicon shortage that will likely cap the growth of solar manufacturing requiring this technology. Due to this shortage, we believe the solar industry overall will only grow 3% in 2006 (1,680MW of cell production) from 30% anticipated growth in 2005 (1,638MW). Resulting high wafer costs will limit industry profits and mass adoption of solar modules without government subsidies. Please refer to our Polysilicon analysis section of this report (Page 13).
- **How To Invest In Alternative Energy Technology?** While there are no single-point technology solutions within alternative energy technology, we recommend a selective approach, favoring companies that: 1) enable lower-cost and better-performing alternative solutions—thus improving the commercial viability; 2) possess proprietary technology; and 3) have a roadmap to profitability. Within solar power, we favor companies with technology that reduces or eliminates the need for polysilicon.

Playing into these themes, we initiated coverage of Evergreen Solar (ESLR) and Energy Conversion Devices (ENER) at Outperform ratings: Both companies are distinguished by proprietary technology for manufacturing lower-cost solar power modules that, ultimately, even without subsidies, will be cost competitive with the electrical grid. Both companies possess unique technology that reduces or eliminates the need for polysilicon. Moreover, ESLR and ENER are gross margin positive and are bringing sizable capacity online, which is expected to yield significant earnings power by 2008.

Risks

1) Companies' history of losses and uncertain future profitability; 2) reduction of government incentives for solar power; 3) operational execution missteps, particularly in expanding manufacturing capacity and bringing technology to its full potential; and 4) an inability to protect patents and intellectual property.

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

TABLE OF CONTENTS CONTINUED

TABLE OF CONTENTS CONTINUED

Exhibits

Energy Conversion Devices, Inc. Exhibits

Evergreen Solar, Inc. Exhibits

Solar Power Industry

We expand our coverage of the semiconductor supply chain and alternative energy technology to include the solar power industry: A solar cell is a simple semiconductor device with much the same manufacturing materials, equipment, and processes as integrated circuits (ICs) for computing and communications.

Alternative Energy Technology: Investment Themes

Why Invest In Alternative Energy?

We believe that alternative energy technology stocks offer a growth play on the insatiable worldwide demand for energy, rising energy costs/record high oil prices, a growing national policy favoring energy independence, and multiplying environmental concerns. We find that catalysts for the group abound as worldwide government subsidies for alternative energy programs grow, and spiking energy/oil costs begin to restrict global economic growth. The greatest number of public pure plays in alternative energy is found in the fuel and solar cell markets.

Alternative Energy Technology: The Growth Engines:

- Worldwide government subsidies for alternative energy are growing.
- Worldwide demand for energy continues to accelerate.
- Energy/utility prices are rising, especially outside the U.S.
- Oil prices are high and crude oil is at its production limit.
- Environmental concerns about global warming and pollution are multiplying.
- Nations desire to be energy independent.
- There is a need for distributed energy generation.
- National security mandates secure energy.
- There is a downward-sloping cost curve for alternative-energy technology.

How To Invest In Alternative Energy Technology?

With no single-point technology solutions within alternative energy technology, we recommend a selective approach that favors companies that enable lower-cost and/or better-performing alternative energy solutions, possess proprietary technology, and have a roadmap to profitability.

- **Lower-Cost, Better-Performing Alternative Energy Solutions.** These allow alternative energy to be more cost-competitive than the grid and will make it commercially viable.
- **Proprietary Technology:** IP for many alternative energy technologies is "out of the bag." Select companies, however, have patented technology that sustains their competitive advantage, and likely higher margins long term.
- **Roadmap To Profitability:** Profitable alternative energy companies are rare. We prefer those that are already gross margin positive, with a roadmap that will lower costs, improve performance, and benefit from manufacturing scale. We look for visibility on higher margins and bottom-line profitability.

Solar Power: Investment Themes

Why Invest In Solar Power Stocks?

The greatest number of publicly-held alternative energy plays is found in the solar power sector. We anticipate four or five solar energy IPOs within 12 months. We highlight the following key reasons to consider solar power investments:

- **Technology And Business Models Are Proven With Clear Path To Profitability:** Unlike other alternative technologies, solar energy is proven, business models have been validated, and the industry is enjoying tremendous growth in worldwide solar subsidies. Although profitable alternative energy companies are rare, some solar energy companies, like Motech of Taiwan or SolarWorld of Germany, are already profitable—or gross margin positive like Evergreen and Energy Conversion's UniSolar.
- **Solar Energy Benefits From The Largest Of All Alternative Energy Subsidies:** Solar power is afforded the greatest subsidies worldwide and these are driving demand. These rebates reduce the breakeven for solar power from 7 - 10 years to 3 - 5 years. Notably, Germany, the country with the greatest subsidy, makes up 39% of the solar market. There also are subsidies in Japan, Spain, Italy, and the U.S. We anticipate expanded worldwide subsidies through 2007.
- **Large And Rapidly Growing Solar Industry:** We expect the solar industry to grow rapidly over the next few years, driven first by worldwide subsidies, then by off-grid electricity demand and utilities seeking to supply peak power to transmission- and load-constrained regions. We peg the solar module market at $4 billion in 2004 (1,256MW of cell production) growing to $5.3 billion in 2005 (1,638MW), then more than doubling to $12 billion in 2010 (4,808MW). These programs indicate that solar demand will exceed supply for several years. There is more than enough demand to sell out solar power manufacturers' capacity through 2006.
- **By 2010, Solar And Grid Prices Will Be Competitive In Certain Markets:** With technology improving and costs declining, we believe that for most applications, select solar companies will be cost competitive with the grid (without subsidies) by 2010. We assume a 5% annual cost reduction through 2010, modules will have fallen to $2.50/watt (from $3.25/watt today). We believe that for thin-film companies, the technology roadmap and cost curve are more aggressive and anticipate $1.75/watt in 2010. Adding balance-of-plant (BOS) savings, we believe this can drive overall system cost to as low as $4.25/watt, effectively lowering level (includes financing cost) solar electricity costs from $0.30/kWh today to $0.18/kWh, making solar energy competitive in certain large markets (for example, Japan's grid electricity cost is $0.20/kWh, while peak power in California can be $0.30/kWh).

Solar Power Versus Other Alternative Energy Technology; Significant Advantages:
- Solar power technology and business models are fully commercialized, making money.
- Truly renewable and a clean energy source.
- Does not require new, complex infrastructure, unlike hydrogen.
- A distributed form of energy generation and does not require transmission.
- Power generation coincides with peak energy demand, daytime peak.
- Represents attractive "fund" investment; solar farms are generating investment returns.
- Reliable and maintenance-free; 25-plus year life.
- Process improvements are continuous thanks to shared processes with IC industry.

How To Invest In Solar Power Stocks; Our Call

- **All Solar Power Manufacturers Will Benefit From Strong Macro Demand:** Expanding subsidies worldwide plus the current solar module market price of $3.25/watt suggest demand that will allow solar manufacturers to pre-sell all available capacity through 2006 and that the market will support several different approaches to solar, regardless of the technology employed.
- **But Supply Limits Are A Concern; Polysilicon Is In Short Supply Industrywide:** Solar cell production is limited by: 1) internal production capacity, a function of production ramp lead-time and CAPX financing; and 2) the supply of refined polysilicon feedstock, the main ingredient in solar cells. Although CAPX financing is readily available, polysilicon production is bottlenecked.
- **Margins And Growth May Suffer:** Of all solar cells produced, 91% use mono- or poly-crystalline silicon wafers. For these cells, the polysilicon feedstock represents 40% of wafer costs and 25% of module costs. Currently, polysilicon production is bottlenecked, and contract prices have doubled over the last 18 months. Despite 10% incremental increases in annual polysilicon capacity through 2007, demand far exceeds supply, and we expect the shortages will remain severe through 2007 until major production increases come online in 2008. Rising solar wafer demand and tight polysilicon supply mean higher costs for solar manufacturers without long-term polysilicon supply contracts and the inability to meet production plans.
- **How To Differentiate Solar Plays:** Solar power companies are best distinguished by technology node and production capacity, not cell efficiency. Technology will determine a specific company's cost structure, production scalability, and vulnerability to rising polysilicon prices or shortages.
- **What About Solar Cell Efficiency?** The solar industry has become enamored of cell efficiency, but higher-efficiency cells require the most expensive manufacturing process using mono-crystalline wafers. Higher efficiency does allow modestly higher ASPs per watt (in area-constrained or architectural aesthetic applications). We, however, do not view higher efficiency at the expense of higher material COGS as a good long-term model; what matters is cost per watt. In our view, low-cost technologies will dominate the broader competitive landscape. Furthermore, given the structure of feed-in tariff programs (subsidies), only the amount of energy produced matters.
- **How To Play These Themes:** Although there are no single-point technology solutions at this early stage of solar power's evolution, rising polysilicon material prices will squeeze margins and limit capacity. We thus prefer solar-cell companies with low-cost manufacturing technology that reduces/eliminates the need for costly polysilicon; these companies will have the greatest competitive advantage long term, and grow well in excess of the overall industry. We recommend caution for investors with exposure to polysilicon-dependent solar investments as growth may be thwarted in 2006.

Initiated Coverage Of Evergreen Solar And Energy Conversion Devices

In conjunction with our solar power industry report, we initiated coverage of Evergreen Solar (ESLR) and Energy Conversion Devices (ENER), at Outperform ratings.

Both companies are distinguished by proprietary technology for manufacturing lower-cost solar power modules that, ultimately, even without subsidies, will be cost competitive with the electrical grid. Both companies possess unique technology that reduces or eliminates the need for polysilicon. Moreover, ESLR and ENER are gross margin positive and are bringing sizable capacity online, which is expected to yield significant earnings power by 2008.

Evergreen Solar

What distinguishes ESLR is a proprietary solar-wafer manufacturing technology—"string ribbon"—unique to the industry that could substantially lower the cost of solar cells by primarily reducing polysilicon usage. Evergreen's initial 15MW plant "proved the concept" of its technology. Now it will validate its business model by ramping 30MW of capacity in Germany; another 90MW is likely to ramp in 2H06. This and other likely new plants are the keys to ESLR's profitability.

- **Rating And Price Target:** In our estimation, ESLR's earnings power will reach $0.40 per share at 135MW of capacity in 2008. We believe that ESLR can grow faster than the 24% rate forecast for the industry and command a 34x multiple (in line with our estimate of earnings growth) of projected 2008 EPS of $0.40, or $13.60. By discounting back two years (CAPM: 16.6% of expected equity rate of return), we establish a 12-month price target of $10 and an Outperform rating. Risks include, but are not limited to: 1) delay of a 120MW ramp in Germany that may defer profitability; 2) fewer/smaller government and economic incentives for solar power; 3) a decline in oil/energy prices; and 4) the company's inability to protect its patents and intellectual property.

Energy Conversion Devices

ENER's UniSolar produces thin-film solar modules using a unique and proprietary deposition process that uses abundant silane gas as raw material and does not require costly silicon wafers. We anticipate rapid revenue and earnings growth for the next five years as ENER expands its solar capacity, records higher royalties for NiMH batteries, and achieves new hybrid vehicle wins for its Cobasys battery JV. We estimate F06 revenue growth of 70% to $130 million, and F07 growth of 42% to $185 million. We believe that ENER also can match or exceed the solar industry's estimated 24% growth rate.

- **Rating And Price Target:** We believe ENER will grow significantly faster than the 24% expected growth rate for the solar industry—it is not subject to the polysilicon shortage. We thus value the stock at 31x $2.00 annualized F4Q08 EPS, which represents a modest discount to the 34% 2005-2010 CAGR we estimate for the company given the distraction and higher opex required of its fuel cell, hydrogen storage, and memory operations, in addition to its poor track record of losses since inception. This suggests a stock price target of $62 in 2008. Discounting back two years (at 11.7% of expected equity rate of return based on CAPM with adjusted beta of 1.19) yields a 12-month price target of $50. Thus, we initiated our coverage with an Outperform rating. Risks include, but are not limited to: 1) the company's history of losses and uncertain future profitability; 2) reduction of government and economic incentives for solar power; 3) a decline in oil/energy prices; and 4) an inability to protect patents and intellectual property.

Solar Power: Peer Group Valuation Multiples

We compare Energy Conversion Devices and Evergreen Solar to an international peer group of publicly traded companies in the solar industry. Primary differentiation would be that ENER and ESLR are U.S.-based and have unique manufacturing processes. Its competitors are listed in Europe or Asia and use the traditional crystalline silicon approach to manufacture solar cells. ENER eliminates the need for polysilicon in a highly efficient thin-film process. ESLR reduces polysilicon requirements by 35% in its unique string ribbon process.

Shares of ENER trade at 7.9x our C06 revenue estimate of $158 million; shares of ESLR trade at 5.7x our estimate of C06 revenue of $95 million. Its peer group trades at 3.9x C06 revenue. However, German solar companies provide lower value-added services such as wafer making, module assembly, and distribution/installation, which are typically lower margin. Of the non-U.S. companies, only Motech provides value-added solar cell manufacturing, and this is reflected in its higher MC/Revenue multiple versus other peers. We feel Motech would be a better direct comp to ENER and ESLR.

Exhibit 1

SOLAR POWER: PEER GROUP VALUATION TABLE

Company	Symb	Rating, Price Target	Price US$	Mkt Cap	EV	Calendar P/E				MC / Rev				EV / Revenue			
			9/29/05			2004	2005E	2006E	2007E	2004	2005E	2006E	2007E	2004	2005E	2006E	2007E
Solar Energy Tech																	
U.S.																	
Energy Conversion	ENER	OP, $50	**$43.29**	1,257	1,161	NM	NM	NM	53.4	16.8	13.2	7.9	6.0	15.5	12.2	7.3	5.6
Evergreen Solar	ESLR	OP, $10	**$8.88**	541	478	NM	NM	NM	NM	23.0	12.9	5.7	2.6	20.3	11.4	5.0	2.3
DayStar	DSTI	NR	**$11.70**	48	38	NM	NA	NA	NA	NM	NA	NA	NA	NM	NA	NA	NA
Spire	SPIR	NR	**$10.12**	71	64	NM	NA	NA	NA	4.1	NA	NA	NA	3.7	NA	NA	NA
Non-U.S.																	
Motech (Taiwan)	6244.TT	NR	**$14.09**	1,144	1,124	59.5	28.3	19.0	12.3	15.5	9.3	7.1	NA	15.2	9.1	7.0	NA
SolarWorld AG (Germany)	SWV.GR	NR	**$147.74**	1,876	1,885	78.2	40.4	31.4	25.3	7.8	5.1	3.7	3.0	7.8	5.1	3.7	3.0
Congergy AG (Germany)	CGY.GR	NR	**$113.97**	1,140	1,117	68.2	33.5	23.0	17.0	3.3	1.7	1.3	1.0	3.3	1.7	1.2	1.0
Solon AG (Germany)	SOO1.GR	NR	**$35.78**	289	299	57.6	27.7	18.5	13.1	2.3	1.0	0.7	0.6	2.4	1.1	0.7	0.6
Solar-Fabrik AG (German)	SFX.GR	NR	**$16.16**	136	131	NM	NM	17.8	11.0	2.2	1.6	0.7	0.7	2.1	1.5	0.7	0.7
					Peer Group Mean	**65.9**	**32.5**	**21.9**	**22.0**	**9.4**	**6.4**	**3.9**	**2.3**	**8.8**	**6.0**	**3.7**	**2.2**
					Mean ex-ESLR, ENER	**65.9**	**32.5**	**21.9**	**15.7**	**5.9**	**3.8**	**2.7**	**1.3**	**5.8**	**3.7**	**2.7**	**1.3**

Source: Piper Jaffray Estimates, Baseline, FirstCall, Bloomberg

SOLAR POWERED: HIGHLIGHTS FROM D.C. SOLAR CONFERENCE

Solar Powered: Highlights From D.C. Solar Conference

On October 6, 2005 we attended the Solar Power 2005 conference in Washington, D.C., and met with several of the world's largest solar cell and module manufacturers, distributors, and installers including Sharp, Kyocera, Sanyo, Suntech Power, SunPower, SolarWorld, MSK, Conergy, Energy Conversion Devices, Evergreen Solar, and Magnetek. Additionally, we toured the 100MW BP Solar plant in Frederick, Maryland.

- **Conclusions:** Executives from across the solar supply chain uniformly endorsed our findings (see our 9/30/05 report): Although demand remains robust, megawatt production growth will be capped at 5% in 2006 and 20% in 2007 due to the polysilicon shortage. Although ASPs are rising, the market will only absorb a 5% increase at the current level of subsidy. We anticipate that many public solar companies (and pending IPOs) that require traditional polysilicon wafers will lower growth assumptions for 2006, and that polysilicon price increases will create margin pressure and delay profits/breakeven. Playing into these themes, we favor solar companies with technology that reduces or eliminates the need for polysilicon, and rate shares of ENER and ESLR with Outperform ratings. We recommend caution for investors with exposure to polysilicon-dependent solar investments as growth may be thwarted in 2006.

- **Demand Remains Robust:** Most module manufacturers have sold out through 2006, with robust demand from Germany, Spain, Japan, Italy, and California. Customers are being rationalized with a six-month lead-time. It is interesting to note that despite the phaseout of subsidies in Japan in 2006 (current subsidy is a mere US$200/kW), demand in Japan remains strong due to environmental interests and rising electricity costs ($0.20-$0.25 /kWh). Both Sharp (No. 1 in Solar) and Sanyo (No. 4) anticipate that 50% of production will ship into the Japanese market. Both companies anticipate that 40% of production will ship to Europe and a mere 10% to the United States. We note that module ASPs in Germany and Japan are 15% higher versus the United States and that contract prices have increased 5% for 2006. China is not a demand driver, but is increasingly a supply-chain factor for low-cost cell and module manufacturing. We anticipate strong production growth from Chinese manufacturers in 2006 driven primarily by share gains.

- **Industry Executives Endorse Our Polysilicon Forecast:** We detailed our polysilicon feedstock production estimates with several wafer/cell manufacturers. All agreed with a realistic scenario of feedstock CAGR of 12% through 2007. For manufacturers using traditional polysilicon wafers (91% of the industry), this translates to flat solar shipment growth in 2006 and 15% in 2007. We understand that polysilicon contracts are sold out for 2006 and 2007, and that recently the spot price has reached $100/kg. Solar players using traditional polysilicon wafers will have growth capped through 2007, and rising raw material prices will squeeze margin. Sharp does not expect to grow its polysilicon wafer production in 2006 and is focusing its efforts on thin-film and concentrator technologies. This theme was echoed by several leading manufacturers at the conference.

- **Non-Polysilicon Solar Technologies Gaining Support:** Given the severe polysilicon shortage that will cap growth through 2007, many manufacturers are accelerating development of thin-film technologies. At the conference, Sharp unveiled its 8% efficiency a-Si modules, with production capacity of 15MW in 2006. Q-Cells' growth plans are now tied to its JV with Evergreen Solar (ESLR/Outperform) string ribbon manufacturing that uses 35% less silicon per watt (or about 8 grams per watt). Kaneka's a-Si thin-film modules were also featured by MSK. Not affected by polysilicon supply constraints, we estimate that the non-polysilicon wafer solar market (including thin films and string ribbon) will grow production by 49% in 2006 and 52% in 2007. Although non-polysilicon solar technologies such as a-Si thin film and string ribbon have lower cell efficiency versus traditional polysilicon wafers, we do not think this will inhibit its broad adoption. The solar industry has become enamored of cell efficiency, but higher-efficiency cells require the most expensive manufacturing process using mono-crystalline wafers. Higher efficiency does allow 10% higher ASPs per watt (in area-constrained or architectural aesthetic applications). However, we do not view higher efficiency at the expense of higher materials COGS as a good long-term model; what matters is cost per watt. In our view, low-cost technologies will dominate the broader competitive landscape. Furthermore, given the structure of feed-in tariff programs (subsidies), only the amount of energy produced matters. We note that higher-efficiency polysilicon wafers are produced by Sanyo, BP Solar, and SunPower.

Risks

1) Companies' history of losses and uncertain future profitability; 2) reduction of government incentives for solar power; 3) operational execution missteps, particularly in expanding manufacturing capacity and bringing technology to its full potential; 4) a decline in oil/energy prices; and 5) raw material shortage.

Ratings, Target Prices, And Risks

Our 12-month price target for Energy Conversion Devices (ENER-OP) is $50 (31x annualized FQ408 EPS, discounted 11.7% for two years). Risks include, but are not limited to: 1) the company's history of losses and uncertain future profitability; 2) reduction of government incentives for solar power; and 3) an inability to protect patents.

Exhibit 2

UPDATED GLOBAL POLYSILICON CAPACITY FORECAST

Company	2004 Capacity	2005 Capacity	2006 Capacity	2007 Capacity	2008 Capacity
Hemlock	7,000	7,400	10,000	10,000	10,000
Tokuyama	4,800	5,200	5,400	5,400	8,400
Wacker	5,000	5,000	5,500	6,500	8,500
REC (ASiMI)	2,600	3,000	3,300	3,300	3,300
REC (SGS)	2,200	2,400	2,700	3,900	7,400
MEMC (Pasadena, TX)	2,700	2,700	2,700	2,700	2,700
MEMC (Italy)	1,000	1,000	1,000	1,000	1,000
Mitsubishi Materials	1,600	1,600	1,600	1,600	1,600
Mitsubishi Polysilicon	1,200	1,200	1,200	1,200	1,200
Sumitomo Titanium	700	700	700	700	700
Sichuan Xinguang	-	-	300	1,250	1,250
JSSI	-	-	100	500	1,000
New Industry Consortium (expected)		-	-	-	1,500
Total	**28,800**	**30,200**	**34,500**	**38,050**	**48550**

Source: Rare Metal News, Photon International, company documents, PJC estimates

Exhibit 3

GLOBAL SOLAR INDUSTRY PRODUCTION FORECAST

Year	Poly Capacity (Metric Ton)	Poly Demand IC / Semi	Poly Demand Solar	Poly Available for Solar*	Poly Shortage	Solar Production (MW)	Wafer c-Si Production (MW)	Other Solar Production (MW)
2003	26,700	17,000	9,000	9,700	(700)	750	671	80
2004	28,800	19,350	14,032	9,450	4,582	1,256	1,142	114
2005E	30,200	20,085	18,181	10,115	8,066	1,656	1,480	176
2006E	34,500	21,166	16,705	13,334	3,371	1,738	1,475	263
2007E	38,050	23,071	17,435	14,979	2,456	2,088	1,689	399
2008E	48,550	26,301	24,089	22,249	1,840	3,154	2,581	573
2009E	53,800	26,827	28,233	26,973	1,260	4,105	3,387	718
2010E	58,800	27,632	32,108	31,168	940	4,729	3,831	898

Note: Wafer c-Si excludes string ribbon and EFG technologies
* Assumes Semi/IC has priority on polysilicon over solar
Source: Photon International, Rare Metal News, PJC Estimate

APPENDIX I: ALTERNATIVE ENERGY PRIMER

Ten Themes In Alternative Energy:

1. Alternative energy technology is the culmination of material science, chemistry, energy science, and electronics.
2. Worldwide demand for electricity is growing constantly.
3. The U.S. grid is load constrained; there is a need for distributed energy generation (Northeast blackout 2003).
4. The paradigm shift to alternative energy is under way.
5. It works! (This is not early-stage biotech.)
6. There are no single technology solutions to alternative energy at this point.
7. Alternative energy is currently more expensive versus grid (coal-powered) and relies on subsidies.
8. The cost curve is downward sloping; select companies have an excellent path to higher sales and profitability.
9. Profitable alternative energy tech companies are rare.
10. There are barriers to the hydrogen economy; hydrogen is currently NOT a natural or abundant fuel source.

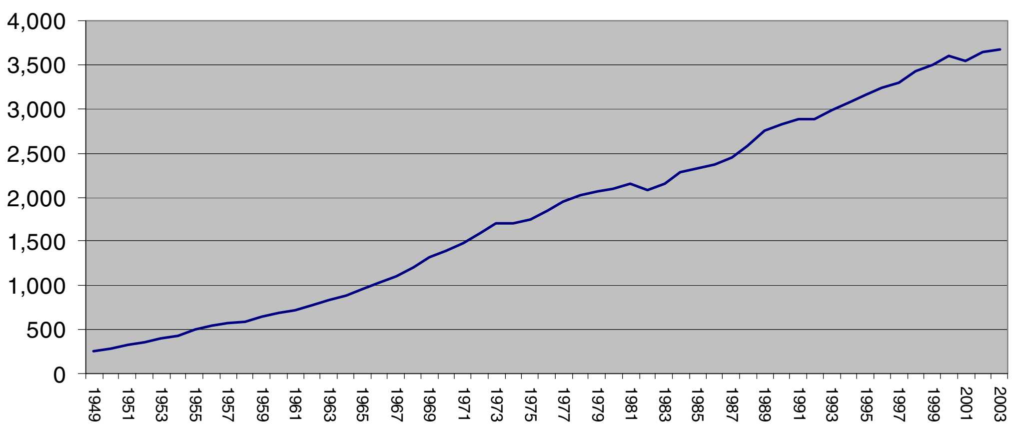
The Need For Alternative Sources Of Power

U.S. electricity usage increased 8 times over the past 50 years to 4 billion kWh in 2003. Seventy-one percent of U.S. electricity is generated from fossil fuels. For the past 20 years, most new electricity-generating capacity is derived from coal, which generates significant amounts of pollutants and greenhouse gases, and is one of the least environmentally friendly methods of energy generation.

Exhibit 4

U.S. ELECTRICITY USAGE

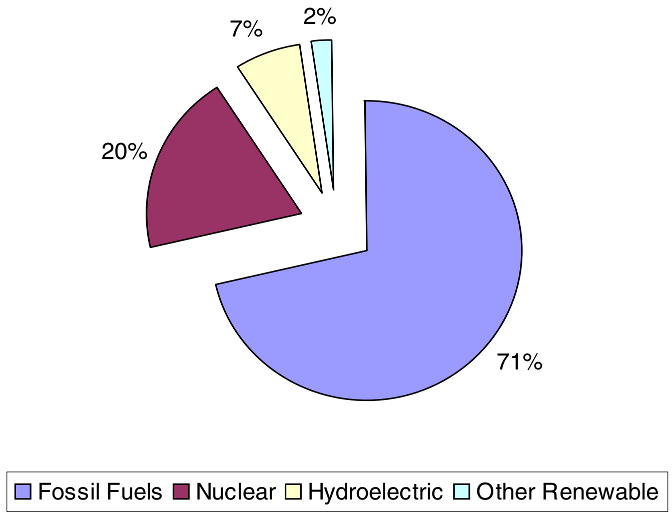
(in Billion kWh)



Source: U.S. Dept. of Energy

Exhibit 5

2003 U.S. ELECTRICITY GENERATION SOURCES



Source: U.S. Dept. of Energy

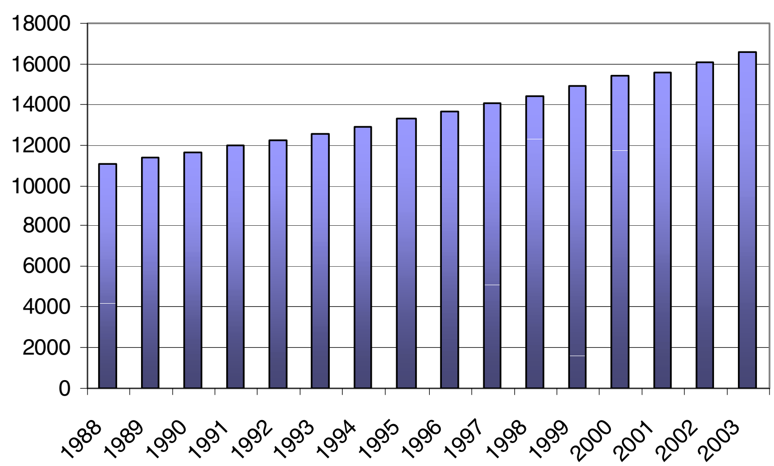
Large Demand For Energy Worldwide

Worldwide electricity production grew at 3% CAGR over the past 15 years. Four billion kWh of electricity generation came online over the past 10 years, which is the current U.S. capacity. Significant new demand is expected from emerging countries, particularly China and India.

Exhibit 6

WORLDWIDE ELECTRICITY PRODUCTION

(Billion KWh)



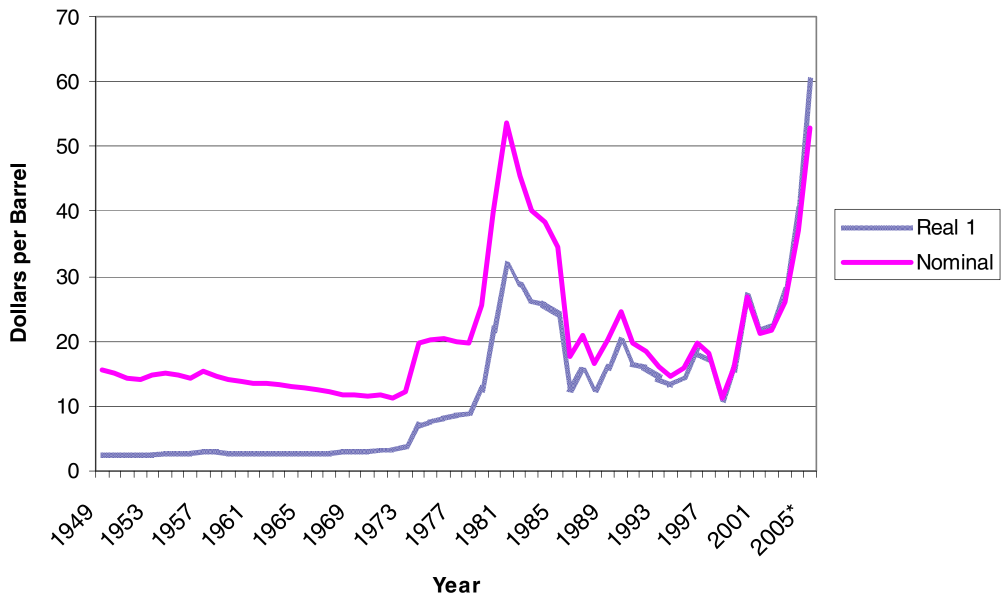
Source: OECD/IEA

Crude Oil Prices

Crude oil prices hit an all-time high in real terms, above the 1981 peak, with crude currently trading near $65/barrel. Crude prices hit an all-time high of $70/barrel after Hurricane Katrina did severe damage to New Orleans and disrupted Gulf Coast crude supplies. Many in the energy industry believe we are now at production limits, while crude demand remains robust with a significant increase in demand expected from China and India over the next several years. Hybrid vehicles are increasingly popular as people are looking for ways to reduce their energy costs.

Exhibit 7

U.S. AVERAGE REAL[1] AND NOMINAL CRUDE OIL PRICES



[1] In chained (2000) dollars, calculated by using gross domestic product implicit price deflators.
Source: USDOE, PJC estimate

What Are Renewable Energy Technologies?

Renewable energies do not require fossil fuels as a fuel source and are generally environmentally friendly with zero or very low emissions. Excluding hydroelectric generation, renewable energies currently constitute less than 2% of world electricity production. Wind turbines, fuel cells, and solar cells are the main types of alternative energy technologies deployed today. The biggest difference between these technologies is that wind and solar are intermittent sources of electricity (dependent on wind and shining sun) while fuel cells can run 24/7. However, fuel cells require a fuel source such as hydrogen or natural gas. We have highlighted some of the advantages and disadvantages of each alternative energy technology below.

Exhibit 8

COMPARISON OF DIFFERENT RENEWABLE ENERGY TECHNOLOGIES

Type	Size	Current Installed Cost ($/kw)	Advantages/ Disadvantages
Wind Turbine	500kW to 2MW	~$3,000 to $5,000	+ No fuel needed - Costly to site - Not where you need it - Environmental hazard - Intermittent
Fuel Cell	1kW to 2MW	~$4,500 to $7,000	+ Base-load, always-on + Cost competitive with battery backup - Needs hydrogen or gas as fuel source
Solar (Photovoltaic)	1kW to 1MW (each module ~150W)	~$6,500 to $8,500	+ No fuel needed + Easy to install + Uses standard semi supply chain for manufacturing - Intermittent

Source: PJC Estimates

APPENDIX II: SOLAR POWER OVERVIEW

How Does Solar Power Work?

A solar cell is a device made of semiconductor materials (such as silicon) that converts the energy in sunlight into electricity. Solar cells are manufactured with a built-in electric field. When sunlight strikes the cell, a portion of the light is absorbed by the semiconductor materials. The solar energy knocks electrons lose from their atoms, allowing electrons to flow freely. The built-in electric field forces electrons freed by light absorption to flow in a certain direction. This flow of electron generates electricity, which can be drawn off to power various objects. The conversion of sunlight (photons) to electricity (voltage) is called the photovoltaic effect.

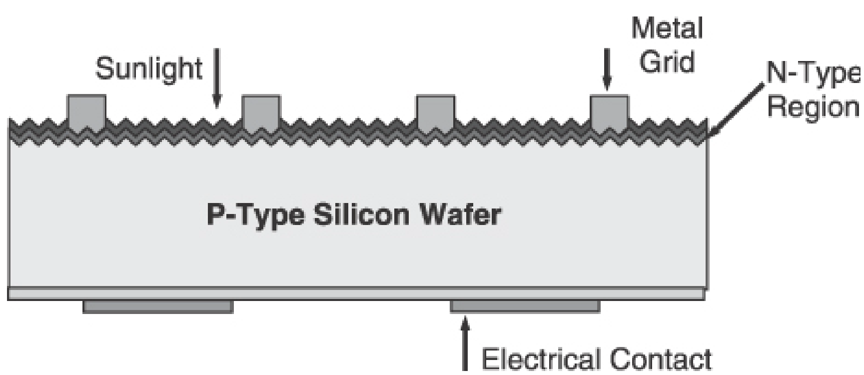
Exhibit 9

MULTI-CRYSTALLINE SILICON SOLAR CELL

Source: USDOE

Exhibit 10

SCHEMATIC OF A CRYSTALLINE-SILICON SOLAR CELL



Source: SunPower

Solar Power Versus Other Alternative Energy Technologies

To reiterate, there is no single-point technology solution within the alternative energy sector. That said we believe that many technologies will succeed in particular applications, but that solar energy technology is a ubiquitous alternative energy investment. We highlight solar's key advantages over other alternative energy technologies:

Relative Advantages Of Solar Power

- **Solar Products Are Fully Commercialized:** Solar power works and is fully commercialized in its current form; other renewable energy technologies require further R&D. Proton exchange membrane-type fuel cells are only just becoming commercialized for off-grid battery backup applications.
- **Solar Is A Renewable, Clean Energy Source:** Solar cells are truly renewable, needing no consumable fuel source. Solar cells have zero emissions and require only shining sun. Fuel cells require a consumable fuel that may be renewable (hydrogen) or fossil (natural gas). Biomass emits carbon dioxide when combusted (offset by growth of new biomass feedstock). Wind is also renewable and clean, but cannot be used everywhere.
- **Solar Is Reliable And Maintenance Free:** Solar cells can operate 20 to 40 years on the initial front-end-loaded investment; maintenance is minimal. Fuel cells require continuing service and costly stack replacement every 1 to 3 years (application dependent). Wind power also requires costly maintenance.
- **Solar Does Not Require New Or Complex Infrastructure:** Solar is relatively quick to deploy in residential or commercial applications and needs no buildout of new infrastructure. Fuel cells running on hydrogen will require a new infrastructure since hydrogen is not a naturally abundant fuel source. Wind power has certain environmental and legal obstacles and needs costly transmission lines to carry power over long distances.
- **Solar Is A Distributed Form Of Energy Generation:** Solar is a distributed energy source that can be deployed where needed most—at the residential or commercial site. Although fuel cells are also distributed, they are not yet commercialized for stationary applications. Wind energy and biomass technologies are somewhat limited by where they can be used and produced.
- **Solar Power Generation Coincides With Peak Energy Demand:** Although active intermittently, solar panels generate electricity whenever the sun is shining, a scenario that coincides with highest peak energy requirements in the U.S. Wind coincides less reliably with peak power requirements.
- **Solar Energy Is Attracting Fund Investing:** Solar subsidy programs have attracted financing for large multi-mega-watt solar projects (called farms). These projects offer the financial investor front-end-loaded returns given the structure of the feed-in tariff programs, and offer funds an attractive internal rate of return (IRR) of 6% - 8%. Wind farms also are attracting fund investment.
- **Solar Manufacturing Supply Base Is Well Defined:** Among solar modules, 90% use technology derived from the semiconductor industry's production of integrated circuits. Supporting material, equipment, and technology suppliers are abundant. Other alternative energy technologies have a limited vendor base and cannot share other industries' process improvements.
- **Solar Shares A Process Improvement Roadmap With The IC Industry:** Solar cell manufacturers are rapidly improving cost and performance, at an accelerated pace thanks to shared processes with the IC industry. Other alternative energy technologies cannot benefit as easily from process improvements across industries.

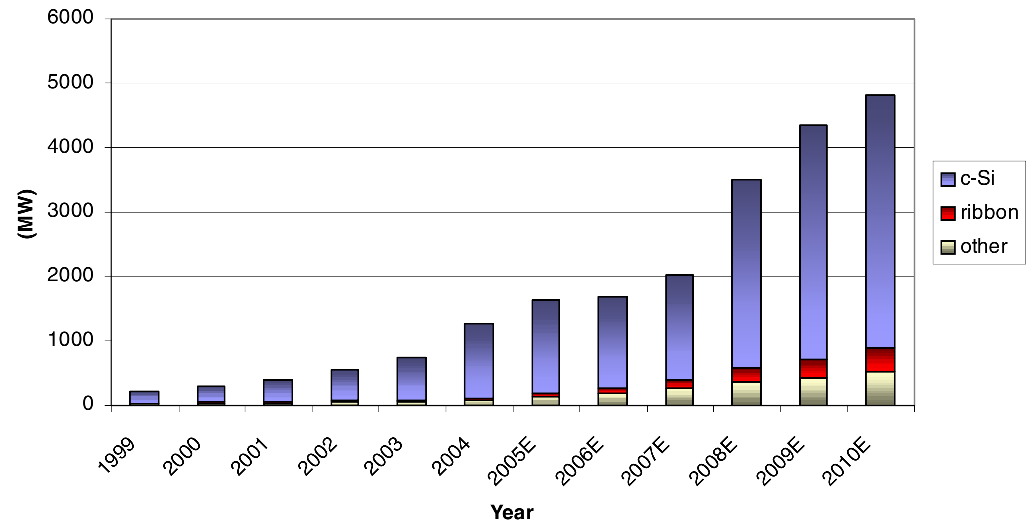
Solar Power Demand

Robust Worldwide Demand Drives Solar Industry Growth

In 2004, solar cell production grew 67% to 1,256MW from 750MW in 2003, according to Photon International. Based on production ramps announced by key players, we estimate solar cell production to grow 30% this year to 1,638MW. We note production and growth would have been higher if not for the severe polysilicon shortage. The robust demand for photovoltaic (PV) systems is driven by higher energy prices, growing subsidies worldwide, and increasing focus on energy independence. With strong demand worldwide, we anticipate the solar industry to achieve 24% annual growth through 2010. We anticipate that the polysilicon shortage will limit solar cell production through 2007 until significant new capacity comes online in 2008. However, we anticipate that non-crystalline silicon players will experience a higher 34% annual growth through 2010.

Exhibit 11

GLOBAL SOLAR CELL PRODUCTION AND FORECAST, 1999 TO 2010 (MW)



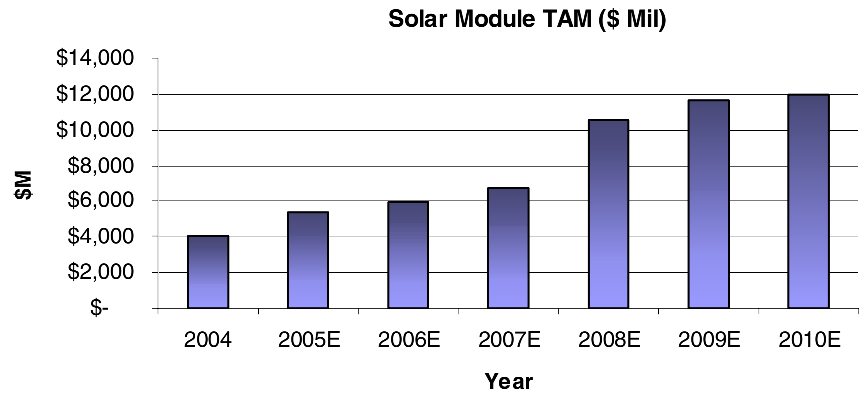
Source: Photon International, PJC Estimates

Sizing The Market

We estimate stable solar module pricing of $3.25 per watt through 2007. We anticipate an annual 10% price reduction beginning in 2007 through 2010. Based on these ASP and volume assumptions, we estimate a TAM of $4 billion in 2004 and $5.3 billion in 2005, growing to $12 billion in 2010.

Exhibit 12

WORLDWIDE SOLAR MODULE TOTAL AVAILABLE MARKET



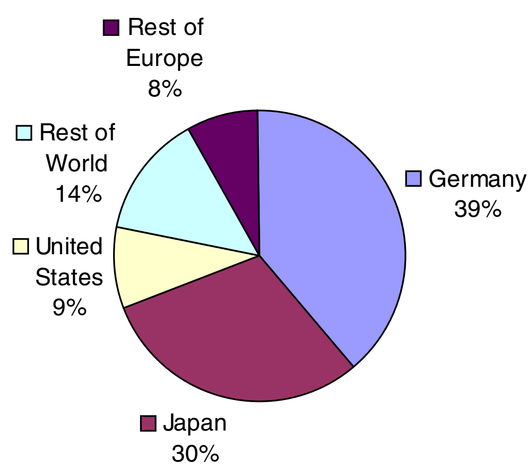
Source: PJC Estimates

Regional Demand

Major subsidies are provided in Germany, Japan, Spain, and increasingly in Italy, and in certain states in the U.S. In 2004, Germany surpassed Japan as the largest PV market in the world, representing 39% of the world's PV installation. Together, Germany and Japan accounted for 69% of the total world PV installation. As a comparison, the U.S. market was only 9% of the world's PV installation.

Exhibit 13

2004 WORLD SOLAR INSTALLATION MARKET SHARE



Source: Solarbuzz

Demand Drivers

The Solar Industry Is Addicted To Welfare

The PV industry relies on government rebates to make solar a compelling investment for consumers, and these rebates reduce consumers' breakeven from 7 - 10 years to 3 - 5 years. Thirty-nine percent of solar market demand is derived from Germany, the country with the greatest subsidy. Despite rising oil prices, with government programs, there is always a risk that funding is reduced. We believe that over the next several years the industry and government will shift funding away from consumers to the electrical utilities. We believe this would represent a better use of funding as utilities would be encouraged to better implement solar energy generation and make it a profitable venture. While utilities are not the leaders of innovation, they do have technical and risk management reasons to include solar in their energy portfolios.

In The Future, Utilities Will Accelerate Solar Demand

Currently solar demand is driven by retail subsidies. We believe the largest volume opportunity for solar is not retail; instead it is with the electrical utilities in which there is a potential need for a large amount of co-located and distributed generation in load- and transmission-constrained areas. The cost for a utility to supply peak power in these areas is significantly higher than the average grid kWh cost and thus the economic benefit of PV to utilities in these locations operating at peak power exceeds the cost of PV installation.

At What Point Is Solar Competitive

Technology improvements and cost reduction will make PV competitive. We assume a 5% cost reduction per year through 2010 and that module cost will be reduced to $2.50 per watt. We believe the technology roadmap and cost curves are more aggressive for thin-film companies and anticipate module cost of $1.75/W in 2010. Adding balance-of-plant (BOS) savings, we believe this can drive overall system cost to $4.25/W, effectively lowering leveled solar electricity costs from $0.35/kWh today to $0.21/kWh excluding subsidies (assuming 25 years of panel life, 1550kWh generated per year, and 6% financing cost). This makes solar energy competitive in certain large markets (for example, Japan's grid electricity cost is $0.20/kWh, while peak power in California can be $0.30/kWh). On an average cost basis (excluding the cost of financing), we anticipate the cost of solar electricity (excluding subsidy) to decline from $0.18/kWh now in California to $0.11/kWh in 2010, lower than the anticipated grid electricity cost of $0.17/kWh. At such pricing, we believe PV will be competitive with the grid without subsidies for many markets/ applications.

Exhibit 14

AVERAGED AND LEVELED COST OF SOLAR ELECTRICITY AT 6% FINANCING COST, 2005

	New Jersey	California
System Price per kW ($)	$ 7,000	$ 7,000
System Price per kW with Subsidies ($/Wp)	3,500	3,500
kWh/yr for 1kW (Estimate)	1,200	1,550
# year of service	25	25
# kWh generated over life	30,000	38,750
Computed Annual Amortization (6% interest)	$ 547.59	$ 547.59
Computed Annual Amortization w/ Subsidies	273.79	273.79
Leveled Cost per kWh without subsidies*	$ 0.46	$ 0.35
Leveled Cost per kWh with subsidies*	**$ 0.23**	**$ 0.18**
Average cost per kWh without subsidies	$ 0.23	$ 0.18
Average cost per kWh with subsidies	**$ 0.12**	**$ 0.09**

* Assumes 6% financing cost
Source: PJC Estimate

Exhibit 15

COMPETITIVENESS OF SOLAR ELECTRICITY GENERATION IN 2010

(Excludes Subsidy)

	New Jersey	California
System Price per kW ($)	$ 4,250	$ 4,250
kWh/yr for 1kW (Estimate)	1,200	1,550
# year of service	25	25
# kWh generated over life	30,000	38,750
Computed Annual Amortization (6% interest)	$ 332.46	$ 332.46
Leveled Cost per kWh without subsidies*	$ 0.28	$ 0.21
Average cost per kWh without subsidies	$ 0.14	$ 0.11
Cost of Grid Electricity (Assume 3% annual increase)	$ 0.14	$ 0.17

* Assumes 6% financing cost
Source: PJC Estimate

Overview Of Worldwide Solar Power Subsidies

- **Attractive Subsidies In Germany:** Germany offers the world's most economically attractive program for solar installations, consisting of a feed-in tariff that remunerates consumers for every kilowatt-hour (kWh) of electricity generated from solar, plus preferential loans supported by the government. As a result, the German PV market has grown rapidly since the law's passage, increasing 152% in 2004. Germany's Renewable Energy Law (EEG) provides €0.545 per kWh of electricity produced for 20 years, reduced by 5% per annum. PV users also have access to federally supported preferential loans. The feed-in tariff makes it profitable to install PV systems, and Germany has seen extensive installations in residential and commercial buildings as well as industrial PV systems. In addition, several "PV funds" have been set up in Germany, where investors finance large-scale PV installations and receive a dividend with 6% - 8% IRR yield.
- **Japan, Spain, And Italy Subsidies:** In Japan, where electricity rates are $0.20/kWh, PV systems can be grid-competitive without significant subsidy. Japan currently provides subsidies, which include a capital cost rebate as well as preferential loans and electricity service under a net-metering tariff. Spain provides a feed-in tariff of €0.414 per kWh produced for the first 25 years and €0.332 per kWh thereafter. Italy recently approved a feed-in tariff program of €0.445 - €0.490 per kWh for 20 years for systems between 1kW and 1MW. PV installations in Spain and Italy are expected to grow rapidly over the next few years.
- **U.S. PV Subsidies Growing:** In the U.S., states with significant subsidies include California, which provides a rebate of up to $2.80 per AC watt for systems up to 30 kW, in addition to a state tax credit of 7.5% of the system's cost net of rebate, plus net-metering tariffs. New Jersey offers $5.30 per DC watt for systems up to 10 kilowatts, and sales tax exemption for solar equipment. Consumers also receive electricity service with net-metering tariffs, as well as the opportunity to sell their solar RECs (renewable energy certificates) to electric suppliers that are required to use solar RECs to comply with state renewable generation obligations. In addition, the federal government provides solar incentives under the Energy Bill, which offers a 30% tax credit for business and residential installations (capped at $2,000 for residential).
- **California Million Solar Roofs Bill Killed, Modest Negative:** The Million Solar Roofs bill (3,000MW of solar panels), the most aggressive solar power policy considered in the U.S., was killed by the California Assembly. Over the past six months the SB 1 bill, which provided $2.5 billion of solar rebates, passed through five committees as well as the State Senate by a strong bipartisan vote of 30 to 5. The bill was derailed when it reached the Assembly Appropriations Committee where three amendments were added to the bill after intense lobbying by two labor unions. Given the widespread support for

the legislation, we speculate the bill may go directly to a vote, or a less comprehensive version of the bill may emerge from the Public Utilities Commission. We believe additional state legislations outside of California are being considered.

Polysilicon Supply Discussion And Analysis

The Polysilicon Shortage Represents Greatest Risk To PV Industry

The rapid increase in solar cell production caused a shortage in polysilicon, and solar cell manufacturers have been forced to pay significantly higher prices to secure silicon supply. The contract price of polysilicon has increased 80% in the past 18 months to $60/kg, and we anticipate pricing to continue to increase over the next two years.

The Shortage Is Most Pronounced In 2006, And Will Cap Solar Industry Growth At 3%

We estimate just the top 10 solar cell makers will need 17,000 metric tons of polysilicon to meet their 2005 planned cell production versus an estimated 30,000 metric tons of total polysilicon production capacity. We estimate the semiconductor industry will require 20,000 metric tons in 2005, thus resulting in a severe shortage. We estimate that solar manufacturers will be able to meet 80% - 90% of their 2005 production plans due to polysilicon stockpiles from 2001/2002, resulting in a 30% solar industry growth over 2004 to 1,638MW. But the picture is bleak for 2006 given that stockpiles are depleted—we estimate only 13,000 metric tons of polysilicon will be available for solar cell production. Despite advances in technology that increases cell efficiency and reduced polysilicon use, the 13,000 metric tons translate to a mere 1,500MW of crystalline solar cell production. Thus, we believe the solar industry overall will only grow 3% in 2006 to 1,680MW of total solar cell production.

Exhibit 16

POLYSILICON SUPPLY AND DEMAND ANALYSIS

Year	Poly Capacity (Metric Ton)	Poly Demand IC / Semi	Poly Demand Solar	Poly available for solar*	Poly Shortage	Solar Production (MW)
2003	26,700	17,000	9,000	9,700	(700)	750
2004	28,800	19,350	14,032	9,450	4,582	1,256
2005E	30,200	20,300	17,966	9,900	8,066	1,638
2006E	34,200	21,500	16,071	12,700	3,371	1,680
2007E	36,800	22,500	16,756	14,300	2,456	2,020
2008E	48,800	23,500	27,140	25,300	1,840	3,493
2009E	53,800	25,000	30,060	28,800	1,260	4,333
2010E	58,800	27,000	32,740	31,800	940	4,808

* Assumes Semi/IC has priority on polysilicon over solar
Source: Photon International, Rare Metal News, PJC Estimate

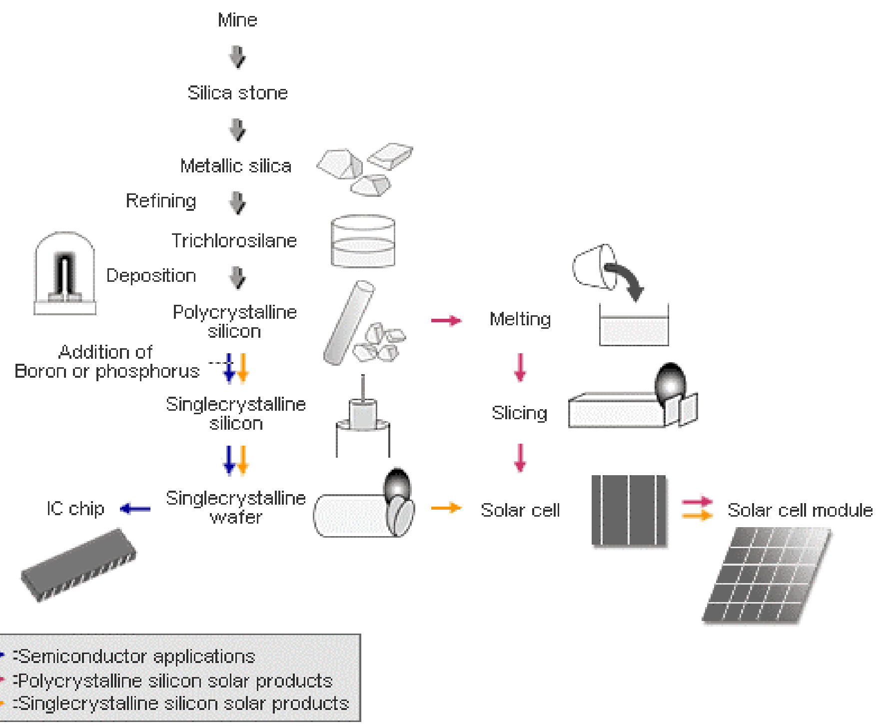
Polysilicon Background

Approximately 94% of solar cells are manufactured using crystalline silicon as the primary raw material. This is essentially the same ultra-pure silicon material used to manufacture ICs. The polysilicon manufacturing process is highly capital intensive and requires investments of $200 million for a 3,000 metric ton capacity that takes three years to ramp. Five major manufacturers constitute 88% of the world's polysilicon production. These are Hemlock, Tokuyama, Wacker, REC (subsidiary SGS and ASiMI), and MEMC. The world capacity is estimated at 28,800 metric tons in 2004 and is expected to grow only 4% to

30,000 metric tons in 2005. Currently, SGS is the only producer of solar grade silicon, producing 2,200 metric tons in 2004. In 2004, about 65% of the polysilicon production was used to manufacture semiconductors, with the balance being consumed by solar cells. Due to the semiconductor down cycle in 2001 that saw polysilicon prices decline below cost to $24/kg, polysilicon manufacturers have been unwilling to add capacity without purchase agreements. Historically, the solar industry has purchased off-spec material that is rejected by the IC industry, as semiconductors require much higher purity silicon. However, as the solar industry has grown, its demand has surpassed the off-spec silicon production. As a result, the solar industry has been forced to buy IC grade silicon.

Exhibit 17

POLYSILICON MANUFACTURING AND SUPPLY CHAIN



Source: Tokuyama

Polysilicon R&D And Capacity Expansion

Wacker, Tokuyama, and REC have launched programs to develop processes for manufacturing granular silicon (fluidized bed reactor for Wacker and REC and vapor to liquid deposition (VLD) reactor for Tokuyama). Tokuyama is building a 200 ton half-commercial VLD pilot plant in Japan, while Wacker already has a 100 ton FBR pilot plant in Germany. REC is also looking to build a 200 ton pilot plant in Moses Lake, WA. In terms of capacity expansion, Wacker is currently expanding its facility in Germany, Hemlock is adding 3,000 ton of capacity, Tokuyama is expanding 400 tons in Japan, while REC has a goal to increase SGS to 2,500 ton per year. However, most production will not come online until 2008.

Exhibit 18

GLOBAL POLYSILICON CAPACITY FORECAST

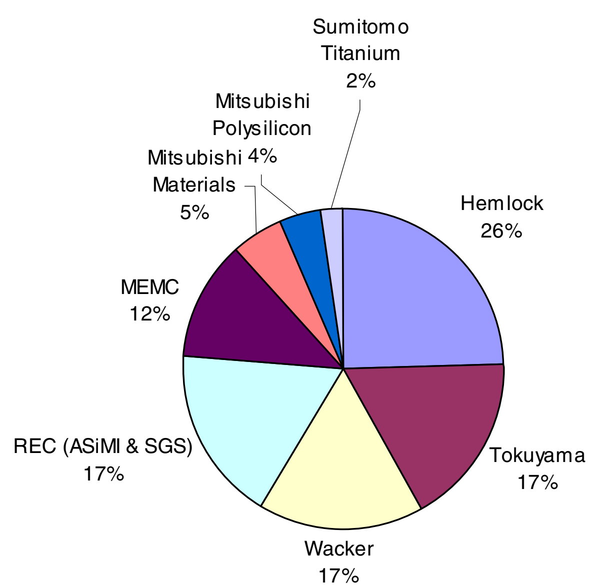
Company	2004 Capacity	2005 Capacity	2006 Capacity	2007 Capacity	2008 Capacity
Hemlock	7,000	7,400	10,000	10,000	10,000
Tokuyama	4,800	5,200	5,400	5,400	8,400
Wacker	5,000	5,000	5,500	6,500	8,500
REC (ASiMI)	2,600	3,000	3,300	3,300	3,300
REC (SGS)	2,200	2,400	2,700	3,900	7,400
MEMC (Pasadena, TX)	2,700	2,700	2,700	2,700	2,700
MEMC (Italy)	1,000	1,000	1,000	1,000	1,000
Mitsubishi Materials	1,600	1,600	1,600	1,600	1,600
Mitsubishi Polysilicon	1,200	1,200	1,200	1,200	1,200
Sumitomo Titanium	700	700	700	700	700
JSSI	-	-	100	500	1,000
New Industry Consortium (expected)		-	-	-	3,000
Total	**28,800**	**30,200**	**34,200**	**36,800**	**48,800**

Source: Rare Metal News, Photon International, company documents, PJC estimates

Exhibit 19

POLYSILICON MARKET SHARE

(2005E Capacity)



Source: Rare Metal News, Photon International, company documents, PJC estimates

The Raw Polysilicon Feedstock Manufacturing Process

The process for making polysilicon feedstock is commonly referred to as the Siemens process using a CVD reactor and silane or trichlorosilane gas. The entire industry uses this CVD process with the exception of MEMC in Pasadena, Texas, which uses a silane fluid bed reactor that produces granular polysilicon. (REC at Moses Lake, WA and Wacker in Germany are both working on fluid bed reactors as is Schumacher Technology). Granular polysilicon, which fluid bed reactors produce, is desirable since it can be easily melted to top off the crystal growing crucible, allowing a longer silicon ingot crystal without the need to shut down the furnace. Furthermore, granular poly may enable innovations in high-speed, high-volume solar cell and module manufacturing.

New Technologies Aimed At Polysilicon Feedstock

Schumacher Technology is currently validating a tribromosilane fluid bed process that has the potential to produce lower-cost, ultra-pure granular polysilicon. The process uses bromine and metallurgical grade silicon that is made in large quantities for the steel industry at $0.50 per pound and is readily available.

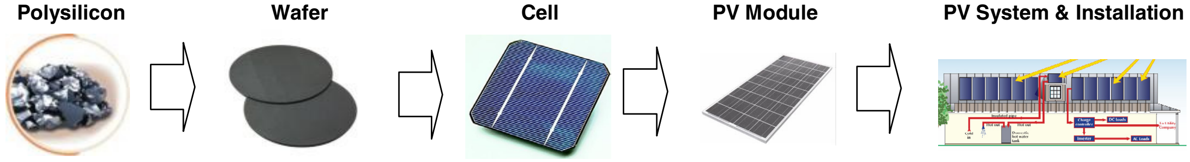
The Case For PV "Virtual" Integration

While PV manufacturers are accelerating manufacturing cost improvements to mitigate rising raw material costs, we believe that the greatest cost improvement for the PV industry can be attained by ensuring a consistent, low-cost supply of polysilicon. We suggest an industry consortium that would mitigate risk in constructing new PV poly capacity. The latest manufacturing techniques for polysilicon production are fluid bed reactors including tribromosilane ($SiHBr_3$) fluid bed reactors and continuous substrate fabrication such as the continuous melt replenishment (CMR) process. According to Schumacher Technology, a $175 million to $200 million investment could generate 3,000 ton of Electronic Grade polysilicon per annum, and supply polysilicon at $20 per kilo. Furthermore, any excess production could be sold into the IC wafer supply chain. We believe that a select few solar wafer manufacturers will adopt a virtual integration approach. In our opinion, this will enable a sustained competitive advantage.

Exhibit 20

SILICON SOLAR WAFER SUPPLY CHAIN

Crystalline Silicon Wafer Solar Supply Chain



	Polysilicon	Wafer	Cell	PV Module	PV System & Installation
ASP per Peak Watt	$0.80	$1.90 to $2.10	$2.60 to $3.00	$3.25 to $3.50	$6.00 to $9.00

Source: AsiMI, Kyocera, US DOE, PJC estimate

Rising Polysilicon Cost Transfers Value Creation From Cell To Wafer/Poly

The rising polysilicon cost and supply shortage will compress margins for the wafer, cell, and module companies. Polysilicon prices have increased 80% to $60/kg over the past 18 months; as a result wafer prices have also nearly doubled to $2/Wp from $1/Wp from a year ago. However, there have only been modest increases in cell and module ASPs per watt, with relatively flat PV system and installation prices. A typical 2kW system remains at $15,000, while the typical 5kW is about $30,000 to $40,000 installed.

Solar Power Manufacturing Process

How Are Solar Cells Processed?

Solar (photovoltaic) cells are simple semiconductor devices and are manufactured using the same materials and similar processing steps as ICs such as computer and memory chips. Because the photovoltaic cells are not miniaturized, solar cells do not require the highest manufacturing standards for contamination and quality control.

Step One: Materials For Solar Wafers

- **Polysilicon (Chunks):** The production of a PV module starts with manufacturing ultra-pure raw polysilicon. Approximately 94% of solar cells are manufactured using polysilicon as the primary material. This is essentially the same pure silicon material used to manufacture integrated circuits (ICs) such as computer or memory chips. Silane or trichlorosilane gases are used to grow ultra-pure silicon rods at very high temperature (1,000 ^{o}C) in reactors and furnaces. The rods are then broken into polysilicon chunks, which become the feedstock for making silicon ingots. The solar industry has historically purchased off-spec material that is rejected by the IC industry, as the chips for computers and memory require much higher tolerances. However, as the solar industry has grown, its demand has surpassed the off-spec silicon production from the IC industry. As a result, the solar industry is forced to buy IC grade silicon. Solar cell manufacturers have incurred significantly higher silicon prices; Silicon contract prices have doubled over the past 12 months to $60/kg, and we anticipate additional price increases through 2007 given tight industry capacity.
- **Exotics:** Two percent of solar cells are manufactured using exotic materials such as cadmium telluride (CdTe), and copper indium gallium di-selenide (CIGS). We believe these materials will find a home with certain solar manufacturers; however, silicon will remain the dominant material of the industry for decades.

Step Two: Wafer Manufacturing

There are four significant wafer manufacturing techniques: 1) mono-crystalline wafers and 2) polycrystalline wafers, 3) Polycrystalline string ribbon wafers, and 4) amorphous silicon thin films.

- **Mono-crystalline Wafers** are derived from a pure single-silicon crystal. For mono-crystalline wafers, the poly chunks are melted in a quartz crucible at very high temperature, and grown into a single crystal ingot via Czochralski or Float-Zone process to form one single crystal of silicon, then sliced into wafers. This type of solar cell yields the highest efficiency cells, but is also the most expensive as it requires pure silicon and a complicated crystal growing batch process with dedicated processing equipment.
- **Multi-Crystalline Cells** are not derived from a single crystal. In the case of multi-crystalline wafers, the chunks are melted in a casting process in which molten silicon is directly cast into a mold to form a square ingot, and then sliced into square wafers. Although efficiencies for polycrystalline cells are lower than mono-crystalline cells at around 15%, the process is less costly as it does not require dedicated crystal growing furnaces.

- **Polycrystalline String Ribbon.** The string ribbon process does not utilize an ingot or cast of silicon and eliminates the wafer sawing step. It is a continuous process where two sets of high temperature strings (80mm wide) are pulled through a crucible of melted (molten) silicon. The molten silicon spans and freezes between the strings. The silicon is then cut into 150mm wafers without interrupting the continuous process.
- **Amorphous Cells** are not crystalline, nor are they made from wafers, but from a thin layer of silicon which is deposited, usually by PECVD, onto a substrate such as metal, glass, or plastic. This is the least expensive manufacturing technique, but the resulting cell efficiency is 50% of crystalline cells, OR approximately 8%. Exotic materials such as cadmium telluride (CdTe) and copper indium gallium di-selenide (CIGS) are manufactured using PECVD.

Step Three: Doping

To make a solar cell from the wafer, an n-type diffusion is performed on the front side of the wafer, forming a p-n junction tens of nanometers below the surface to create a built-in electric field. The process is typically done via gaseous diffusion, heat diffusion, or spray diffusion of phosphorus.

Step Four: Anti-Reflective Coating

Typically, a layer of silicon nitride (SiN) is deposited on the doped wafer via Plasma-Enhanced Chemical Vapor Deposition (PECVD), or more recently via sputtering for higher throughput. The SiN layer offers both anti-reflective properties and surface passivation, which saturate the dangling bonds and act as recombination centers in the material.

Step Five: Metallization

A metal contact is made on the back surface, and a grid-like metal contact made up of fine "fingers" is screen-printed onto the front surface. The rear contact is usually made by evaporating aluminum, and the front contact is usually made from silver paste. The metal electrodes then require some kind of heat treatment or "sintering" to make contact with the silicon.

Step Six: Module Assembly

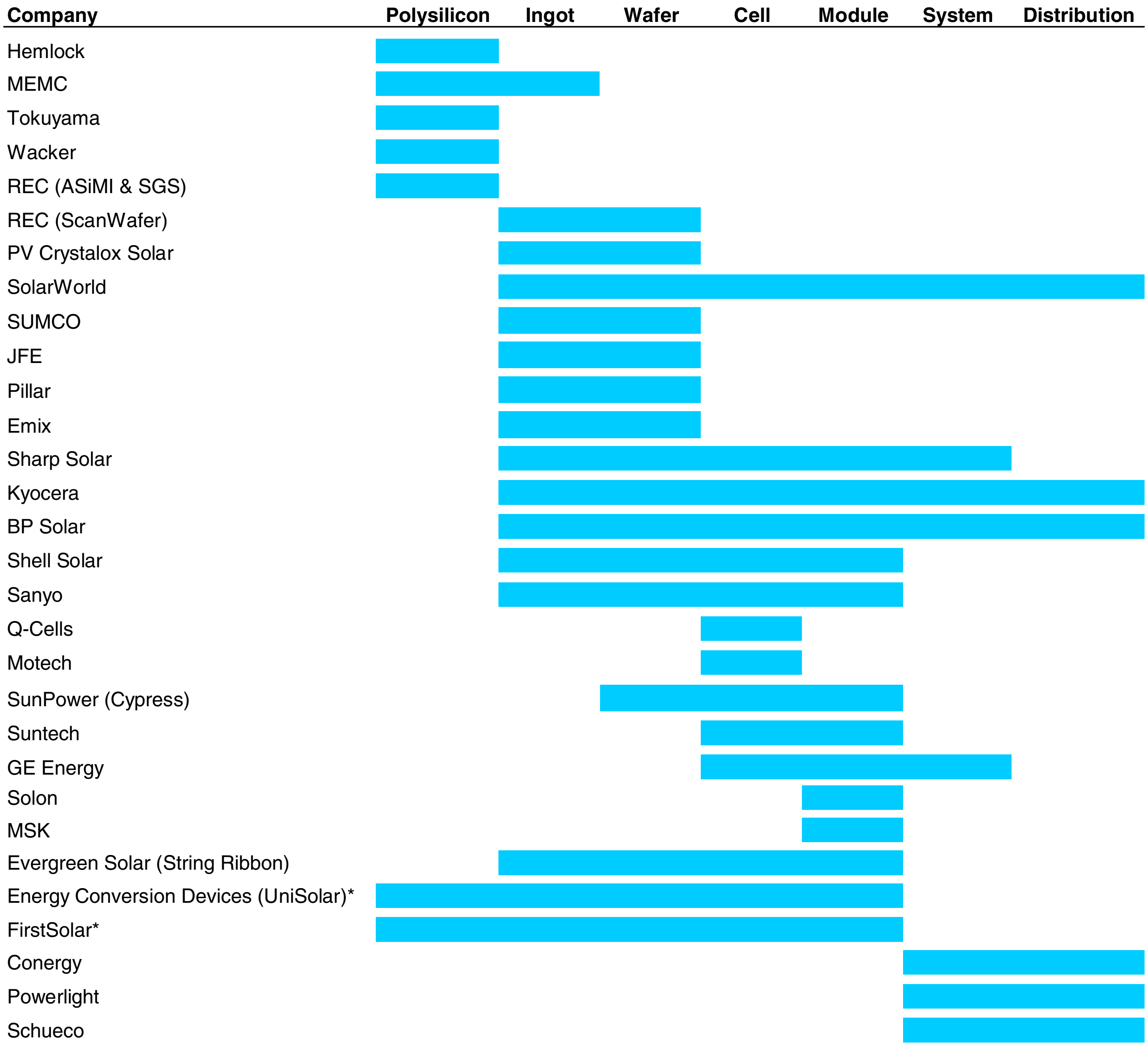
Solar cells are interconnected by wires and assembled into modules or "solar panels." The panels essentially protect the cells with a sheet of glass with an aluminum frame.

Step Seven: Installed

The modules are then sent to PV distributors, system integrators, and installers; ultimately they are installed in a PV system which includes the rack and mounting system, the PV modules, inverters, charge controller, and sometimes a battery bank. The entire PV system including installation ranges between $6 to $9/Wp (peak watt).

Exhibit 21

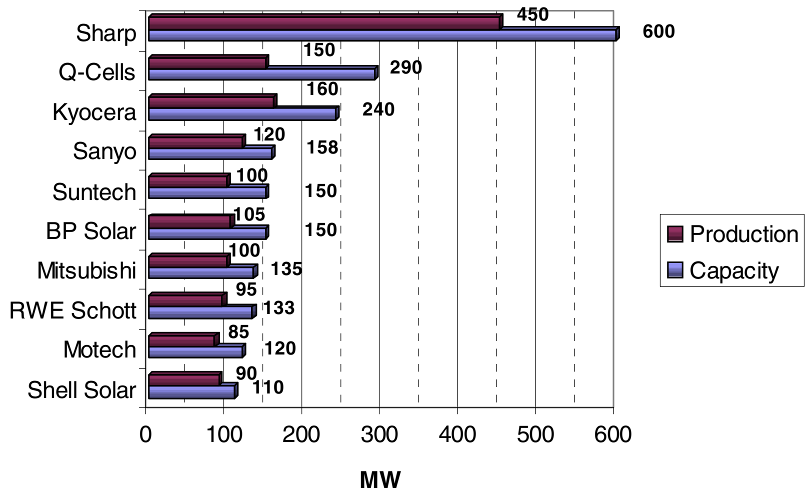
SOLAR INDUSTRY PLAYERS AT A GLANCE



* Thin-film PV
Source: Company documents, PJC estimates

Exhibit 22

TOP 10 PLANNED CELL CAPACITY AND PRODUCTION FOR 2005



Source: Photon International

Solar Cell Efficiency; Discussion And Analysis

Does Efficiency Matter?

Before we discuss the advantages and disadvantages of each technology, it may be helpful to discuss cell efficiency. Often technologies are distinguished by maximum cell efficiency — the most expensive to produce mono-crystalline wafers yield the highest efficiency of 16%-21%, while lower-cost thin-film technologies record efficiencies of 5% - 8%. While higher efficiency allows modestly higher ASPs per watt for area constrained or architectural aesthetics applications, we do not believe that higher efficiency at the expense of higher material COGS is a good business model long term. We posit that only the cost per watt matters and low-cost technologies will dominate the broader competitive landscape long term. Furthermore, given the structure of the feed-in tariff programs, only the amount of energy produced matters for the vast majority of the market.

- **Area Constraints:** Module efficiency determines the surface area that is required for any given power output. Higher efficiency modules are possible by using higher-quality and more expensive mono-crystalline solar wafers. The increased cost of higher efficiency PV modules becomes beneficial if there are space constraints. For a typical 3kW system, higher efficiency mono-crystalline modules will save 20% of the area versus conventional multi-crystalline modules.

Exhibit 23

SOLAR TECHNOLOGY AREA REQUIREMENT COMPARISON

Technology	High Efficiency Mono-Crystalline	Mono-Crystalline	Multi-Crystalline	String Ribbon	Amorphous Silicon	CdTe
Cell Efficiency	18.50%	16.50%	15.30%	13 to 13.5%	8%	9%
Module Efficiency	16.10%	14 - 15%	12 - 14%	12%	8%	9%
Typical Module Output	200W	175W	160W	115W	136W roll laminate	65W
Typical Module Size (mm x mm)	1559 x 798	1600 x 800	1600 x 800	1600 x 650	5486 x 394	1200x600
Area required for 3kW system (M^2)	18.7	21.9	24.0	27.0	47.7	33.2
Area vs. Multi-crystalline	78%	91%	100%	113%	199%	138%

Source: Company documents, US DOE, PJC Estimate

- **Installation Costs:** Less efficient modules will require more framing and mounting structures per watt. This is more important when the modules are mounted on tracking mounts. However, some thin film players (ENER) are integrating solar modules into roofing and building materials (commercial roofing, residential; shingles)—thus glass and framing are not required. Additionally, the incremental installation cost of solar becomes less significant for a customer that is already purchasing a new roof or siding.

Mono-Crystalline Solar Cells

Advantages

<u>Advantages And Disadvantages Of Various Solar Technologies:</u>

- **Highest Efficiency Solar Cells:** Mono-crystalline wafers have the highest efficiencies of any solar cell in mass production today. Its efficiency is rated at 16% - 23%.
- **Wide Install Base Of Equipment:** The mono-crystalline manufacturing process is nearly identical to that of IC semiconductors; as a result, the number of potential market entrants is large and the installed base of equipment (at semiconductor manufacturers) is enormous.
- **Technology Roadmap:** Mono-crystalline solar cells will benefit from continuous process improvement and best practices learned from the IC industry.
- **Twenty Percent Area And Module Material Savings:** On a per watt basis, mono-crystalline cells will require 20% less area and offer 20% cost savings on module framing materials and rack and mounting systems.
- **Potentially Best Durability:** Mono-crystalline wafers are thought to have the longest durability, as many as 45 years. It is at present unclear if other solar wafer technologies can surpass durability of 20 years.

Disadvantages

- **Highest Variable And Fixed Cost:** Mono-crystalline manufacturing is the highest cost manufacturing technique because it requires the greatest amount of silicon (high variable cost) in addition to additional cell processing steps and dedicated and expensive batch equipment (high fixed cost).
- **Most Exposed To Silicon Shortages:** Mono-crystalline wafers require the most silicon per watt versus other technologies. The likelihood of higher silicon prices is likely to significantly impact mono-crystalline manufacturers. As a result several mono-crystalline wafer manufacturers are adding to their portfolios by adding polycrystalline, string ribbon, and thin film manufacturing techniques.

Market Players

- SunPower (Cypress), Shell Solar, GE Solar, Sanyo, BP Solar, Isofoton, Suntech, Motech, Deutsche Cells, Q-Cells.

Multi-Crystalline Solar Cells

Advantages

- **Higher-Efficiency Solar Cells:** Multi-crystalline solar cells have relatively high efficiencies of 15.5% for mass produced cells, second only to mono-crystalline cells.
- **Wide Availability Of Equipment:** The multi-crystalline cell manufacturing process utilizes a simplified semiconductor process such as gaseous diffusion and PECVD, and as a result production equipment is readily available from a number of manufacturers.
- **Technology Roadmap:** Multi-crystalline solar cells benefit from continuous process improvement and economies of scale, with an efficiency target of 17% of mass produced cells.
- **Good Durability:** Multi-crystalline wafers have an estimated lifetime of 35 years and cell manufacturers typically offer a power output warranty of 25 years.

Disadvantages

- **High Variable Cost:** Multi-crystalline manufacturing also requires a significant amount of polysilicon as well as high wafer manufacturing and processing costs.
- **Exposure To Silicon Shortages:** Multi-crystalline wafers require 12 - 14 metric tons per MW of solar cell production. Higher silicon prices and a near-term shortage of silicon will also impact multi-crystalline manufacturers. The multi-crystalline solar cell manufacturers have made wafer sourcing their top priority.

Market Players

- Multi Cells represent 50% of solar cell production and have the largest number of market players, which include BP Solar, Kyocera, Sharp Solar, Suntech, Motech, Deutsche Cells, and Q-Cells.

String Ribbon Solar Cells

Advantages

- **String Ribbon Uses Less Polysilicon:** In traditional wafer manufacturing, silicon ingots are sawed into 270-300 micron wafers using a steel wire blade. The wire blade is 200 micron thick; each slice creates silicon sawdust that cannot be reclaimed. Some 25% - 35% of the silicon ingot is wasted in what is known as "Kerf" loss. The string ribbon produces a continuous thin silicon wafer 312 microns thick; no sawing is required. ESLR's process uses 35% less silicon than traditional wafer manufacturing; with the production of thinner wafers in 2006, this percentage could increase to 50% longer term. We estimate that traditional solar wafers require 12 - 14 metric tons of polysilicon per MW of solar cells; string ribbon requires only 8.5 metric tons. Viewed another way, a 130-micron traditional wafer (assuming the industry can get as thin) would use as much polysilicon as a 250-micron string ribbon wafer.
- **Continuous Improvement Process; Thinner Wafers Likely By Year-End:** At 312 microns, ESLR's current ribbon wafers are modestly thinner than traditional sawed 300-micron to 350-micron wafers. ESLR announced its roadmap to substantially thinner, 150-micron wafers by year-end 2005. String ribbon manufacturing is early in its development and has the potential to achieve better performance over the longer term. Traditional wafers are incrementally more difficult to improve given that its technology has already been improved upon for years; it is nearing its performance limitations for solar applications.
- **String Ribbon Uses Less Consumable Materials:** The traditional wafer-sawing process requires consumable stainless steel blades/wire, slurry, and caustic chemicals (acid) to polish or etch the wafer. The string ribbon process uses less of these consumable materials as well, again lowering costs.
- **The String Ribbon Process Is Efficient And Continuous:** Traditional silicon ingots are manufactured in a batch process. The string ribbon process is continuous, enabling more efficient processing and equipment utilization.

Disadvantages

- **String Ribbon Requires Specialty Granular Polysilicon:** Rather than chunk polysilicon, the string ribbon process requires small granular polysilicon, currently produced in substantial volume by just one supplier, MEMC (WFR). With a severe shortage of polysilicon anticipated, we suspect that MEMC would prefer using its internally produced silicon for its higher-margin IC wafers. ESLR suffered a 43% polysilicon price hike in December 2004 and 38% in July 2005. In August, ESLR announced that it had secured a second supplier, as well as a longer-term supply through up-front payments.
- **Does Not Eliminate Polysilicon:** Unlike thin film technologies, ESLR requires polysilicon and will not be immune to the shortages and price increases we anticipate through 2006.

- **Resulting Solar Cells Have Modestly Lower Efficiency:** String ribbon wafers have modestly lower efficiency: 13% versus multi-polycrystalline wafers' PV efficiency of 15%. Multi-polycrystalline wafers have efficiencies of 15% - 16%; mono-crystalline wafers, a higher 18% - 21%. Per single kilowatt, an ESLR module requires 20% more area than mono-crystalline suppliers.
- **Thin Wafers Are Fragile:** Because the string wafers are thin, the material is subject to cracking and breaking in the manufacturing process; this may reduce yields somewhat. We understand that ESLR must further improve its back-end process equipment to handle the substantially thinner, more-fragile 150 micron wafers anticipated in 2006.
- **Limited Base Of Tool Suppliers:** ESLR's proprietary ribbon furnaces are manufactured by only two vendors under contract. The traditional wafer manufacturing process uses standardized equipment produced by several suppliers.

Market Players

- Evergreen Solar, RWE Schott Solar (a similar Edge-defined Film-fed Growth (EFG) process).

Amorphous Silicon Solar Cells

Advantages

- **Potentially Lowest Material, Module, And Installation Cost:** a-Si cells only require 3µn of silicon versus 300µn for traditional crystalline silicon. The leading a-Si technology does not require glass encapsulation and aluminum framing, thus offering lower module material cost. Also, it can be integrated in building materials; this would lower installation costs.
- **Not Affected By Raw Silicon Shortage:** a-Si solar cells use silane gas as their source of silicon and not polysilicon, thus production is not affected by the raw silicon shortage.
- **Potentially Greater Energy Output Per Rated Peak Watt:** By capturing a wider spectrum of light via a "triple-junction" structure, a-Si cells are tuned to the red, green, and blue spectrum of light and can potentially generate more energy (kWh) per rated peak watt (Wp).
- **Flexible, Durable, And Lightweight Solar Cells:** By using a stainless-steel substrate, a-Si solar modules are flexible, more durable, and lighter in weight per rated watt versus crystalline silicon solar modules.

Disadvantages

- **Low Cell Efficiency:** a-Si cells only have conversion efficiency of 8% versus 15% for typically multi-crystalline silicon cells.
- **High Required Area Per Watt (lower peat watt per given area):** The lower efficiency results in the highest required area per watt of commercial solar technologies. The a-Si modules typically require 90% more area per watt versus multi-crystalline solar modules. Thus, for area-constrained applications, a-Si may not be the right solution.
- **Product Durability:** Historically, a-Si and other thin film technologies have had problems with degradation. We believe that industry leaders such as Energy Conversion Devices have made numerous improvements to the technology to address this issue. ECD offers a 20-year warranty on power ratings.

Market Players

- Energy Conversion Devices (UniSolar), Sanyo, Kaneka.

Exotic Materials: CdTe

Advantages

- **Potentially Lowest Material Cost:** The main ingredients of CdTe are cadmium and tellurium; Cd is a byproduct of the mining, smelting, and refining of zinc sulfide ores. Approximately 16,900 metric tons of cadmium were produced in 2003, at a price of $0.50/lb. Tellurium is a byproduct of copper mining and refining. The price of tellurium was $17/lb in 2004. Although the price of tellurium is rising sharply, as a thin-film technology, less than 5µn of CdTe material is used for the solar cell.
- **Unaffected By Raw Silicon Shortage:** CdTe technology does not use raw silicon, thus production is not limited by the raw silicon shortage.
- **Lower Equipment Cost:** CdTe technology uses thin-film deposition techniques similar to the production of flat panel displays. The equipment cost per watt is potentially lower than those required by crystalline-silicon technology.

Disadvantages

- **Lower Cell Efficiency:** Commercial CdTe solar modules have average efficiency of 9%, lower than those of crystalline silicon. However, there's a roadmap to get efficiency to 10%, with lab efficiency as high as 17%.
- **Raw Material Not Answer For Entire Industry:** Tellurium is a rare metal, and we estimate less than 200 metric tons of production in 2004. Due to increased demand and production shortages at a leading U.S. producer, tellurium's spot price has been rumored to have increased to $100 in recent days. Although this would limit industry growth, only a small amount is used and there is sufficient supply for existing market players to grow for decades.
- **Cadmium Has A Negative Environmental Profile:** Cadmium is a widely known toxic chemical and causes severe health damage to humans when consumed. However, the CdTe compound is stable, and is encapsulated in glass for the solar module. The module does not release CdTe, and the primary CdTe solar module maker is funding solar module reclamation and recycling at end of use.

Market Players

- First Solar, Antec.

Solar Concentrators

Solar Concentrators focus solar energy from the sun using reflective materials such as mirrors. PV concentrators are used in conjunction with traditional solar cells while large-scale concentrators work on the sun's heat that is converted into electricity.

PV concentrators use inexpensive flat, plastic Fresnel lenses as an intermediary between the sun and the cell. These magnifying lenses focus and concentrate sunlight approximately 250 times onto a relatively small cell area. Through concentration, the required silicon cell area needed for a given amount of electricity is reduced by an amount approximating its concentration ratio (250 times). In effect, a low-cost plastic concentrator lens is being substituted for relatively expensive silicon. PV concentrators come in larger module sizes, typically 20 kilowatts to 35 kilowatts each; they track the sun during the day and are more suitable for large utility installations.

- **Trough Collectors:** Parabolic trough systems use curved mirrors to focus sunlight on an absorber tube filled with oil or other fluid. The hot oil boils water to produce steam, which is used to generate electricity. Since 1985, nine power plants in the Mojave Desert, called the Solar Electric Generating Systems (SEGS) that use parabolic trough technology, have been in full commercial operation.

- **Power Towers:** Power tower systems use an array of sun-tracking mirrors, called heliostats, to concentrate sunlight onto a receiver on the top of a tower. The sun heats a fluid inside the receiver to generate steam in the tower to drive a turbine to generate electricity.
- **Dish/Engine Systems:** A dish/engine system uses mirrors in the shape of a dish to collect and concentrate the sun's heat onto a receiver. The receiver transfers the solar energy to a heat engine—usually a Stirling cycle engine—that converts the heat into mechanical energy, which drives a generator to produce electricity.

Advantages

- Large-scale power generation is possible.
- Relatively inexpensive for large-scale power generation.
- Concentrating solar power technologies utilize many of the same technologies and equipment used by conventional central station power plants, simply substituting the concentrated power of the sun for the combustion of fossil fuels.

Disadvantages

- Technological challenges currently exist.
- Costly initial CAPX.
- Only suitable for Sunbelt area at present.
- Not a distributed power generator, not for rooftops.

Market Players

- Solar Systems (Australia), Armonix (U.S.), Guasor (Spain), Prism Solar, Boeing-Spectrolab, Rosestreet Labs, Energy Innovations.

Other Exotic Solar Technologies In Research And Development Stage

It is no coincidence that many of these emerging solar power companies are developing thin film or concentrator technology that minimizes the supply limitation of polysilicon.

- **Konarka** is commercializing organic-polymer solar cells manufactured using a roll-to-roll printing process on a lightweight, flexible substrate. While it offers the promise of ultra-low-cost solar cells using common industrial printing techniques, the efficiency and durability of this technology have not yet been validated. However, even with lower efficiency and durability, there still may be a market for such product.
- **Rosestreet Labs'** subsidiary, RSL Energy, will initially offer solar concentrators. RSL is also developing high-efficiency full spectrum solar cells utilizing thin film technology. The company is working on two types of thin-film PV cells—indium gallium nitride (InGaN) materials licensed from Cornell with 31% efficiency, and a zinc manganese tellurium oxide (ZnMnTeO) solar cell licensed from Lawrence Berkeley National Lab with a theoretical efficiency of 55%.
- **Miasole** is commercializing copper indium gallium selenium (CIGS) thin-film solar cell technology. The CIGS material is stable and is noted for its "self-healing" properties. The solar cells are manufactured using a sputtering technique to deposit thin-film on flexible substrates with roll-to-roll processing.
- **Nanosolar** is developing low-cost thin-film solar cells based on non-silicon semiconductors (inorganic semiconductors of the IIb/VIa and Ib/IIIa/VIa families as well as solution-coatable organic semiconductors).
- **CSG Solar AG** is developing crystalline silicon on glass solar cells, by depositing a thin film silicon on glass. The company expects commercial product launch in 2006.

- **EMCORE's** photovoltaic division designs and manufactures high-efficiency III-V multi-junction compound semiconductor solar cells and solar panels for commercial satellite applications. Products include InGaP/InGaAs/Ge advanced triple-junction (ATJ) solar cells with 27.5% conversion efficiency that are epitaxially grown via organo-metallic chemical vapor deposition (OMCVD) reactors on 140-mm uniformly thick germanium substrates.
- **Daystar** is developing copper indium gallium diSelenide (CIGS) solar cells on flexible specialty metal substrates. The company is in the process of commercializing its technology, and is currently expanding its production capacity 2.0 to 2.5MW per year to validate its manufacturing process.
- **HelioVolt** is developing copper indium selenide (CIS) thin film solar cells on multiple substrates. The technology offers the promise of high efficiency and durability among thin-film PV technology.
- **Advent Solar** is commercializing back-contact solar cells and modules via "Emitter Wrap-Through" technology licensed from the Sandia National Laboratories.
- **Energy Innovations** has a number of technologies under development including Stirling-engine Sunflower, dual-axis solar tracking concentrator system, and various other solar concentrator technologies.
- **XsunX** is developing thin semi-transparent coatings and films to create monolithic solar cell structures. The solar cell structure allows glass windows to produce electricity from the power of the sun.
- **Solaicx** is building a pilot factory in California for production of silicon wafers for solar cells, using its proprietary manufacturing process. Solaicx claims its manufacturing process makes mono-crystalline silicon wafers in about half the time of the existing process, using a Continuous Czochralski Grower machine. The technology can potentially produce significantly lower-cost mono-crystalline solar wafers.

ENERGY CONVERSION DEVICES, INC.

Key Points

Lowest-Cost Solar With Hybrid Play; EPS Power Of $2.00 In 2008: Initiated With An Outperform Rating.

- **Unique, Low-Cost Approach To Solar Modules:** ENER's UniSolar division manufactures solar modules using proprietary materials and an innovative "thin film" manufacturing process. Key advantages include: 1) substantially lower material cost than traditional solar wafers; 2) a highly efficient, continuous-production process; 3) a lightweight and flexible solar module; and 4) potentially higher energy output per rated watt.
- **Capacity Expansion Is Under Way:** ENER's UniSolar division is selling solar modules to near full capacity in its first 25MW plant, contributing $80 million annually. Its second 25MW facility will ramp over 18 months; we anticipate $160 million of solar revenue in CY07. In addition, it is ramping a 25MW JV plant in China, with the JV partner funding the entire investment, contributing annual JV income of $5 million when ramped.
- **Capacity Ramp Is Key To Profitability:** ENER's 25MW facility will operate at strong 30% gross margin (among the industry's highest). The company will continue to post net losses until the second 25MW line ramps in FQ207 (December 2006). We anticipate that ENER will announce additional 25MW plants through 2007, each plant adding EPS of $0.66 at full ramp.
- **Also A Rare Play On Hybrid Electric Vehicles That Offers Strong Intermediate-Term Growth Potential:** ENER owns the patents for nickel metal hydride (NiMH) batteries and collects royalty on every Sanyo battery used in a hybrid vehicle. Moreover, ENER has a 45% JV with Chevron, Cobasys, to manufacture NiMH batteries for hybrids. We estimate that from $9 million in F05, battery revenue will grow to $16 million in F07.
- **Potential Catalysts Are In The Offing Near Term:** These include the announcement of a new solar plant, a major win for Cobasys and introduction of solar cell efficiency/ capacity improvement.
- **Historical Financials Are Poor:** In our opinion, the biggest detraction from an otherwise promising investor thesis is ENER's poor historical financials. It has never turned a profit since its 1967 IPO, instead sustaining high R&D expenses. We believe that management is now more focused on the solar market and will rationalize spending.

Investment Recommendation

We anticipate rapid revenue and earnings growth as ENER expands its solar capacity, records royalties for NiMH batteries, and achieves hybrid vehicle wins for its Cobasys JV. ENER's UniSolar is not subject to the polysilicon shortage and, in our opinion, can grow at a 34% growth rate through 2010, well ahead of the overall industry. We value ENER at 31x annualized $2.00 EPS in FQ408 ($62), then discount back two years (CAPM). Thus, our 12-month price target is $50.

Risks To Achievement Of Target Price

Risks include, but are not limited to: 1) the company's history of losses and uncertain future profitability; 2) reduction of government incentives for solar power; and 3) an inability to protect patents.

Company Description

ENER is an innovative company that develops and commercializes amorphous thin-film materials, with applications in solar power and NiMH batteries.

Investment Thesis

- **An Innovative Materials Company With A Broad Technology Portfolio:** ENER designs, develops, and commercializes unique materials based on its amorphous thin-film material expertise. These materials are being commercialized in various applications in energy generation, energy storage, and data storage. ENER is commercializing its technologies through a number of subsidiaries and joint ventures, including United Solar Ovonic (UniSolar) for photovoltaic (PV) solar cells and modules; Cobasys for hybrid electric vehicle battery systems; Ovonyx for phase-change memory; Ovonic Fuel Cell Company for generative fuel cell technology; and Ovonic Hydrogen Systems for solid hydrogen storage system.
- **UniSolar Has Potentially Lowest-Cost Solar Manufacturing Technology:** More than 90% of solar cells use wafer manufacturing processes developed for the integrated circuit (IC) semiconductor industry. In this process, polysilicon represents up to 40% of the cost of a solar wafer and 25% of the total module cost. Exacerbated by a severe polysilicon shortage, high wafer costs are limiting industry profits and mass adoption of solar modules without government subsidies. UniSolar produces amorphous-silicon (a-Si) based thin-film solar modules using a unique and proprietary deposition process that uses abundant silane gas as a raw material and does not require costly silicon wafers that are in short supply. This manufacturing process is highly automated and efficient, able to process six 1.5-mile rolls of stainless steel sheets continuously. Moreover, UniSolar's solar cells can be deposited on flexible substrates that are incorporated into building materials. ENER is unfolding several process enhancements that will improve capacity, efficiency, and margins.
- **Expect Solar Sales To Drive Near-Term Growth:** UniSolar is producing solar modules at its first 25MW facility at near capacity (2MW/month); we estimate annual solar revenue of $80 million. The second 25MW facility broke ground July 14 and should achieve initial production in 15 - 18 months. We anticipate an additional $80 million of PV revenue once the facility ramps. On September 19, ENER announced a photovoltaic JV with China's Tianjin Jinneng Investment Company. We would expect ENER to receive a 30% ownership for its technology contribution and recognize $5 million of JV equity income when ramped. In addition, ENER will provide the tools for the 25MW JV plant, recording $65 million in revenue over the next five quarters.
- **Large Solar Power Market:** With record high oil prices, insatiable demand for electricity worldwide, and a growing national policy favoring energy independence, solar cells and alternative energy are attracting government and market attention. We expect the solar industry to grow rapidly over the next few years, driven first by worldwide subsidies, then by off-grid electricity demand and utilities seeking to supply peak power to transmission- and load-constrained regions. With technology improving and costs declining, we believe that for most applications, select solar companies will be cost competitive with the grid (without subsidies) by 2010. We peg the solar module market at $4 billion in 2004 (1,256MW) of cell production) growing to $5.3 billion in 2005 (1,638MW), then more than doubling to $12 billion in 2010 (4,808MW). We believe solar demand will exceed supply for several years, and there is more than enough demand to sell out solar manufacturers' capacity through 2006.
- **We Also View ENER As A Play On Hybrid Batteries, Offering Strong Intermediate-Term Growth Potential:** ENER owns the fundamental patents for nickel metal hydride (NiMH) batteries. ENER collects a $100 royalty for each Sanyo battery used in a hybrid vehicle, now found in the Ford Escape and Honda Accord and Civic. Moreover, ENER has a 45% JV with Chevron and Cobasys to design and manufacture NiMH battery systems for hybrids. Although current production models do not incorporate Cobasys batteries, we believe it may have development initiatives with General Motors, and may become the second source to Toyota and Ford for hybrids made in the U.S. We estimate

battery revenue at $9 million in F05, rising to $11 million in F06 and $16 million in F07. Cobasys JV income is unlikely before 2008.

- **Historical Financials Are Poor:** In our opinion, the biggest detraction from an otherwise promising investor thesis is ENER's poor historical financials. The company went public in 1967 and has never turned a profit, instead sustaining high R&D expenses to fund a variety of long-range projects. We believe that management is now more focused on the solar market and will rationalize spending toward more near-term opportunities.

Valuation

Although the photovoltaic industry still relies on government subsidies to be viable, we believe that as solar generation spreads, ENER will reap significant benefits by being a low-cost producer with unique product advantages. In our opinion, ENER's technology has been validated, and that continuous improvements in yields, efficiency, and process will widen margins as the company executes on its technology roadmap. In addition, the potential for JV plants worldwide offers additional revenues from machine builds and JV equity income. Other significant revenue sources expected to grow rapidly include Sanyo NiMH battery royalty for hybrid vehicles, NiMH electrode material sales, and Cobasys battery JV income. We estimate F06 revenue growth of 70% to $130 million and F07 growth of 42% to $185 million.

- **Earnings Power:** We estimate that each additional 25MW PV plant at capacity can generate ~$80 million of annual revenue with a 30% gross margin and only $5 million in annual operating expense. Thus, we suggest that a PV plant can contribute $19 million of operating income per year, or $0.66 in EPS. On an $85 million capital investment ($65 million equipment capx, $5 million of leasehold improvement, and $15 million working capital), each PV plant generates a healthy 22% of return on investment. For each solar plant JV (with CAPX funded by JV partner) at full ramp, we estimate a $5 million annual benefit to ENER, or $0.17 in EPS.
- **Rating And Price Target:** We value shares of ENER on earnings power of $2.00 in annualized EPS, based on the anticipated run rate at year-end F08 ($0.50 in F4Q08 with 75MW of solar production). We believe ENER will grow significantly faster than the 24% expected growth rate for the solar industry—it is not subject to the polysilicon shortage. We thus value the stock at 31x $2.00 annualized F4Q08 EPS of $0.50, which represents a modest discount to the 34% 2005-2010 CAGR we estimate for the company given the distraction, and higher opex required, of its fuel cell, hydrogen storage, and memory operations, in addition to its poor track record of losses since inception. This suggests a stock price target of $62 in 2008. Discounting back two years (at 11.7% of expected equity rate of return based on CAPM with adjusted beta of 1.19) yields a 12-month price target of $50. Thus, we initiated our coverage with an Outperform rating.

Investment Risk

Company-specific risks include, but are not limited to:

- The reduction or elimination of government subsidies for solar power, especially in Germany.
- A decline in oil and energy prices that could stall solar installations.
- Problems with manufacturing capacity ramp, efficiency, and yield.
- A history of operating losses and uncertain future profitability.
- Operational execution missteps, particularly in expanding manufacturing capacity and bringing technology to its full potential.
- Inability to protect and maintain proprietary technology and patent litigation/challenges.
- Inability to commercialize unproven memory technologies.

General risks include, but are not limited to:
- Impact of geopolitical events.
- Uncertain future industry growth rates.
- General economic risk.

Industry Overview

Below are excerpts from our detailed analysis of the Solar Industry published on September 30, 2005 - *Solar Powered: An Emerging Growth Industry Facing Severe Supply Constraints.*

Why Invest In Solar Power Stocks?

The greatest number of publicly-held alternative energy plays are found in the solar power sector. We anticipate four or five solar energy IPOs within 12 months. We highlight the following key reasons to consider solar power investments:
- **Technology And Business Models Are Proven With Clear Path To Profitability:** Unlike other alternative technologies, solar energy is proven, business models have been validated, and the industry is enjoying tremendous growth in worldwide solar subsidies. Although profitable alternative energy companies are rare, numerous solar energy companies are already profitable—or gross margin positive.
- **Solar Energy Benefits From The Largest Of All Alternative Energy Subsidies:** Solar power is afforded the greatest subsidies worldwide and these are driving demand. These rebates reduce the breakeven for solar power from 7-10 years to 3-5 years. Notably, Germany, the country with the greatest subsidy, makes up 39% of the solar market. There also are subsidies in Japan, Spain, Italy, and the U.S. We anticipate expanded worldwide subsidies through 2007.
- **Large And Rapidly Growing Solar Industry:** We expect the solar industry to grow rapidly over the next few years, driven first by worldwide subsidies, then by off-grid electricity demand and utilities seeking to supply peak power to transmission- and load-constrained regions. We peg the solar module market at $4 billion in 2004 (1,256MW of cell production) growing to $5.3 billion in 2005 (1,638MW), then more than doubling to $12 billion in 2010 (4,808MW). These programs indicate that solar demand will exceed supply for several years.
- By **2010, Solar And Grid Prices Will Be Competitive In Certain Markets:** With technology improving and costs declining, we believe that for most applications, select solar companies will be cost competitive with the grid (without subsidies) by 2010. We assume a 5% annual cost reduction through 2010, when we estimate module cost will have fallen to $2.50/watt (from $3.25/watt today). We believe that for thin-film companies, the technology roadmap and cost curve are more aggressive and anticipate $1.75/watt in 2010. Adding balance-of-plant (BOS) savings, we believe this can drive overall system costs to as low as $4.25/W, effectively lowering leveled solar electricity costs from $0.30/kWh today to $0.18/kWh, making solar energy competitive in certain large markets (for example, Japan's grid electricity cost is $0.20/kWh, while peak power in California can be $0.30/kWh).

How To Invest In Solar Stocks; Our Call

All Solar Power Manufacturers Will Benefit From Strong Macro Demand: Expanding subsidies worldwide plus the current solar module market price of $3.25/watt suggest demand that will allow solar manufacturers to pre-sell all available capacity through 2006 and that the market will support several different approaches to solar, regardless of the technology employed.

But Supply Limits Are A Concern; Polysilicon Is In Short Supply Industrywide: Solar cell production is limited by: 1) internal production capacity, a function of production ramp lead-time and CAPX financing; and 2) the supply of refined polysilicon feedstock, the main ingredient in solar cells. Although CAPX financing is readily available, polysilicon production is bottlenecked.

Margins And Growth May Suffer: Of all solar cells produced, 91% use mono- or poly-crystalline silicon wafers. For these cells, the polysilicon feedstock represents 40% of wafer costs and 25% of module costs. Currently, polysilicon production is bottlenecked, and contract prices have doubled over the last 10 months. Despite 10% incremental increases in annual polysilicon capacity through 2007, demand far exceeds supply and we expect the shortages will remain severe through 2007 until major production increases come online in 2008. Rising solar wafer demand and tight polysilicon supply mean higher costs for solar manufacturers without long-term polysilicon supply contracts and the inability to meet production plans.

How To Differentiate Solar Plays: Solar power companies are best distinguished by technology node and production capacity, not cell efficiency. Technology will determine a specific company's cost structure, production scalability, and vulnerability to rising polysilicon prices or shortages.

How To Play These Themes: Although there is no single-point technology solution at this early stage of solar power's evolution, rising polysilicon material prices will squeeze margins and limit capacity. We thus prefer solar-cell companies with low-cost manufacturing technology that reduces/eliminates the need for costly polysilicon; we believe these companies will have the greatest competitive advantage long term and grow well in excess of the overall industry.

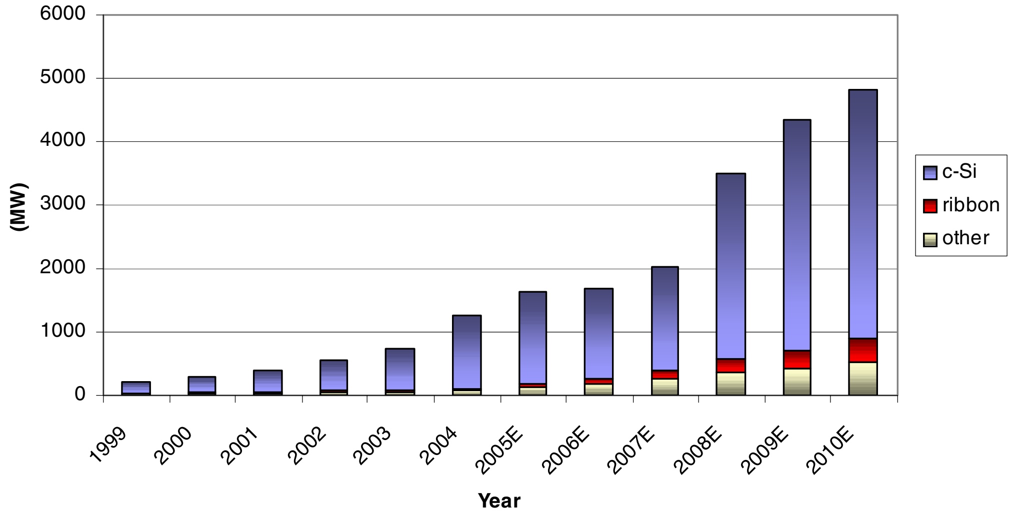
Solar Power Demand

Robust Worldwide Demand Drives Solar Industry Growth

In 2004, solar cell production grew 67% to 1,256MW from 750MW in 2003, according to Photon International. Based on production ramps announced by key players, we estimate solar cell production to grow 30% this year to 1,638MW. We note production and growth would have been higher if not for the severe polysilicon shortage. The robust demand for photovoltaic (PV) systems is driven by higher energy prices, growing subsidies worldwide, and increasing focus on energy independence. With strong demand worldwide, we anticipate the solar industry to achieve 24% annual growth through 2010. We anticipate that the polysilicon shortage will limit solar cell production through 2007 until significant new capacity comes online in 2008. As a result of this shortage, we anticipate that non-crystalline silicon players will experience a higher growth rate—we anticipate a 34% CAGR to 2010.

Exhibit A-1

GLOBAL SOLAR CELL PRODUCTION AND FORECAST



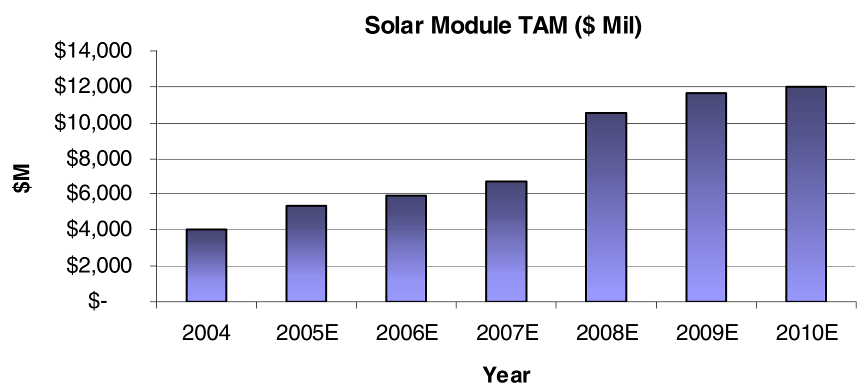
Source: Photon International, PJC Estimates

Sizing The Market

We estimate stable solar module pricing of $3.25 per watt through 2007. We anticipate an annual 10% price reduction beginning in 2007 through 2010. Based on these ASP and volume assumptions, we estimate a TAM of $4 billion in 2004 and $5.3 billion in 2005, growing to $12 billion in 2010.

Exhibit A-2

SOLAR MODULE TOTAL AVAILABLE MARKET



Source: PJC Estimates

Company Analysis

UniSolar Photovoltaic Materials—The Primary Company Driver

UniSolar Has Unique Solar Technology

United Solar Ovonic (UniSolar), a 100%-owned subsidiary of ENER, contributes more than 75% of ENER revenue. UniSolar uses a unique manufacturing process to produce amorphous-silicon (a-Si) based thin-film solar modules. Key product/manufacturing advantages include:

- **The Industry's Lowest Materials Cost, A Sustainable Competitive Advantage:** Because it uses silane gas as a raw material, UniSolar is unaffected by the current polysilicon shortage or price increases.
- **Low Processing Cost:** ENER's highly efficient, roll-to-roll manufacturing process handles six 1.5-mile stainless steel sheets at once.
- **Higher Output Per Rated Watt:** UniSolar's product can produce 20% more energy per rated watt than conventional solar panels.
- **Flexible Solar Cells Allow Multifaceted Products:** UniSolar modules can be rigid, flexible, or incorporated into building materials.

Capacity And Revenue Potential

UniSolar currently has 30MW of annual solar module capacity—5MW for R&D and 25MW for commercial production. In July, UniSolar reached near full production of 2MW/month. At a $3.20/W solar module selling price, we estimate an annual revenue run rate of ~$80 million ($20 million quarterly). With a six-month (13.7MW) backlog, UniSolar's facility is production constrained. In July, UniSolar broke ground on its second PV facility, which will cost $60 million to $70 million to build, take about 15 months to complete, and ramp within three to six months. When completed in 2H06/07, UniSolar will have annual capacity of 55MW for an annual revenue run rate of $160 million.

25MW Chinese JV

On September 19, ENER announced a memorandum of understanding with Tianjin Jinneng Investment Company (TJIC), a major Chinese utilities company, to form a joint venture that will establish a 25MW PV facility in China. We suggest that, in return for its technology contribution, ENER will receive a 30% ownership with royalty payments likely. Over the next five quarters, ENER also will record $65 million in machine-building revenues for the plant. At full production, we estimate that the JV could contribute $5 million in annual JV equity income.

UniSolar Technology Overview

UniSolar manufactures amorphous-silicon alloy solar cells based on a proprietary "triple-junction" technology. The technology deposits amorphous-silicon alloys on lightweight flexible substrates using a highly-efficient, roll-to-roll continuous deposition process. Advantages of triple-junction technology and manufacturing process include low-cost materials and processing; high-yield, flexible cells; and higher energy output per rated watt. The solar cells have 8% efficiency.

Advantages Of a-Si Based Solar Cells

- **Low Materials Cost:** Low cost is a leading advantage of a-Si PV cells. The two major ingredients of the a-Si alloy are silicon and hydrogen, both abundant on earth. a-Si alloys need only 1 µm to absorb the sunlight versus 300 µm for conventional crystalline-silicon solar cells. The technology uses abundant silane gas as raw material and does not require silicon wafers.
- **Low-Cost Manufacturing:** UniSolar produces its solar cells using a low-cost, high-yield manufacturing process. The roll-to-roll deposition utilizes six 1.5-mile-long stainless steel sheets in a continuous process. This patented, proprietary process, now in its eighth generation, incorporates state-of the-art design with in-line diagnostic sensors.
- **Higher Output Per Rated Watt:** The triple-junction design responds to three wavelengths of light (red, green, and blue), resulting in higher energy output per rated watt in cloudy/low light environments than crystalline-silicon-based solar cells. According to white papers from UniSolar, under various test situations in outdoor environments, UniSolar's cells can generate as much as 20% more energy (in kWh) per rated peak watt (Wp) versus conventional crystalline solar cells. In a study done in 2000 for Dutch outdoor conditions, ECD's product generated 1,164 kWh/kWp/y (annualized per kW system yield) versus 967 average for crystalline solar modules (we note a-Si modules average 1,083 kWh/kWp/y). In another test done in Lugano, Switzerland, UniSolar's modules generated 1,341 kWh/kWp/y, versus 1,077, average for crystalline solar modules.
- **Flexible Solar Cells Allow Multifaceted Products:** UniSolar's unique manufacturing process allows it to make rigid, flexible, and building-integrated solar modules. The rigid modules are framed for large-scale power generation and battery charging applications. The flexible modules generally are used in recreational vehicles, sailboats, and foldable battery charger applications. Building-integrated applications include PV laminates with a peel-and-stick backing that can be integrated into commercial metal roofs, as well as PV shingles for homes.
- **Technology Roadmap:** ENER's solar R&D initiatives include improving the efficiency of its production thin-film solar cells and roll-to-roll production process, and developing ultra-lightweight thin-film solar cells with a plastic substrate for airship and space applications. ENER plans to increase capacity at its existing PV plant from 25MW to 100MW via process improvement and technology advances.
- **Cells Achieve The Highest Efficiency Among Thin-Film a-Si Competitors:** UniSolar has the highest conversion-efficiency a-Si solar cells. The a-Si technology uses radio-frequency plasma-enhanced chemical vapor deposition (RF PECVD) methodology and has demonstrated a stable cell efficiency of 13% using a spectrum-splitting triple-junction structure. Commercial high-volume production cells have efficiency of 8%.

How Does It Work?

UniSolar's triple-junction solar cell consists of three solar cells deposited one on top of the other. The multi-junction structure incorporates materials with different band gaps to increase the device's overall spectral response, which heightens efficiency. Each junction responds to a different wavelength of light (red, green, or blue) versus crystalline-silicon-based solar cells; this yields higher energy output per rated watt in low-light environments. A silver zinc oxide layer deposited as a back reflector facilitates light-trapping in the solar cell.

Manufacturing Process Technology

UniSolar manufactures its solar modules using a roll-to-roll continuous deposition process with flexible substrates. A roll of 5-miles of thick stainless steel substrate goes through four consecutive roll-to-roll machines: 1) wash, 2) back reflector deposition, 3) triple-junction structure deposition, and 4) top conductive layer. The stainless steel rolls are 14 inches wide; six 1.5 miles of stainless steel sheets are processed at one time. The resulting coated web is cut to a predetermined size for module fabrication. The end product is a flexible, thin-film solar module.

Exhibit A-3

UNISOLAR MANUFACTURING FACILITY

Source: UniSolar

NiMH Batteries; Strong Intermediate-Growth Potential

NiMH Battery (Ovonic Battery Subsidiary)—An Intermediate-Term Growth Driver

ENER has developed proprietary materials and technologies for nickel metal hydride (NiMH) batteries, and has 85 U.S. patents covering all commercial NiMH batteries. ENER licenses its technology to several battery manufacturers including Sanyo Electric and various Chinese companies. ENER receives a 0.5% royalty for consumer applications and 3% for transportation applications. Honda and Ford use Sanyo's NiMH battery packs for their hybrid vehicles, generating a royalty of $100 per vehicle for ENER. ENER also provides product development services to a 46% JV with Cobasys (Chevron) and other licensees. Ovonic contributed $9.2 million of revenue in F05. We estimate $11 million for F06, growing to $16 million in F07 on higher Sanyo royalties and materials sales.

Cobasys JV With Chevron

Cobasys designs and manufactures NiMH battery systems for use in hybrid electric vehicles and stationary backup power. Originally named "Chevron Ovonic Battery Systems," Cobasys is a Chevron Texaco-ENER JV, 50% owned by Ovonic Battery with ENER having an effective 45.7% ownership (Sanyo owns 2.2% of Ovonic; Honda, 3.2%; and Sanoh, 3.2%). Chevron has invested $160 million into the JV, with ENER contributing patents/technology. Cobasys has a fully integrated battery system product, with a 10-year/150,000 mile life. Cobasys also has a collaboration agreement with Motorola to jointly supply electronic control systems and NiMH battery systems for the hybrid-electric drive train.

Cobasys Orders Anticipated For 2006/ 2007

No currently produced hybrid electric vehicles use Cobasys NiMH battery systems. Panasonic EV Energy (PEVE), a Toyota-Matsushita JV, currently supplies NiMH battery packs for Toyota and some Honda hybrid vehicles. Sanyo supplies NiMH systems for the hybrid Ford Escape and Honda Accord and Civic. However, Cobasys announced in August that it has received orders for hybrid vehicle production programs and is in the testing and development stage for several automotive OEMs. We believe Cobasys has won a number of programs at a large automotive OEM and will begin shipping products in volume in the near future. We suspect that Cobasys is working with General Motors on several of its upcoming hybrid-electric vehicles that may be revealed when GM announces its hybrid vehicle programs. Cobasys may also become the second source for Toyota and Nissan's U.S.-made hybrid electric vehicles such as the new Camry and Altima.

Market Positioning And Potential

In terms of end market demand, U.S. shipped 73,000 hybrid electric vehicles in 2004, with 2005 shipments estimated at 150,000. JD Power estimates that U.S. hybrid electric vehicle shipments will reach 410,000 in 2007. We believe that Cobasys can achieve a 25% - 33% market share by 2008. In our view, strong growth in hybrid electric vehicle shipments along with future Cobasys program wins will provide accelerated growth in FY07/08.

Manufacturing Capacity And Growth

Cobasys' 170,000-sq. ft. manufacturing facility in Springboro, Ohio, is undergoing Phase I buildout; fully equipped, capacity will be 1.2 million battery modules (60,000 vehicles) a year. The current facility could ultimately support capacity of 2 million units a year (100,000 vehicles). At $3,000 - $4,000 per vehicle for a NiMH battery system, we estimate that Cobasys' current facility can produce $300 million - $400 million of revenue.

Panasonic Settlement And Licensing

In July 2004, ENER settled its patent lawsuit with PEVE, Matsushita, and Toyota and entered cross-licensing agreements. ENER received a patent license fee of $10 million,which will be recognized at $238,000 per quarter, and Cobasys, $20 million, of which $4 million was for advanced NiMH battery development and $8 million was distributed to ENER. Cobasys also will receive royalties on NiMH batteries PEVE sells in North America. Under the expanded cross-licensing agreement (July 2005), Cobasys will receive royalties on PEVE North American sales of NiMH battery products through 2014.

Longer-Range Technical Efforts

Optical / Nonvolatile Semiconductor Data Storage Materials

ENER has developed unique phase-change materials and technology for use as rewritable optical memory, which has been commercialized in CD-RWs and DVD-RAM. Current licensees include Matsushita, Ricoh, Sony, and various Taiwanese optical media manufacturers. Optical and OUM royalty and product development agreements currently contribute $2 million in annual revenue.

Ovonyx JV

Ovonyx develops and commercializes the "Ovonic Unified Memory" (OUM), a multi-element thin-film material that exhibits reversible structural phase-change properties. An OUM device can change its crystal structure and electrical characteristics when a voltage is applied; it is being commercialized as a flash memory replacement. Ovonyx CEO Tyler Lowrey was the CTO of Micron Technology and served as Micron's COO, VP for R&D, VP for manufacturing, and a member of Micron's board of directors as well as its vice chairman. Ovonyx is 41.7% owned by ENER (31.4% fully diluted). Other investors include Intel Capital and Tyler Lowrey.

OUM can be used as a nonvolatile semiconductor memory device, making it a potential flash memory replacement, with applications in all products utilizing solid-state memory. Development partners and licensees include Intel, STMicroelectronics, Elpida, BAE systems, and Nanochip. We see a three- to five-year time frame to overcome technical and scale challenges.

Regenerative Fuel Cell And Hydrogen Storage System

ENER is developing a regenerative fuel cell. This electrochemical device combines oxygen with hydrogen to produce electricity without combustion, the only byproducts being water and heat. Unlike traditional fuel cells, ENER uses metal hydride at the anode to store hydrogen in its regenerative fuel cell. The approach has the advantages of energy storage in the fuel cell stack, as well as sub-zero temperature instant start capability. The technology is being developed for use in stationery, portable power, and transportation applications. We view fuel cell technology and market adoption as being at least five years away, primarily due to cost and technological hurdles. To complement its fuel cell development, Ovonic Hydrogen, an ENER subsidiary, is developing a storage system to provide hydrogen to fuel cells, hydrogen combustion engines, and various other applications. ENER's technology uses metal hydrides to store hydrogen in a solid metal matrix without the need for high pressure compression. The material can be packaged in various sizes and shapes to meet application requirements. In one structure, the metal hydride material has been packaged in a black "hockey puck"-like shape to fit inside hydrogen gas canisters. Originally a JV with Chevron Texaco, Chevron transferred its interest in Ovonic Hydrogen to ENER in December 2004 and paid ENER $4.7 million for restructuring fees. In return, ENER relieved Chevron of continuing obligations to fund Ovonic Hydrogen. ENER has since reduced funding for Ovonic Hydrogen, tightening its focus to small, portable, metal hydride storage systems.

Financial Discussion

Poor Historical Financials

ENER went public in 1967, offering investors a number of promising technologies. However, the company has been unable to successfully commercialize its inventions or turn a profit since its inception. In the interim, ENER had incurred substantial expenses to fund its R&D programs and experienced significant operating losses. Despite past disappointments, we believe that ENER has reached a turning point. Its solar product has been commercialized successfully and is starting to generate substantial profit with healthy gross margins. Its NiMH technology is just now being commercialized, with Cobasys expected to begin product shipment in 2006 and to contribute meaningfully to JV income in 2007/2008. ENER royalties from Sanyo will also accelerate. In addition, we believe management is focused on the solar market and will rationalize spending toward more near-term opportunities.

FY06 Revenue And Earnings

For FY06, we estimate revenue of $130 million, up 70% Y/Y given that the solar division is producing at full 25MW capacity. We expect UniSolar to contribute $80 million in FY06, shipping ~24MW, up from $51 million in FY05 with 16MW shipped. We also anticipate that ENER will record $20 million of revenue for building the tools for the 25MW China JV. We estimate an operating loss of $10 million and a net loss of $8 million for FY06, resulting in a loss of $0.28 per share.

Outlook For FY07

We estimate revenue of $185 million (+40%Y/Y) as the second 25MW facility comes on-line. We estimate that UniSolar will contribute $125 million in FY07 revenue, shipping 39MW. The second facility will begin production in FQ107 (September 2006), reaching full production in FQ307, in our estimation. Based on the high-growth expectation in hybrid vehicle shipments and Cobasys program wins, we estimate that Ovonic Battery's revenue contribution at $16 million on higher NiMH materials sales, battery royalties, and product development revenue. We estimate operating profit of $7 million and net income of $10 million for FY07, resulting in EPS of $0.32.

Balance Sheet And Cash Flow

As of June 2005, ENER had $96 million of cash, no debt, and minimal liabilities. In 1HCY05, ENER raised $109 million from a 5.1 million share sale (proceeds of $82.2 million) and the exercise of outstanding warrants by certain holders. ENER has since spent $20 million to exercise an option to purchase 4.4 million shares from Chevron Texaco and has canceled those shares. ENER has sufficient cash to finance all its immediate capital needs; although given the recent share price strength, the company may approach the capital markets in the near term to fund PV capacity expansion. For FY05, ENER used $17 million of operating cash flow ($20 million free cash burn); we anticipate modestly positive operating cash flow in FY06 with free cash burn of $58 million.

Near-Term Capital Expansion Requirements

As solar production increases and the gross margin widens, we expect ENER to be operating cash flow positive in FY06. ENER is building its second 25MW PV plant, at an anticipated total cost of $70 million ($65 million in equipment, $5 million in leasehold improvements). We anticipate $60 million being spent in FY06, the remaining $10 million in FY07. Production will begin in FQ207, and full ramp is expected within about two quarters, requiring $15 million in working capital for accounts receivables and inventory. At full capacity (FQ407), we expect the plant to generate $80 million in revenue, $24 million in gross income, and $19 million in operating income. We believe that ENER is likely to build another PV plant in FY07, at an additional $70 million in CAPX.

Exhibit A-4

ENER PRODUCTION RAMP, REVENUE ESTIMATES, AND CAPX REQUIREMENTS

Solar Module Production (MW)	Jun 2005 FY05A	Jun 2006 FY06E	Jun 2007 FY07E	Jun 2008 FY08E
25MW (UniSolar 1)	*15.8*	*24.3*	*24.4*	*25.0*
25MW (UniSolar 2)	-	-	*14.5*	*25.0*
25MW (Assumes 3rd plant, location TBD)	-	-	-	*13.3*
Total MW Production	**15.8**	**24.3**	**38.9**	**63.3**
MW run rate exiting fiscal year	*17.6*	*24.4*	*48.4*	*75.6*
Company Revenue Breakdown ($M)				
Solar Productions Revenue	$50.8	$83.0	$124.5	$202.6
UniSolar Development Agreements	$8.7	$9.2	$9.2	$9.1
Total Solar Revenue	**$59.5**	**$92.2**	**$133.7**	**$211.7**
Nickel Hydride Battery Materials	$1.8	$3.4	$5.1	$8.4
Battery Royalties	$4.5	$4.2	$7.6	$12.6
Battery Product Development	$0.0	$0.0	$0.0	$0.0
Battery Prod Dev - Cobasys	$2.0	$2.3	$2.0	$2.0
Battery - Matsushita NiMH License	$1.0	$1.0	$1.0	$1.0
Total Battery Revenue	**$9.2**	**$10.9**	**$15.7**	**$24.0**
Optical Product Dev Agment	$1.0	$1.2	$1.2	$1.2
Optical/OUM Royalty	$0.9	$1.5	$1.2	$1.2
Total Optical/OUM Revenue	**$1.9**	**$2.7**	**$2.4**	**$2.4**
Machine Building	-$0.6	$21.0	$30.0	$8.0
Hydrogen & other development agreemen	$5.9	$2.0	$2.0	$2.0
Other Rev	$0.9	$0.8	$0.8	$0.8
TOTAL COMPANY REVENUE ($M)	**$76.8**	**$129.5**	**$184.5**	**$251.6**
JV Income Contribution - China Solar JV	$0.0	$0.0	$1.3	$5.0
JV Income Contribution - Cobasys	$0.0	$0.0	$0.5	$3.5
Net Income ($M)	**($29.6)**	**($8.0)**	**$9.7**	**$46.1**
EPS	**($1.07)**	**($0.28)**	**$0.32**	**$1.46**
CAPX Requirement ($M)	**($3.2)**	**($60.0)**	**($60.0)**	**($20.0)**

Source: Company documents, Piper Jaffray estimates

EVERGREEN SOLAR, INC.

Key Points

Capacity Upscaling UnderWay; Earnings Power Of $0.40 In 2008; Initiated With An Outperform Rating.

- **Evergreen Solar Technology Promises Lower-Cost Solar Cells:** What distinguishes ESLR is a proprietary solar-wafer manufacturing technology—"string ribbon"—that could substantially lower the cost of solar cells. Versus the incumbent manufacturing process, which produces 90% of all solar wafers, ESLR's patented process requires 35% less polysilicon. Polysilicon is in severe shortage and prices are rising; it now represents 40% of a solar wafer's cost and 25% for the module/panel.

- **Capacity Is Expanding:** Evergreen's initial 15MW-plant in Massachusetts "proved the concept" of its unique manufacturing technology. We expect ESLR to now validate its business model by ramping capacity in Germany, in a JV with Q-Cells, expected to reach a full 30MW capacity by Q406 and become the model for larger-scale expansion. To that end, another 90MW expansion is likely in 2H06, reaching full ramp in 2008 at 135MW.

- **We Anticipate Break-Even EPS In 2006, But Earnings Power Of $0.40 In 2008:** The first 15MW line lacks sufficient scale; its gross margin cap is 5% - 10% on revenue of $40 million. We believe the 30MW German line can achieve a 30%-plus gross margin on a revenue run rate of $95 million. Incremental OPEX will be minimal. We forecast overall break-even EPS in Q406. Although plans are not final, we expect an additional 90MW to ramp in Germany in 2H06; this and other likely new plants are key to ESLR's profitability. At 90MW, the German plant will contribute $9 million of net income per quarter (assuming a 50/50 JV) for total company earnings power of $0.40 in 2008.

- **Technology Improvements And Margin Expansion Are Afoot:** Over the next 12-24 months, ESLR will unfold three continuous-process improvements that we expect to widen margins: 1) thinner 150µm wafers (from 312µm) in 2006; 2) 2x capacity tools in 2H07, and 3) cell efficiency of 15% (from 13%) by 2008.

- **But Ramp Risks Exist:** The primary risk to ESLR is whether the 120MW capacity adds are smooth and timely. The added capacity is key to ESLR's breaking even in Q406 and reaching profitability in 2008. Delays would push out profitability.

Investment Recommendation

ESLR's 15MW line succeeded as a proof of concept, but will record losses until the 30MW line nears full ramp in Q406. In our opinion, this line will validate ESLR's business model and lay the groundwork for a 90MW expansion beginning in 2H06. Thanks to its lower polysilicon requirements, we believe that ESLR can grow faster than the solar industry and command a 34x multiple of projected 2008 EPS of $0.40, or $13.60. By discounting back two years (CAPM: 16.6% expected equity rate of return), we establish a 12-month price target of $10.

Risks To Achievement Of Target Price

Risks include, but are not limited to: 1) delay ramp in Germany that may defer profitability, 2) erosion of government incentives for solar power, and 3) inability to protect its patents.

Company Description

Evergreen Solar manufactures and markets solar wafers, cells, and modules using a proprietary low-cost manufacturing technology.

Founded in 1994, Evergreen Solar (ESLR) engineers, manufactures, and markets solar wafers, cells, and modules holding patents in all three areas. ESLR is distinguished by its proprietary, low-cost, wafer-manufacturing technology, which requires less polysilicon feedstock. This continuous-flow process lends itself to highly efficient, automated manufacturing. The company has a 15MW production facility outside Boston, Massachusetts. Through a JV with Q-Cells, ESLR is adding 30MW of capacity in Germany with a 90MW expansion anticipated in 2H06.

Investment Thesis

- **Evergreen Solar Enjoys A Highly Differentiated Manufacturing Technology:** More than 90% of solar cells use wafer manufacturing processes developed for the integrated circuit (IC) semiconductor industry. In this process, polysilicon feedstock represents up to 40% of the cost of a solar wafer and 25% of the total module cost. Exacerbated by a severe polysilicon shortage, high wafer costs are limiting industry profits and mass adoption of solar modules without government subsidies; we estimate the shortage will likely cap the growth of solar manufacturing using this technology. ESLR brings a unique, low-cost approach to solar wafer manufacturing. Its scalable, continuous process uses 35% less polysilicon, lowering materials costs. Moreover, the process is in the early stage of continuous improvement; ESLR is unfolding three technology improvements that will further cut polysilicon usage, increase throughput, and expand margins. Although ESLR is not immune to the polysilicon shortage, we estimate that it will need a mere 200 ton to meet its 2006 production goal.
- **ESLR's Technology Roadmap Is Well Defined:** Incumbent IC wafer manufacturing technology for solar applications is reaching its cost and performance limitations. ESLR, however, is unfolding three technologies over the next 12-24 months to markedly improve yields and efficiency, and lower costs: 1) A transition to thinner 150μm wafers (from 312μm) in 2006 (this will be 50% less polysilicon versus incumbent wafer technology); 2) new 2x capacity tools to be launched by 2008; and 3) process technology developed by JV partner Q-Cells that will boost cell efficiency from 13% today to nearly 15% in 2008.
- **Large Solar Power Market:** With record high oil prices, insatiable demand for electricity worldwide, and a growing national policy favoring energy independence, solar cells and alternative energy are attracting government and market attention. We expect the solar industry to grow rapidly over the next few years, driven first by worldwide subsidies, then by off-grid electricity demand and utilities seeking to supply peak power to transmission- and load-constrained regions. With technology improving and costs declining, we believe that for most applications, select solar companies will be cost competitive with the grid (without subsidies) by 2010. We peg the solar module market at $4 billion in 2004 (1,256MW of cell production) growing to $5.3 billion in 2005 (1,638MW), then more than doubling to $12 billion in 2010 (4,808MW). These programs indicate that solar demand will exceed supply for several years. There is more than enough demand to sell out solar power manufacturers' capacity through 2006.
- **Evergreen's Capacity Ramp Is Under Way And Funded:** Evergreen's 15MW plant validated its unique manufacturing technology. Limited scale, however, has inhibited profitability. ESLR will now validate its commercial business model by ramping 30MW of capacity in Thalheim, Germany, in a joint venture with Q-Cells partly funded by the German government. The German government is funding 45% (€27.5 million) of the

required €61 million in CAPX. Of the remaining €33.5 million, Q-Cells will fund 25% for a 25% share of the JV. The 30MW plant is set to reach full capacity by Q406 and become the working model for future global expansion on a larger scale. To that end, another 90MW capacity expansion is highly likely for 2H06, also via a JV (50/50) with Q-Cells. The German government is likely to finance 30% of required CAPX. Other JVs are likely worldwide in 2008.

- **More Capacity Is Key To Profitability:** The 15MW (3MW reserved for R&D) line in Boston lacks sufficient scale; at annual revenue of $40 million, its gross margin caps at 5% - 10%. We believe the 30MW line in Germany can achieve 30%-plus gross margin on a more-than-double revenue run rate of $95 million. Incremental OPEX will be minimal. We forecast break-even EPS companywide in Q405. Although plans are not final, we forecast that an additional 90MW German capacity expansion will ramp in 2H06; this and other likely new plants are key to ESLR's profitability. The 90MW plant will contribute $9 million of net income per quarter (assumes 50/50 JV) and yield total company earning power of $0.40 (run rate) at full 135MW in 2008.
- **Financial Metrics:** A recent follow-on and convertible bond financing endowed ESLR with cash of $155 million. Long-term debt stands at $90 million. We anticipate break-even EPS in Q406 with a run rate of $0.40 by 2008 as capacity additions in Germany take ESLR's total to 135MW. We forecast strong revenue growth and margin expansion beyond 2007 as ESLR executes its technology roadmap. Long term, we suggest that ESLR's combined technology and business model can support multiple JV plants worldwide.
- **But Ramp Risks Exist:** The primary risk to ESLR is whether the 120MW capacity adds are smooth and timely. A 30MW ramp is in progress in Germany, and another, to a total 120MW, is set to begin in 2007. The added capacity is key to ESLR's breaking even in Q406 and reaching profitability in 2008. Unanticipated ramp delays would push out eventual profitability.
- **Technology Improvements And Margin Expansion Are Afoot:** Over the next 12 to 24 months, ESLR will unfold three continuous-process improvements to throughput that we expect to widen margins: 1) a transition to thinner 150μm wafers (from 312μm) in 2006; 2) 2x capacity tools to be introduced in 2H07, and 3) process technology developed by JV partner Q-Cells that will bolster cell efficiency from 13% today to nearly 15% by 2008.

Valuation

While this still-nascent industry relies on government subsidies, we believe that, as solar generation gains favor and the industry grows, ESLR will reap significant benefits as a low-cost supplier. Its technology, although validated, is in early development. We foresee better capacity, yields, efficiency, and margins as the company executes its technology roadmap. Long term, we envision that ESLR's business model can support multiple JV plants worldwide. The polysilicon shortage will limit industry growth until new capacity comes online in 2008. Versus the incumbent manufacturing process, which produces 90% of all solar wafers, ESLR's patented process requires 35% less polysilicon—a true competitive advantage. Lowered polysilicon requirements will allow ESLR to grow in excess of 24% industry growth through 2004.

- **Rating And Price Target:** We value shares of ESLR looking to earning power of $0.40 (EPS) run rate in 2008 at 135MW of capacity. We believe ESLR will grow faster than the 24% projected industry rate and thus value the stock at 34x (the growth rate we envision for ESLR) annual $0.40 EPS power in 2008 or $13.60. Discounting back two years (at 16.6% of expected equity rate of return based on CAPM using an adjusted historical two-year beta of 1.96) yields a 12-month price target of $10. We initiated our coverage with an Outperform rating.

Investment Risk

Company-specific risks include, but are not limited to:
- The reduction or elimination of government and economic subsidies for solar power, especially in Germany.
- A decline in oil and energy prices, which might stall solar installations.
- Problems and potential delay to manufacturing capacity ramp that would delay breakeven and profitability.
- The current polysilicon shortage may worsen and degrade gross margins and/or lower capacity.
- A history of operating losses and uncertain future profitability.
- Operational execution missteps, particularly related to manufacturing capacity adds are affecting technology upgrades.
- Inability to protect and maintain proprietary technology and patent litigation/challenge.

General risk factors include, but are not limited to:
- Impact of geopolitical events.
- Uncertain future industry growth rates.
- General economic risk.

Industry Overview

Below are excerpts from our detailed analysis of the Solar Industry published in October, 2005, *Solar Powered: An Emerging Growth Industry Facing Severe Supply Constraints*.

Why Invest In Solar Power Stocks?

The greatest number of publicly held alternative energy plays are found in the solar power sector. We anticipate four or five solar energy IPOs within 12 months. We highlight the following key reasons to consider solar power investments:
- **Technology And Business Models Are Proven With Clear Path To Profitability:** Unlike other alternative technologies, solar energy is proven, business models have been validated, and the industry is enjoying tremendous growth in worldwide solar subsidies. Although profitable alternative energy companies are rare, numerous solar energy companies are already profitable—or gross margin positive.
- **Solar Energy Benefits From The Largest Of All Alternative Energy Subsidies:** Solar power is afforded the greatest subsidies worldwide and these are driving demand. These rebates reduce the breakeven for solar power from 7 - 10 years to 3 - 5 years. Notably, Germany, the country with the greatest subsidy, makes up 39% of the solar market. There also are subsidies in Japan, Spain, Italy, and the United States. We anticipate expanded worldwide subsidies through 2007.
- **Large And Rapidly Growing Solar Industry:** We expect the solar industry to grow rapidly over the next few years, driven first by worldwide subsidies, then by off-grid electricity demand and utilities seeking to supply peak power to transmission- and load-constrained regions. We peg the solar module market at $4 billion in 2004 (1,256MW of cell production) growing to $5.3 billion in 2005 (1,638MW), then more than doubling to $12 billion in 2010 (4,808MW). These programs indicate that solar demand will exceed supply for several years.
- **By 2010, Solar And Grid Prices Will Be Competitive In Certain Markets:** With technology improving and costs declining, we believe that for most applications, select solar companies will be cost competitive with the grid (without subsidies) by 2010. We assume a 5% annual cost reduction through 2010, when we estimate module costs will have fallen to $2.50/watt (from $3.25/watt today). We believe that for thin-film companies, the technology roadmap and cost curve are more aggressive, and anticipate $1.75/watt in 2010. Adding balance-of-plant (BOS) savings, we believe this can drive

overall system costs to as low as $4.25/W, effectively lowering leveled solar electricity costs from $0.30/kWh today to~$0.18/kWh, making solar energy competitive in certain large markets (for example, Japan's grid electricity cost is $0.20/kWh, while peak power in California can be $0.30/kWh).

How To Invest In Solar Power Stocks; Our Call

- **All Solar Power Manufacturers Will Benefit From Strong Macro Demand:** Expanding subsidies worldwide plus the current solar module market price of $3.25/watt suggest demand that will allow solar manufacturers to pre-sell all available capacity through 2006 and that the market will support several different approaches to solar, regardless of the technology employed.
- **But Supply Limits Are A Concern; Polysilicon Is In Short Supply Industrywide:** Solar cell production is limited by: 1) internal production capacity, a function of production ramp lead-time and CAPX financing; and 2) the supply of refined polysilicon feedstock, the main ingredient in solar cells. Although CAPX financing is readily available, polysilicon production is bottlenecked.
- **Margins And Growth May Suffer:** Of all solar cells produced, 91% use mono- or poly-crystalline silicon wafers. For these cells, the polysilicon feedstock represents ~40% of wafer costs and 25% of module costs. Currently, polysilicon production is bottlenecked, and contract prices have doubled over the last 10 months. Despite 10% incremental increases in annual polysilicon capacity through 2007, demand far exceeds supply and we expect the shortages will remain severe through 2007 until major production increases come online in 2008. Rising solar wafer demand and tight polysilicon supply mean higher costs for solar manufacturers without long-term polysilicon supply contracts and the inability to meet production plans.
- **How To Differentiate Solar Plays:** Solar power companies are best distinguished by technology node and production capacity, not cell efficiency. Technology will determine a specific company's cost structure, production scalability, and vulnerability to rising polysilicon prices or shortages.
- **How To Play These Themes:** Although there is no single-point technology solution at this early stage of solar power's evolution, rising polysilicon material prices will squeeze margins and limit capacity. We thus prefer solar-cell companies with low-cost manufacturing technology that reduces/eliminates the need for costly polysilicon; we believe these companies will have the greatest competitive advantage long term and grow well in excess of the overall industry.

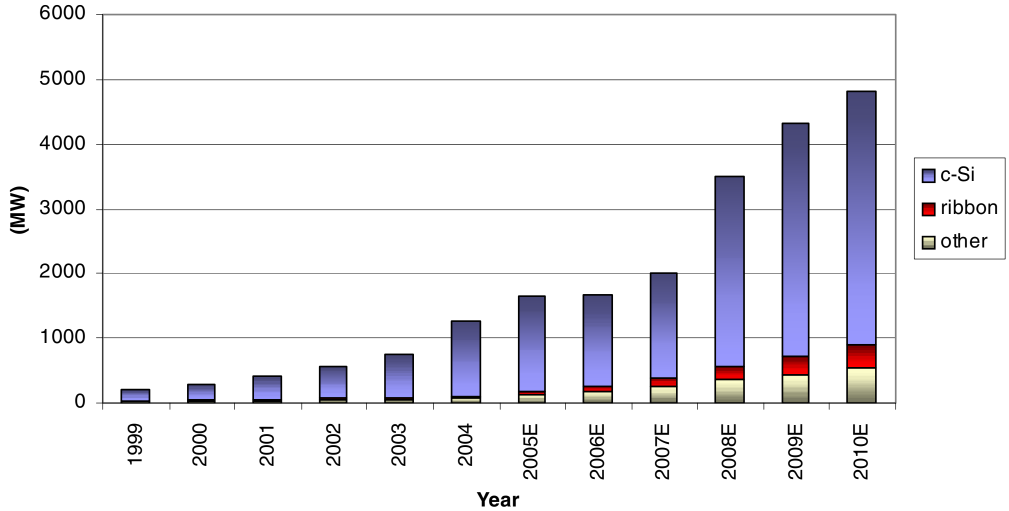
Solar Power Demand

Robust Worldwide Demand Drives Solar Industry Growth

In 2004, solar cell production grew 67% to 1,256MW from 750MW in 2003, according to Photon International. Based on production ramps announced by key players, we estimate solar cell production to grow 30% this year to 1,638MW. We note production and growth would have been higher if not for the severe polysilicon shortage. The robust demand for photovoltaic (PV) systems is driven by higher energy prices, growing subsidies worldwide, and increasing focus on energy independence. With strong demand worldwide, we anticipate the solar industry to achieve 24% annual growth through 2010. We anticipate that the polysilicon shortage will limit solar cell production through 2007 until significant new capacity comes online in 2008. As a result of this shortage, we anticipate that non-crystalline silicon players will experience a higher growth rate—we anticipate a 34% CAGR to 2010.

Exhibit B-1

GLOBAL SOLAR CELL PRODUCTION AND FORECAST



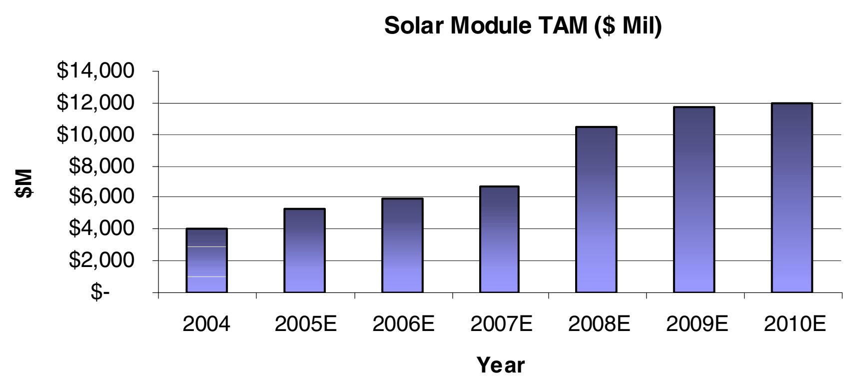
Source: Photon International, PJC Estimates

Sizing The Market

We estimate stable solar module pricing of $3.25 per watt through 2007. We anticipate an annual 10% price reduction beginning in 2007 through 2010. Based on these ASP and volume assumptions, we estimate a TAM of $4 billion in 2004 and $5.3 billion in 2005, growing to $12 billion in 2010.

Exhibit B-2

WORLDWIDE SOLAR MODULE MARKET FORECAST



Source: PJC Estimates

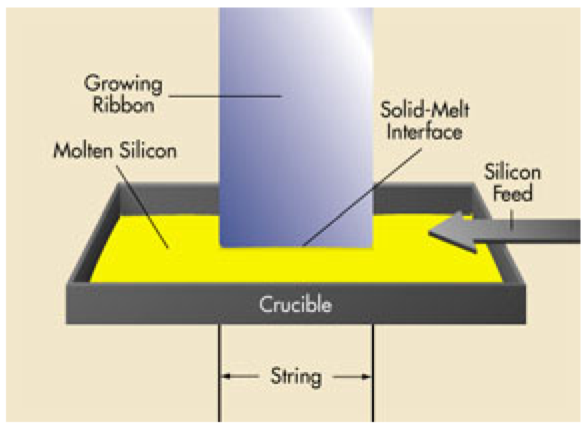
Company Analysis

Unique Manufacturing Process

- **String Ribbon Process:** Evergreen's solar wafers are manufactured using multi-crystalline polysilicon feedstock in a unique string ribbon manufacturing process licensed from MIT. In this continuous process, two sets of high-temperature strings (80mm wide) are pulled through a crucible of molten silicon, which spans and freezes between the strings. The silicon is then cut into 150mm wafers.
- **Patents:** ESLR has 17 U.S. patents that cover wafer, cell, and module manufacturing. Nine more wafer patents are pending. It also has 57 international patents granted, with 17 pending. Patent protection aside, we believe ESLR's process requires substantial trade secrets and would be difficult to duplicate.

Exhibit B-3

DIAGRAM OF STRING RIBBON PROCESS; PICTURE OF FURNACE



Source: Evergreen Solar

Competitive Positioning

Advantages

The biggest advantage of ESLR's string ribbon process versus traditional wafer manufacturing is lower cost. The ESLR ribbon wafer requires less polysilicon and consumes less material.

- **String Ribbon Uses Less Polysilicon:** In traditional wafer manufacturing, silicon ingots are sawed into 270 - 300 micron wafers using a steel wire blade. The wire blade is 200 micron thick; each slice creates silicon sawdust that cannot be reclaimed. Some 25% - 35% of the silicon ingot is wasted in what is known as "Kerf" loss. The ESLR string ribbon produces a continuous thin silicon wafer 312 microns thick; no sawing is required. ESLR's process uses 35% less silicon than traditional wafer manufacturing; with the production of thinner wafers in 2006, this percentage could increase to 50% longer term. We estimate that traditional solar wafers require 12-14 metric tons of polysilicon per MW of solar cells; ESLR requires only 8.5 metric tons. Viewed another way, a 130-micron traditional wafer (assuming the industry can get as thin) would use as much polysilicon as a 250-micron string ribbon wafer.
- **Thinner Wafers Likely By Year-End:** At 312 microns, ESLR's current ribbon wafers are modestly thinner than traditional sawed 350-micron wafers. ESLR announced its roadmap to substantially thinner, 150-micron wafers by year-end 2005. ESLR is now running five wafer tools (furnaces) at 150nm; we expect all tools to be upgraded to 150 microns by Q306, and at minimal cost.
- **String Ribbon Uses Less Consumable Materials:** The traditional wafer-sawing process requires consumable stainless steel blades/wire, slurry, and caustic chemicals (acid) to polish or etch the wafer. The string ribbon process uses less of these consumable materials as well, again lowering costs.
- **The String Ribbon Process Is Efficient And Continuous:** Traditional silicon ingots are manufactured in a batch process. The string ribbon process is continuous, enabling more efficient processing and equipment utilization.

Disadvantages

- **String Ribbon Requires Specialty Granular Polysilicon:** Rather than chunk polysilicon, the string ribbon process requires small granular polysilicon, currently produced in substantial volume by just one supplier, MEMC (WFR). With a severe shortage of polysilicon anticipated, we suspect that MEMC would prefer using its internally produced silicon for its higher-margin IC wafers. ESLR suffered a 43% polysilicon price hike in December 2004 and 38% in July 2005. In August, ESLR announced that it had secured a second supplier, as well as a longer-term supply through up-front payments.
- **Does Not Eliminate Polysilicon:** Unlike thin film technologies, ESLR requires polysilicon and will not be immune to the shortages and price increases we anticipate through 2006. ESLR needs very little polysilicon to meet 2006 production of 35MW (full ramp), only 200 ton.
- **Resulting Solar Cells Have Modestly Lower Efficiency:** String ribbon wafers have modestly lower efficiency: 13% versus multi-polycrystalline wafers' PV efficiency of 15%. Multi-polycrystalline wafers have efficiencies of 15% - 16%, mono-crystalline wafers, a higher 18% - 21%. Per single kilowatt, an ESLR module requires 20% more area than mono-crystalline suppliers.
- **Thin Wafers Are Fragile:** Because the string wafers are thin, the material is subject to cracking and breaking in the manufacturing process; this may reduce yields somewhat. We understand that ESLR must further improve its back-end process equipment to handle the substantially thinner, more fragile 150 micron wafers anticipated in 2006.
- **Limited Base Of Tool Suppliers:** ESLR's proprietary ribbon furnaces are manufactured by only two vendors under contract. The traditional wafer manufacturing process uses standardized equipment produced by several suppliers.

Solar Manufacturing Capacity

- **Current Capacity**
  ESLR has annual production capacity of 12MW-13MW with a separate 2MW-3MW reserved for R&D.
- **Expansion Plans**
  ESLR will increase its capacity by 30MW in Germany through a joint venture with Q-Cells. The Thalheim, Germany, facility broke ground in July and is scheduled to be operating in February 2006, reaching full capacity in July 2006. We anticipate that the German site will be expanded to 120MW in 2006-2007, taking the company to 135MW of capacity in 2008.

Q-Cells Joint Venture: ESLR and Q-Cells AG announced a JV (called EverQ) for a 30MW cell manufacturing plant in Thalheim, Germany. The plant will use ESLR's proprietary string ribbon manufacturing process and require about €72 million investment, €61 million for property, plant, and equipment and €11 million in working capital. The German government will fund 45% of property, plant, and equipment (or €27.5 million). Of the remaining €44.5 million, 75% will be financed through ESLR (€33.4 million) and 25% by Q-Cells (€11.1 million). ESLR will own 75.1% of the JV, Q-Cells, 24.9%.

Status Of 30MW Expansion: ESLR broke ground in July. The Thalheim building will be completed in December 2005, equipment is on order (six-month lead-time), and initial production is scheduled for Q206, reaching full ramp in September 2006.

Expansion's Effect On Margins: The 30MW plant is anticipated to post a 30%-plus gross margin when fully operational. Given that all R&D and senior management functions will reside in Boston, little R&D expense is anticipated in Germany and incremental OPEX will be modest.

CAPX Savings: The German government grant effectively lowers ESLR's required capital spending per MW of capacity. Absent the grant, ESLR would incur CAPX of $75 million for 30MW of installed capacity, or to $2.5 million/MW. The grant effectively lowers CAPX to $41 million or $1.36 million/MW, which will make ESLR's CAPX/MW plants among the industry's lowest. The downside to the plant is a 35% German tax that cannot offset losses in the U.S.

Additional Benefit From Q-Cells: We believe that by incorporating Q-Cells' highly efficient doping process (versus ESLR's current spray diffusion), ESLR may achieve 14% - 15% higher efficiency PV cells in 175MW modules.

Future 90MW Expansion: As the 30MW line reaches full capacity, we anticipate that ESLR will expand the facility 90MW at an adjacent site. We anticipate additional required CAPX at €50 million per 30MW of capacity (€150 million for 90MW). The German government is likely to contribute 30% of required CAPX for the Phase II expansion, with ESLR financing 50% of the residual funding and Q-Cells, 50% (versus 75%/25% today).

Financial Discussion/ Income Statement

- **Outlook For 2006:** For 2006, we estimate 126% year-over-year revenue growth to $95 million (29.3MW of production) on an added 30MW of capacity (from 15MW) with EPS of $(0.22). The 15MW proof of concept line lacks scale and has gross margin of a mere 6%. The 30MW line should contribute 30% gross margin on twice the revenue at full ramp. We estimate a 23% blended gross margin at full ramp in Q406, EPS at breakeven.
- **Outlook For 2007:** We model an incremental 90MW expansion in Germany, beginning in 2007, reaching total capacity in 2008. We estimate 120% revenue growth to $210.6 million (65.8MW of production) and loss per share of $0.08 given the 90MW line's significant start-up costs. Although details of the 90MW expansion are not finalized, we model a 50/50 JV structure with Q-Cells on a consolidated basis. At a full 135MW in 2008, we anticipate an EPS run rate of $0.40. We expect additional plants to be announced through 2008.

Exhibit B-4

ESLR PRODUCTION RAMP AND REVENUE ESTIMATES

	CY05	CY06	CY07	CY08
Solar Module Production (MW)				
15MW (Mass.)	*12.9*	*12.8*	*12.8*	*12.8*
30MW (Germany Phase 1)	*-*	*16.5*	*30.0*	*30.0*
90MW (Germany Phase 2)	*-*	*-*	*23.0*	*85.5*
Total MW Production	**12.9**	**29.3**	**65.8**	**128.3**
MW run rate exiting year	*12.9*	*42.8*	*102.8*	*132.8*
Total Revenue (In $M)	**$42.0**	**$95.2**	**$210.6**	**$399.2**

Source: PJC

Balance Sheet/Cash Flow

- **Strong Balance Sheet:** ESLR secured $90 million in a convertible offering in Q305. It has cash of $155 million, convertible debt of $90 million, and $2 million in other debt. Cash should be sufficient to fund CAPX and working capital requirements through 2007. Additional plant expansions would require further financing.
- **High CAPX Needs:** We estimate ESLR will incur CAPX of $90 million through Q107 to fund the entire 120MW expansion in Germany. We estimate $24 million of CAPX in CY05 ($17 million in 2H05) and $60 million in CY06. The 30MW line will require ESLR to make a CAPX investment of $40.5 million (€33.4 million) after funding from the German government and Q-Cells. The assumed 90MW line will require a $43 million to $54 million investment (assuming 30% - 45% German funding atop the 50/50 JV structure with Q-Cells).
- **Cash Burn Rate:** We estimate free cash outflow from operations at $27 million in 2H05, and $94 million for 2006. We estimate cash of $34 million exiting 2006. Although current financing appears sufficient to fully ramp the 135MW, additional financing would be required for further expansion.

Important Research Disclosures

Rating and Price Target History for: Energy Conversion Devices, Inc. as of 09-29-2005

Rating and Price Target History for: Evergreen Solar, Inc. as of 09-29-2005

Distribution of Ratings/IB Services

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Rating	Count	Percent	IB Serv./Past 12 Mos. Count	IB Serv./Past 12 Mos. Percent
BUY [OP]	294	50.69	68	23.13
HOLD [MP]	264	45.52	33	12.50
SELL [UP]	22	3.79	2	9.09

Notes: The boxes on the Rating and Price Target History chart above indicate the date of the Research Note, the rating, and the price target. Each box represents a date on which an analyst made a change to a rating or price target, except for the first box, which may only represent the first Note written during the past three years. Distribution of Ratings/IB Services Firmwide and by Sector shows the number of companies in each rating category from which Piper Jaffray received compensation for investment banking services within the past 12 months.

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