IEA CLEAN COAL CENTRE executive summary

China – policies, HELE technologies and CO_2 reduction

China is currently the world's largest producer, consumer and importer of coal. In 2014, China produced and consumed 3.87 and 4.12 Bt coal, respectively. China has the world's largest installed power generation capacity of more than 1500 GWe. Of this 877 GWe, or over 58%, was coal-fired at the end of 2015. Largely as a result of high coal consumption, China is also the world's leading CO_2 emitter, releasing 8.25 $GtCO_2$ (26% of world total) in 2012. Therefore, China's role in the international effort to combat climate change can hardly be overstated. Over the years, China has made considerable efforts to reduce CO_2 emissions and control pollution levels, and notable progress has been made through the implementation of ambitious programmes aimed at improving energy efficiency across a number of industrial sectors and a rapid scale up of renewable energy.

Major developments in China's policies

China has taken a number of measures to curb emissions of air pollutants from coal-fired power plants. Environmental protection law was enacted in the late 1980s. Emission standards for air pollutants from coal-fired power plants were issued that have been tightened over the years and are among the most stringent in the world. Over the years, China's energy policies and development strategies have become increasingly focused on energy conservation, efficiency improvement, the use of renewable energy and reduced reliance on coal. Climate change has been highlighted in China's energy and environmental policies and regulations. Key policy elements include 'Large substituting small' (LSS), 'Energy conservation and emissions reduction', and reducing carbon intensity. The two former measures, in effect, drive R&D and the deployment of high efficiency low emissions (HELE) technologies for power generation in China.

LSS programme The earlier reform and opening up of the power sector to various investors resulted in the construction of many small conventional thermal power plants during the 1980s and 1990s. Many of these power generating units are inefficient with few or no air pollutant emission control devices installed. In the late 1990s, the 'Notice on strict control of small thermal power equipment manufacturing, construction' was issued which banned the construction of small power generating units of ≤25 MW and started to close small, inefficient and polluting power units ≤50 MW. In 2004, the National Development and Reform Commission (NDRC) published the 'Notice on requirements for coal-fired power plant project planning and construction' which set technical standards for new coal-fired power plants. All new coal power units were to be 600 MW or larger, with a power supply coal consumption rate of ≤286 g/kWh. They should have particulate removal and flue gas desulphurisation (FGD) systems installed, and the use of supercritical and ultrasupercritical (SC/USC) technology and combined heat and power (CHP) was encouraged. In 2007 China launched the LSS programme. The programme established the 'Build after decommission' principle which made a link between decommissioning inefficient small units and the eligibility of new power projects. The Program also required the parallel installation of FGD to all new coal power projects and the retrofitting of FGD to all existing coal-power units ≥135 MW.

The NDRC leads the programme implementation at the national level and is supported by multi government agencies and major grids. China has introduced a number of measures including economic incentives and command and control methods to ensure the effective implementation of the programme.

Energy conservation and emissions reduction The Five Year Plan (FYP) sets a national target of overall energy efficiency, efficiency improvement and air pollutant emissions reduction from coal-fired power generation. In 2014, China published the 'Action Plan on Upgrade and Reconstruction of Coal-Fired Power Plants for Energy Conservation and Emission Reduction (2014-2020)'. This Plan sets new technical standards with higher power generation efficiency and ultralow emission levels that are comparable to a gas-fired power plant for both new and existing coal power plants after upgrading by 2020. It also requires that 1) all new pulverised coal (PC) power units adopt

China – policies, HELE technologies and CO_2 reductions

Qian Zhu

CCC/269, ISBN 978-92-9029-592-1, 76 pp, August 2016

executive summary

≥600 MWe and USC technology; PC heating units and circulating fluidised bed (CFB) units of ≥300 MWe adopt SC technology. The deadline for meeting the targets has been brought forward to 2017 for coal power plants in Eastern China and to 2018 for coal plants in Central China.

To incentivise the deployment of HELE technologies, from 2016, feed-in tariffs for electricity generated from ultralow emission coal power plants are subsidised.

Energy and carbon intensity reduction National targets for energy intensity reduction were set in the 10th, 11th and 12th FYPs. Since 2013, China has published several action plans (such as The Action Plan on Prevention and Control of Air Pollution, Energy Development Strategy Action Plan (2014-2020)) setting a cap on annual coal consumption of ≤62% in primary energy mix at ~4.2 Bt by 2020. China has pledged to reduce its carbon intensity by 40–45% in 2020, relative to 2005 levels, to increase the share of non-fossil fuels in primary energy consumption to 15% by 2020 and 20% by 2030, and to for its GHG emissions to peak by 2030. China also published a wide range of policy documents to promote the deployment of renewables and cleaner energy sources such as nuclear and gas (including coal-bed methane and shale gas).

Accomplishments

It is estimated that China decommissioned small thermal generating units with a total capacity of around 95 GWe between 2005 and 2014. By the end of 2014, the share of units ≥300 MWe in the installed thermal power capacity was 77.7% and the share of units ≥600 MWe reached 41.5%. The share of CHP units increased from 13.3% in 2000 to almost 29% of thermal power generation capacity in 2013. The national average coal consumption rate for power supply in 2015 was 315 g/kWh, which is a 55 g/kWh reduction from the 2005 level. The total amount of particulate matter (PM), SO_2 and NOx emitted from thermal power plants in 2014 was halved compared to that of 2006. Energy and carbon intensity reduced by 13.41% and 15.54% in 2014 from 2010 level, respectively. A total of ~6 billion tonnes of carbon emissions were saved between 2006 and 2014 (based on 2005 value). Today, China has the world's largest hydro, wind and solar power capacity.

Chinese HELE technologies

Technology innovation, particularly clean coal technologies, is central to China's energy development strategies. Over the past two decades, China has adapted and improved technologies developed overseas, developed its own technologies and optimised engineering designs that are applicable to various parts of the power generation process. Today, China has the world's most efficient coal-fired power plants which have lower air pollutant emission levels than a comparable gas-fired power plant. China is beginning to play a more leading role in developing and deploying HELE technologies, drawing on its growing base of skills and R&D capabilities.

Outlook

China's economy is currently undergoing a major structural transformation, moving away from heavy-industrial investment and towards domestic consumption, particularly services and innovation. The structural changes are occurring on top of ongoing energy conservation initiatives that have led to advances in the more efficient use of coal. China has also experienced an economic downturn in recent years with a strong decline in energy intensive industries such as steel and cement. In addition, the rapid development and expansion of renewables and cleaner energy are significantly curtailing demand for coal. In 2014, China's coal consumption fell for the first time since 2000. The decrease accelerated in 2015. Furthermore, there has been a recent sharp decrease in the growth of power demand. In 2014, coal use for power generation was reduced by 3.59%. Thermal power generation fell by 0.3% in 2014 and it fell even further, by 2.7%, in 2015. This trend is likely to continue, particularly given the trajectory of government policies. The slower growth in demand for energy and power, and decreases in coal consumption and power generation from coal observed since 2014 indicate that CO_2 emissions in China are likely to peak sometime within the next decade before 2025 or even before 2020. CO_2 emissions from coal power generation may have reached a maximum in 2013, and are likely to plateau or fall slightly over the next few years although some fluctuations are expected.

Guodian Taizhou Phase II Project: 2 x 1000 MWe USC, double reheat Steam condition: 31 MPa/600°C/610°C/610°C Emissions: PM 2.3 mg/m³ SO_2 15 mg/m³; NOx 31 mg/m³ Net unit efficiency: 47.82%

Guohua Sanhe power plant upgrade: 2 x 350 and 2 x 300 MWe, subcritical Emissions after upgrade (mg/m³): PM ≤3, SO_2 ≤25, NOx ≤38, reduced by 85.3%, 60.5% and 88.9%, respectively. Power supply coal consumption rate decreased by 11.3 g/kWh

IEA Clean Coal Centre 14 Northfields London SW18 1DD
www.iea-coal.org | +44 (0)20 8877 6280 | email: mail@iea-coal.org