Challenges facing the renewables supply chain

Key trends and growth opportunities

Columbus, OH – September 1, 2009
Renewable energy sources such as wind and solar are well-positioned for growth in the US

**CURRENT LEGISLATIVE SUPPORT**
- Stimulus package
- RES/RPS in place in more than half the states

**HIGH OIL AND GAS PRICES**
- Continued high oil and gas prices
- Relaxation of price level unlikely

**PROPOSED LEGISLATIVE CHANGES**
- Potential cap and trade legislation
- Renewable energy bill

**INVESTMENT BY ENERGY/FINANCIAL GROUPS**
- Large energy groups are investing in wind and solar parks
- Wall Street is picking up financing again

**DECLINING PRODUCTION COSTS**
- Technology increasing efficiency faster than anticipated
- Production costs declining as volumes increase

**SHORTER LEAD TIMES**
- 3-5 year lead time for wind/solar parks
- Extension of PTC/ITC and grants ensures investment in supply chain

Source: Roland Berger analysis
Renewables are going through rapid evolutionary change – presenting many opportunities.

Source: BTM 2008 and 2009

YESTERDAY

THE PAST

TODAY

STILL OPPORTUNITIES BUT COMPETITIVE

TOMORROW

GET IN ON THE GROUND FLOOR

THE FUTURE?

BECOME A GAME CHANGER
Today, the crisis has brought a temporary calm to the wind industry, but there are still significant opportunities.

**US wind capacity installation forecast [MW]**

- **Annual**
- **Cumulative**

**ROOT CAUSES**

- **Slowdown...**
  - Lack of financing
  - Reduced urgency
  - Economic uncertainty

- **... but long-term growth trend still intact:**
  - Economic stimulus
  - State (national?) RPS/RES
  - Cap and trade

Source: BTM 2008 and 2009; Roland Berger
Solar is also continuing its growth, with an increasing percentage being grid-tied.

PV and CSP electricity installations\(^1\)\(^2\) [MW]

<table>
<thead>
<tr>
<th>Year</th>
<th>PV Off-Grid</th>
<th>PV Grid-Tied</th>
<th>CSP</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>21</td>
<td></td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>2001</td>
<td>21</td>
<td>21</td>
<td>22</td>
<td>33</td>
</tr>
<tr>
<td>2002</td>
<td>27</td>
<td>22</td>
<td>30</td>
<td>58</td>
</tr>
<tr>
<td>2003</td>
<td>30</td>
<td>45</td>
<td>33</td>
<td>88</td>
</tr>
<tr>
<td>2004</td>
<td>45</td>
<td>58</td>
<td>38</td>
<td>124</td>
</tr>
<tr>
<td>2005</td>
<td>58</td>
<td>79</td>
<td>105</td>
<td>234</td>
</tr>
<tr>
<td>2006</td>
<td>33</td>
<td>105</td>
<td>40</td>
<td>274</td>
</tr>
<tr>
<td>2007</td>
<td>79</td>
<td>64</td>
<td>161</td>
<td>435</td>
</tr>
<tr>
<td>2008</td>
<td>1</td>
<td>1</td>
<td>50</td>
<td>485</td>
</tr>
</tbody>
</table>

\(^1\) CSP = concentrating solar power; \(^2\) 354 MW of CSP came online in 1989/1990

**SOLAR GROWTH**

- Annual electricity installations have grown at a 20% CAGR since 2000
- PV could reach 8-12 GW by 2015
- Installed capacity is also being tied to the grid at higher percentages in 2008 than 2000
- Over 6 GW of CSP projects are in progress due to new technologies and successful demonstrations

Source: IREC; EIA; SEIA; Roland Berger analysis
Five market trends will contribute to the continued growth, but will create challenges for margins

Medium-term market trends

1. Legislative and regulatory support
   - Impact on Growth: Up
   - Impact on Margin: Up

2. Focus on costs
   - Impact on Growth: Up
   - Impact on Margin: Down

3. Changes in ownership approach
   - Impact on Growth: Up
   - Impact on Margin: Down

4. Focus on global network of local supply chains
   - Impact on Growth: Up
   - Impact on Margin: Up

5. New entrants
   - Impact on Growth: Down
   - Impact on Margin: Down

Source: Roland Berger
The current legislative environment is helping to drive the growth of renewable energy

**AMERICAN RECOVERY AND REINVESTMENT**
- USD 20 bn tax incentives for clean energy
- USD 8 bn available as loans for renewable energy generation and transmission projects
- USD 2 bn available for clean energy R&D
- Goal to unleash USD 100 bn in private sector co-investment capital

**RENEWABLE PORTFOLIO STANDARD**
- RPS commitments vary by state and range from 10-25% with target dates from 2010 to 2025

**CARBON REDUCTION INITIATIVE**
- RGGI states will distribute a set amount of CO₂ allowances through regional auctions, 188 million tons
- Utilities will be forced to look at renewable solutions as the CO₂ allowances are decreased 10 percent by 2018

**RENEWABLE ENERGY**
- Production tax credit, PTC, was renewed for 3 years in October 2008
- Investment tax credit, ITC, was extended by Congress in October 2008 for 8 years
- Allow PTC or ITC to be replaced with a grant from the US Treasury Department
Technology advances and higher volumes will continue to reduce the costs of renewables, increasing competitiveness

Levelized cost of energy [constant USD 2005]

**WIND**
COE cents/kWh [USD 2005]

**PHOTOVOLTAIC**
COE cents/kWh [USD 2005]

**CONCENTRATING SOLAR POWER**
COE cents/kWh [USD 2005]

Source: NREL Energy Analysis Office; FirstSolar; Roland Berger analysis
Turbine costs are the main lever to decrease wind energy prices – a strong focus on cost reduction is expected

Typical life cycle costs of a 2-MW onshore wind turbine [%]

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine (ex works)</td>
<td>57%</td>
</tr>
<tr>
<td>Grid connection</td>
<td>7%</td>
</tr>
<tr>
<td>Foundation</td>
<td>5%</td>
</tr>
<tr>
<td>Other up-front costs</td>
<td>7%</td>
</tr>
<tr>
<td>Total capex</td>
<td>75%</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Remarks**

- Turbine cost is the main lever for reducing wind energy costs
- Turbine manufacturers will face price reductions
- Suppliers will face increased pressure on margins
- O&M also provides opportunities
  - Service and repair technicians
  - New repair technologies

Source: EWEA, DEWI, Eon, RWE, Roland Berger
50% of US wind farm capacity is now owned and operated by 6 large utilities

Wind farm capacity ownership 2008 [GW]

- FPL/Nextera: 6.3 GW
- Iberdrola: 2.1 GW
- EDP/Horizon: 1.9 GW
- Edison Mission: 1.0 GW
- AES: 1.0 GW
- EON: 0.8 GW
- Other: 12.5 GW

**TRENDS**

- Continued consolidation
- Fewer but larger orders for suppliers
  - New parks
  - Repowering activities
- Increasing global reach of utilities
- Strong pressure to reduce energy costs

Source: Roland Berger
In solar, roles in the larger facilities are beginning to overlap

Source: SEIA; Emerging Energy Research; EIA; Roland Berger analysis
The supply chain focus is changing from the ability to deliver to the global development of local supply networks.

Focus today vs. tomorrow

**FOCUS TODAY**

<table>
<thead>
<tr>
<th>Supply situation of key wind turbine components</th>
<th>Production capacities</th>
<th>Market structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotor blades</td>
<td>Production capacities have been ramped up and further increases are announced</td>
<td>Approximately 70% in-house production at WTG OEMs</td>
</tr>
<tr>
<td>Gearboxes</td>
<td>Major gearbox suppliers planned or started to increase production which should ease the supply situation</td>
<td>The 5 major gearbox manufacturers account for approx. 75% of total supply capacity</td>
</tr>
<tr>
<td>Bearings</td>
<td>Since the wind industry gets more attractive for bearing manufacturers, major bearing suppliers are increasing production capacities</td>
<td>Oligopolistic market structure: only a handful of manufacturers can supply the required sizes and qualities</td>
</tr>
<tr>
<td>Towers</td>
<td>Production of wind turbine towers does not require difficult technologies, capabilities can be found globally</td>
<td>Many WTG OEMs with in-house production of towers. Other suppliers are very fragmented and globally available</td>
</tr>
</tbody>
</table>

> Ability to deliver – Secure supply of key components
> Ways to overcome constraints in markets – increasing capability
> Develop clusters with local supply networks in key markets on a global level
> Importance of "Buy Local" to participate in governmental economic stimulus programs

Source: Roland Berger
Five of the top six WTG manufacturers lost market share – increased competition is expected over the next two years

Overview market shares 2005-08 [% MW delivered]

Source: BTM, EER, Companies, Roland Berger

REMARKS

> Market share of the top 6 fell by 16 points
> Opens the door for new regional turbine manufacturers
> Creates opportunities for local component suppliers
Acciona began developing and owning US wind farms in 2006 – now owns three wind farms with more in the pipeline.

**WIND**

> Owns/operates three wind parks:
  > – Tatanka (180 MW)
  > – Velva (11.9 MW)
  > – Minority holding in Blue Canyon (74.3 MW)

> Currently building 2 farms that total 223.5 MW

> 60 projects in development in twenty states, with a total capacity of over 10,000 MW.

**SOLAR**

> MW.Nevada Solar One project
  > – 64 MW concentrating solar power plant
  > – Construction completed June 2007
  > – At time was largest solar project in the world
  > – All power purchased by Nevada Power Company and Sierra Pacific Resources under long term PPAs

Source: Roland Berger analysis
Suppliers need to act now to capture growth and minimize negative impacts on margin

Challenges wind turbine manufacturers

1. MARKET
   - Maximize benefits of government incentives
   - Identify and approach new markets and clients
   - Keep an eye on new competition

2. TECHNOLOGY
   - Increase reliability
   - Increase yield
   - Look for next gen opportunities
   - Drive standardization
   - Partner to develop new technology

3. SUPPLY CHAIN
   - Manage supply chain risks
   - Eliminate supply constraints
   - Establish and manage local supply chains globally

4. OPERATIONS
   - Manage liquidity shortages
   - Optimizing financing
   - Improve operating efficiency
   - Build up global capabilities

Source: Roland Berger
The current market trends create opportunities for suppliers to expand their positions in the US

**MARKET TRENDS - WIND**

- Large industry with strong growth
- Expansion across the value chain by developers and manufacturers
- Industry consolidation by domestic and global players
- Longer term agreements with WTG manufacturers due to supply chain bottlenecks
- Increasing size of turbines and wind farms favoring well-capitalized developers/owners

**MARKET TRENDS - SOLAR**

- Strong industry growth
- Spain and Germany, the two largest markets have reduced solar subsidies
- Expansion across the value chain by manufacturers and developers
- BLM\(^1\) federal land lease application process shaping industry
- New technologies altering supply chain and enabling greater production capacities
- Market growth and new technologies will lead to new players in the market

Source: Roland Berger
Offshore wind creates new market opportunities for suppliers

Development of offshore wind

**OPPORTUNITIES**

- New/ improved products to increase reliability and yield
- New approaches to problems
  - Platform
  - Maintenance
  - Ice
- Partnerships to conduct joint R&D and mitigate risk

**TECHNOLOGY – EXAMPLE**

ONSHORE  NEARSHORE  FAR-OFFSHORE

<30 m water depth  >30 m water depth

126 m
100 m
Developing local supply networks on a global level is a must to access key markets and keep costs low.

Overview development of local supply networks on a global level

BUILDING LOCAL SUPPLY NETWORKS ON A GLOBAL LEVEL

> Access to markets and incentives requires local content
> Logistics issues requires more local production/assembly
> Requires partnering and involvement of local suppliers
> Consider repair and maintenance facilities

Source: Roland Berger
Suppliers will need to focus on operational excellence to meet the price reduction targets of their clients.

MANAGE LIQUIDITY SHORTAGES AND OPTIMIZE FINANCING
- Improve working capital
- Assess financing options
- Optimized cash management

IMPROVE OPERATING EFFICIENCY
- Develop solid and efficient industrial processes along the whole value chain
- Conduct on-going process improvements

BUILD GLOBAL CAPABILITIES
- Assess locations to develop global footprint
- Identify potential local partners

Source: Roland Berger
Key takeaways

1. Renewables are definitely a growth industry

2. Current trends will increase growth, but hurt margins

3. Suppliers (and potential suppliers) need to act now to capture the growth opportunities:
   - New markets
   - New technology
   - Optimized supply chain
   - Optimized operations

Source: Roland Berger