Woodlawn Associates

Management Consulting

Wind Turbine Manufacturer Recommendations (Round 2)

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About Woodlawn Associates

- **Management consulting firm focusing on high tech, telecommunications, and industrial clients**
  - Most recent work in cable TV, mobile phones, wind energy, and private equity
- **Help clients with strategy, M&A, process optimization, channel design, and supply chain management**
- **Offices in Chicago, New York, and San Francisco**
  - Extensive experience in China, Japan, Europe, and the United States
- **Partial team experience:**
  - Chief Quality Officer, Fortune 100
  - Chief Supply Chain Officer, Fortune 100
  - Master Black Belt, GE Wind Energy (China)

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Executive Summary

- **Significant trend towards de-integration since last update ("Round 1")***
  - Suzlon sold 35% stake in Hansen on Nov 24, 2009 (still owns 26%)
  - "We have increased our activity with strategic suppliers" – Jose Clavet, CEO, Gamesa, 2H09 conference call
- **Goldwind and REPower, which both have very low vertical integration, now show highest return on invested capital**
- **Public financials suggest two different paths to financial improvement**
  - Decrease opex & invested capital (Examples: Nordex, Gamesa, Suzlon)
  - Reduce cost of goods sold (Examples: Vestas, REPower, Nordex, Goldwind)
- **Fewer than half of OEMs do best-in-class supply chain management activities comprehensively**
  - Lean and six sigma up the supply chain
  - Hands-on supplier quality management
  - Evaluate total cost (including cost of quality, working capital), not just landed cost or ex-works unit cost
  - Optimize collaboration with strategic suppliers
  - Use comprehensive IT tools for supplier evaluation and management
- **In our experience, OEMs sourcing in China should give special consideration to a few key areas:**
  - Audit systems and processes in addition to samples
  - More extensively use hands-on supplier quality management
  - Use cost of quality estimates to drive decisions
  - Train staff and suppliers in lean and six sigma techniques

Notes: * Published September 3, 2009. Available upon request

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- **Introduction and executive summary**
- **Financial performance and manufacturer recommendations**
- **Supply chain management best practices**

As a reminder, levels of vertical integration vary significantly in the industry

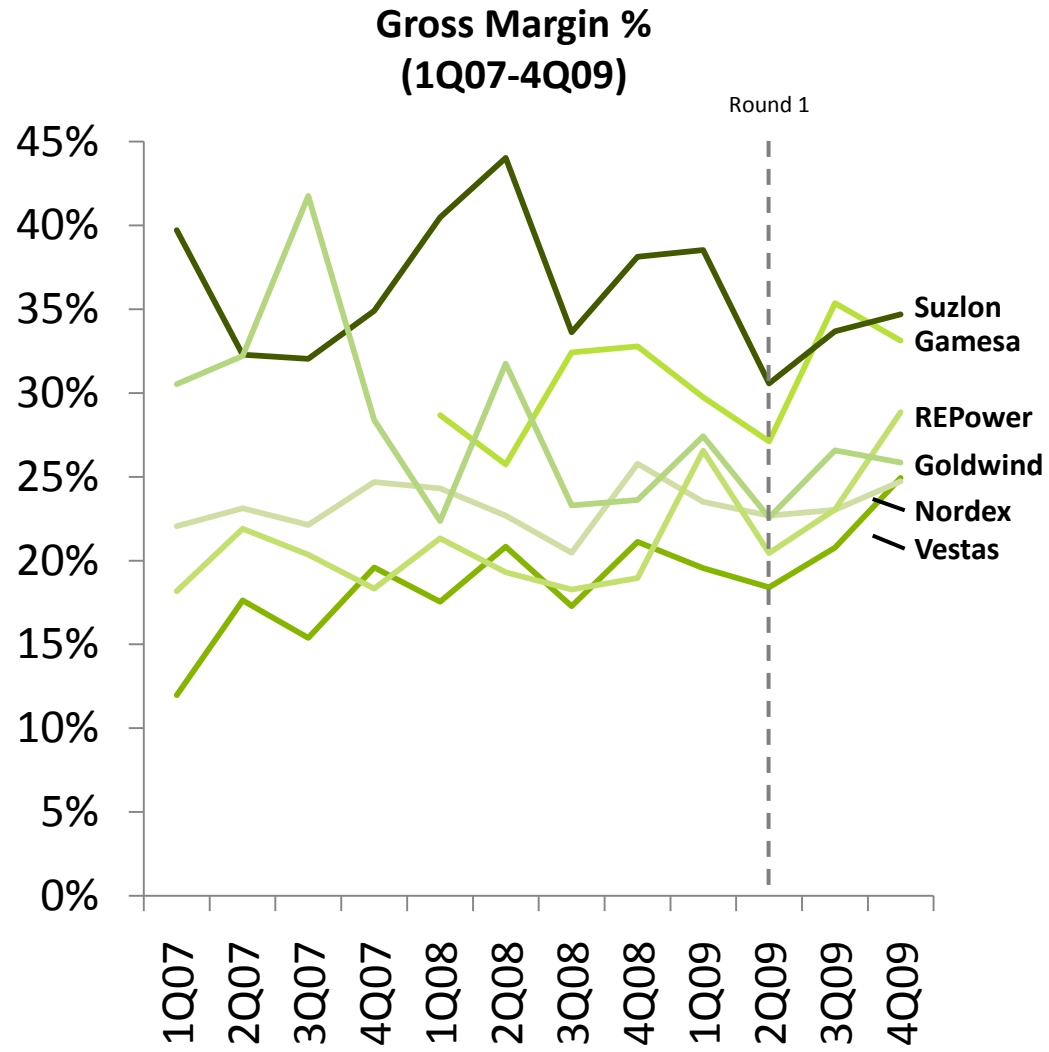
	Blades	Gearbox	Generator	Castings & Forgings	Tower	Overall
Goldwind	○	○	○	○	○	Very Low
Repower	◔	○	○	○	○	Very Low
Acciona	◔	○	○	○	○	Very Low
Clipper	○	●	○	○	○	Low
Nordex	◑	○	○	○	◑	Low
GE	○	◑	◑	○	○	Low
Dongfang***	◕	○	◑	◑	○	Moderate
Vestas	◕	○	◔	◑	◑	Moderate
Siemens	◕	●	◑	○	○	Moderate
Gamesa	◕	◑	◑	◑	◑	High
Mitsubishi	●	◕	◕	○	◑	High
Suzlon	◕	◔	◕	●	◑	High
Enercon	◕	n/a*	◕	○	◕	Very High
Sinovel**	○	●	◑	◕	●	Very High

Source: Company reports, Woodlawn Associates experience & analysis, CCM International

Notes: * uses gearless design; ** Including parent DHI DCW: *** including parent Dongfang Electric Corp. and subsidiaries

○ = 100% outsourced
◔ = Some internal production, mostly outsourced
◑ = Equally internally and externally sourced
◕ = Internal, but may 2nd source in some cases
● = 100% internal. May sell on merchant basis

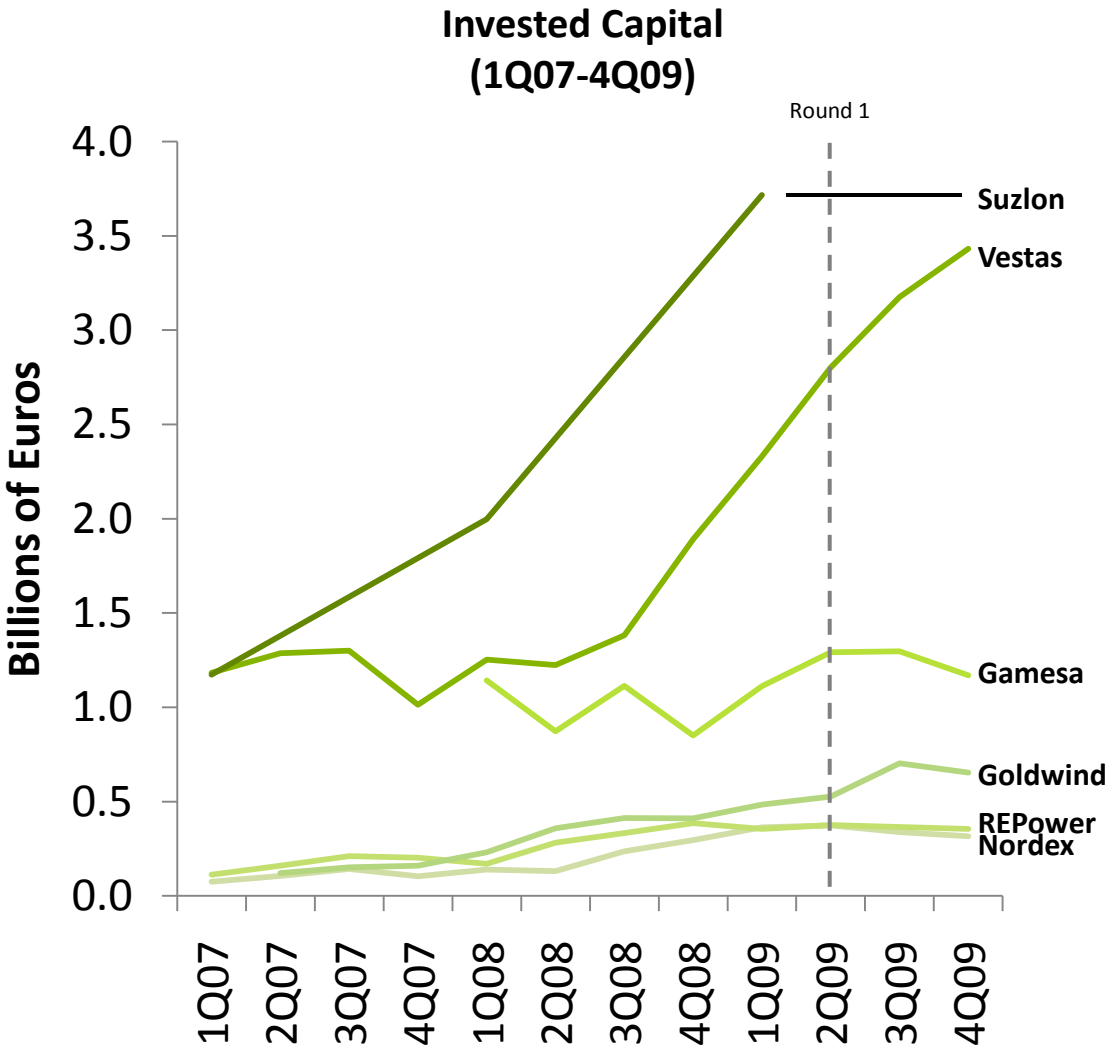
Suzlon & Gamesa still leaders in GM%, showing results of higher vertical integration



- **All companies' GM% trending up since 2Q09**
- **Most vertically integrated companies (Suzlon and Gamesa) have highest GM%**
- **Nordex, REPower scale does not appear to put them at a disadvantage for purchasing relative to larger firms**
- **Vestas GM% surprisingly low given scale in purchasing, moderately high vertical integration**

Source: Reuters, company reports, Woodlawn Associates analysis
Notes: Gamesa data for wind turbines + holding company only (excludes solar and wind farm activities)

Suzlon and Vestas have used far more of their investors' capital than other firms

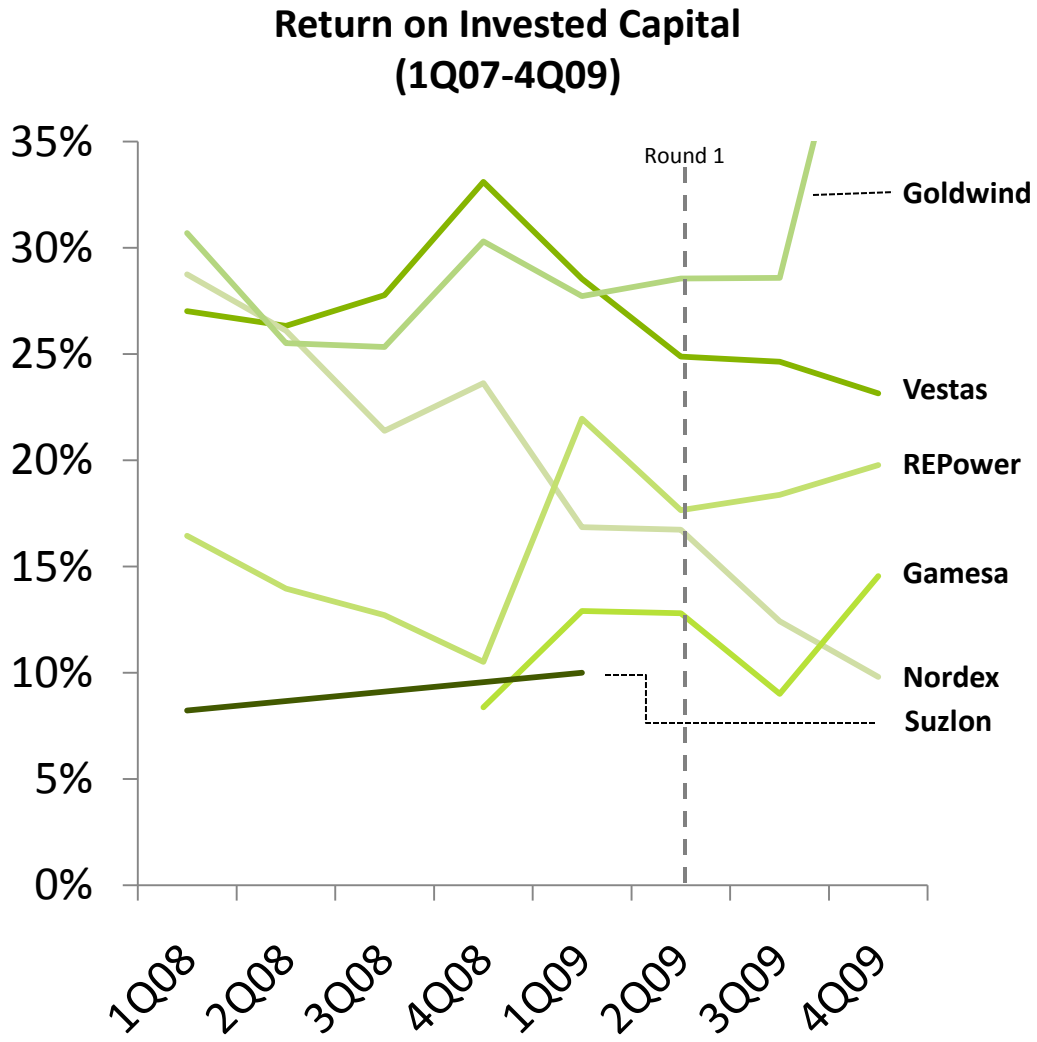


- **Both Suzlon and Vestas use about €3.5B of investor capital**
  - Vestas ~2X larger on revenue basis
  - Suzlon invested capital may come down modestly after sale of Hansen stake
- **Vestas new investments expected to be lower in 2010 than 2009 as U.S. and China are up-to-speed**
  - EBIT will need to accelerate to maintain ROIC given significant capital expansion in 2009
- **Nordex, REPower, and Goldwind demonstrate relatively cautious approach to expansion and vertical integration**
  - Should ensure investments are sufficient to secure future growth

Source: Reuters, company reports, Woodlawn Associates analysis

Notes: Gamesa data for wind turbines + holding company only (excludes solar and wind farm activities). Used €1 = 62.36 INR for Suzlon data. Suzlon balance sheet data only available annually. Used €1 = 9.0882 CNY for Goldwind data.

Vestas & Goldwind have best ROICs



- **Return on Invested Capital = 12-month EBIT, less projected taxes, divided by average capital invested**
- **Goldwind ROIC highest of group, driven by very good EBIT margins and very low capital invested relative to size**
- **Vestas GM% and EBIT also improving, but invested capital growing**
- **REPower improvement in ROIC driven by improvement in GM% and EBIT. Invested capital stable**
- **Gamesa ROIC up because of improving EBIT and stable capital base**
- **Nordex ROIC driven down by lower EBIT and higher invested capital in 2009 relative to 2008**

Source: Reuters, company reports, Woodlawn Associates analysis
Notes: Gamesa data for wind turbines + holding company only (excludes solar and wind farm activities). Suzlon only reports balance sheet data annually

Financials suggest two major paths to improvement: reducing COGS and decreasing opex & invested capital

Vestas

- GM% relatively low, which is surprising given Vestas' scale and moderate vertical integration
  - Focus on supply chain for lower cost

Goldwind

- GM% moderate, EBIT margins exceptionally good
  - Focus on supply chain for lower cost

REPower

- Invested capital is low. No production in U.S. and only JV in China
  - Ensure sufficient factory capacity
  - Develop supply chain to allow fast growth when market accelerates
- GM% is very good considering low vertical integration, but still room for improvement
  - Focus on supply chain for lower cost

Nordex

- GM% is relatively low
  - Focus on supply chain for lower cost
- EBIT margin in quite low
  - Decrease operating expense relative to sales

Suzlon

- GM% is high, but EBIT% is low
  - Decrease operating expense relative to sales
  - Sacrifice price to get more volume and EBIT
- Invested capital quite high
  - Consider divestitures to reduce capital and opex requirements

Gamesa

- GM% is high, but EBIT% is moderate
  - Decrease operating expense relative to sales
  - Sacrifice some price to get more volume and EBIT
- Invested capital moderate
  - Consider divestitures to reduce capital and opex requirements
  - Use third parties for any additional capacity

Notes: Most recommendations here could apply to any of these companies. For example, any company would benefit from higher GM%, lower working capital, or lower operating expenses. These recommendations focus on the places mostly likely to be fruitful for each company

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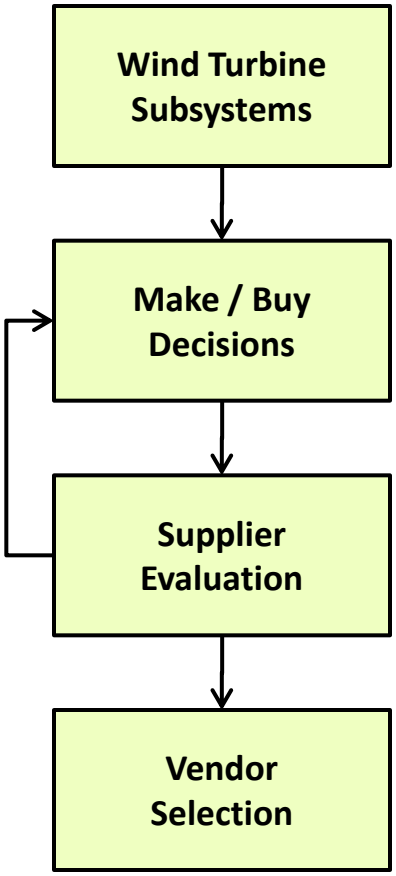
At some level, most wind turbine firms have similar supply chain management approaches

High-level Sourcing Process



Supplier Evaluation and Management Activities Common Across Wind Turbine OEMs

- **Explicit supplier approval process**
  - Prioritization of suppliers with wind turbine experience
  - Well-documented, explicit requirements supplemented by supplier discussion and Q&A
- **Comparison of landed costs**
- **Team-based assessment**
  - "If there is still interest on our side we will do an audit. A team of people…including people from quality, R&D, and procurement, will make the audit trip." – Turbine manufacturer A
  - "To evaluate suppliers, we do a cross-functional evaluation with engineering, quality, and purchasing." – Turbine manufacturer B
  - "We do financial due diligence, EHS compliance checks, and technical and operational due diligence. There is also a questionnaire." – Turbine manufacturer E
- **Sample evaluation**
  - "Once we make a decision, we do a first article inspection." – Turbine manufacturer B
  - "If they get approved through this process we will get 1-2 sets of prototypes. Quality and R&D evaluate these. If they are OK we will get a small series of 8-10 units. If these pass inspection we have a 'qualified supplier.'" – Turbine manufacturer A
- **Periodic supplier visits**

Source: Woodlawn Associates interviews and experience

Fewer than half of OEMs do best-in-class supply chain management activities comprehensively:

1. **Extend lean and six sigma up the supply chain**
   - Higher throughput and quality with lower investment
     - One turbine OEM helped supplier eliminate need for $25M expansion by using lean techniques across both enterprises
   - Lower inventory reduces working capital requirements and cost of rework
     - Another manufacturer helped suppliers reduce their inventories by 50% with same delivery performance
   - Visibility up supply chain gives more control of changes to vendors' suppliers

2. **Hands-on supplier quality management**
   - Have OEM quality engineers on site at important or developing suppliers. For other suppliers, visit regularly
   - Communication improved. Joint problem solving. Train in lean and six sigma.
   - Get early warning of (potential) problems. Earlier detection → lower cost to fix

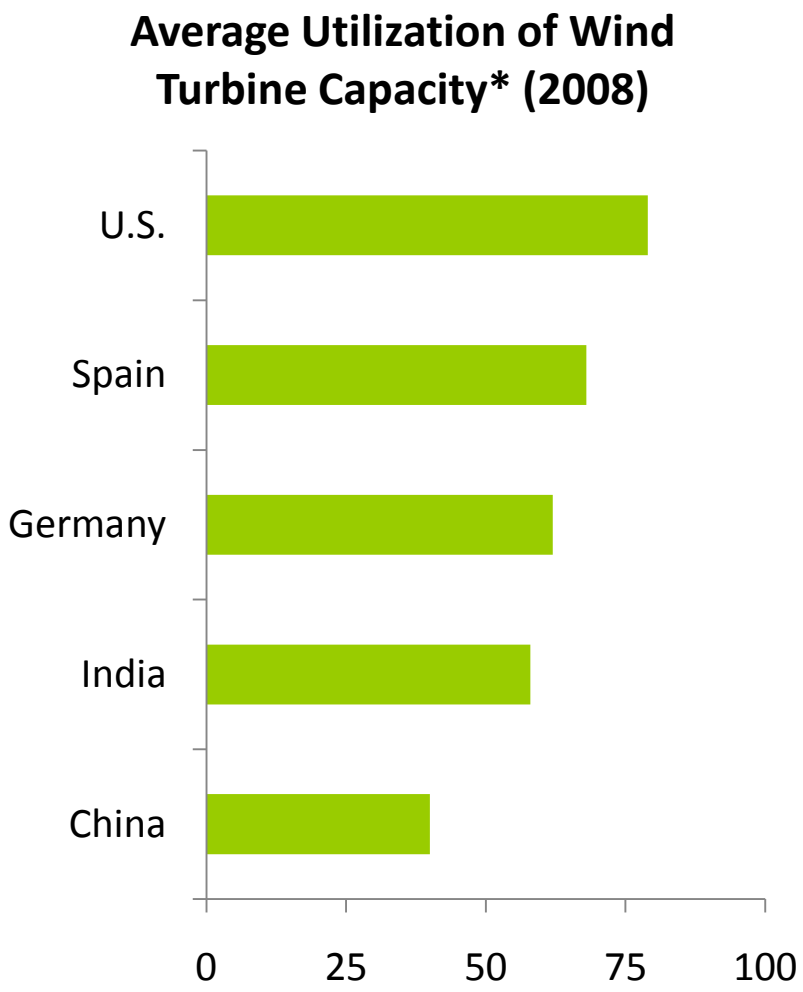
3. **Evaluate total cost (best), not just landed cost (better) or ex-works unit cost (worst)**
   - Consider cost of freight, duties, insurance, etc. to point of assembly
   - Consider delivery lead time and its impact on buffer stock and working capital requirements
   - Consider cost of poor quality: warranty, additional test and assembly, quality training and monitoring, etc.

4. **Optimize collaboration with strategic suppliers**
   - Strategic suppliers are those that can deliver optimized cost or performance with closer collaboration with OEM
     - Certain OEMs pay more / unit if supplier willing to invest in R&D or has other benefits (see total cost, above)
   - Nonetheless, almost always have second and/or third source to ensure cost competitiveness
   - Use commodity cost indexing, supplier cost estimates, and benefit sharing so strategic suppliers get fair but not excessive margins

5. **Use comprehensive IT tools for suppliers evaluation and management**
   - Manage history of supplier relationship: Approvals, POs, invoices, deviation requests and approvals/denials, quality data
   - Avoids ad-hoc agreements by email, phone that are difficult to track

Source: Woodlawn Associates interviews and experience

Many turbine manufacturers now looking to China to supply globally, but quality perception slows progress



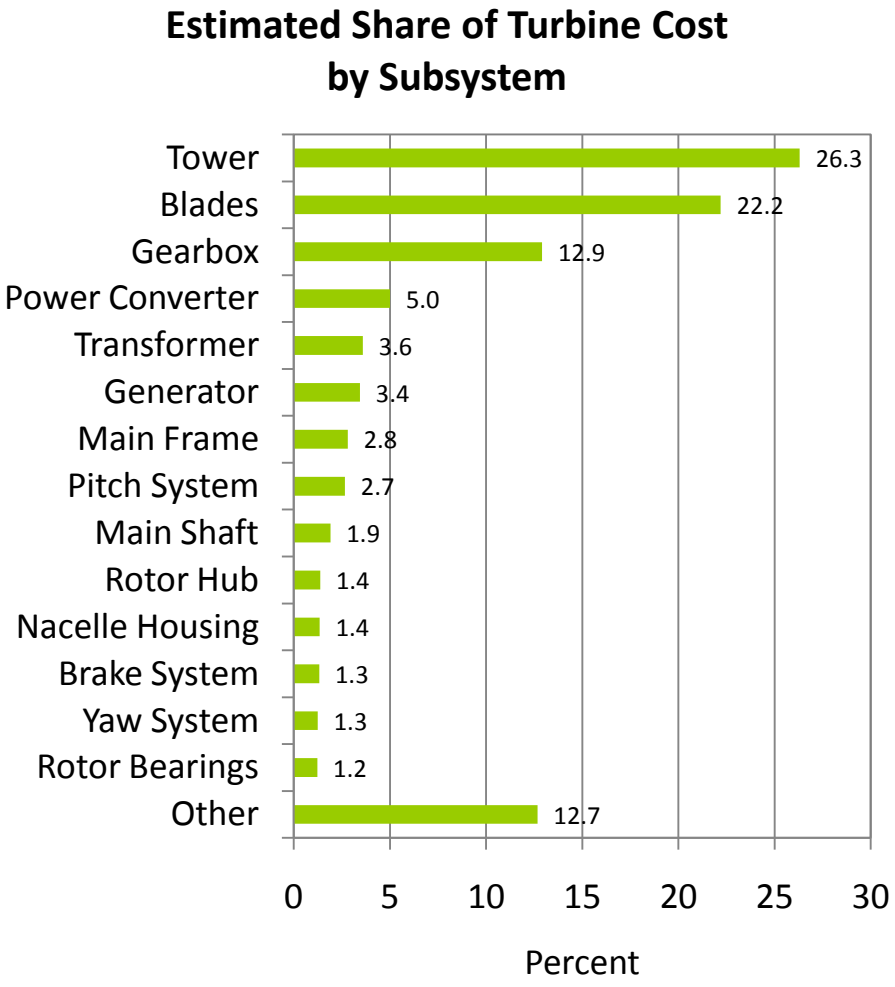
- **For foreign turbine manufacturers in China, original priority was to localize production**
- **Chinese turbines and parts about 10-20% less expensive than alternatives**
  - "Chinese components are often 20% less expensive, although that advantage can be reduced by shipping" – Turbine manufacturer F
  - "Some parts are 10-20% cheaper from China." – Turbine manufacturer A
- **Given cost advantages some turbine manufacturers now looking to supply globally**
  - "Made in China for China" to "Made in China for the World"
  - "We are discussing global supply now with headquarters." – Turbine manufacturer A
  - "The trend at global manufacturers is using the world to source." – Former GM, China, major turbine manufacturer
- **Quality perception has prevented more rapid adoption of Chinese components overseas**
  - "We don't current supply anything from China…Quality is the reason." – Turbine manufacturer B

Source: Dewey & LeBoeuf (*China's Promotion of the Renewable Electric Power Equipment Industry)*, Woodlawn Associates interviews and experience
Notes: * Utilization = MWh generated / (Rated capacity * 30% assumed capacity factor * number of hours in rating period)

In our experience, OEMs sourcing in China should give special consideration to a few key areas:

1. **Audit systems and processes in addition to samples**
   - Chinese firms often achieve quality targets through inspection, not process
   - Have seen many examples of pilot units that look great, but system not in place to do serial production
   - Experience is that Chinese suppliers more likely to suffer from changes by their own suppliers
2. **More extensively use hands-on supplier quality management**
   - Not unique to China, but a much higher share of suppliers benefit from this investment in China
   - Supplier quality engineers less costly in China than in the West
3. **Use cost of quality estimates to drive decisions**
   - Explicitly calculate cost of quality
   - Consider investments in audits, inspections, and training
4. **Train staff and suppliers in lean and six sigma techniques**
   - These techniques significantly less understood in China than in Europe and U.S.

Best items to source in China for global supply meet three key criteria



- **Lowest landed cost at point of assembly**
  - Considers freight, insurance, duty, etc.
  - "We ship our controllers globally. Other small stuff also often gets shipped." – Turbine manufacturer D
  - "Transportation cost is something that often drives us to have a local supplier." – Turbine manufacturer C
  - Generally favors small, light components, but even large and heavy components may compete if transport is mostly by sea → opportunity in offshore market?
- **Easy to evaluate quality**
  - "We would source mostly mechanical parts. Rotor shafts, disc brakes, hubs, mainframes. It is easier to measure the quality of these things than electronics or controls." – Turbine manufacturer A
  - "I would look to them especially for forgings, castings, and machined parts." – Turbine manufacturer C
- **Also have second source local to assembly site**
  - Avoids risk of supply interruption due to shipping, avoids need for large buffer stock and working capital

Source: Merrill Lynch, Wind Directions Jan-Feb 2007. Data for REPower MM92 turbine

Thank you

- **We would like to hear from you**
  - What is your own experience? Let us know!
- **Our partners and associates have extensive experience in wind turbines, strategy, supply chain management, and quality**
- **Partial team experience:**
  - Chief Quality Officer, Fortune 100
  - Chief Supply Chain Officer, Fortune 100
  - Master Black Belt, GE Wind Energy (China)

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