



Renewable Energy

The problem with fossil fuels

Since the beginning of the 20th century, industrialization in developed countries like the US and EU has led to an enormous increase in CO₂ in the Earth's atmosphere. Before industrialization the concentration of the main greenhouse gas, carbon dioxide (CO₂) in the atmosphere was around 280 parts per million (ppm) and essentially stable over time. As humans began to burn fossil fuels in massive quantities the concentration has increased substantially and the rate had accelerated in recent years. The latest measurements of this alarmingly rapid growth in atmospheric CO₂ concentrations showed that they have reached a record high of 379 ppm at Mauna Loa in March 2004.¹

The impact of this change in carbon concentration is to heat up the Earth's atmosphere by trapping the sun's radiation. According to the Intergovernmental Panel on Climate Change (IPCC), the globally averaged surface temperature of the Earth has increased by $0.6 \pm 0.2^{\circ}\text{C}$ over the 20th century and is projected by models to warm 1.4 to 5.8°C by 2100, relative to 1990 levels². For context, the last ice age was only 2 to 5°C degrees colder than our current climate.³

So in short the principal reason for the mounting thermometer is a century and a half of burning of ever-greater quantities of oil, gasoline, and coal with the compounding factor of the cutting of the world's forests, and certain farming methods.⁴ This means that the question of where we will get the energy to power the global economy and the development of countries like China in the future without committing ourselves to

¹ *The contribution of renewable energies in meeting the climate challenge* – statement made by Joke Waller-Hunter, Executive Secretary, UNFCCC - Keynote address at the International Conference for Renewable Energies, Bonn, Germany, 1-4 June 2004

² IPCC (2001) Third Assessment Report - *Climate Change 2001: Working Group I: The Scientific Basis* 聯合國氣候變化委員會 (2001) 第三份評估報告《氣候變化 2001：工作小組一之科學基礎》，請參閱 available at <http://www.klima.ph/resources/IPCC/TAR/wg1/index.htm>.

³ <http://www.heatisonline.org/science.cfm> (note degrees C:degrees F converted at 1:0.55 from source text)

⁴ http://unfccc.int/essential_background/feeling_the_heat/items/2908.php

global disaster is one of the most challenging issues facing the world today.

The clean energy solution

An obvious and essential way to reduce the carbon emissions from energy production is to use less energy and make sure that the energy we do use is used as efficiently as possible. This approach is crucial, and also economically beneficial, but cannot give a complete solution. As developing countries grow their economies, increases in energy use are unavoidable. Space must be allowed for countries to develop, but the challenge is how to achieve this without the benefits of development being wiped out by the impacts of climate change. We must ultimately get our energy from somewhere. Clean renewable energy such as solar, wave, tidal and wind power along with geothermal, small-scale hydropower and modern biomass (energy from crops) offer massive energy resources that do not harm the climate, cause other pollution (such as acid rain or air pollution) and offer the prize of an endless supply of independent energy that is completely secure.

For this reason the promotion of renewable energy technology has become a crucial element in the climate change response of world governments. Renewable energy promotion, both in developed and developing countries, is part of the role of the Kyoto Protocol and its mechanisms. According to the latest national communications under the Climate Change Convention, practically all developed countries actively support the development and use of renewables as part of their climate policies⁵.

And renewable energy is already delivering the goods for millions of people worldwide. By UNFCCC's definitions currently renewables account for around 14% of world energy production. For the world, on average, about 2.3 tonnes of CO₂ are released per tonne-of-oil-equivalent energy supplied. This means that the 14% of renewable energies in the world's energy supply help avoid the emission of more than 3 billion tonnes of CO₂ every year⁶.

⁵ *The contribution of renewable energies in meeting the climate challenge* – statement made by Joke Waller-Hunter, Executive Secretary, UNFCCC - Keynote address at the International Conference for Renewable Energies, Bonn, Germany, 1-4 June 2004
Joke Waller-Hunter, 《联合国气候变化框架公约》执行秘书长，于德国波恩「可再生能源国际会议」（2004年6月1日至4日）的致辞：「可再生能源对解决气候危机的贡献」

⁶ Ibid 同上

In large part because of the pressure of climate change renewable energy has become a burgeoning industry around the world. The fastest growing renewable technology is wind power. Global wind power capacity has expanded at an average cumulative rate of 32% over the past five years. By the end of 2003, the capacity of wind turbines installed globally had reached a level of 39,294 MW. This was enough power to satisfy the equivalent needs of 19 million average European households, or close to 47 million people⁷. According to the European Wind Energy Association (EWEA), by 2020 wind turbines could meet 12% of the world's needs for electricity, create 1,800,000 employment opportunities and avoid more than 10 billion tons of CO₂ discharged globally⁸.

With the advancement of technology, average single capacities of commercialized wind turbines have risen from 55kW to 1,650kW. Whilst land-based wind farms will continue to provide the core contribution to ongoing development, the new frontier for wind energy is offshore. EWEA confidently predicts that, given the current speed of technological advancement, as long as a sea area of 150,000 square kilometres with a water depth of less than 35 metres could be available, this would provide enough power to satisfy all of Europe's electricity demand⁹. Already offshore turbines are planned at an enormous 5MW¹⁰ each and new offshore wind farms typically use at least 3.6MW models now. Many of the wind farms planned in the next few years are an order of magnitude bigger than previous developments, including several individual projects that are planned at over 1000MW in size¹¹.

⁷ European Wind Energy Association (2005) *The Current Status of the Wind Industry* 歐洲風能協會 (2005) 「風能產業的現況」，請參閱 – see – http://www.ewea.org/documents/factsheet_industry2.pdf (accessed February 6th 2005)

⁸ EWEA and Greenpeace (2004) *Wind Force 12* 歐洲風能協會和綠色和平 (2004) 《風力 12》，請參閱 – available from <http://www.ewea.org/03publications/WindForce12.htm> 和新聞稿請參閱 with summary press release at <http://www.ewea.org/documents/0511%20-%20Wind%20Force%2012.pdf>

⁹ European Wind Energy Association (2005) *The Current Status of the Wind Industry* 歐洲風能協會 (2005) 「風能產業的現況」，請參閱 – see – http://www.ewea.org/documents/factsheet_industry2.pdf (accessed February 6th 2005)

¹⁰ For example Nordex – see – http://www.nordex-online.com/e/produkte_und_service

¹¹ For example several projects in the second round of UK offshore wind farms 如多個英國的離岸風場計劃，請參閱 – see – <http://www.bwea.org/offshore/round-2.html> (accessed February 6th 2005)

With its large land mass and long coastline, China enjoys massive wind energy resources. According to the China Meteorology Research Institute, based on wind at a height of ten meters, exploitable land-based wind resources have a potential power generation capacity of 253GW while exploitable potential ocean-based wind resources are about 750GW, totalling 1,000GW¹².

As the world's fastest growing economy, the energy situation of China plays a significant role with regard to the global economy, as well as the global response to climate change. China has a great challenge ahead, but also a great opportunity. China is well-placed to develop renewable energy with its massive renewable energy resources and the right policy support, the support of the developed world with technology transfer and investment, China should become a world leader in renewable energy. There is still a long way to go. At the end of 2003, the total grid-connected installed capacity of wind power in China was 567MW - ninth place in the world¹³. However the pace is already picking up enormously. As the Renewable Energy Promotion Law approaches (expected in June 2005) it also looks like 2005 could deliver 1000MW of new wind capacity in China¹⁴.

For China, wind power can play an enormous role not only to help avert climate disaster, but also to relieve the current energy shortages. Wind farms in China, those in place and those to come, are exciting examples of what renewable energy can deliver. The development of a huge and vibrant wind industry in China will prove that economic development and environmental protection can go hand in hand.

¹² Chinese Renewable Energy Industry Association (CREIA) 中國可再生能源產業委員會，請參閱- see -

http://www.creia.net/cms_eng/code/english/industry/detail_info.php?column_id=67&item_id=12

(accessed 5th February 2005)

¹³ Ibid 同上

¹⁴ Private correspondence with CREIA. 與中國可再生能源產業協會的私人會面資料