

China's Energy Transition: Strategies to mitigate carbon lock-in

Sussex Energy Group / Tyndall Centre research project

Update: February 2008

Background

China's economy is growing rapidly, with increases in GDP of around 10% per year. This economic expansion is leading to large increases in energy demand. Coal continues to dominate the Chinese energy system despite a slowly declining share, and is fuelling the majority of new power generation capacity. Demand for imported oil is also increasing sharply as car ownership rises and domestic oil output matures. China's oil import dependence is going to exceed 50% in 2010 compared with 29% in 2000. Demand for natural gas is also growing, and largely exceeds China's supply capacity.

These trends bring with them a number of pressing challenges. Securing enough energy to sustain economic growth is an important priority. Alongside this, more attention is being given to addressing the environmental side effects of economic development. These include desertification, poor air quality in many cities and water pollution. They also include an increasingly large contribution to international environmental problems, particularly climate change. One group of analysts has recently argued that China is now the world's largest emitter of carbon dioxide (CO₂), the most important greenhouse gas. Furthermore, some areas of China will be increasingly vulnerable to the impacts of climate change such as increased flooding and desertification.

The research

This Tyndall Centre project is assessing alternative energy and carbon emissions futures for China. The aim is to evaluate the scope for mitigating CO₂ emissions. A key question is whether China can avoid the

problem of 'carbon lock-in' that is faced by most developed countries. This is characterised by dependence on carbon intensive energy systems and infrastructure that are difficult to change. The project is exploring a range of scenarios for China's future energy trends and carbon emissions, and aims to inform policy making in both China and the UK.

Progress to date

The project began in August 2006 and will be completed in March 2009.

The project has already examined the unfolding energy transition in China, initially through a historical analysis of energy supply and demand trends, and of policy and institutional developments. This initial research has also analysed available scenarios that explore potential future energy developments.

Work is underway to develop a set of cumulative emissions scenarios to 2050 that are based partly on methods developed for the Tyndall Centre's 'Decarbonising the UK' project and subsequent work by Tyndall Centre in Manchester for Friends of the Earth and the Co-op Bank. A workshop was being held in September 2007 in Beijing to help define the key features of these scenarios.

The scenarios will include a range of cumulative carbon 'budgets' for China from 2000 to 2050 – these, in turn, reflect a range of different stabilisation targets for greenhouse gas emissions and apportionment regimes (e.g. contraction and convergence or equalisation of emissions per unit of GDP). The scenarios will also include a range of turning points at which emissions might begin to fall. The research is

using official Chinese data and involves collaborations with Chinese institutions.

As part of this process, the project is considering the contribution to emissions from different sectors and the relationship between China's emissions and international trade. The contribution of exported goods and services to China's current carbon footprint is substantial – and a critical issue for the future as the country's economy develops further.

In the latter part of the project, the scenarios will be used to inform a small number of case studies of Chinese policy initiatives. These will focus on technology and/or policy options that are being implemented or are being developed for future deployment. They might include incremental improvements to fossil fuel combustion in the power and industrial sectors that could deliver substantial carbon emissions reductions. They could also include renewable energy policies and technologies, the switch from coal to gas-based heating systems in some cities and more radical medium term options such as carbon capture and storage.

Collaboration

The project team are working with a range of organisations. Within China, our principle collaborating institution is the Energy Research Institute of the National Development and Reform Commission. We are also working with the UK Foreign Office through the Partners in Science Programme and other international organisations such as Chatham House.

Outputs

The most significant outputs to date have focus on China's emissions and international trade. A Tyndall Centre briefing note published in September 2007 suggested that 23% of China's carbon emissions were due to net exports in 2004. This work has also been published on the bilingual *Chinadialogue* website and is the basis of a journal article being prepared for *Climate Policy*.

For the scenarios themselves, a background paper on our approach was prepared for our Beijing workshop. This and the presentations are available on the Sussex Energy Group website. Further publications will be prepared over the remainder of the project that describe and analyse the scenarios in more detail. There are plans to launch the final report at a workshop in Beijing in early 2009. These papers and reports will be used as a basis for several journal articles.

Most of these outputs will be put on the Sussex Energy Group and Tyndall Centre websites as they become available:

<http://www.sussex.ac.uk/sussexenergygroup/1-2-11.html>
<http://www.tyndall.ac.uk/>

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