

Woodlawn Associates

Management Consulting

Solar Photovoltaics: A High-Tech Commodity

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Woodlawn Associates' recent energy experience

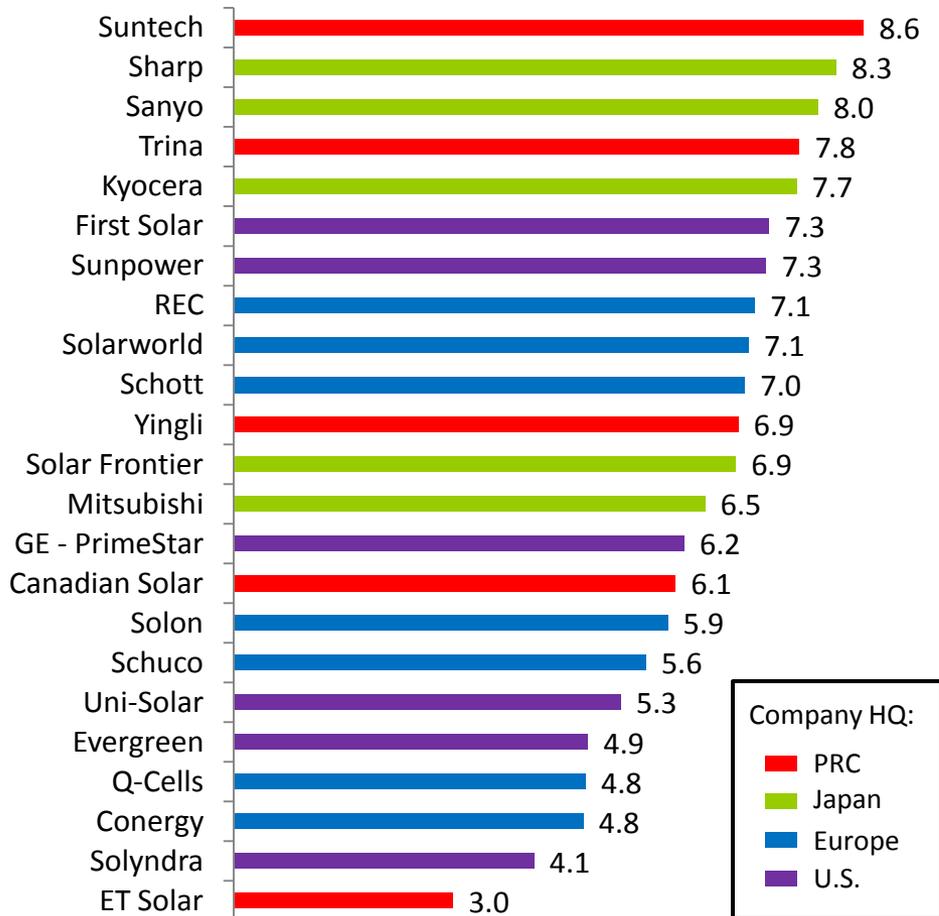
- **Advised lithium-ion battery company on valuation and value maximization**
- **Advised wind turbine manufacturers on appropriate level of vertical integration, how to reduce fixed and working capital requirements, and perception by top 10 wind farm developers in the U.S.**
- **Counseled global wind farm developer on implications of choosing emerging wind turbine vendor over established blue chip alternatives. Examined financing availability, cost, and capital structure implications**
- **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 interviewed nearly 20 U.S. and European solar developers, integrators, and financiers to gauge their impressions of PV module vendors and learn how they could improve**
- **Nationality of manufacturer has little relationship to module consideration**
 - Suntech, a Chinese company, is #1 in consideration rate
- **PV modules viewed as commodity-like**
 - Cost is the most important criteria in vendor selection
- **Interviewees suggested a few ways to stand out, however**
 - Financing
 - More certainty in pricing, product availability, and energy production
 - Highly integrated systems potentially interesting, but loss of flexibility concerning
- **Utility-scale developers concerned some module vendors also develop projects**
 - Such conflicts could create opportunities for bankable vendors without project development arms, such as GE, Sanyo, Kyocera, and Suntech
 - First Solar, SunPower, and Sharp (with Recurrent) need to clearly delineate where they will compete for projects
- **Across industries, high returns on capital go to firms with either differentiation or low costs**
 - Both customer comments and distribution of returns in PV are consistent with commodity industry
- **Although module vendors should pursue differentiation where possible, given commodity status of modules it is essential to lead on cost**
 - Possible exception for specialized niches

Nationality of manufacturer has little relationship to module consideration

Consideration Rate (0-10 Scale)*



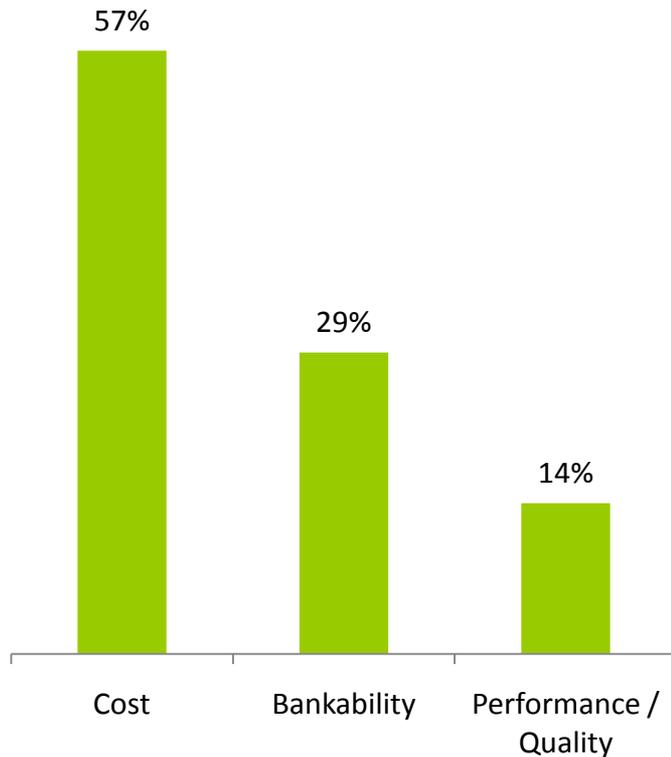
- Scores based on interviews with top U.S. and European developers, integrators, and finance providers
- Suntech, a Chinese company, ranked highest
- Japanese companies score well as a group
 - High confidence in warranty, respect for long history
- Interviewees said they prefer domestic modules, but 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?"

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

Financing could be potentially distinguishing

- **Both utility-scale developers and residential/commercial integrators said they would be interested in vendor financing**
 - “Financing is a really good idea...In FiT markets you want to go as fast as possible to get the highest tariff, so not having to deal with construction financing would help a lot.”
CTO, Utility-Scale Developer E
 - “How do we finance construction? Most of the project lenders don’t want to be involved in that. So if a module maker can arrange financing or make it so I don’t have to pay until construction is completed, that will really make my life easier.”
CEO, Utility-Scale Developer A
 - “If instead of paying \$1.50 per watt I agreed to \$1.70 per watt but paid that over 15 years, that would be very attractive to me. I also like that there could be a linkage of payment to how well their modules perform over time...”
VP, Residential and Commercial Integrator E
 - “For smaller companies like ours, working capital can be a challenge.”
Director of R&D, Commercial Integrator F
- **However, for developers within larger companies financing may be less important**
 - “Financing wouldn’t do anything for us because we use our own money [to finance projects].”
Project Development Manager, Commercial Integrator G

Interviewees also want more certainty in pricing, product availability, and energy production

- **Make pricing and availability more predictable**

- “They should be more transparent with prices. Everyone is speculating and it is difficult to plan our business.”
CTO, Utility-Scale Developer E
- “There is a lot of banter around availability. You hear ‘we are sold out,’ but then you hear back two days later ‘Oh, it turns out we have some capacity overall.’ It is hard to plan.”
Origination Manager, Utility-Scale Developer D

- **Clarify and warrant long-term efficiency and production**

- “The biggest challenge I have is understanding the performance of the modules in the real world. Anything the module manufacturer could do to clarify that would be helpful.”
Director of R&D, Commercial Integrator F
- “Manufacturers should be more aggressive in terms of the degradation they will warrant. We have been asking for...a warranty for a certain [higher] level of performance for the first 3-5 years.”
CTO, Utility-Scale Developer E
- “[We would like] to match the warranty to the actual degradation curves we see. For example, if the actual degradation is 0.5% per year, the current warranty is 1% per year. Or, it would be good to pay less for the 1% warranty.”
Origination Manager, Utility-Scale Developer D

- **Other suggestions:**

- Simplified packaging, cooperative advertising, referrals, and improved pre-sale support

Highly integrated systems potentially interesting, but loss of flexibility concerning

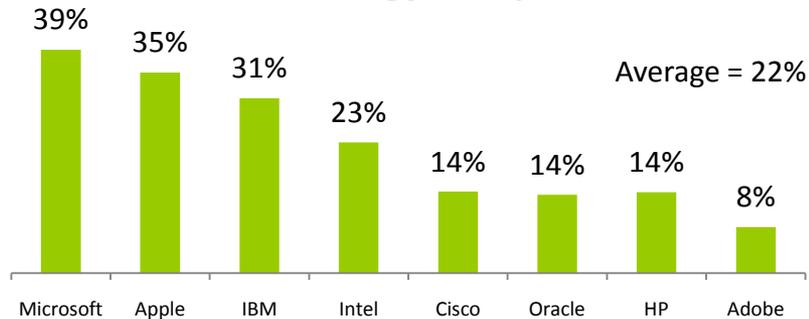
- **To be attractive, integrated systems need to be irrefutably less expensive than customer-led integration**
 - “Integrated systems are interesting...but perhaps we’re less interested than some others because we have the capability to do that type of integration internally. SunPower has their Oasis thing, but I guess we feel like there’s a markup that comes with that.”
Origination Manager, Utility-Scale Developer D
 - “[Integration] could be attractive. It is ultimately about getting the right price, and the racking of the modules is definitely an area where we think some cost can be removed. However, if there were more integration we’d want some sort of guaranteed supply contract. We’d be more locked into that supplier.”
Director of R&D, Commercial Integrator F
 - “If they could do BOP design that could reduce costs, that’s good, but I wonder if it is a distraction and are they better doing that or just focusing on modules...If you are playing on roofs like we do, with different load bearing requirements and different locations of the electrical room, you can’t have one standard mount.”
Project Development Manager, Commercial Integrator G
 - “The closer the product profile is to a commodity, the easier it is for us to integrate it into a project.”
Director, Commercial Integrator H
 - “If you are BP, Tioga, or Solar Power Partners, you are going to be worried about a reliable source of supply. You will try to sell systems as panel-agnostic.”
Former BP Solar Executive
 - “They should focus on what they do best, which is modules.”
CTO, Utility-Scale Developer E

Utility-scale developers concerned some module vendors also develop projects

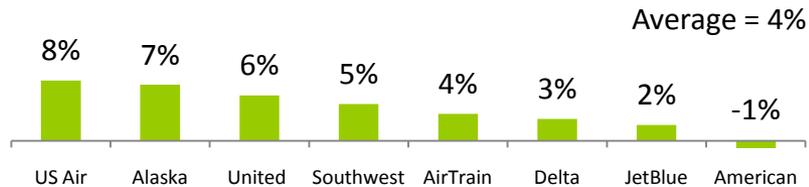
- **Utility-scale developers have a hard time dealing with module vendors that also develop projects**
 - “It’s a challenge from our point of view...Whether or not we would buy their modules depends on the situation—i.e., primarily whether we are competing with them on that project.”
Project Development Manager, Utility-Scale Developer C
 - “They are a competitor on many projects, and it is hard to deal with them. They have a bizarre business model. It is hard to get their attention...”
Origination Manager, Utility-Scale Developer D
- **Could create opportunities for bankable vendors without project development arms, such as GE, Kyocera, Sanyo, and Suntech**
- **First Solar, SunPower, and Sharp (with Recurrent) need to clearly delineate where they will compete for development projects**
- **Commercial and residential integrators rarely compete with module vendors on such projects**
 - “I guess to the extent we compete with them for an RFP it would concern me, but it hasn’t happened so far. First Solar competes in a different universe with their utility deals.”
Project Development Manager, Commercial Integrator G
 - “Project development by module vendors does not affect us too much because of the way our business is set up. We mostly do residential and commercial, and they are doing utility-scale projects.”
VP, Operations, Residential and Commercial Integrator I

Across industries, high returns on capital go to firms with either differentiation or low costs

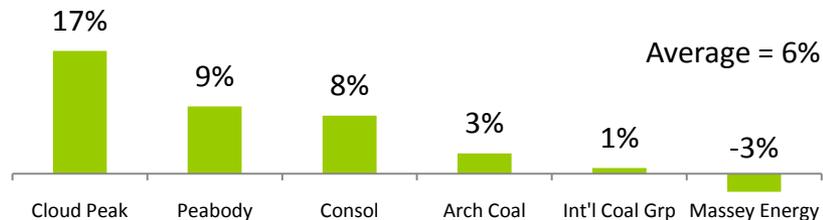
TTM ROIC at: Technology Companies...



...Airlines...



... Coal Mines



- Customers of businesses with highly differentiated offerings and high barriers to entry cannot easily switch to competitors
- Even “average” firms of this type can achieve ROIC above the cost of capital
- Another example: patented pharmaceuticals

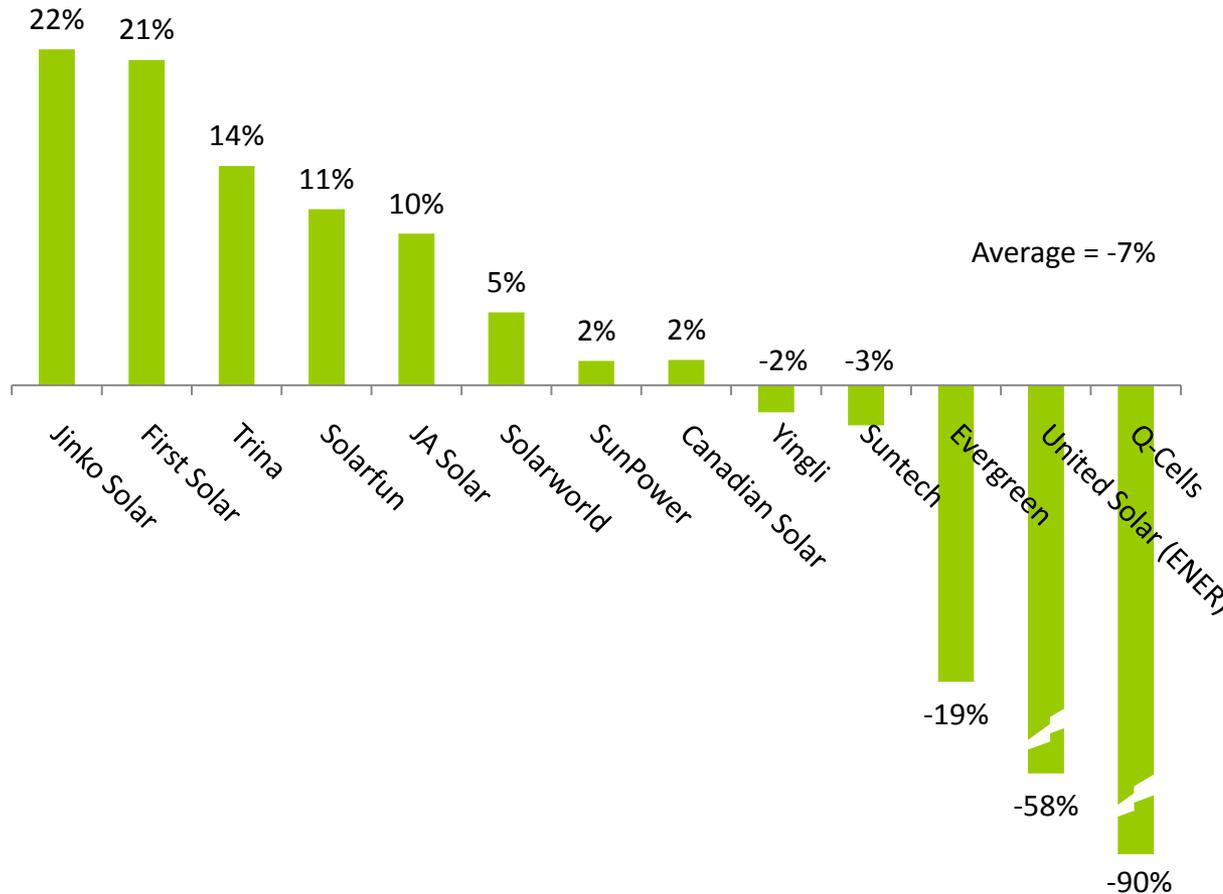
- Customers in “commodity” businesses view providers as essentially interchangeable
- Especially when capacity is easily and quickly added by current or new providers, it is hard for firms to earn more than the cost of capital
- When costs are similar, results will be similar

- Even in commodity markets, firms that can achieve cost advantages can achieve returns above the cost of capital
- Cloud Peak, Peabody, Consol, and Arch control low-cost coal resources, while International Coal and Massey control high-cost resources
- When demand is unpredictable, firms with high costs find it difficult to earn their cost of capital
- Other examples: aluminum scrap, computer DRAM memory, copper, and building materials

Distribution of returns in PV cells and modules is consistent with commodity industries

TTM ROIC:

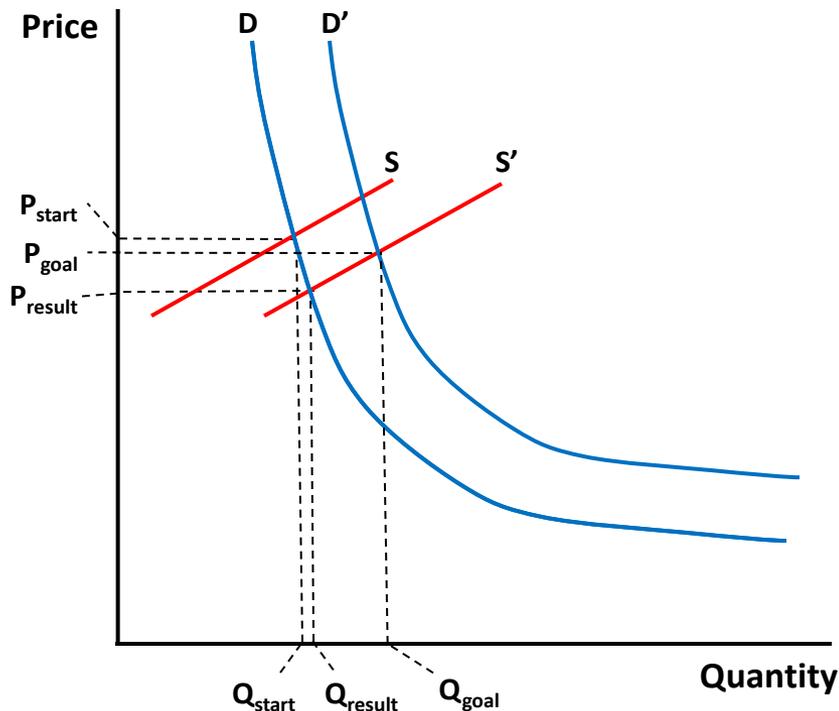
PV Module Suppliers



- Firms with high cost of production have low returns on capital, and vice-versa
- Some PV module company ROICs may be low due to ramp up of new capacity
 - Sales enabled by new capacity investments may have not yet flowed through to operating profits

In markets with inelastic demand, volatile prices make life especially hard for high-cost producers

Supply and Demand—
Impacts of Demand Elasticity



- In markets with inelastic demand, unexpected demand or supply shifts dramatically impact price
- Over the past several years, most parties have expected growth in solar demand (for example, from D to D')
- Given declining costs, module suppliers have aimed for controlled decline in prices (P_{start} to P_{goal}) as they add supply (S to S')
- In 2008, financial crisis unexpectedly slowed increase in demand, so both price and quantity were lower than expected (P_{result} and Q_{result})
 - High cost producers significantly hurt
- Significant uncertainty about demand growth in 2011 and beyond
 - End of U.S. ITC refund
 - Impact of reduction of European feed in tariffs

Although module vendors should pursue differentiation where possible, essential to lead on cost

Strategic Alternatives

Differentiation

Low Cost

Vertical / Horizontal Integration

Examples:

- **Improve power / price ratio**
- **Improve power / size ratio**
- **Offer longer payment terms, construction or project financing**
- **Manufacture locally**
- **Offer system integration services for large-scale projects**
- **Participate in market niches with special requirements**
 - Low weight
 - Building integration

Comments:

- **Unlikely to be game changer; worth pursuing where possible**
- **Conjoint analysis could quantify value of non-price offerings**

- **Improve power / cost ratio**
- **Reduce material usage, conversion costs, scrap**
- **Shift production to lowest cost areas**
- **Integrate module, inverter, and BOS to reduce overall system cost**
- **Explore scale advantages**
 - Input prices
 - Manufacturing overhead / unit
 - Operating expense
 - Sales prices

- **Given customer views on commodity status of modules, focus here is essential, at least for non-specialized suppliers**

- **A method to achieve differentiation or low cost**
- **Upstream vertical integration**
 - Polysilicon, ingots, or wafers
 - Manufacturing equipment and processes
- **Downstream vertical integration**
 - Project development
 - Project financing
- **Horizontal integration**
 - Consolidation of cell / module makers
 - Inverters, other balance of system
 - System monitoring and control
 - Energy storage
- **See questions on next page**

To assess integration moves consider six key questions

Are key inputs likely to be supply constrained?

- Low cost inputs can yield competitive advantage, but key is not giving value of this advantage to the seller in the price of acquisition—usually requires proprietary insight into long-run supply and demand
- Do not purchase high-cost producer if supply-demand balance could shift

Does participation create an information advantage?

- Participation in the target business may give access to information that would be helpful to the core business

Will integration create cost or performance synergies?

- Sometimes tight product integration requires a level of coordination and trust that is difficult to achieve across organizational boundaries
- Scale may reduce average cost or increase pricing power

Is integration required to catalyze take-off of new technology?

- Downstream moves like project development may be required to get new technologies into the market
- Possible to do this in a limited way

Are there dis-synergies?

- Vertical integration can create situations where a company is competing with its customers
- Loss of focus can be a problem in larger organizations

Is the target attractive its own right?

- Consider size, growth, competitive position, and profitability
- Also consider capital demands

Woodlawn Associates

Management Consulting

- 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