A future for coal in Asia’s power sector

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Introduction

- The role of coal in IEA (Paris) projections for primary energy and power generation
- The rise of coal-fired power generating capacity in Asia
- How can coal clean up its performance?
Global coal use grows by just 0.6%/y, Gas (1.4%), nuclear (2.2%) and renewables (7.9%) outpace coal by considerable margin.
The world is building 220 new coal-fired stations

IEA CCC CoalPower Database (2010)

- Globally, ~220 coal-fired stations were under construction (or being repowered)
- Totalling ~223,000 MW_e (223 GW_e)

Of which:
- 58 GW_e in China
- 80 GW_e in India
- As well as 13 GWe in Indonesia, 16 GW_e in Vietnam, and interest in smaller growth in Malaysia, Bangladesh, Pakistan, Philippines and Thailand
Indonesian Crash Programme adds 13 GWₑ of coal

Coal is fuel of choice to move away from oil-fired power; gas reserves are dwindling while coal is abundant
Vietnam could add 16 GW of baseload coal, and still be short of power. Coal is fuel of choice to diversify away from gas and hydro; 106 GWe of new capacity is planned, half will remain coal.
Malaysian saw 400% rise in coal capacity since 2000

Gas-fired capacity was 80% of total, now 60%; coal has edged up to 37%; potential for biomass cofiring is good.
Why is there confidence in coal?

- Coal remains a relatively stable commodity
- and lowest price fossil fuel compared with oil and gas (even when standardised to $/tce)
- Current prices at 100-110 $/t still well above the cost of production
CLEANER EMISSIONS FROM COAL
Coal is natural, but complex and dirty

- Coal is a natural substance and also a complex fuel, uncontrolled emissions can lead to a number of pollutants including:
  - Sulphur dioxide ($SO_2$)
  - Nitrogen oxides ($NO_x$)
  - Particulate matter (PM)
  - Mercury (Hg)
New for old

- Increase the efficiency of the coal-fired fleet
- China closed 70,000 MW of inefficient plants
- China’s newer fleet is more efficient than the USA ageing fleet

Average Coal-Fired Power Plant Fleet Efficiency in China and the United States

Source: US Energy Information Administration, Annual Energy Review 2008; China Electricity Council Statistical Data
Modern coal efficiencies now regularly perform like old CCGTs

• In the 2000-10, the UK fleet of CCGTs averaged 45-47% efficiency

Coal plants designed to the highest standards of efficiency and pollution control can achieve

• Torrevaldaliga Nord (Italy) >44.7% (LHV)
• Nordjylland 3 (Denmark) 47% (LHV)
• Isogo 1 and 2 (Japan) 42% (LHV)

achieving airborne pollution levels equivalent to a modern gas plant

Although modern CCGT remains unmatched at 60%
Pathway to a near-zero CO₂ emissions plants

Efficiency gains using today’s technology can cut CO₂ emissions by 33%

Efficiency gains can make significant changes in fuel use and emissions

*Adapted from VGB 2007; efficiency – HHV.net

Average worldwide

- 30% efficiency, 1116 gCO₂/kWh
- 38% efficiency, 881 gCO₂/kWh
- 45% efficiency, 743 gCO₂/kWh
- 50% efficiency, 669 gCO₂/kWh

EU

- 38% efficiency, 881 gCO₂/kWh

State-of-the-art

- 45% efficiency, 743 gCO₂/kWh

Steam power plant 700°C technology

- 50% efficiency, 669 gCO₂/kWh

CCS technology, but efficiency loss of 7-12% points

2010

2020

CO₂ reduction

- 21%
- 33%
- 40%
- 90%
IEA 450ppm scenario needs CCS

There is no silver bullet for cutting CO₂, ALL measures must be attempted
IEA CCS Roadmap to 2050 is not just about coal for power

Coal could account for just 40% of future stored CO₂
Alternative technology possibilities

- **Cofiring biomass waste** with coal in large coal-fired stations – can utilise waste and reduce CO$_2$ emissions

- **Underground coal gasification (UCG)** – potential for coals inaccessible by mining, could expand resources to 18 trillion tonnes (>2700 years)