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University of Wollongong

Carbon Captured: Australia, climate change & the coal industry
Outline of main topics covered

1. International context for GHG emission reduction
2. Coal & climate change in Australia
3. Coal consumption in Australia
4. Coal mining’s contribution to Australia’s economy
5. Global trends in coal production & consumption, 1980-2010
6. Australian coal production, 1910-2010
7. Coal reserves & ‘peak coal’
8. Australia’s role in coal export trade, 1900-2010
9. Australia’s coal trade with Asia & Europe, 1970-2010
10. Conclusion
INTERNATIONAL CONTEXT FOR GHG EMISSION REDUCTION
Global atmospheric CO2: 800k BP to 2013

Temperature anomaly (°C)

Thousands of Years Ago

Atmospheric CO2 (ppm)

Current CO2 level
Global atmospheric CO2: 650k BP to 2011

1850-2013: 35% INCREASE IN GHGS IN ATMOSPHERE
BEST global temperatures, 1800-2010
(funded by Bill Gates & Koch brothers)
The great weather and flood catastrophes over the last forty years

Losses in US billion dollars

Source: Munich Re Group, 1999.
An increase in severe storms is helping to drive up the number of recorded disasters, but this cannot be conclusively attributed to climate change.
Climate change models

Likely effects of four emission reduction models

- Business as usual: No action taken
  - 132% increase in emissions by 2050
  - 5.5-7.1°C rise in global temperature by 2100

- Late and slow decline: Action starts in 2030
  - 76% increase in emissions by 2050
  - 2.9-3.8°C rise in global temperature by 2100

- Early but slow decline: Action starts in 2010
  - Emissions return to 1990 levels by 2050
  - 2.1-2.8°C rise in global temperature by 2100

- Early and rapid decline: Action starts in 2010
  - 47% decrease in emissions

Sea-level rise (m)

- A1B: Meehl et al. (2007)
- A2: Meehl et al. (2007)
- A1FI: Meehl et al. (2007)
- Rahmstorf et al. (2007)
- Rahmstorf et al. (2007)
- Rahmstorf et al. (2007)
- Rahmstorf et al. (2007)
- Rahmstorf et al. (2007)
- Rahmstorf et al. (2007)
- Kopp et al. (2008)
- Grinsted et al. (2009)

*From 2010 levels
**Average rise in relative sea-level, including land changes, and based on a 10% chance of occurrence
Per capita GHG emissions (2006):
Australia – 28.1 tonnes
US – 20.6 tonnes
UK – 11.0 tonnes
OECD average – 14.4 tonnes
World average – 6.6 tonnes
Figure ES.1 Australia’s total net greenhouse gas emissions from 1990 to 2010 including LULUCF and total excluding wildfire.
CO2e emissions from electricity generation by fossil fuels, 1990-2009

Fugitive CO2e emissions from coal mining, 1990-2009
Australian domestic emissions around 1.8% of global emissions, with 0.3% of world population.

Domestic & overseas consumption of Australian coal responsible for more than 2% of global emissions.

Black coal export emissions 130% of domestic emissions.

Coal industry responsible for 3.6% of GDP (historic high).

If coal export emissions added to domestic emissions, total contribution to global CO2 emissions in excess of 4.3%.

Plans to triple or even quadruple coal export volumes over next 10 yrs: Australia’s total contribution to global GHG emissions will grow to around 9% to 11% by 2020, discounting export LNG & CSG.
Australia’s coal-fired electricity

- Australia uses twice as much coal to generate electricity than world average.
- Third highest in world as proportion of total electricity generating capacity:
  - between 80% & 84% of Australia’s electricity comes from coal-fired power stations;
  - less than 70% of China’s electricity comes from coal;
  - around 50% of US electricity comes from coal;
  - only 40% of world electricity generated by coal;
- Poland & South Africa only countries using more coal to generate electricity.
GHG emissions of Australia’s coal-fired power stations

- Produce 33% of national emissions (50% in NSW).
- 24 coal-fired power stations produce 97% of locally generated coal emissions (15 in NSW).
- Responsible for emitting 190 million tonnes of CO2 annually:
  - equivalent to 40 million cars
  - 3 x size of Australia’s car fleet
  - 1/4 of China’s total car fleet in late 2008.
Australia’s coal-related CO2e emissions (Mt): 1990-2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Domestic Emissions (incl. LULUCF)</th>
<th>Domestic fossil electricity generation</th>
<th>Domestic black coal-fired electricity generation</th>
<th>Coking coal exports</th>
<th>Thermal coal exports</th>
<th>Total coal exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1991</td>
<td>200</td>
<td>200</td>
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<tr>
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<td>300</td>
<td>300</td>
<td>300</td>
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<td>300</td>
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<tr>
<td>1993</td>
<td>400</td>
<td>400</td>
<td>400</td>
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</tr>
<tr>
<td>1994</td>
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<td>500</td>
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<td>500</td>
<td>500</td>
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<tr>
<td>1995</td>
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<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>1996</td>
<td>700</td>
<td>700</td>
<td>700</td>
<td>700</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>1997</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>1998</td>
<td>900</td>
<td>900</td>
<td>900</td>
<td>900</td>
<td>900</td>
<td>900</td>
</tr>
</tbody>
</table>

Not shown: Thermal coal exports and Total coal exports.
Environmental & public health impacts of Australian coal mining

1. Destruction of native vegetation, waterways & wildlife habitats by open-cut mining developments & operations.

2. Unintentional fracturing of bedrock by longwall drilling beneath waterways & water catchment areas.

3. Contamination of rivers & estuaries by mine tailings & saline wastewater from coal-fired power stations.

4. Inadequate industry investment in housing & social infrastructure for coal mine workers & their families.

5. Higher risk of cancer & respiratory disease for:
   - coal miners & coal mining communities from inhaling & ingesting mine tailings & coal dust,
   - populations living close to coal-fired power stations from inhaling waste & flue gases & air-borne particulates.

Coal mining 2nd largest source of methane emissions, 1990-2007

3.27 MAIN SOURCES OF METHANE EMISSIONS

Source: Australian Greenhouse Emissions Information System (AGEIS), National Greenhouse Gas Inventory - Kyoto Protocol Accounting Framework.
Coal mining is the 3rd largest source of particulate emissions.

<table>
<thead>
<tr>
<th>Source</th>
<th>$PM_{10}$</th>
<th>$PM_{2.5}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal ore mining</td>
<td>270,000</td>
<td>9,100</td>
</tr>
<tr>
<td>Burning (fuel reduction, regeneration, agricultural) / Wildfires</td>
<td>240,000</td>
<td>—</td>
</tr>
<tr>
<td>Coal mining</td>
<td>210,000</td>
<td>4,600</td>
</tr>
<tr>
<td>Windblown dust</td>
<td>190,000</td>
<td>—</td>
</tr>
<tr>
<td>Paved/unpaved roads</td>
<td>160,000</td>
<td>—</td>
</tr>
<tr>
<td>Electricity generation</td>
<td>27,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Solid fuel burning (domestic)</td>
<td>20,000</td>
<td>—</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>12,000</td>
<td>—</td>
</tr>
<tr>
<td>Basic non-ferrous metal manufacturing</td>
<td>11,000</td>
<td>920</td>
</tr>
<tr>
<td>Water transport</td>
<td>11,000</td>
<td>790</td>
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<tr>
<td>Oil and gas extraction</td>
<td>2,400</td>
<td>3,100</td>
</tr>
<tr>
<td>Log sawmilling and timber dressing</td>
<td>1,300</td>
<td>770</td>
</tr>
</tbody>
</table>

Source: Department of the Environment, Water, Heritage and the Arts, National Pollution Inventory.

— nil or rounded to zero (including null cells)
COAL CONSUMPTION IN AUSTRALIA
NSW Black Coal Consumption by Major Consumers, 1960-2010 (‘000 tonnes)
Australian Black Coal Consumption by States, 1950-2010
('000 tonnes)
Australian Black Coal Consumption by Major Consumers, 1950-2010
(‘000 tonnes)

Electricity Generation
Iron & Steel Industry
Metallurgical Coke (other)
Railways & Gas Works
Cement Industry
Other Consumers
TOTAL
Black coal consumption by power stations, Australia ('000 tonnes)
Coal consumption by state by type

- NSW Electricity: 41%
- Qld Electricity: 34%
- WA Electricity: 7%
- Other: 8%
- SA Steel Industry: 1%
- SA Electricity: 5%
- NSW Steel Industry: 4%
- Other: 8%

2006
COAL MINING’S CONTRIBUTION TO AUSTRALIA’S ECONOMY
Australian mining industry: perception vs reality

PERCEPTION
- Mining contributes 35% of GDP.
- Mining industry employs around 16% of Australia’s workforce.
- Australia’s mining assets 53% controlled by foreign companies.

REALITY
- Mining contributed 11.3% of GDP in 2011/12 (100 yr record).
- Mining industry employed 1.9% of workforce in 2010/11: (100 yr record).
- Australia’s mining assets 83% controlled by foreign companies.

Sources: Australia Institute, June 2011; DIICCSRTE, 2013
<table>
<thead>
<tr>
<th>Year</th>
<th>Rural</th>
<th>Mining</th>
<th>Manufacturing</th>
<th>Services</th>
<th>Rural</th>
<th>Mining</th>
<th>Manufacturing</th>
<th>Services</th>
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<tr>
<td>1900-01</td>
<td>19</td>
<td>10</td>
<td>12</td>
<td>59</td>
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<tr>
<td>1910-11</td>
<td>26</td>
<td>6</td>
<td>13</td>
<td>55</td>
<td>25</td>
<td>6</td>
<td>21</td>
<td>48</td>
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<tr>
<td>1920-21</td>
<td>28</td>
<td>3</td>
<td>13</td>
<td>56</td>
<td>24</td>
<td>3</td>
<td>22</td>
<td>51</td>
</tr>
<tr>
<td>1930-31</td>
<td>21</td>
<td>2</td>
<td>16</td>
<td>61</td>
<td>26</td>
<td>2</td>
<td>18</td>
<td>54</td>
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<tr>
<td>1940-41</td>
<td>(b) 20</td>
<td>(b) 3</td>
<td>(b) 19</td>
<td>(b) 58</td>
<td>19</td>
<td>2</td>
<td>25</td>
<td>54</td>
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<tr>
<td>1950-51</td>
<td>31</td>
<td>2</td>
<td>23</td>
<td>44</td>
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<td>55</td>
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<tr>
<td>1955-56</td>
<td>16</td>
<td>2</td>
<td>28</td>
<td>54</td>
<td>13</td>
<td>2</td>
<td>28</td>
<td>57</td>
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<tr>
<td>1960-61</td>
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<td>29</td>
<td>56</td>
<td>11</td>
<td>1</td>
<td>28</td>
<td>60</td>
</tr>
<tr>
<td>1965-66</td>
<td>10</td>
<td>2</td>
<td>27</td>
<td>61</td>
<td>9</td>
<td>1</td>
<td>26</td>
<td>63</td>
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<tr>
<td>1970-71</td>
<td>7</td>
<td>4</td>
<td>25</td>
<td>64</td>
<td>7</td>
<td>2</td>
<td>25</td>
<td>66</td>
</tr>
<tr>
<td>1972-73</td>
<td>8</td>
<td>4</td>
<td>24</td>
<td>64</td>
<td>7</td>
<td>1</td>
<td>24</td>
<td>68</td>
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<tr>
<td>1974-75</td>
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<td>4</td>
<td>22</td>
<td>68</td>
<td>7</td>
<td>1</td>
<td>22</td>
<td>70</td>
</tr>
<tr>
<td>1976-77</td>
<td>5</td>
<td>4</td>
<td>21</td>
<td>70</td>
<td>7</td>
<td>1</td>
<td>21</td>
<td>71</td>
</tr>
<tr>
<td>1978-79</td>
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<td>4</td>
<td>19</td>
<td>70</td>
<td>7</td>
<td>1</td>
<td>20</td>
<td>72</td>
</tr>
<tr>
<td>1980-81</td>
<td>6</td>
<td>4</td>
<td>20</td>
<td>70</td>
<td>7</td>
<td>1</td>
<td>20</td>
<td>72</td>
</tr>
<tr>
<td>1982-83</td>
<td>4</td>
<td>5</td>
<td>18</td>
<td>73</td>
<td>7</td>
<td>2</td>
<td>18</td>
<td>73</td>
</tr>
<tr>
<td>1983-84</td>
<td>5</td>
<td>5</td>
<td>18</td>
<td>72</td>
<td>6</td>
<td>2</td>
<td>18</td>
<td>74</td>
</tr>
<tr>
<td>1984-85</td>
<td>5</td>
<td>5</td>
<td>18</td>
<td>72</td>
<td>6</td>
<td>1</td>
<td>18</td>
<td>75</td>
</tr>
</tbody>
</table>

(a) At current prices. (b) 1938-39.


Source: ABS Yearbook 1988
Proportional contribution to goods & service exports by industry sector, 1980-2010

- Services
- Coal
- Mining
- Agriculture
- Manufacturing
Coal, mining & manufacturing export revenues ($ billion)

Coal export revenue average, 1980-2010: 10.13%
Coal mining % of GDP, 1980-2010: 2 – 4% p.a.
FOB value of Australian coal exports, 1967-2010 ($A’000)

- Metallurgical
- Steaming
- TOTAL
Australian coal industry employed more than 54,000 people at height of mining boom, compared with:

- Bunnings hardware - 30,000 people;
- McDonald’s restaurants - 75,000 people;
- Great Barrier Reef tourism - 60,000 people;
- Australian tourism industry – 500,000 people;
- Australian agricultural industry – 300,000 people.

Kennett Government sacked 50,000 public servants, 1992-1994;
Howard Government sacked 25,000 public servants, 1996-1998;
Howard Govt oversaw 108,000 jobs lost in manufacturing, 1996-2007
Australian Coal Industry Employment, 1910-2010
Australia’s coal mining oligarchy

- BHP-Billiton (UK-Australia)
- Rio Tinto (UK-Australia)
- Xstrata (Switzerland)
- Anglo American (UK)
  - responsible for more than 75% of the country’s coal production & exports.

  - None of these companies are majority Australian owned, so most of their profits go offshore.
  - According to Australian Greens, 71% of mining profits go overseas.
  - According to Australia Institute, 83% of mining profits go overseas.
## Black Coal Revenue

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royalties to state governments</td>
<td>$1.6 billion</td>
</tr>
<tr>
<td>Wages &amp; salaries</td>
<td>$2.692 billion</td>
</tr>
<tr>
<td>Employer superannuation &amp; workers compensation</td>
<td>$314 million</td>
</tr>
<tr>
<td>Purchase of goods &amp; materials</td>
<td>$3.298 billion</td>
</tr>
<tr>
<td>Repairs &amp; maintenance</td>
<td>$1.156 billion</td>
</tr>
<tr>
<td>Freight &amp; cartage</td>
<td>$1.738 billion</td>
</tr>
<tr>
<td>Contracts &amp; commissions</td>
<td>$3.21 billion</td>
</tr>
<tr>
<td>Motor vehicle running expenses</td>
<td>$40 million</td>
</tr>
<tr>
<td>Rent, leasing &amp; hiring services</td>
<td>$309 million</td>
</tr>
<tr>
<td>Operating profit before tax</td>
<td>$9.998 billion</td>
</tr>
</tbody>
</table>

**Total annual revenue**

$29.9 billion

---

## Black Coal Subsidies & Externalities

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct government subsidies</td>
<td>$1.7 billion</td>
</tr>
<tr>
<td>Indirect infrastructure subsidies in NSW</td>
<td>$1.1 billion</td>
</tr>
<tr>
<td>Indirect infrastructure subsidies in Qld</td>
<td>$1.1 billion (?)</td>
</tr>
<tr>
<td>Climate change &amp; health effects</td>
<td>$2.6 billion</td>
</tr>
<tr>
<td>Water consumption</td>
<td>unknown</td>
</tr>
<tr>
<td>Pollution of waterways</td>
<td>unknown</td>
</tr>
<tr>
<td>Undermining waterways &amp; aquifers</td>
<td>unknown</td>
</tr>
<tr>
<td>Destruction of native habitats &amp; ecosystems</td>
<td>unknown</td>
</tr>
<tr>
<td>Inadequate housing &amp; social infrastructure</td>
<td>unknown</td>
</tr>
<tr>
<td>Structural distortions created by mining boom</td>
<td>unknown</td>
</tr>
</tbody>
</table>

**Total annual subsidies & externalities**

*More than* $6.5 billion

**Estimate of coal mining’s direct economic benefit to Australia**

*Less than* $2.86 billion

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**Estimate of coal mining revenue which remained in Australia**

$9.36 billion
## Australian Electricity Subsidies (2005-2006)

<table>
<thead>
<tr>
<th>2005-06 Support for:</th>
<th>Million Australian dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>1,091 - 1,866</td>
</tr>
<tr>
<td>Oil</td>
<td>3</td>
</tr>
<tr>
<td>Gas</td>
<td>120</td>
</tr>
<tr>
<td>Total fossil Fuels</td>
<td>1,214 - 1,989</td>
</tr>
<tr>
<td>Renewable Energy &amp; Energy Efficiency</td>
<td>110 - 119</td>
</tr>
</tbody>
</table>

GLOBAL TRENDS IN COAL PRODUCTION & CONSUMPTION 1980-2010
<table>
<thead>
<tr>
<th>Country</th>
<th>Coal Production (millions of short tons)</th>
<th>Global Share of Total Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. China</td>
<td>3,362.1</td>
<td>43.8%</td>
</tr>
<tr>
<td>2. United States</td>
<td>1,072.8</td>
<td>14.0%</td>
</tr>
<tr>
<td>European Union</td>
<td>739.9</td>
<td>9.6%</td>
</tr>
<tr>
<td>3. India</td>
<td>611.4</td>
<td>8.0%</td>
</tr>
<tr>
<td>4. Australia</td>
<td>440.1</td>
<td>5.7%</td>
</tr>
<tr>
<td>5. Indonesia</td>
<td>332.4</td>
<td>4.3%</td>
</tr>
<tr>
<td>6. Russia</td>
<td>327.1</td>
<td>4.3%</td>
</tr>
<tr>
<td>7. South Africa</td>
<td>272.6</td>
<td>3.5%</td>
</tr>
<tr>
<td>8. Germany</td>
<td>203.7</td>
<td>2.7%</td>
</tr>
<tr>
<td>9. Poland</td>
<td>148.3</td>
<td>1.9%</td>
</tr>
<tr>
<td>10. Kazakhstan</td>
<td>111.9</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

Coal Production, 1980-2010*
Top six coal-producing nations


* thousands of short tons
Global Coal Consumption: 1980-2010

Global Coal Consumption, 1997 (green) & 2007 (yellow)

Chinese coal consumption accounted for more than two-thirds of global growth.

Coal Consumption in the EU*
1980-2010

* thousands of short tons
Coal Consumption in the EU*
1980-2010


* thousands of short tons
Coal Consumption in the Asia-Pacific* 1980-2010

# Growth & Decline in Coal Consumption
(comparison of 1980 & 2010 figures)

<table>
<thead>
<tr>
<th>Decreased consumption</th>
<th>Increased consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>-70%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>-59%</td>
</tr>
<tr>
<td>Germany</td>
<td>-53%</td>
</tr>
<tr>
<td>Spain</td>
<td>-47%</td>
</tr>
<tr>
<td>Poland</td>
<td>-37%</td>
</tr>
<tr>
<td>India</td>
<td>+518%</td>
</tr>
<tr>
<td>China</td>
<td>+450%</td>
</tr>
<tr>
<td>Japan</td>
<td>+112%</td>
</tr>
<tr>
<td>Australia</td>
<td>+63%</td>
</tr>
<tr>
<td>United States</td>
<td>+50%</td>
</tr>
</tbody>
</table>

Australian Black Coal Production, 1910-2010
(millions of tonnes of raw coal)
New South Wales coal production, 1939-2010
(millions of tonnes of raw coal)

- TOTAL
- Open Cut
- Underground
Queensland coal production, 1939-2010
(millions of tonnes of raw coal)
Number of Australian coal mines in production, 1974-2010

- New South Wales
- Queensland
- South Australia
- Western Australia
- Tasmania
- Underground
- Open Cut
- TOTAL
Qld & NSW: expanding coal production

2008
- Qld & NSW Govts approved expansion of Gladstone’s & Newcastle’s coal export facilities at est. cost of $4.5 billion.
- Expansion will enable more than 70% increase over Australia’s peak export volume from 2008.

2009
- Qld Govt developing Abbott Pt coal terminal to increase capacity from 50 Mt to 385 Mt by 2020, plus doubling capacity of Hay Pt, & new terminals at Raglan Creek, Balaclava Island, Dudgeon Point and Cape York.
- Waratah Coal announced development of Australia’s largest thermal coal mine in Galilee Basin (Qld): will more than double Australia’s coal exports by 2020.
- BHP-Billiton announced its intention to expand the Mt Arthur mine in the Hunter Valley from 11.5 million tonnes of coal per annum to 15 million tonnes.

2020
- 320% increase in Queensland coal exports over 2010 exports.
- 10,150 coal ships through Great Barrier Reef annually.
Australian coal industry strategy

- Lock as much of Australia as possible into continuation of coal mining, coal exporting & coal burning for electricity production.
- Mine, burn & export as much coal as possible, as quickly as possible.
- Saturate media with message that:
  - ‘jury is out’ on human impacts re climate change;
  - renewable energy is too expensive & cannot provide baseload energy;
  - any curtailment of coal industry will be catastrophic for economy & cost tens of thousands of jobs.
## Coal Reserves 2008 (top 12 proven recoverable)

<table>
<thead>
<tr>
<th>Country</th>
<th>Anthracite &amp; Bituminous (Mt)</th>
<th>Sub-bituminous &amp; lignite (Mt)</th>
<th>Total Coal Reserves (Mt)</th>
<th>Global Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>108,950</td>
<td>129,358</td>
<td>238,308</td>
<td>28.9</td>
</tr>
<tr>
<td>Russia</td>
<td>49,088</td>
<td>107,922</td>
<td>157,010</td>
<td>19.0</td>
</tr>
<tr>
<td>China</td>
<td>62,200</td>
<td>52,300</td>
<td>114,500</td>
<td>13.9</td>
</tr>
<tr>
<td>Australia</td>
<td>36,800</td>
<td>39,400</td>
<td>76,200</td>
<td>9.2</td>
</tr>
<tr>
<td>India</td>
<td>54,000</td>
<td>4,600</td>
<td>58,600</td>
<td>7.1</td>
</tr>
<tr>
<td>Ukraine</td>
<td>15,351</td>
<td>18,522</td>
<td>33,873</td>
<td>4.1</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>28,170</td>
<td>3,130</td>
<td>31,300</td>
<td>3.8</td>
</tr>
<tr>
<td>South Africa</td>
<td>30,408</td>
<td>-</td>
<td>30,408</td>
<td>3.7</td>
</tr>
<tr>
<td>Poland</td>
<td>6,012</td>
<td>1,490</td>
<td>7,502</td>
<td>0.9</td>
</tr>
<tr>
<td>Brazil</td>
<td>-</td>
<td>7,059</td>
<td>7,059</td>
<td>0.9</td>
</tr>
<tr>
<td>Columbia</td>
<td>6,434</td>
<td>380</td>
<td>6,814</td>
<td>0.8</td>
</tr>
<tr>
<td>Canada</td>
<td>3,471</td>
<td>3,107</td>
<td>6,578</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Global Peak Coal Production by Region

Source: Energy Watch Group 2007

Only India & Australia have revised hard coal reserves upward since 1987.

All other coal-producing countries have revised reserves downward by combined 35% over same period.

Large producers, India & US, have already hit peak production.

China will hit peak production within 5-15 years, as it has already consumed 30% of its proven recoverable reserves since 1994.

Australia will hit peak production by 2025

• HOWEVER Australia has large untapped reserves that are not currently economic to recover;

• arguably these reserves should never be recovered due to their potential contribution to climate change.
Australia’s black coal resources

Source: Australian Coal Association
How much more coal can Australia mine?

- Remaining proven black coal reserves: 36 Gt
- Emissions from 36 Gt of coal = 94 Gt CO₂
- Global carbon budget up to 2050 = 565 Gt:
  - provides 80% chance of maintaining global average temp. increases below 2 degrees Celsius.
- Burning Australia’s remaining proven coal reserves will use 17% of global carbon budget.
- Therefore extremely unlikely even proven reserves will be mined over next 20 years.
  - Meinshausen et al., 2009; Allen et al., 2009; Schmidt and Archer, 2009
AUSTRALIA’S ROLE IN THE COAL EXPORT TRADE 1900-2010
Black Coal Export Trade
New South Wales, 1900-1970 (‘000 tons)
Black Coal Exports – Major Destinations (excl. Japan) 
New South Wales, 1942-1966 
('000 tons)

- Noumea (New Caledonia)
- Fiji
- Sri Lanka (Ceylon)
- Hong Kong
- Argentina
- Korea
Australia’s black coal exports by volume (Mt) 1956 - 2010

There has been a fifty-fold increase in Australia’s coal exports since 1965; tripling in size in 20 years to 2010.
Global share of coal exports 1990

Australia 26.7%
United States 24%
South Africa 12.4%
USSR 9.5%
Canada 7.7%
Poland 7%
Rest of the world 12.7%

Source: Joint Coal Board/Qld Coal Board
Global share of coal exports 2009

NSW coal exports by type 1956-2010
(‘000 tonnes)

NSW has almost tripled production (257% increase) between 1990 & 2010.
Queensland coal exports by type 1958-2010 (‘000 tonnes)

Australian thermal coal exports: Value per tonne, 1966-2010

Unit Value ($/t)

Price per tonne fell in wake of GFC & increased international competition.
International coal prices, 1987-2008

- Northwest Europe marker price
- US Central Appalachian coal spot price index
- Japan coking coal import cif price
Australia’s Black Coal Exports 2007-08

<table>
<thead>
<tr>
<th>Region</th>
<th>Coking Coal</th>
<th>Thermal Coal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>100.9</td>
<td>109.1</td>
<td>210</td>
</tr>
<tr>
<td>Europe</td>
<td>26.8</td>
<td>3.4</td>
<td>30.2</td>
</tr>
<tr>
<td>Other countries</td>
<td>9.8</td>
<td>2.3</td>
<td>12.1</td>
</tr>
<tr>
<td><strong>Total 2007-08</strong></td>
<td><strong>137.5</strong></td>
<td><strong>114.8</strong></td>
<td><strong>252.3</strong></td>
</tr>
</tbody>
</table>

Source: Australian Coal Association
AUSTRALIA’S COAL TRADE WITH EUROPE & ASIA
1970-2010
Australian coal export snapshot 2005-06

- > 80% of Australian coal exported to 35 countries
- 75% export coal to Japan, South Korea, Taiwan, India & China
- 45% export coal to Japan
- 60% coal consumption by Japan
- < 1% coal consumption by China
Black Coal Exports to Europe from Australia 1970-2010 (‘000 tonnes)
Black coal exports to Europe by volume, 1970-2010 (Mt)

Megatonnes of black coal

- United Kingdom
- Netherlands
- France
- Italy
- Spain
- Belgium
- Germany
- Sweden
- Denmark
- Romania
- Greece
Black coal exports to Asia by volume, 1970-2010 (Mt)

- Japan
- South Korea
- Taiwan
- India
- Malaysia & Singapore
- Hong Kong
- Indonesia
- Pakistan

Megatonnes of black coal
Black Coal Exports to Japan from Australia 1970-2010 (‘000 tonnes)
Black Coal Exports to Asia from Australia (excl. Japan) 1970-2010 (‘000 tonnes)

- South Korea
- Taiwan
- India
- China
- Malaysia & Singapore
- Hong Kong
Black Coal Exports to South Korea from Australia 1970-2010 (‘000 tonnes)
Black Coal Exports to Taiwan from Australia 1970-2010 ('000 tonnes)
Black Coal Exports to India from Australia 1970-2010 (‘000 tonnes)
Black Coal Exports to China from Australia 1970-2010 (‘000 tonnes)

- TOTAL
- Metallurgical
- Thermal
Ten reasons for reducing Australia’s involvement in the coal industry

1) Highest per capita emitter of GHGs in the developed world.

2) Annual GHG emissions >30% higher in 2009 than in 1990.

3) Annual emissions from electricity >50% higher in 2011 than in 1990.

4) Coal-fired power produces 40% of national emissions (50% in NSW)

5) Biggest coal exporter in the world (27-40% of global market from 2000-2010)

6) Emissions from coal exports more than doubled domestic GHG emissions since 2004, making coal single largest contributor to Australia’s ‘carbon footprint’.
7) Australian governments committed to **tripling production of coal industry** over next two decades, **quadrupling Australia’s carbon footprint** to between 9% & 11% of global GHG emissions.

8) **Direct & indirect subsidies** to the coal industry & coal-fired power stations are in the vicinity of $4–6 billion p.a.

9) Coal industry opposes government action on climate change mitigation.

10) **Continued govt support for coal industry** is obstacle to development of renewable energy industry, producing further ‘carbon lock-in’ of investment & skilled labour.
1. Export demand for, & value of, coking coal grew significantly over past decade.

2. Army of coal lobbyists & PR companies continually reiterate value of industry to politicians across political spectrum.

3. Revolving door between relevant senior bureaucratic positions & senior executive positions within coal industry.

4. Relevant union executives convinced of coal industry’s economic importance to nation & those unions form powerful voting bloc within Labor Party.

5. Coal industry & sympathetic politicians & bureaucrats realize Australia has limited window of opportunity to exploit country’s coal resources due to climate change obligations (& peak coal?).