Coal and sustainable development

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McDonnell Academy Global Energy & Environment Partnership
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World Coal Association

**WCA** provides the global voice for coal

**COAL** provides
- 30% of world primary energy
- 41% of world electricity
- 68% of world steel

- Assocarboni (Italy)
- Associacao Brasileira do Carvao Mineral
- Association of UK Coal Importers
- Australian Coal Association
- Camara Asomineros
- CEMBUREAU
- Coal Association of Canada
- Coal Association of New Zealand
- Confederation of UK Coal Producers
- CO2 CRC (Australia)
- German Hard Coal association
- Indonesian Coal Mining Association
- Iranian Mines and Mining Industries
- Japan Coal Energy Center
- National Mining Association (USA)
- Shaanxi Coal Industry Bureau
- Svenska Kolinstituten
- UK Association of British Mining Companies
- World Energy Council (UK)
- EURACOAL
- Global CCS Institute
- UCG Association
- VGB PowerTech
- PT Adaro Indonesia
- Anglo Coal
- Arch Coal
- BHP Billiton Energy Coal
- BHP Billiton Mitsubishi Alliance
- Carbones del Cerrejon Colombia
- Caterpillar Global Mining
- ChinaCoal
- Consol Energy
- Glencore International
- Joy Global
- Katowice Holdings
- Mitsubishi Development
- Orica Limited
- Peabody Energy
- Rio Tinto Limited
- SHENHUA GROUP
- Solid Energy NZ
- TOTAL SA
- VALE
- XSTRATA Coal
The 21st century world has been built on coal.

**Growth in global energy demand, 2000-2010**

Coal accounted for nearly half of the increase in global energy use over the past decade, with the bulk of the growth coming from the power sector in emerging economies.

*Source: International Energy Agency*
Skepticism of coal’s future

<table>
<thead>
<tr>
<th>Global Coal Demand according to the IEA</th>
<th></th>
<th>Average Annual Growth Rates</th>
<th>Growth period</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Energy Outlook Reference Scenario</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coal Demand in 2010 (Mtoe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEO 2000</td>
<td>2820</td>
<td>1.70%</td>
<td>2000-2010</td>
</tr>
<tr>
<td>WEO 2002</td>
<td>2702</td>
<td>1.40%</td>
<td>2000-2010</td>
</tr>
<tr>
<td>WEO 2004</td>
<td>2763</td>
<td>1.80%</td>
<td>2002-2010</td>
</tr>
</tbody>
</table>

| Actual Global Coal Consumption         |          |                            |               |
|                                        | Actual 2010 coal consumption |          |               |
|                                        | 3664     |                            |               |
|                                        | Size of underestimation        | 23% - 26%  |               |
|                                        | Actual Average Annual Growth Rate | 4.60%       | 2000-2010     |
Political correctness? Misdirection?

“We do everything we can not to invest in coal – everything we possibly can.”

President Jim Yong Kim
World Bank
November 2012
Global primary energy demand grows by 40% between 2009 & 2035, oil remains the leading fuel though natural gas demand rises the most in absolute terms.

Source: International Energy Agency
Coal fuels India’s future

- 1,199 coal plants proposed globally
- 455 – India
- India has been the fourth largest recipient of public international finance for coal power

“WE DO EVERYTHING WE CAN NOT TO INVEST IN COAL – EVERYTHING WE POSSIBLY CAN.”
Coal is here to stay

World primary energy demand by fuel and scenario (Mtoe)

Coal demand will increase substantially over the coming decades even if all the commitments contained in the Copenhagen Accord are fully delivered.

Source: IEA World Energy Outlook 2011
Critical enabler

Share of coal in primary energy consumption (%) in industry subsectors

<table>
<thead>
<tr>
<th>Industry Subsector</th>
<th>China</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron and steel</td>
<td>95</td>
<td>92</td>
</tr>
<tr>
<td>Chemical and petrochemical</td>
<td>69</td>
<td>16</td>
</tr>
<tr>
<td>Non-ferrous metals</td>
<td>76</td>
<td>78</td>
</tr>
<tr>
<td>Non-metallic minerals</td>
<td>89</td>
<td>94</td>
</tr>
</tbody>
</table>

Incremental world primary energy demand by fuel, 2000 - 2010

- **68%**: Coal is used to produce 68% of the world’s steel output
- **41%**: Coal is used to generate 41% of the world’s electricity
The energy security difference: oil, gas and coal

- **Oil**: 2% of the People, Control 52%
- **Gas**: 3% of the People, Control 54%
- **Coal**: 42% of the People, Control 50%
China is a model for many developing countries...

China's rapid growth
Real change in gross domestic product (GDP) since 1990, in percent

Source: IMF

GDP per capita 2009 projection

CHINA $3,566
US $46,443

+ 536%

+ 61%
Over the past three decades:

- China lifted over 660 million people out of poverty
- China’s steel production multiplied by 18
- China’s cement production multiplied by almost 14
- China’s connected 99% of its population to the grid

| Poverty measures for $1.25 a day in 2005 PPP (number of people, in millions, below $1.25 a day) |
|---|---|
| World | 1981 | 2008 |
| China | 835.1 | 173 |
| World excluding China | 1102.8 | 1116 |

Source: World Bank 2012

China’s coal consumption grew by 400%
Reconciling rising coal consumption with climate change priorities

Supply side efficiency is valuable …

1% increase LHV efficiency = 2–3% points decrease in CO₂ emissions

Replace:
- < 300 MW
- > 25 years old

Reduces 1.7 GtCO₂ / yr
- 22% ▼coal emissions
- 5.5% ▼global emissions

an essential prerequisite for CCS
Comparative climate actions

Initiatives needed to cut 2 Gt of CO2 emissions

• Run the EU ETS for 53 years
• Run the Kyoto Protocol 3 times
• Multiply the world’s current solar power capacity by 195
• Increase the efficiency of all coal power plants from 34% to 40%
Investments in clean coal technologies

Supercritical and ultrasupercritical power plants in operation or under construction

**430 GW of Advanced Coal Plants Worldwide**

- United States: 97 GW
- China: 155 GW
- Japan: 30 GW
- India: 25 GW
- Germany: 22 GW
- South Korea: 22 GW
- Russia: 16 GW
- Other European Union: 21 GW
- ROW*: 35 GW

*Rest Of World

Around the world, there are nearly 430 gigawatts (GW) of supercritical and ultrasupercritical power plants in operation or under construction. China leads this effort, representing 36 percent of the world’s advanced coal fleet.
In the power sector roughly 25% of the answer to climate change lies in coal. Effective climate policies should not dismiss this potential.

Source: IEA Energy Technology Perspectives 2010
Global investments necessary to effectively combat climate change

<table>
<thead>
<tr>
<th>Technology</th>
<th>Present Rate</th>
<th>Rate to Achieve 50% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal-fired with CCS</td>
<td></td>
<td>35 CCS coal-fired plants (500 MW)</td>
</tr>
<tr>
<td>Gas-fired with CCS</td>
<td></td>
<td>20 CCS gas-fired plants (500 MW)</td>
</tr>
<tr>
<td>Nuclear</td>
<td></td>
<td>32 nuclear plants (1,000 MW)</td>
</tr>
<tr>
<td>Hydro</td>
<td></td>
<td>1/5 of Canada’s hydropower capacity</td>
</tr>
<tr>
<td>Biomass plants</td>
<td></td>
<td>100 biomass plants (50 MW)</td>
</tr>
<tr>
<td>Wind-onshore</td>
<td>0</td>
<td>14,000 wind turbines (4 MW)</td>
</tr>
<tr>
<td>Wind-offshore</td>
<td>0</td>
<td>3750 wind turbines (4 MW)</td>
</tr>
<tr>
<td>Geothermal</td>
<td>0</td>
<td>130 geothermal units (100 MW)</td>
</tr>
<tr>
<td>Solar PV</td>
<td>0</td>
<td>215 million m² solar panels</td>
</tr>
<tr>
<td>Solar CSP</td>
<td>0</td>
<td>80 CSP plants (250 MW)</td>
</tr>
</tbody>
</table>

Source: IEA “Energy Technology Perspectives” (2008)
...but in comparison to other low-carbon technologies CCS is seriously underfunded

Public funding support commitments to CCS demonstration

![Bar chart showing public funding on low carbon technologies]

- Nuclear: $45 billion annually
- Renewables: $27 billion annually
- CCS: $12.2 billion since 2005
Thank you

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Sustainable development implies social and economic growth together with the protection of environmental quality, all reinforcing the other.