“Renewable Energy Development in Asia Pacific”

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1 Introduction

Global climate change, including the rise of the earth’s average temperature as a result of human beings’ activities affecting the environment through the build up of greenhouses gases, has become a worldwide discussion topic. The average temperature of the earth's surface has risen 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. The various impacts of global climate change have caused increasing concerns globally - governments, science and business communities, green groups, and the public have started to realise the issues and actions are being considered or implemented. It is widely recognised that now is the critical timing to address global climate change issues, not only because of the economic activities in developed economies such as the US and Europe, but also the current and future growth in developing countries particularly China and India.

Today, we are seeing China and India growing at very high growth rates. China’s GDP grew by 10% annually and India had an over 7% annual growth in the past 5 years, and the trend is expected to continue in the foreseeable future. To fuel the strong economic growth, reliable electricity supply is required and therefore both China and India have aggressive developments plans for power plants (mostly coal-fired). The real challenge is how to continue economic growth in a sustainable manner and minimise the global climate change impacts. Using China as an example, it has an average 76 GW new electricity capacity commissioned every year during the period between 2003 and 2006 and this is equivalent to the overall electricity capacity installed in the entire United Kingdom. The situations require proactive and urgent management. This paper does not intend to cover all the possible solutions globally but will focus on how to utilise renewable energy in the overall electricity generation mix to reduce (or avoid) green house gases emission, mainly carbon dioxide, in the world’s two biggest developing countries of China and India.

CLP Holdings, a leading international private sector power company in Asia-Pacific, is committed to generating 5% of our total capacity from renewable energy sources by 2010. With this target, CLP Renewables was formed in June 2005 to oversee the development of our renewables portfolio in the region. The paper provides a brief overview of renewable energy potentials, project development, government supports and challenges in these two

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1 United Nations Framework Convention on Climate Change (UNFCC)
2 International Monetary Fund (IMF)
3 China’s Power Sector Reform, International Energy Agency (393 GW in 2003), Xinhuanet (622 GW in 2006)
4 US Energy Information Administration (UK’s total electricity installed capacity was 76.187 GW in 2004)
countries. Since projects will not be able to go ahead without financing, the paper also provides a briefing on key aspects of project financing and carbon finance.

2 China

The Chinese economy has experienced an annual reported GDP growth rate of more than 9% over the past two decades\(^5\). A massive increase in electricity demand and consumption due to economic surge, however, presents the country with some serious challenges, notably how to ensure that power infrastructure is accessible to its population across the whole country and how to sustain growth with due care for the local and global environment.

China government is fully aware of the challenges and it has taken a proactive approach to develop renewable energy. In 2005, it enacted a renewable energy legislation which took effect on January 1, 2006. This legislation is very comprehensive and ahead of many other developing and even some developed countries. With the benefits of the new legislation, China presents a great opportunity for both local and foreign companies in the renewable energy industry.

2.1 Renewable Energy Potential

The Chinese government, through National Development and Reform Committee (“NDRC”), has indicated its focus on various preferred renewable energy technologies and has set ambitious targets for renewable energy development up to 2020 (see Table 1).

<table>
<thead>
<tr>
<th>RE Technology (power generation)</th>
<th>Exploitable</th>
<th>By end 2004</th>
<th>2010 target</th>
<th>2020 target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro</td>
<td>400GW</td>
<td>100GW</td>
<td>160GW</td>
<td>300GW</td>
</tr>
<tr>
<td>Wind</td>
<td>1,000GW</td>
<td>760MW (1,260MW by end 2005)</td>
<td>5,000MW</td>
<td>30,000MW</td>
</tr>
<tr>
<td>- 250GW onshore</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 750GW offshore</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass</td>
<td>Agriculture waste: 700m tons p.a.</td>
<td>2,000MW</td>
<td>5,000MW</td>
<td>20,000MW</td>
</tr>
<tr>
<td>- Wood waste: 800-1000m tons p.a.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Urban Waste: 130m tons p.a.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar PV</td>
<td>3,340 - 8,400MJ per m² land</td>
<td>60MW</td>
<td>NA</td>
<td>1,000MW</td>
</tr>
</tbody>
</table>

Currently, hydropower accounts for more than 20% of total installed power generation capacity in China. This represents approximately 25% of the estimated potential at 400GW which is the largest potential in the world.

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\(^5\) China’s Power Sector Reform, International Energy Agency

\(^6\) Chinese Renewable Energy Industries Association
The greatest potential among all four preferred renewable energy is wind energy which is about 1,000GW. It is estimated that 25% of the total is onshore and offshore makes up the rest. High wind resource areas are concentrated along the coast and in the north and west of the country. However, it should be noted that not all exploitable potential will be able to implement and so its target is much smaller than hydro.

Biomass also offers considerable opportunities for power generation throughout the country. The country’s main biomass resources include agricultural wastes, residues from forestry and forest product industries. Municipal solid waste and landfill gas are also classified as biomass from the view of energy utilisation.

China has good solar resources which provides good potential for developing solar energy applications in remote parts of the country such as Tibet, Xinjiang, Qinghai, and Inner Mongolia. However, generally speaking, these areas are not easily accessible to power grid and are economically underdeveloped.

2.2 Policy Environment

As discussed previously, the Chinese Government has set strong medium and long-term targets for renewable energy development. To provide a national policy framework for renewable energy development, the Renewable Energy Law was endorsed by National People Congress’s Standing Committee in February 2005 and came into effect on 1 January 2006. Some notable clauses include:

1. Renewable energy facilities will enjoy an on-grid priority status, which ensures all renewable energy\(^7\) generated electricity will be connected to their local grid for despatch. Grid companies are also obliged to purchase all renewable energy generated electricity.

2. The electricity tariff of a specific renewable energy project will receive a government directed price according to their types, locations, benefits to the local community, the average costs among the same type of technology, as well as the project developer bidding price.

3. Once the renewable energy facility is connected to the grid, the costs are spread and shared among users of the grid.

4. Special fund will be considered for the development of renewable energy projects in rural areas.

\(^7\) Renewable energy in the Renewable Energy Law refers to non-fossil energy of wind energy, solar energy, water energy, biomass energy, geothermal energy, and ocean energy, etc.
Renewable Energy Development in Asia Pacific

5. Banks, depending on the potential of the project, should provide preferential loans to project developers in order to encourage renewable energy development.

3 India

Over the past five years, India has been experiencing an annual growth rate of 7%\(^8\). Similar to China, India is experiencing surging economic growth and, hence the need for electricity demands. Challenges of building a reliable supply of electricity and diversification of fuel mix have become a key focus for India. India has been seeking strategic alternative options, and renewable energy is a solution being pursued. India has ranked as the 4\(^{th}\) largest wind energy producer in the world, and the country’s wind power market is the most developed in Asia. It shows a good example of how important government supports are in developing renewable energy.

3.1 Renewable Energy Potential

India has vast potentials in renewable energy sources, and especially in the area of hydro power, biomass power and wind power. With an existing 7,100MW of installed renewable energy capacity, the Indian government sets an objective of achieving a target of 10,000MW of installed renewable energy capacity by the year of 2010. Table 2 lists various types of existing installed renewable energy capacity and its potential in India.

<table>
<thead>
<tr>
<th>RE Technology</th>
<th>Existing Installed Capacity</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>~4,400MW</td>
<td>45,000MW</td>
</tr>
<tr>
<td>Small Hydro (up to 25MW)</td>
<td>~1,700MW</td>
<td>15,000MW</td>
</tr>
<tr>
<td>Biomass power/cogeneration</td>
<td>~950MW</td>
<td>19,500MW</td>
</tr>
<tr>
<td>Solar PV</td>
<td>Very low exploitation</td>
<td>20MW/sq.km</td>
</tr>
<tr>
<td>Urban and Industrial Waste-based power</td>
<td>Very low exploitation</td>
<td>2,700MW</td>
</tr>
</tbody>
</table>

3.2 Policy Environment

In order to reach the country renewable energy target, several policies and regulatory frameworks were implemented:

1. A mandatory minimum percentage for purchase of energy from renewable energy source, which was made applicable by April 1, 2006.

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\(^8\) International Monetary Fund (IMMF)

\(^9\) Ministry of New and Renewable Energy, Government of India
2. Renewable energy sources should be offered with a preferential tariff until a particular renewable energy technology has been evolved and able to compete with conventional sources of electricity generation.

3. A series of fiscal benefits, such as duty exemptions, income-tax holidays, accelerated depreciation for taxation purposes, have been extended.

4. Extended financial support will be provided by the Indian Renewable Energy Development Agency.

4 Project financing
Renewable energy project is usually built at a premium cost in comparison to traditional energy plant, and thus various types of funding option are available at various stages of project development to facilitate renewable energy investments as shown in Table 3.

**Table 3: Funding Options**

<table>
<thead>
<tr>
<th>Development Stage</th>
<th>Construction and Operation Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developer/Sponsor equity</td>
<td>Developer/Sponsor equity</td>
</tr>
<tr>
<td>Government grant</td>
<td>Corporate finance loan</td>
</tr>
<tr>
<td>Soft loan</td>
<td>Non-recourse project finance loan</td>
</tr>
<tr>
<td>Venture fund</td>
<td>Lease finance for equipment</td>
</tr>
<tr>
<td></td>
<td>Carbon finance</td>
</tr>
<tr>
<td></td>
<td>Project bundling and portfolio financing</td>
</tr>
</tbody>
</table>

During the development stage, funding sources such as developer or sponsor equity funds reflect the risk profile of development projects in their early stages. Government grants or soft loans, particularly for small to medium-sized projects are usually through government’s renewable energy initiative programmes, to assist renewable energy developers ‘off the ground’.

In the construction and operation stage, developers or project companies will rely on other third parties financings such as corporate loan, limited-course and/or non-recourse project finance loans, lease finance for equipment and carbon finance. Carbon finance is closely associated Clean Development Mechanism which will be discussed further in the next section.

5 Clean Development Mechanism (CDM)
CDM is a flexible tool which was developed under the Kyoto Protocol (KP) from the United Nations. As renewable energy emits no carbon dioxide or much less than traditional fossil fuel sources during the electricity generation process, the difference of carbon emission
between burning fossil fuel to obtain the same amount of electricity from a thermal power plant becomes a “carbon credit” (Certified Emission Reduction or CER). For those parties who are under emission reduction obligations, they can acquire CERs to meet with their requirements, hence creating a market for CERs. Since CERs are tradable under the European Union Emission Trading Scheme (EUETS), it has become a hot financial instrument particularly for European buyers and sellers from China and India.

Many financial institutes, such as the World Bank (PCF carbon fund), Deutsche Bank (KfW carbon fund) or Japan Bank for International Cooperation (JBIC carbon fund) have entered into the “carbon” market and shown strong carbon finance interest which in turn enhances the return on climate-friendly investments such as renewable energy projects. With the combination of carbon finance, CDM provides extra revenue and cashflow to projects which were not profitable originally.

Like many other financial instruments, CER prices fluctuate but are rising. Depending on the structure of the sale, CER is currently trading at Euro 7-11 per ton of CO2. For a typical renewable energy project (depending on technologies), the availability of CER can potentially boost up the investment return by about 1-4%.

6 CLP’s Renewable Energy Efforts

CLP Holdings, a leading international independent power producer (“IPP”) in Asia-Pacific, is committed to generating 5% of our total capacity from renewable energy sources by 2010. With this target, CLP Renewables was formed in June 2005 to oversee the development of our renewables portfolio in the region. We have diversified fuel mix from hydro, wind to biomass. Currently we have operating and under-construction projects in China, Australia and India. We have successful joint ventures with Hydro Tasmania in Roaring 40s, China’s Huaneng Group and other local partners. In addition, we are exploring the feasibility of a major offshore wind power project in the eastern seawater of Hong Kong, close to the Ninepins Islands.

We have achieved good progress during last year. To date, we have approximately 286MW (our equity portion) of renewable energy in our portfolio (see Figure 1) and another 500MW in the pipeline. This represents 2.6% of our total generation capacity. Our efforts have been recognized internationally and in September 2006, we were named “Corporate Developer of the Year” in the prestigious “Global Renewable Energy Awards” by Euromoney and Ernst & Young.
7 Conclusions

To support development of renewable energy, both Chinese and Indian governments have taken major steps in establishing strong legal frameworks to encourage and protect renewable energy investment. Various incentive measures are also provided to renewable energy investors to ensure a sustainable investment return. The availability of CER and carbon finance is also critical to the successful development of renewable projects which are typically more expensive than traditional thermal generation.

In summary, various actions are required by the whole world to mitigate or improve global climate change issues. As far as electricity generation is concerned, renewable energy is an effective way of reducing or avoiding green house gases emission. Positive movements are now taking place in China and India. CLP will continue our efforts in renewable energy in the region and we are fully committed to the 5% generation target by 2010.
Biography

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Managing Director, CLP Renewables

Dr K. K. Chan is responsible for the renewable energy projects in Asia Pacific and corporate finance activities in China. Starting his career as an investment banker with Credit Suisse First Boston, Dr Chan had extensive experience in major international investment banks, and focused on the origination and execution of capital markets and advisory transactions. Dr Chan had previously conducted research on state-of-the-art semiconductor materials and microelectronic device fabrication in Cambridge University. His research work was published and quoted in major international journals. He received his Bachelor of Arts degree (first class honours) in Electrical and Information Sciences and Doctor of Philosophy degree in Electronic Engineering from Cambridge University. Dr Chan also holds a LLB degree from London University and is pursuing an EMBA degree at Tsinghua University, Beijing.