

Woodlawn Associates

Management Consulting

Chinese Solar Powers Up: Lessons for the Wind Energy Industry

November 29, 2010

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Woodlawn Associates' recent energy experience

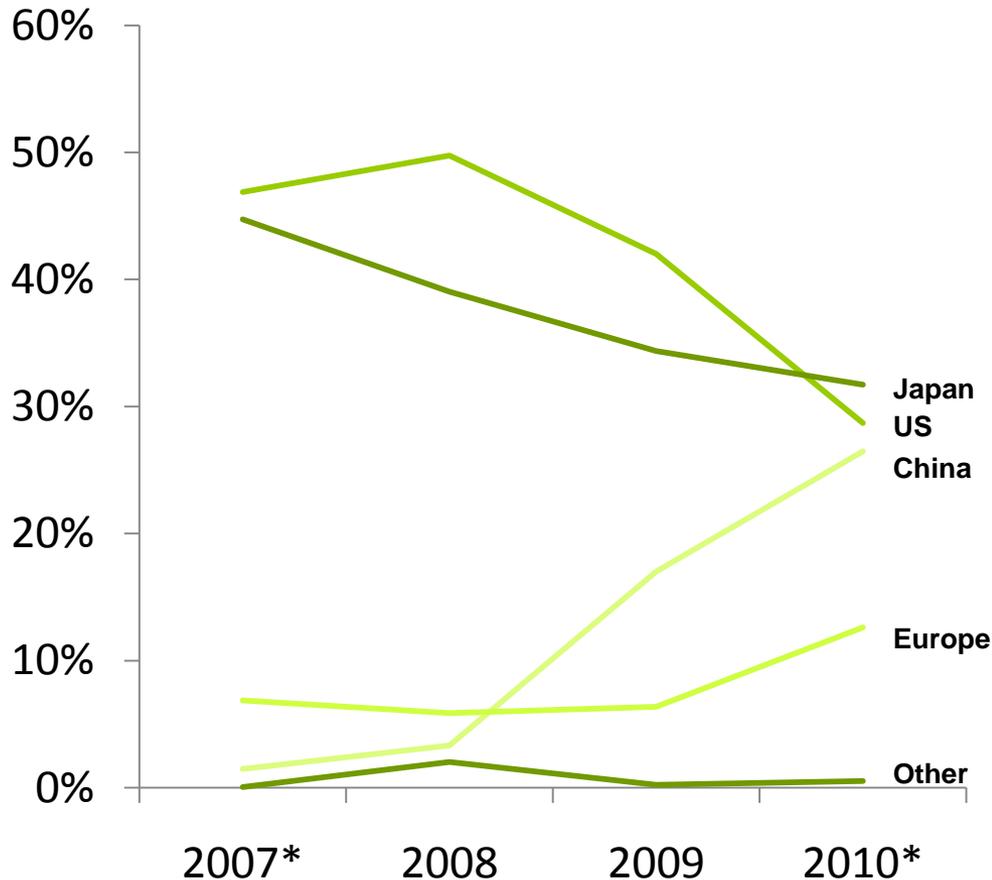
- **Advised wind turbine manufacturers on appropriate level of vertical integration, how to reduce fixed and working capital requirements, and perception by top 10 wind farm developers in the U.S.**
- **Counseled global wind farm developer on implications of choosing emerging wind turbine vendor over established blue chip alternatives. Examined financing availability, cost, and capital structure implications**
- **Advised lithium-ion battery company on valuation and value maximization**
- **Helped supplier to fuel cell company evaluate expanding capacity to meet its customer's demand projections. Conducted end-customer interviews and modeled economic value of fuel cell to those end-users**
- **Facilitated a three-month strategic overhaul at fuel cell maker. Developed scenarios, evaluated more than two dozen possible markets, and narrowed to three. Conducted detailed economic modeling of value propositions. Wrote new business plan and helped management close new round of funding**
- **Evaluated investments in ethanol production for large global private equity fund**

Executive summary

- **Woodlawn Associates studied the overseas penetration of Chinese solar photovoltaic module makers to see if there might be lessons for the wind turbine industry**
- **Chinese PV module manufacturers have rapidly penetrated overseas markets**
 - Increased from about 0 to 30% of California market in three years; similar performance in Germany
- **Today, nationality of manufacturer has little relationship to module consideration**
 - Suntech, a Chinese manufacturer, is #1 in consideration rate in our U.S. / European survey
- **Six main factors account for this growth:**
 1. Cost leadership
 2. Entered market when supply tight
 3. Solar (relatively) simple, modular, and scalable, which makes entry easier for new entrants
 4. PV modules viewed as commodity-like
 5. Executive teams have extensive experience outside China
 6. Businesses are transparent to those outside China
- **Implications for wind turbine manufacturers expanding into new regions**
 1. Expect new market penetration will take a long time due to need for an operating track record
 - May be a long time before local manufacturing capacity is required
 2. Purchasing projects or doing project development can get beyond bankability issues
 3. Developing local engineering and support capabilities should be high priority in overseas expansion
 4. Certain partnerships could accelerate progress and increase probability of success
 5. Prioritize markets appropriately

Chinese solar PV module makers have rapidly penetrated overseas markets

Share of PV Module Capacity Installed, California Solar Initiative Rebate Program



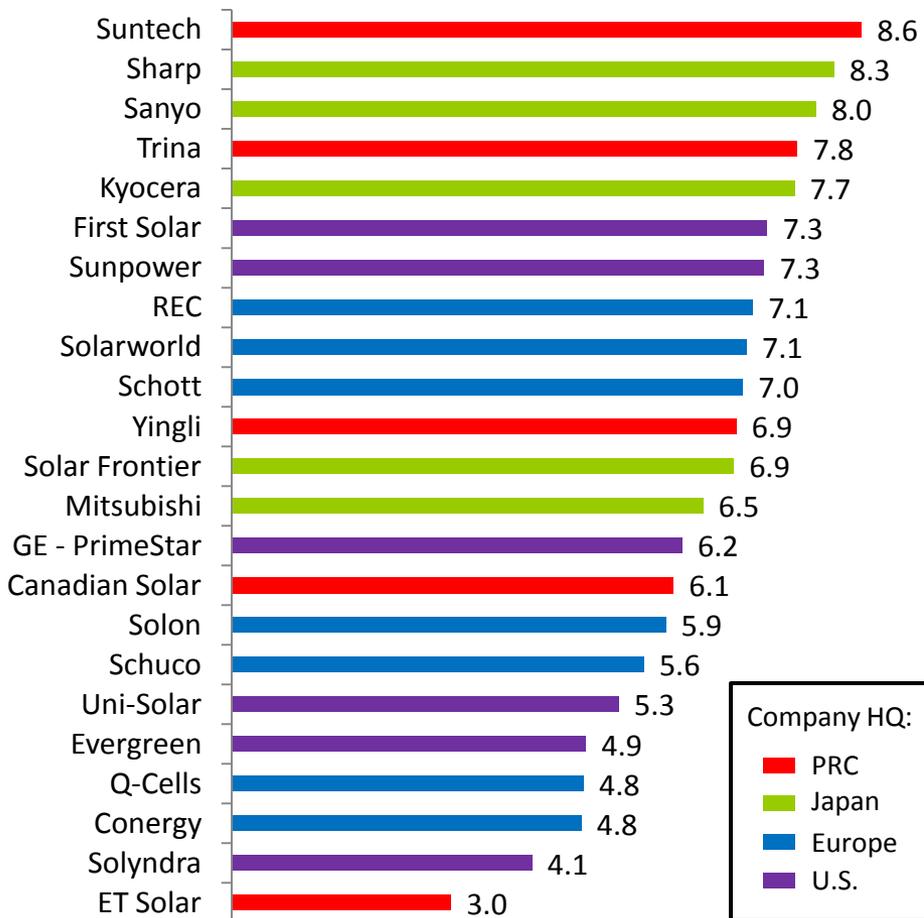
- **California accounts for about 50% of US solar installations**
- **Chinese vendors have increased share of California market from about zero to 30% since 2007**
 - Gains have largely come at the expense of US and Japanese suppliers
- **Suntech and Yingli expect to get about 40% of the overall U.S. market in 2010**
- **Chinese also have prospered in Germany, where more than 2/3 of panels are imported, mostly from China**
 - More than 50% of revenue at Yingli and Suntech is from Germany

Source: California Solar Initiative, Woodlawn Associates analysis, Reuters, Yingli, Suntech, GTM Research

Notes: The CSI program is for PV installations in existing residential and new and existing commercial, agricultural, government, and non-profit buildings in areas served by three investor-owned utilities (PG&E, SCE, and SDG&E). * Partial Year. 2010 data through October 12

Today, nationality of manufacturer has little relationship to module consideration

Consideration Rate (0-10 Scale)*



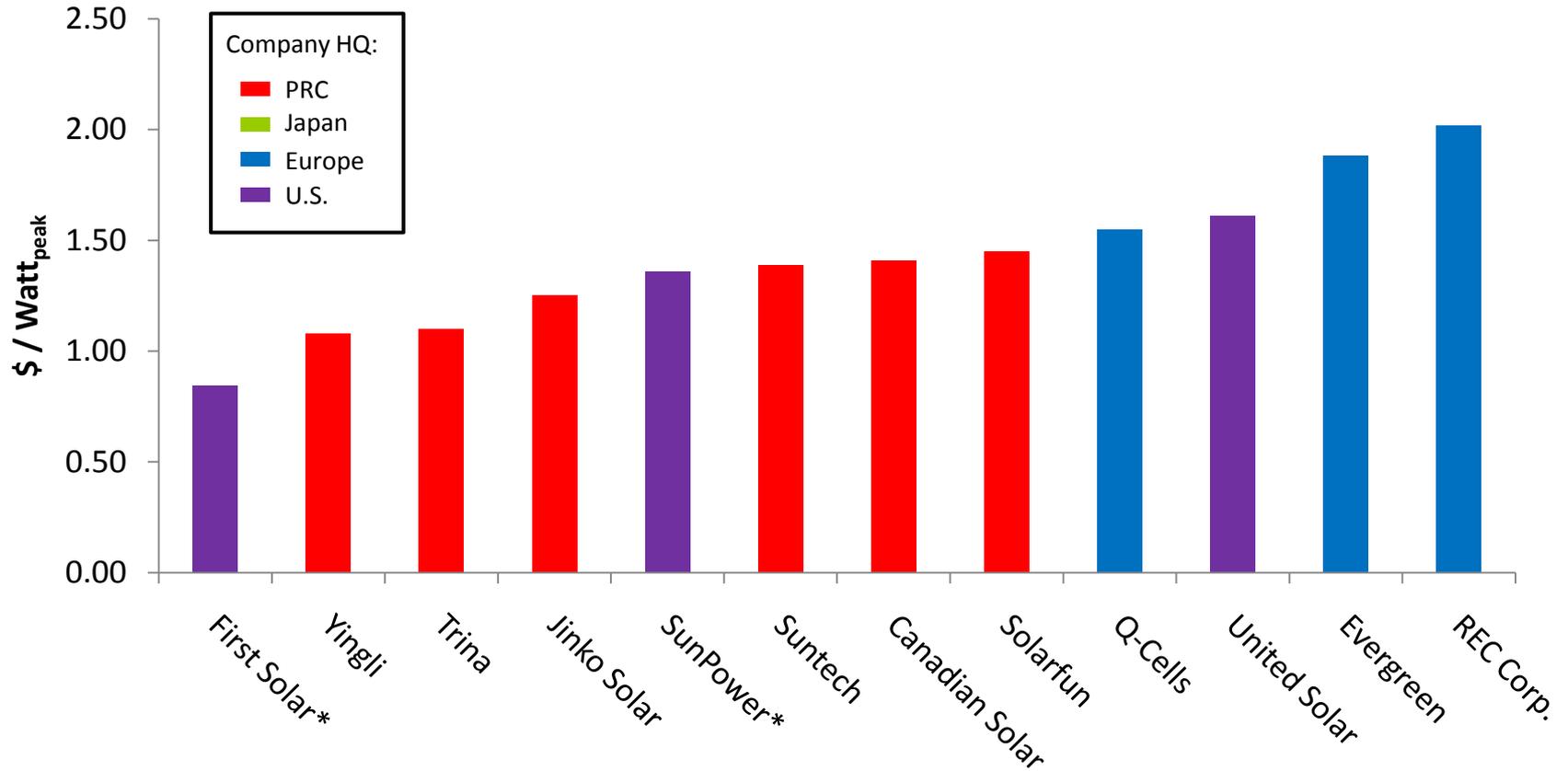
- Scores based on interviews with top U.S. and European developers, integrators, and finance providers
- Suntech, a Chinese company, ranked highest
- Japanese companies score well as a group
 - High confidence in warranty, respect for long history
- Interviewees said they prefer domestic modules, but often don't use them due to price
- Companies with products well suited for a niche may have scored better in narrower survey
 - For example, Uni-Solar does well when installers concerned with weight, but not as well otherwise

Source: Woodlawn Associates; n=13

Notes: * "How likely would you be to consider using each of these vendors, with 0 being not at all likely and 10 being extremely likely?"

Chinese firms among worlds' leaders in module cost

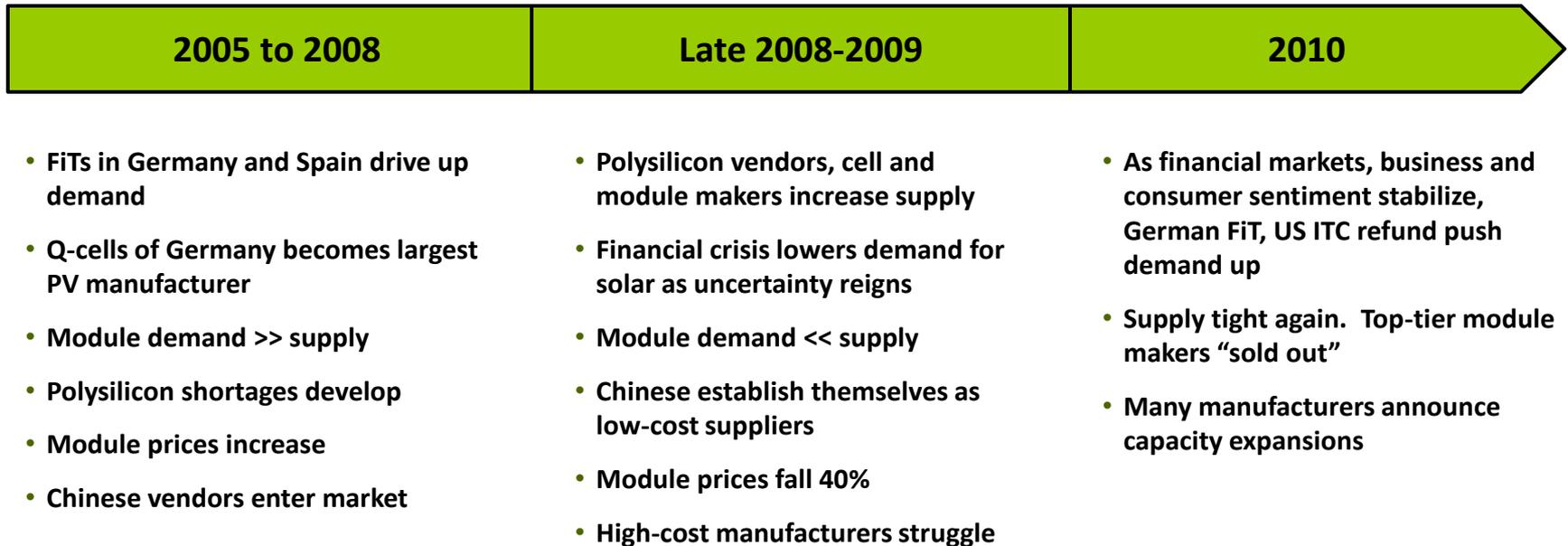
Estimated Module Cost / Watt_{peak}
(2Q10)



Source: Credit Suisse, SunPower, Evergreen Solar, REC Corporation, Morningstar, and Woodlawn Associates analysis

Notes: * Adjusted to c-Si efficiency (SunPower per company, First Solar per Woodlawn Associates estimate)

When Chinese entered U.S. and European solar markets, supply was extremely tight



“It was totally price...and availability...We used to call BP but could not get what we needed from them or Sharp.”
GM, Operations, Residential and Commercial Integrator B

“Back in 2007 you had to pay for modules before you got them.”
Procurement Manager, Commercial Integrator D

PV systems simple, modular, and scalable; enables fast penetration in new markets and with new technologies

SunPower E18/400 Solar Modules

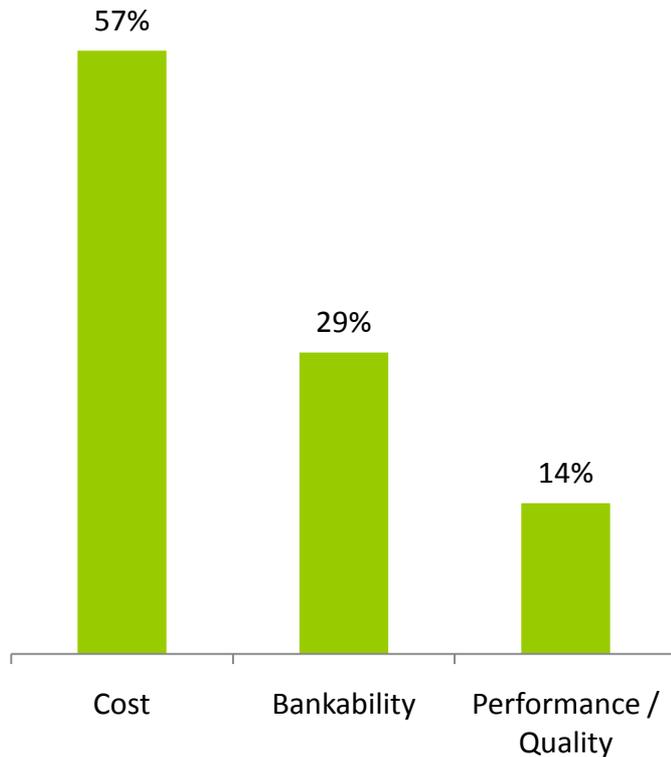


- **Solar PV systems**
 - Largely solid state
 - Module warranty typically 20-25 years
 - Modular
 - Systems consist of many PV modules and inverters
 - FPL's 25MW DeSoto plant in Florida uses 90,000 modules
 - Ground- or roof-mounted
 - Repairs relatively straightforward
- **Wind Turbines**
 - Largely mechanical
 - Thousands of components, some very complicated and sophisticated
 - Warranty typically 2-5 years
 - Monolithic
 - Must be tested as complete system
 - Smallest unit costs \$1M+
 - Tower mounted
 - Repairs logistically difficult and expensive

Evaluating quality and predicting lifetime performance of PV modules is relatively simple, facilitating entry of new producers and technologies

PV modules are viewed as commodity-like

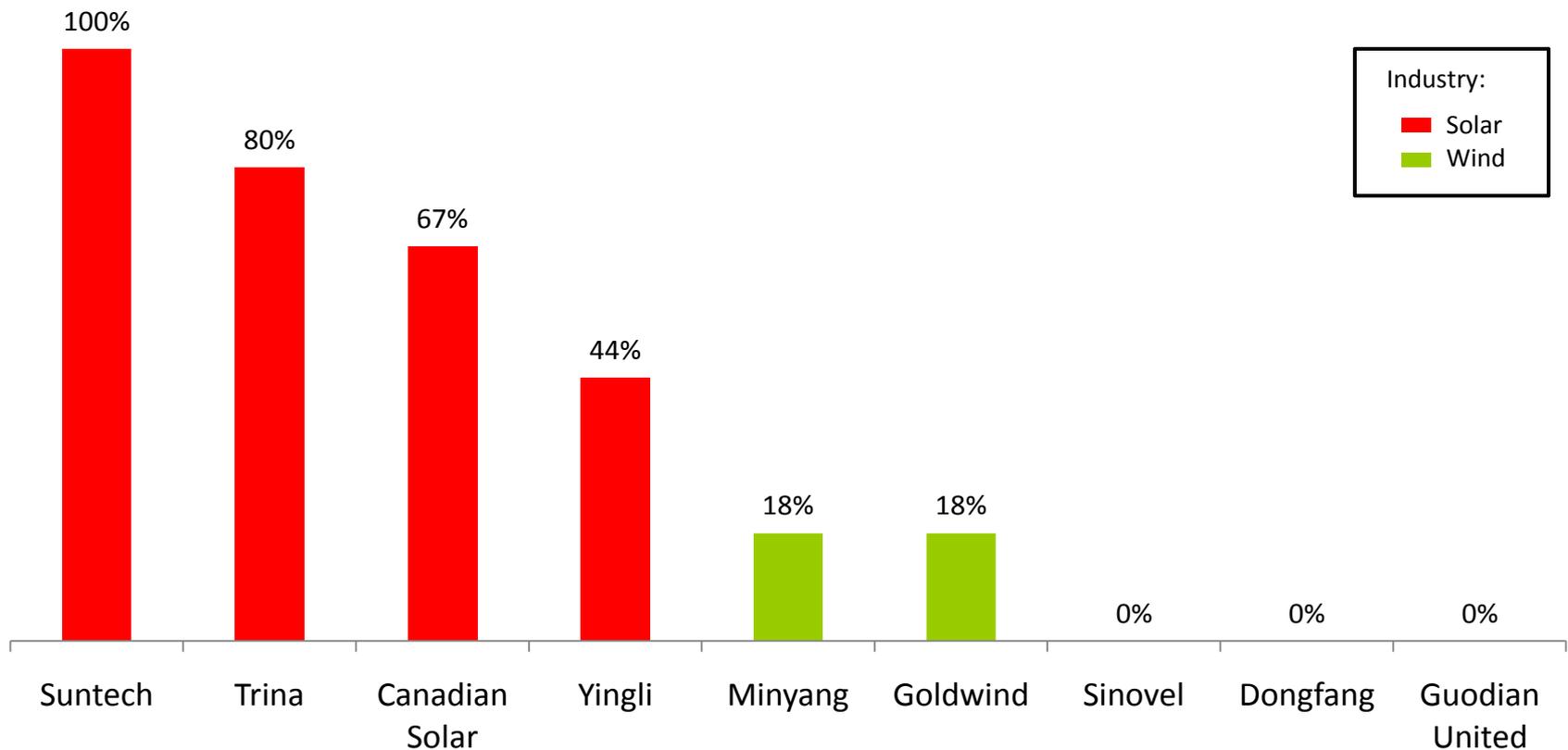
Vendor Selection Criteria (First Mention)



- **Developers and integrators see modules as commodities**
 - “A solar panel is a solar panel is a solar panel. It’s amusing to me when these guys try to tell you how different they are. It is a complete commodity.”
CEO, Utility-Scale Developer A
 - “You have a lot of people who say a module is a module.”
Director of R&D, Residential & Commercial Integrator A
 - “A panel is commoditized.”
Managing Director, Equity Investor A
- **Interviewees typically mention cost as the most important criteria in vendor selection**
 - “Cost. Performance. Reliability. Warranty. Ability to stand behind the project...It is more and more down to cost.”
Project Development Manager, Utility-Scale Developer B
 - “Everything is price driven.”
Director of R&D, Residential & Commercial Integrator A
 - “Cost and efficiency.”
Project Development Manager, Utility-Scale Developer C
 - “Price, availability, and output.”
GM, Operations, Residential and Commercial Integrator B
- **However, bankability and secure warranties are must-haves as well**
 - “Bankability is number one. Period.”
CEO, Utility-Scale Developer A
 - “Number one is bankability. Second is landed cost.”
Procurement Manager, Commercial Integrator D
 - “I look for whether they are high quality modules and whether they can get financed.”
Project Finance Manager, Commercial Integrator C

Chinese solar executive teams have extensive international experience

Share of Named Executives with Experience Outside China*



Source: Woodlawn Associates analysis

Notes: * Excludes Country and Region Managers

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Leading Chinese solar firms are also transparent to those outside China

		High Quality English Web Site	Publicly Traded	Traded on Western Exchange
Solar	Suntech	Yes	Yes	Yes
	Canadian Solar	Yes	Yes	Yes
	Trina	Yes	Yes	Yes
	Yingli	Yes	Yes	Yes
Wind	Mingyang	No	Yes	Yes
	Goldwind	No	Yes	No
	Sinovel	No	No	No
	Dongfang Turbine	No	No	No
	Guodian United	No	No	No

In wind, overseas penetration may take a long time

- **Supply-demand balance does not currently create imperative to look to emerging suppliers**
 - From 2005-2008, emerging solar and wind vendors benefited from supply shortages
- **Need to develop an operating track record to get banks and developers comfortable**
 - Complexity of wind turbines makes it difficult to quickly evaluate expected long term performance (à la solar)
 - Unfortunately, difficult to predict how many turbines, operating for how long, will get developers and financiers comfortable
 - Clearly some relationship with home-market track record and occurrence of serious defects
 - Clipper has installed 477 turbines (mostly in U.S.) with 5.5 million runtime hours and still is not considered blue chip
 - Nordex, REPower, Gamesa are bankable though they have installed fewer turbines in U.S.
- **Emerging vendors can get their first deployments by purchasing or developing projects, particularly if they bring their own financing**
 - “They should try to finance a project themselves, with their own balance sheet. Then they should get engineers out to review to see how it is going.” – Debt Investor A
 - “... I would just finance a project with equity for a few years, then let the engineers crawl all over it to see that it is operating well.” – Debt Investor B
- **Since it will take several years to demonstrate good performance in a new market, local manufacturing capabilities may not be needed for some time**
 - Blades, towers, and balance of plant can provide required local content in most circumstances
 - Possible exception if first projects are very large

Developing local engineering and support capabilities should be initial priority in overseas expansion

- **Turbines must be adopted to local market conditions**
 - Grid, weather, and wind conditions
 - IEC vs. UL codes
 - Maintainability by local personnel
 - Operator safety standards (i.e. OSHA in the U.S.)
- **Turbine makers also need to demonstrate the ability to support turbines over the long term**
 - “You have to answer the question about if it doesn’t work, who is going to pay? You can do that through warranty terms, having a strong balance sheet, and showing that you have the people to support it.” – Head of Development, Wind Developer
 - “Bigger companies can make good on the warranty. They have the labor and financial resources to show up overnight to fix any problems that exist.” – Debt Investor C
 - “...Having the balance sheet to stand by the warranty is really important.” – Debt Investor D

**Local engineering and support teams needed
before local manufacturing**

Partnerships could accelerate progress and increase probability of success

Agricultural and Construction Equipment Manufacturers

Company	Description
Caterpillar	World's largest manufacturer of heavy construction machinery. Produces engines for its own off-highway vehicles and others' machines. Financial services arm, logistics business, and remanufacturing service work.
Deere	Agricultural, landscaping, construction, and forestry equipment. Finances a large portion of sales through its Deere Credit subsidiary.
CNH	Agricultural and construction equipment. 11,000 dealers worldwide. Financial services arm supports machinery sales. Fiat owns 90%.
Agco	Manufactures agricultural equipment such as tractors, combines, sprayers, and hay balers. Manufactures about one third of its engines, and owns 49% of an equipment-financing JV.
Cummins	Designs, manufactures, distributes, and services diesel and natural gas engines, electric power generation systems, and engine-related products. Network of 500 independent distribution centers and 5,200 dealer locations globally.
Terex	Heavy construction and materials processing equipment such as cranes, aerial work platforms, and rock crushers.
Kubota	Japan's largest manufacturer of farm equipment, small engines, and construction machinery. It also makes pipes and valves for use in municipal water supplies, industrial engineering systems, and vending machines.

- **For example, agricultural and construction equipment firms have assets that could be helpful:**
 - Distributed parts and service capabilities, often in rural areas
 - Financing arms
 - Political muscle to manage trade issues
 - Strong local supply chain relationships
- **JV structure could alleviate customer concerns about support**
 - “I would find a blue chip parent.” – Debt Investor E
 - Depending on structure, JV could alleviate balance sheet and longevity concerns
- **Other industries with possible fit:**
 - Automotive and Automation: Eaton, Honeywell, Rockwell
 - Electric equipment: ABB, Emerson, Schneider Electric
 - Industrial Trading: Hitachi, Sumitomo, Marubeni, Mitsui
 - Mining equipment: Sandvik, Joy Global

Prioritize markets appropriately

- **Chinese market world's largest and expected to grow quickly**
 - Maximize potential in Chinese market before increasing investment in U.S. and Europe
- **Use existing overseas assets to localize turbines and do project engineering with least incremental expense**
 - For example, Goldwind owns 70% of Vensys, an 80-person German firm specializing in wind turbine design
- **U.S. market may be challenged for several years and has a history of cyclicity**
 - Low power demand and significant U.S. natural gas discoveries have decreased wholesale cost of power significantly
 - Republican victories in Congress make aggressive climate change legislation unlikely
 - Expiration of ITC refund will make financing more difficult
- **European markets typically have smaller wind farms, perhaps reducing the investment required to demonstrate good performance**
- **New sub-markets may be easier to enter than established ones**
 - No dominant players in offshore, for example

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- Growth strategy
 - Restructuring
- Vertical / horizontal integration
- Competitor and market analysis
 - Business development
 - Strategic marketing
 - Catalyzing innovation
 - Strategic planning
 - Scenario planning
 - Portfolio optimization
 - Business plans



- Process optimization
- Change management
- Organization design
 - Pricing
- Customer retention
 - Channel design
- Interim management
- Progress acceleration
- Goal setting and performance measurement
 - Root-cause analysis

Industry Experience

- Cable TV networks and infrastructure
- Energy technology
- Gaming technology
- Medical devices
- Mobile devices and wireless networks
- Private equity
- Wind energy

Locations

- Chicago
- New York
- San Francisco

- Extensive experience in China, Japan, Southeast Asia, India, and Germany

- Acquisition / divestment strategy
- Acquisition / buyer screens and evaluation
 - Negotiation support and valuation
 - Financing strategy, fundraising
 - Due diligence
- Integration or separation management
 - Working capital management