Coal Market Overview

IEA High Efficiency, Low Emissions (HELE) Technology Roadmap

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Introduction

- Present the status of global coal use, coal trade and regional influences
- Understand current trends in coal markets
- Consider issues that might shape the next 10-20 years
30% rise in 20y preceding 2000; 46% rise in 8 years after 2000

Global coal demand by main economic sector, Mtce

- Power and heat generation
- Coke, iron and steel
- Other industry
- Residential
- Commercial
- Other

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Hard steam coal dominates by volume, 5000 Mtce in 2009

Hard steam coal, hard coking coal, lignite/brown coal production since 1980, Mtce

- Coking
- Lignite/brown
- Hard steam
Trends reflected by OECD retreat from coal; and advance by non-OECD

World hard steam coal production (incl China), %

- Others
- France
- Germany
- United Kingdom
- Canada
- Ukraine
- Vietnam
- Poland
- Colombia
- Kazakhstan
- Russian Federation
- Australia
- South Africa
- Indonesia
- India
- United States
- People's Republic of China

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (Mt)</th>
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<tbody>
<tr>
<td>1971</td>
<td>1665</td>
</tr>
<tr>
<td>1980</td>
<td>1807</td>
</tr>
<tr>
<td>1990</td>
<td>2838</td>
</tr>
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<td>2000</td>
<td>3093</td>
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<td>2009</td>
<td>5082</td>
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Coal-fired fleet still consists of many subcritical stations

IEA CoalPower Database (2010)

- ~220 stations under construction (or repowered)
- Totalling ~223 GWe of which 113 GWe is known to be SC or USC, mostly hard steam coal

Of which:
- 58 GWe in China (35 GWe is known SC or USC)
- 80 GWe in India (48 GWe is known SC or USC)
- 8-15 GWe in each of the following countries: Indonesia, Vietnam, S Africa, Germany, and USA
Coal-fired power investments carry a number of risks to financial institutions and investors:

- higher $/kWe capital cost compared with gas
- higher carbon lock-in (in the absence of CCS or appropriate ‘offset’)
- continuing stringency of emission regulation (SOx, NOx, and PM)
BUT

• Coal remains a relatively stable commodity and lowest price fossil fuel compared with oil and gas (even when standardised to $/tce)
CIF price of major fossil fuels ($/tce)

International fuel price comparison, US$/tce

- Natural Gas average for EU CIF
- Crude oil average for OECD CIF
- Steam coal marker for NWE CIF
Steam coal markets are still subject to volatility

- NW Europe steam coal prices peak at 210 $/t in September (Brent crude hits 100 $/bbl)

- 2008 – triple supply shock and freight shortage
  - Coal demand in China soars; exports stop; winter weather causes demand spike
  - Record flooding in Queensland
  - South African power cuts
  - Freight averages 30 $/t (max. 60 $/t)

Although before 2008 ends
- Financial meltdown halts price momentum and prices slump to 60-80 $/t
Dec 2010 - supply and demand shocks hit world markets again

- NW Europe steam coal prices return to 120 $/t
  - China imports continue to rise (119 Mt steam, 47 Mt coking)
  - Record floods return to Queensland
  - Japanese earthquake/tsunami closes 8 GWe nuclear plants and 8 GWe of coal-fired plants; demand in remaining thermal plants rise to compensate, including coal
  - Germany closes pre-1980 nuclear stations for safety approval
Over the Roadmap period, the market could look different

- These short term phenomena are important to monitor, while longer term trends are also difficult to foresee

- There’s no guarantee that prices will remain high over the entire Roadmap period
Roadmap needs longer term perspective

• Will prices change, if so, who or what will be the key drivers
• Imports account for just 14% of hard steam coal supplies (26% for coking coal, negligible for lignite)
• Yet, world prices are having a larger impact on domestic prices
• So who are the biggest influences on world prices
Global steam coal exports by % market share

World steam coal exports, %

- 1971: 146 Mt
- 1980: 101 Mt
- 1990: 288 Mt
- 2000: 425 Mt
- 2009: 707 Mt

Countries and their market share:
- Poland
- Germany
- United States
- People's Republic of China
- Kazakhstan
- Vietnam
- South Africa
- Colombia
- Russian Federation
- Australia
- Indonesia

Other market share
Rising exports suppliers

- Mongolia (30-50 Mt/y?) – Tavan Tolgio

- Southern Africa – Botswana, Mozambique, and Zimbabwe (>70 Gt of reserves, but needs rail)

- US West Coast – Powder River Basin coal exports
Average international coal prices

FOB prices of steam and coking coal, US$/t

*Steam market based on MCIS NWE minus capesize freight rate
END
Hard coal has an estimated life of 120 years (~730 Gt, 6 Gt/y production)
(but where it matters, China’s R/P was 38 years based on 2008 production)
Lignite has a life of 270 years, assuming an estimated reserve of ~270 Gt and 1 Gt/y production
Resources of hard coal (total 17,167 Gt) in 2009 of the top ten countries as well as their distribution by region.

Source: BGR 2010
Top 10 most abundant energy reserves (BGR, 2009)