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## Comparison of Chinese Polysilicon Based Solar Module Manufacturers

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Vertical integration in this context refers to integrating the different steps in the Polysilicon Based Solar Module production process. Module production involves four steps in chain event:

- Use the raw material sand (SiO<sub>2</sub>) to produce a very pure form of silicon called polysilicon.
- Use polysilicon to produce wafers and ingots.
- Use wafers and ingots to produce solar cells.
- Use solar cells to produce solar modules.

Manufacturers are yet to immerse in vertically integrating the whole process. There are a few getting their feet wet - Trina Solar ([TSL](#)), Yingli Green ([YGE](#)), [Suntech Power](#) ([STP](#)) and Canadian Solar ([CSIQ](#)).

- Trina produces solar modules from polysilicon and has plans in the offing for very large scale polysilicon manufacturing.
- Yingli also has business plans along similar lines. They are yet to announce any plans to produce polysilicon.
- Suntech is focused on the wafer to module business currently.
- Candian Solar started out focused solely on producing solar modules from cells but since then has expanded to wafer to solar cell production line and has announced plans for a polysilicon to wafer and ingot line.

The table below compares these 4 manufacturers (click to enlarge):

Manufacturer	Suntech Power (STP)	Trina Solar (TSL)	Yingli Green (YGE)	Canadian Solar (CSIQ)
Level Of Vertical Integration as of EOY2007 (Announced)	Wafer to Module 100% Integrated Business	100% Integrated Ingot & Wafer, Cell, and Module Business	100% Integrated Ingot & Wafer, Cell and Module Business	Cell Capacity at 25% of Module Capacity. No Ingot & Wafer Production Capacity
Procurement for 2008 projected production	Longer-term wafer contracts with fixed price to account for most of the production.	70% raw material is in place.	Unknown – majority of raw material may be in place.	90% raw material in place.
Projected Vertical Integration going forward	Same	Same. Announced Polysilicon production plant board approval.	Same	Cell and Ingot/Wafer capacity to reach 60% & 10-15% of module capacity respectively by summer 2008.
EOY 2007 Module Capacity (Announced)	540MW	150MW	200MW (Q3 2007)	400MW

EOY 2008 Module Capacity (Projected)	1GW	350MW	400MW	400MW by Summer 2008.
2008 Module Shipments (Projected)	>530MW	>200MW	>275MW	>200MW
2007 Revenue Expectation	\$1.3B	\$290M	\$500-510M	\$285-295M
2007 Net Earnings Expectation	\$160M	\$32M	\$54.61	(\$2.7M)
2007 Per Share Earnings Expectation	\$1.04	\$1.38	\$0.43	(\$0.10)
2007 Net Profit Margin	12.3	11	10.92	(0.95)
2008 Revenue (projected)	\$1.9-2.1B	\$650-750M	\$800-900M	\$650-750M
2008 Net Earnings (Projected)	\$254M	\$71M	\$107M	\$30M
2008 Per Share Earnings (Projected)	\$1.65	\$3.09	\$0.84	\$1.11
2008 Net Profit Margin (Projected)	13.37	10.92	13.38	4.6
Forward P/E	38	12.3	29	13.11

Suntech has the edge in most aspects with the closest rival Yingli lagging well below 50% in terms of integrated capacity. On the raw material procurement side, Suntech has procured most of its needs through long-term supply contracts. Yingli may be close too although the exact figures remain unannounced. Trina is at 70% for 2008 and may encounter high spot pricing to procure the rest of the raw material. Canadian Solar claims to have procured 90% of the raw material. Raw materials needs are different for each company. For Canadian Solar it is a mixture of polysilicon, wafer/ingots, and solar cells, for Yingli and Trina it is just polysilicon and for Suntech it is wafers.

## Summary

Since the solar modules produced by these manufacturers are technically similar, the difference in profitability is largely determined by the raw material acquisition costs and efficiency in the production supply chain. Vertical integration along with raw material acquisition through long-term supply contracts is the solution the bigger manufacturers are opting for. The downside to long-term supply contracts is the risk of raw material prices falling as supply approaches or exceeds demand.

There are a couple of business risks associated with the whole group:

- Competition from pure-play solar manufacturers.

- Competition from solar manufacturers that use a material other than polysilicon as the base raw material.

Pure-play solar manufacturers have to their advantage the ability to concentrate on one step thereby realizing better efficiency and ultimately better profit margins. Such solar companies include MEMC Electronic Materials ([WFR](#)) and LDK Solar ([LDK](#)) in the polysilicon and wafer production business and JA Solar Holdings ([JASO](#)) and China Sunergy ([CSUN](#)) in the cell to module business. Eventually, some of these manufacturers may become part of vertically integrated businesses.

Competition using raw materials that are alternatives to polysilicon comes from manufacturers such as First Solar ([FSLR](#)), which uses cadmium telluride (CdTe) and Ascent Solar ([ASTI](#)), which uses copper-indium-gallium-diselenide [CIGS]. There are also a number of [other technologies](#) that are in early stages of development. First Solar has profit margins well beyond the polysilicon based producers because of lower raw material and production costs. The projections are for the company to grow at an even faster rate keeping cost advantages intact. [However this is a moot point](#). The real challenge for the polysilicon manufacturers is to reduce costs in the production chain swiftly to compete with all such technologies successfully. The biggest advantage that polysilicon manufacturers have is the abundant availability of raw material at the very basic level – **silica** (found as sand or quartz)

Canadian Solar and Trina Solar have the biggest upside, given the low forward P/E. An announcement regarding procurement of the remaining raw material requirements at reasonable prices for 2008 should allow Trina Solar to reduce the gap in valuation. Canadian Solar is projected to have very low net profit margins. Skepticism surrounding the net profit margins the company will realize going forward is a major reason for the valuation gap.

***Disclosure: We have a position in Suntech Power ([STP](#)), have traded Canadian Solar ([CSIQ](#)), and have a long position in LDK Solar ([LDK](#)).***



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"moot point" depends on whether you believe First Solar's CFO - who can go to jail if he misinforms us - or a whacko (IMO) blogger, who won't even get his wrist slapped.

In any case, a solar panel producer's key raw material is hardly moot. If CIGS can be scaled up to give efficiencies comparable to Si, but costs below CdTe, all the Si-based companies, as well as FSLR, will be left behind. There are literally billions of VC dollars chasing CIGS. However, there have been hundreds of millions spent already over the last 5+ years without success. Eventually nano-tech will produce a cheap solution, but that may be more than a decade away. In the meantime, First Solar is well ahead of the rest of this nascent industry.



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