Climate Change: The spotlight on renewables

Renewable Energy Development

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China’s GDP grew by 10% annually and India had an over 7% annual growth in the past 4 years.

The trend is expected to continue in the foreseeable future.

To fuel the strong economic growth, reliable electricity supply is required.

Uneven mix of energy sources

Over 70% of the generation capacity in the region are thermal power plants (mostly coal-fired)

Renewables make a small contribution of overall power demand

Source: Energy Information Administration (official energy statistics from the US Government)
The average earth's surface temperature has been increased by 0.74 °C since the late 1800s. It is expected to increase by another 1.8 °C to 4 °C by the year 2100.*

Impacts:
- Extreme weather
- Drought
- Rising sea level
- Desertification

The result of human activities by....

Not only the economic activities in developed economies, but also the current and future growth in developing countries such as China and India.

* United Nations Framework Convention on Climate Change
Urgent Need for Combating the Challenges

- Now is the critical timing to address the issues
- The real challenge is how to:
  - Continue economic growth in a sustainable manner
  - Minimise the global climate change impacts
- Hybrid solutions:
  - Using fossil fuels more efficiently
  - Energy efficiency
  - Renewable energy
  - Nuclear energy
  - Carbon capturing
- Renewable energy is attractive:
  - Reduce/avoid emission of greenhouse gases
  - Provide sustainable and diversified energy supply
Availability of RE Resources
Potential of Wind Resources:

- Onshore 250 GW
- Offshore 750 GW

Concentrated in the northern, western and coastal areas

Transmission constraints and grid stability
Exploitable capacity 400GW, the largest in the world

Existing 100GW with 35GW from small hydropower stations
Solar power concentrates on the far west, away from load centres.
Challenges of Developing RE

RE is clean and environmental friendly

BUT...

- Uncertain/intermittent resources
- Lower utilisation hours
- Smaller or lack of economy of scale
- Shortage of equipment supply (wind)
- Technology still being developed (solar)
- Higher capex
- More stringent environmental constraints
- Governmental supports
- Public/stakeholder’s opinions
- Availability of project financing
The Current Situation

- Considerable technology advancement achieved in the last 20 years

- Renewable energy is increasingly competitive with conventional power generation

- For instance, wind energy is:
  - Rapidly developing in mainstream power sources in some of the developed and developing countries
  - With over 60,000 MW installed capacity

- Small hydro more developed; biomass, wind and solar energy all offer large unexploited potentials
**Mission** – To be a leading renewable energy player in Asia Pacific

**Objectives**

- **5% Renewables Target** – To meet with our commitment of 5% generating capacity from renewable energy sources by 2010

- **Meaningful Return** – To build a successful renewables portfolio across Asia Pacific generating meaningful return to CLP

- **Potential long term hedge to carbon exposure** – a source of carbon credit to offset exposure in CLP’s international coal portfolio
- Expanded renewables portfolio by type and by geography

- **India**
  - Wind: Maharashtra

- **Australia**
  - Wind: South Australia, Tasmania

- **Hong Kong**
  - Wind: offshore wind farm study in Southeast waters

- **China**
  - Wind: Shandong, Jilin, Guangdong
  - Hydro: Guangdong
  - Biomass: Shandong
CLP-Huaneng Changdao Wind Project

CLP’s first greenfield renewable energy project

- **Stake**
  - A joint venture in which CLP holds a 45% stake was formed with China Huaneng Group in December 2004.

- Finding a good partner is critical

- **Project Scale**
  - The 27.2MW project approximately accounts for one-third of wind power installed generating capacity in Shandong (Wind power installed generating capacity in the province: 80MW).
  - Of the 32 x 850kW wind turbine generators, 21 are installed on the North Island of Changdao and 11 on the South Island.
  - A 110kV Substation on the South Island of Changdao is connected to the Shandong power grid via 110kV underwater cable.
  - A total of 19.4km 35kV cable laid for the entire wind farm.

- **Project operation**
  - May 2006
  - Good wind resource
A 2nd joint venture in which CLP holds a 45% stake was formed with China Huaneng Group in 2005.

The Phase I- 19.5MW project located at a coastal town Gangxi, Rongcheng

13x1.5 MW using foreign and local turbines

Phase 2 (50MW) under construction

Phase 3 (50MW) under planning

Same partner and team

Potential for higher gearing permitted due to higher capitalisation
Investment in Roaring 40s

- **Strategic Partnership**
  - **CLP Group** - has more than 100 years of experience in the power industry, and being the largest IPP investor in Asia-pacific
  - **Hydro Tasmania** – Australia largest renewable energy business, generating over 60% of country’s total renewable energy

- Target to achieve a portfolio of **1000MW** by 2010, of which existing assets and late stage development projects account for almost 600MW

- Additional growth targeted primarily from China, further Australian projects and additional markets in Asia (e.g. India)

Maximize technical, commercial, and financial capability with strong local connection across Asia Pacific
Investment in Roaring 40s

- **Total Capacity** (*as of 31st January 2007*)

<table>
<thead>
<tr>
<th></th>
<th>Operation</th>
<th>Construction</th>
<th>Development</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roaring 40s (Gross MW)</td>
<td>131</td>
<td>173.1</td>
<td>50.4</td>
<td>354.5</td>
</tr>
<tr>
<td>50% CLP Share (Equity MW)</td>
<td>49</td>
<td>61.5</td>
<td>25.2</td>
<td>135.7</td>
</tr>
</tbody>
</table>

- **Good portfolio of assets under operation and construction**

  e.g. (1) Woolnorth with 140MW total - 65MW (Bluff Point) in operation and 75MW (Studland Bay) in construction phase
  - Availability above 97% for last 2 years.
  - Achieved capacity factor up to 60% in some months
  - 3MW WT in Studland Bay will be the largest onshore WT in southern hemisphere

- **Strong pipeline of projects, including those in other Asia pacific countries**

  e.g. Rongcheng project (partnership with Guohua), Shuangliao project (partnership with Datang) in China and Maharashtra wind project in India
### CLP Renewables Portfolio

#### Operation

<table>
<thead>
<tr>
<th>Location</th>
<th>Technology</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huaiji, Guangdong</td>
<td>Hydro</td>
<td>105.6MW (88.6MW in operation)</td>
</tr>
<tr>
<td>Woolnorth Bluff Point, Australia</td>
<td>Wind</td>
<td>65MW</td>
</tr>
<tr>
<td>Cathedral Rocks, Australia</td>
<td>Wind</td>
<td>66MW</td>
</tr>
<tr>
<td>Changdao, Shandong</td>
<td>Wind</td>
<td>27.2MW</td>
</tr>
<tr>
<td>Weihai I, Shandong</td>
<td>Wind</td>
<td>19.5MW</td>
</tr>
<tr>
<td>Shuangliao, Jilin*</td>
<td>Wind</td>
<td>49MW</td>
</tr>
<tr>
<td>Woolnorth Studland Bay, Australia</td>
<td>Wind</td>
<td>75MW</td>
</tr>
<tr>
<td>Rongcheng, Shandong*</td>
<td>Wind</td>
<td>49MW</td>
</tr>
</tbody>
</table>

#### Construction

<table>
<thead>
<tr>
<th>Location</th>
<th>Technology</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weihai II, Shandong (2007)</td>
<td>Wind</td>
<td>49.5MW</td>
</tr>
<tr>
<td>Nanao, Guangdong (2007)</td>
<td>Wind</td>
<td>45MW</td>
</tr>
<tr>
<td>Khandke, India* (2007)</td>
<td>Wind</td>
<td>50MW</td>
</tr>
<tr>
<td>Datong, Jilin* (2008)</td>
<td>Wind</td>
<td>49.5MW</td>
</tr>
<tr>
<td>Hekou, Lijin, Zhanhua, Shandong*</td>
<td>Wind</td>
<td>3 x 49.5MW</td>
</tr>
<tr>
<td>Samana, India (2008/09)</td>
<td>Wind</td>
<td>101MW</td>
</tr>
<tr>
<td>Boxing, Shandong (2008)</td>
<td>Biomass</td>
<td>14MW</td>
</tr>
<tr>
<td></td>
<td>Equivalent to 14MW biomass</td>
<td></td>
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<td></td>
<td>Combined heat &amp; power</td>
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* Thru' Roaring 40's

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Total 462MW (Equity) as of 30 Sep 2007, approx 4.6% of total generating capacity
Renewable Energy in Hong Kong – Offshore Wind Farm

- 150-200MW (depending on 2.3MW or 3MW turbine model)
- 67 turbines
- 1.5-2% of CLP-HK’s capacity (1-1.5% of HK total)
- Submarine power cable to Tseung Kwan O grid connection
- ~9 km east of Clearwater Bay peninsula
- Feasibility study and EIA are in progress
Photomontage from Clearwater Bay Country Park
Global Renewable Energy Award

“Corporate Developer of the Year”

by Euromoney and Ernst & Young Global Renewable Energy Awards 2006
More Awards to CLP

- CLP named “Best in Energy Development” in the 2007 Prime Eco-Business Awards

- Changdao wind farm received “China Electric Power Industry’s Best Quality Engineering Award 2007”
  Total 35 power projects awarded; only 2 wind farms incl. Changdao and Huaneng’s Taobei wind farm in Jilin
Thank You !