Wind Power in Guangdong
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Current situation (1)

1. A policy led industry
2. Vulnerable energy security. 90% of GD’s energy (mainly raw coal, crude oil, fuel oil & electricity) supplied by other provinces. 70% of its electricity coal-fired and oil, 30% clean energy (2007)
3. Environmental problem. Reliance on conventional energy causes serious pollution. GD largest emitter of CO2 in China
4. Wind power a potential solution to above challenges
   - Most mature
   - Shorter payback time
   - Potentially cost efficient (equal to coal in 4 yrs if cost of environmental effect included, if not, equal in 2015)
Current situation (2)

5. GD’s pros & cons on wind power development
   • Large potential capacity in GD. 20GW - 20% of GD 2020 planned power generation capacity
   • Scattered wind resource.
   • Developed power grid
   • Relative favourable pricing (tariffs) compared to other provinces
   • Typhoons. A source of wind, but potential damage to wind turbins
6. Rapid development and high goals – from a low base.

Wind power accounts for 0.47% of GD’s total capacity in 2007

- 3 major wind farms in GD. GD ranks 11th in China in wind power generation.
- Extensive future plans 12 planned wind farms in eastern and wester coastal areas by 2010
- Growing manufacturing base - wind turbine production clusters taking shape in Guangzhou, Zhongshan, Foshan & Dongguan
Stakeholders

A. Government

1. Guangdong Energy Leading Group Office of Guangdong DRC – chief planning agency
   广东省发展改革委员会能源领导小组办公室
   - Overall planning of energy strategies and guidelines, approve and supervise energy projects

2. Guangdong Construction Department 广东省建设委员会
   - Energy saving and integration technologies with buildings

3. Guangdong Science & Technology Department 广东省科技厅
   - Support R&D on new and renewable energy development & energy saving

4. Guangdong Economic and Trade Commission 广东省经济贸易委员会
   - Industry planning & supervision

5. Guangdong Agriculture Department 广东省农业厅
   - Utilization of solar and wind power in rural areas

6. Guangdong Environment Protection Bureau 广东省环保局
   - Supervise companies on achieving environmental protection target and issue approval of projects
B. Electricity producers

1. Plays key role and most affected by policies.
2. Separate from the grid since 2002.
3. Majority are state owned (80%). These companies dominate the large scale projects.
4. Their business rationale is
   • Rising energy demand & soaring cost of conventional energy
   • Government mandatory quota on clean energy targets
   • Good prospect of wind power
### Some Major Electricity Producers

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Owner</th>
<th>Description</th>
<th>Projects in GD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guangdong Yuedian Group</td>
<td>Guangdong government 76%, China Huaneng Group (1 of 5 big state-owned electricity companies) 24%</td>
<td>Biggest state-owned electricity company in GD specialised in energy, investment, real estate, shipping, etc with a focus on clean energy power generation (hydro, wind, clean coal, LNG, solar). It produces 1/3 of GD’s total capacity.</td>
<td>1. Huilai Shibe Mountain projects, investment 0.7 billion RMB, capacity 100 MW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clean energy proportion reached 24% in 2007 and planned to reach 27% in 2010 (include hydro, LNG and wind)</td>
<td>2. Xuwen Yangqian Wind Farm &amp; Yongshi Wind Farm, investment 5.6 billion RMB, first phase capacity 49.5 MW</td>
</tr>
<tr>
<td>Guangdong Baolihua New Energy Group</td>
<td>Public listed company, not majority ownership by government</td>
<td>A leading private energy company in China specialised in clean coal and renewable energy development.</td>
<td>1. Lufeng Offshore Wind Farm, first phase investment 4.27 billion RMB, capacity 49.5 MW</td>
</tr>
<tr>
<td>China Lighting &amp; Power Group</td>
<td>Hong Kong company</td>
<td>Biggest foreign electricity company in China, total investment USD 8 billion, project located in Shangdong &amp; Guangdong province</td>
<td>1. Zhanjiang project, capacity 50 MW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Shanwei project, capacity 50 MW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Yangjiang Hailing Island project, investment 1 billion RMB, capacity 100 MW</td>
</tr>
</tbody>
</table>
Policies affecting electricity producers (1) – Renewable energy law & clean energy quota

1. Since 2006 renewable energy law in place to provide legal support
   • Guaranteed grid connection & full purchase by power grid.
   • 70% of wind turbines must be domestic made.
   • Favourable financing (soft loans) and tax incentives (50% reduction on VAT)
   • Special fund by NDRC to boost R&D and technology commercialisation
   • Subsidies on wind power price and grid connection
   • (however – details about these financial mechanisms are unclear)

2. Future mandatory renewable energy quota – 3% by 2010 & 8% by 2020
Policies affecting electricity producers (2) – NDRC licensing Program & Non-licensing program

1. NDRC licensing program - government’s primary scheme to support wind power development (since 2001)
   • Investor selected through public tendering -> lower feed-in price (previously too high)
   • Power grid must purchase all energy generated -> reduce investor risk
   • Rule of 70% wind turbines should be homemade -> encourage localized production by foreign brands -> local technology upgrade
   • Mostly large scale projects (100MW-300MW)

2. Non-licensing program
   • Approval authority different depending on scale of project. (above 50 MW NDRC, below 50 MW local DRCs)
   • No bidding process. First come – first serve. Negotiation with local government.
   • Compulsory grid connection and domestic requirement same as for NDRC licencing program
Policies affecting electricity producers (3) – Pricing (Feed-in-tariff)

1. Feed-in price approval:
   - NDRC projects: bidding (lower price likely to win)
   - Non-licensing projects: price to be approved by authorities

2. Price for NDRC projects is normally lower than non-licensed projects. The gap is about 0.1 Yuan/kWh

3. The feed-in tariff is an important channel for government subsidies

4. Price difference of wind & coal-fired electricity paid by government subsidies
   - Government subsidies partly from additional charge to end user (0.002 RMB/kWh since June 2008), partly shared within national grid

5. Why shared within national grid
   - Less developed areas -> more wind power generation + higher price difference
     - less power grid capacity + less revenue to cover price difference
   - Developed areas -> less wind power generation + lower price difference
     - more developed power grid with more revenue to share price difference of other areas

<table>
<thead>
<tr>
<th>Area</th>
<th>Wind Power Generation in 2007 (million kWh)</th>
<th>Price difference with coal-fired electricity (RMB/kWh)</th>
<th>Total difference (million RMB)</th>
<th>Power Grid Capacity (million kw)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner Mongolia</td>
<td>798.54</td>
<td>0.2</td>
<td>159.7</td>
<td>6</td>
</tr>
<tr>
<td>GD</td>
<td>330.69</td>
<td>0.25</td>
<td>82.7</td>
<td>60</td>
</tr>
</tbody>
</table>
Policies affecting electricity producers - Issues of concern (1)

1. Mandatory clean energy quota
   • Attracts investment and increase wind power capacity by forcing electricity companies to develop wind capacity
   • But, without policies to support profit driven growth of producers -> this policy is insufficient to encourage further marketisation of wind power

2. NDRC licencing program promote acceptance of large scale wind power to power grid, but
   • The tendering system has led to vicious price war resulting in lack of necessary profit for wind power producers
   • All the projects have been won by large state-owned companies (nationalism)
     - Race to occupy the best land for wind resource for long-term business strategies
     - Government support to domestic companies cause short-term thinking as loss can more easily be financed
   • Some bidders establish JV with companies registered abroad to avoid VAT and reduce income tax -> unfair competition
   • Private and foreign investors discouraged ➔ delay investment decision
3. Further need for improvement of price mechanism
NRDC lisencing program:
• Too low bidding price result is unfavorable for wind turbine manufacturers amd local economic development (tax revenue)
• Improving situation: Bidding price change from the lowest to the average price recently.

Non-lisencing program:
• Price requirements improved ➔ from unprofitable to break-even point (0.6 RMB /kWh)

4. Unfavorable Tax Policies
• VAT for wind power project reduced by half, but is still higher than other energies.

5. Unfavorable Finance Policies
• Payback time of loan for wind power projects only 7 years - shorter than projects real payback time

6. Financial crisis
• Disadvantage of high cost is amplified when the price of conventional energies dropped
• Finance is more difficult due to credit crunch
• Progress of wind power projects is slower due to drop of the energy demand
• Industry reshuffle due to the broken fund chain
Policies affecting electricity producers - Issues of concern (3)  GD specific

1. Mostly small scale projects. Only one NDRC licensed project. Reasons include
   • Lack of large scale wind resources
   • Difficulties in land expropriation because wind resource close to economic hub
   • Less uncertainty and more flexibility to work with authorities (some wind developers tend to develop projects of 49.5 MW to avoid going through NDRC)

2. Higher feed-in-tariff 0.689 RMB/kWh (fixed) for non-licensing projects (0.25 RMB added on standard local coal-fired price - a subsidy from government) results in more profitable projects
Electricity producers – future prospects


<table>
<thead>
<tr>
<th>Energy</th>
<th>Cost (RMB/kWh)</th>
<th>Feed-in-tariff (RMB/kWh)</th>
<th>Sales Price (RMB/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal-fired power</td>
<td>0.4-0.5</td>
<td>0.3-0.4</td>
<td>0.5-0.7</td>
</tr>
<tr>
<td>Wind power</td>
<td>0.5-0.6</td>
<td>0.51-0.61</td>
<td>0.5-0.7</td>
</tr>
</tbody>
</table>

2. Increased feed-in-tariff less likely – need to reduce the equipment cost

3. Government policies still uncertain – hard for wind developers to make good profits

4. Cost of wind power estimated to be close to coal-fired power in 2012 - considering environmental cost and benefit
   Without environment elements wind power cost estimated to be close to coal-fire power in 2015

5. With proper policies, GD’s capacity in 2020 reach 20 million kw, equal to 20 % of GD’s total power consumption in 2020, reduce 29 million tons CO2 emission

6. China will be the world’s largest wind power market in 2011.
C. Equipment Manufacturers

1. Policy driven. More than 60 wind turbine manufacturers and over hundred core part manufacturers in China. (8 manufacturers of wind turbines and many core parts in GD. Clusters located in Guangzhou, Zhongshan, Foshan, Dongguan.)

2. Foreign investors (mainly from US, Spain, Denmark & India) set up in China attracted by domestic demand

3. Domestic companies are catching up:
   • Before 2003 most turbines were imported
   • In 2007: 56% domestic made

4. Demand > supply → short term problems. (high costs, price competition)

5. Some manufacturers also involved in development of wind power production
## C. Some major equipment manufacturers

<table>
<thead>
<tr>
<th>Company</th>
<th>Owner</th>
<th>Description</th>
<th>Technology and R&amp;D</th>
<th>Involved Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhongshan Mingyang Electric Co.</td>
<td>Private owned</td>
<td>A leading manufacturer of wind turbine in GD. Its 1.5 MW wind turbine designed</td>
<td>Purchase design and technologies and work with Aerody (Germany), produce China's 1.5</td>
<td>Xuwen wind farm</td>
</tr>
<tr>
<td>Ltd</td>
<td></td>
<td>in co-operation with German partner Aerody represent leading technology level in GD. The first manufacturer to export products to US market. GD government provide special support.</td>
<td>MW generation set with proprietary IPR.</td>
<td></td>
</tr>
<tr>
<td>Engga Investment Co. Ltd</td>
<td>Hong Kong company</td>
<td>A leading generator manufacturer from Hong Kong, has a base in Huadu, plan to spend RMB 5 billion to build an wind turbine manufacturing base in Yangjiang, also work with Welwind (Canada) to develop wind farms in Zhanjiang and Yangjiang, total investment RMB 6 billion.</td>
<td>Major product 750 kw wind turbine, developing technologies of 1.2 MW, 1.5 MW, 2 MW and 2.5 MW</td>
<td>Zhanjiang wind farm &amp; Yangjiang wind farm</td>
</tr>
</tbody>
</table>
Policies influencing equipment manufacturers

1. New tax policy in 2008:
   - import tariff waived for core parts and raw materials
   - resume import tax for wind turbines below 2.5 MW – current rate 12%
   - home made core parts still pay VAT

2. Government subsidies to support R&D. Chinese manufacturers get 600RMB / kw from the Ministry of Finance for the first 50 wind turbines. This is equivalent to 10% of cost of wind turbine
1. **Lack of core technologies**
   - No specialized R&D institution in China for wind power (lack of R&D base) -> Lack of skilled talents
   - Most core parts imported, design of whole sets rely on foreign partners
   - Focus on whole set manufacturing – lack of components specialists. (Contradictory tax policy)
   - Lack of domestic core technologies is the bottleneck to reduce the cost

2. **Irrational industrial expansion has resulted in increase of cost and quality problems:**
   - Products of nearly all whole set manufacturers encountered problems during test & operation
   - Quality problems affect the actual output of wind farms -> bring high maintainence fee and less investment return for electricity producers.
3. Price pressure shifted to wind turbine manufacturers
   • 70% localisation rate ensure market share but profit is squeezed by developers because of unprofitable feed-in-tariffs. → Limited profit/loss → discourage R&D by manufacturers

4. Wind turbines account for 80% of wind farm project cost
   • Local production can reduce cost by 20%-30%
   • Further lowering the cost is pre-condition for large scale production
Equipment manufacturers – Future prospect

1. Situation improving:
   - Government pays R&D cost for local companies (subsidies for homemade wind turbines)
   - Among China’s financial stimulus package, 0.8 billion RMB will be used to subsidize the upgrade of wind power and nuclear power technologies. 10% (leading manufacturers) will be funded.

2. Large scale wind turbine technologies within Chinese’s International Co-operation Program on Renewable & Clean Energies

3. Industry call for establishment of technology standard, testing and certification system for wind turbine.

4. As the industry become more mature, large scale of production will reduce the cost. Estimate 2010- RMB 0.32 / kwh, 2020 – RMB 0.22 /kwh

5. China’s wind turbine manufacturing industry is expected to have a huge expansion by 2012 and China will become one of the world’s wind turbine manufacturing bases
D. Power Grid

China Southern Power Grid

• one of the 2 state-owned power grid in China, covering 5 provinces. (Guangdong, Guangxi, Hainan, Guizhou, Yunnan).
• Accounts for 20% of China’s total high voltage power network
• Responsible for power transmission, distribution and selling
• By 2010: Plans to spend 234 billion on power network construction. Capacity from renewable energy (including hydro and wind) will be 6 million kw, 36.3% of the total.
D. Power Grid

• Well developed grid – capacity seems to be available for new projects. (Advanced compared with other provinces)
  - GD’s wind resource close to economic hub → reduced cost for grid construction and less transmission loss

• Power grid has no risk in wind power development:
  They are obligated to connect to wind farms and fully purchase the electricity produced, but additional cost can be passed to end users, shared among national grid and covered by government subsidies.
E. Foreign Investors

1. Chinese government’s ambitious plans (10% in 2010 and 15% in 2015) for renewable energy attracts foreign investors.

2. Foreign investors are welcomed to participate in all parts of the value chain: wind power development, equipment manufacturing and even power grid construction and management.
   - Developer: Price war excludes foreign investors from NDRC licenced projects.
   - Manufacturer – Localization policy attracts foreign companies to set up production bases in China. Among over 60 wind turbine manufacturers, 7 are JV and 4 are foreign owned.
   - Grid - China Southern Power Grid signed co-operation framework agreement with EDF (leading electricity company from France) in Sep 2008. They plan to work together on grid construction and management. This is a sign of the monopoly system loosening.
Foreign Investors – Issues of concern

1. Because of foreigners holding back their investment plans,
   • Market has become more monopolistic and dominated by the state-owned producers
   • Another reason for reduced will of foreign investment is the slow down of the international wind power market

2. Most foreign investors choose to locate in Northern China due to its proximity to wind resources, more comprehensive industrial clusters and availability of skilled personnel

3. Foreign investors play an important role in the technology upgrade of Chinese manufacturers. The government welcome co-operation between leading foreign companies and Chinese counterparts.
Stakeholders

F. R&D institute

1. Research Centre of Wind Resource, Sun Yat-Sen University
   - A major R&D institute on wind field modeling, wind resource assessment and wind farm siting. Interested to work with Norway

2. GD Weather Bureau
   - An important institute for GD’s wind resource assessment
Future outlook

Research and development

In addition to successful policy implementation, R&D is crucial to boost further wind power development.

1. Wind resource assessment. Inaccurate assessment caused 20% less return. GD similar terrain with Norway – area to co-operate.

2. Large turbine design & manufacturing technologies key to cost reduction.

3. Offshore wind power technologies:
   • Chinese Ministry of Science and Technology has a special program focusing on offshore wind power development.
   • Despite no offshore wind farms yet, GD has great potential to develop offshore wind power technologies. By 2020, an estimated 1/3 of wind power generation will come from offshore wind resources.
   • A key success factor is to develop wind turbines strong enough to resist typhoons and extreme weather.
Main sources

4. Telephone interview with Ms. Zhou Qing, Energy Section, GD DRC
5. Interview with Mr. Robin Xiong, Sales Manager, Vestas China (Danish wind turbine manufacturer)
6. Interview with Mr. He Xun, Manager, Strategic Development Department, Guangdong Yuedian Group
7. Interview with Professor Deng Yuanchang, Research Centre of Wind Resource, Sun Yat-Sen University
8. Interview with Professor Liao Cuiping, Energy Strategy Research Center, Guangzhou Institute of Energy Conversion

10. Three major power companies invest 8.6 billion yuan developing Xuwen Wind Power, 10 June 2008, from http://cleanenergychina.blogspot.com/2008/06/three-major-power-companies-invest-86.html


32. BP will focus on North American market and will not come back to Asian market provisionally BP发展重点将集中在北美，暂不回返回亚洲市场， World Wind Power, 18 Nov 2008, from http://www.86wind.com/info/detail/2-8245.html


36. China’s 11th Five Year Plan for Renewable Energy

37. China’s Renewable Energy Law & its relevant regulation