

A clean sweep

China's ever-growing appetite for fuel has brought an economic miracle and an environmental nightmare. Justin Cunningham reports as the country embraces renewables as a viable way forward



It is the world's worst polluter and has a name for being less than willing to change its ways. Although China has perhaps paid lip service to international calls to curb carbon emissions, it is only now coming to terms with the impact of climate change first hand and recognises it needs to do something.

Much of the problem comes from the need to provide its 1.3 billion people with electricity. It is the second largest energy consumer in the world after the US and with consumption increasing at around 10% a year, is likely to become the largest by 2025.

Rebecca Gunning, a group manager at IT Power, a leading international consulting firm in renewable energy and sustainable development, says: "China needs every bit of energy it can get. China has huge resources of coal but has very little gas and oil. Energy security is a huge thing for the government. There have already been energy shortages in terms of blackouts and brownouts all over the country."

At the end of 2007 installed capacity was 713GW compared to the UK's 83GW. The majority of Chinese capacity is from coal-fired plants and as a result last year it became the biggest CO₂ emitter in the world, overtaking the US.

Despite this, China already uses significant amounts of renewable energy. Around 8.5% of total primary energy consumption was provided by renewables in 2007 with the government investing around \$12 billion, the second largest amount in the world. Most notable is its use of hydroelectric technology to provide 145GW of power.

Beijing is increasingly looking to diversify its energy mix to safeguard future energy security. The renewable energy law passed in 2006 targets 16% of power from renewables by 2020. This has led to something of a boom in the sector over the past few years.

Jonathan Johns, head of renewable energy at Ernst & Young, says: "Investment in China has been boosted by the government's energy policy, which secures renewable energy as a vital and important part of the country's energy mix. China's stellar growth in renewables can also be attributed to the speed at

which it has built up its supply chain capability.

“It is also likely to become a significant exporter of wind turbine equipment in a few years, adding to its already strong presence in the solar industry.”

The quality of many of its solar water heating systems is very good, allowing it to competitively export the equipment to Europe and other countries. The country has an estimated 3,000 solar water heating manufacturers, meaning a national capacity of 10 million m² per year, which dominates 95% of the Chinese market and around 75% of the world market.

It is estimated that around 100MW of solar photovoltaic (PV) panels have already been installed. Solar PV offers the possibility of

cards. Nuclear generation has been increased to about 40GW or 5% of installed capacity within the same timeframe.

Progress towards these targets is making good headway. Last year alone, 3.3GW of wind generation was installed, with a further 5GW expected by the end of this year. But this rapid growth has not been without operational problems.

“There is a problem with the quality of domestic manufacturing,” says Gunning. “A lot of manufacturers have brought a design off the shelf from Europe but there isn’t the same stringent testing of the wind turbine.” Some windfarms are operating at 20% capacity or lower, often because of equipment failure.

David Raubenheimer, chairman

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built from scratch on greenfield sites. They are planning 100 such towns in the next 10 years. The scale is quite incredible and has to be seen to be believed.”

The impact of the renewable energy law has seen a vast expansion in the technology, increased investment in rural areas and a boom in manufacturing. The energy conservation law looks likely to improve efficiency and reduce

around 50GW of capacity nationally – will close over the next few years. Lost capacity will be taken up by a new generation of cleaner super-critical and ultra-super-critical coal-fired plants. By the end of the year orders will have been placed for 50 1GW ultra-super critical plants and 60 600MW plants, all installed with flue-gas desulphurisation systems. By 2010 about 50% of all the super-critical plants in the world will be in China.

Biomass power stations are also being introduced with 12 plants, each of around 25MW, built last year. “I went to a plant [site] in April and took a photo of an empty field – in December of the same year it was being commissioned,” says Gunning.

Perhaps the most prevalent source of clean and sustainable energy in the country is hydropower, which has been key in electrifying rural areas. The ambitious Three Gorges dam, when completed in 2011, will produce a staggering 22.5GW of electricity. At least eight other hydropower stations with a capacity greater than 1GW are being built or will be built in the next few years.

China’s investment in renewable energy has used technology predominately developed in the West. But, as time moves on, it is more likely to develop its own technology and innovation. Scientists are already carrying out research and development in ocean and tidal technologies as well as in carbon capture and storage.

“Traditionally China has used other people’s technology and copied it,” says Gunning, “but that is changing. There are huge numbers of technical graduates coming out of the universities each year and many are training overseas and taking back their ideas to China.

“There are a few universities in Shanghai and Beijing where they are providing innovative research. In the medium term China will be giving new technologies to the world.”

If this mirrors the success it has seen in the solar water heating market, China could scrub its unenviable reputation for pollution and end up in the ironic position of becoming one of the biggest international renewable energy players.

Cleaning up its act: Along with many cities, Beijing (left) has been dogged by appalling air pollution but the Three Gorges dam (below) is pointing the way forward



electrification in even the most rural areas, far removed from the national grid. The government is pushing China’s 300 PV cell manufacturers – largely uncompetitive because of high international silicon prices – to a target of 300MW installed solar PV capacity by 2010, increasing to 1.8GW by 2020. Two large concentrated solar power plants, plus generation of a further 300GW from hydro, 30GW from wind and 30GW from biomass are also on the

of the renewable power committee at the IMechE, says: “The scale of China, the scale of opportunity for British companies and the scale for implementing renewable technologies that have been pioneered in the UK is tremendous. I have been involved in various projects in the last three years in China and was looking at an integrated low-carbon town concept and urbanisation project.

“These are for towns with a population of one million each,

energy consumption per GDP by 20% by 2010.

Gunning says: “One of the big problems is that China is less efficient than many other places. Every MWh of electricity generated in China has more than double the carbon dioxide emissions compared to the UK.”

Much of this is down to the reliance on coal, which only now the government is trying to rein in. All coal-fired power stations producing less than 50MW –