Seaborne Energy Coal – Continuing Growth

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Fossil fuels a major part of the global energy market

Global Energy market  384EJ pa*

By Industry Sector

- Power Generation 40%
- Industrial & Commercial 30%
- Other 3%
- Transport 19%
- Losses 8%

Power Generation

- Gas
- Coal
- Oil

Industrial & Commercial

- Gas
- Coal
- Oil

Other

- EJ = 1,000 PJ
- ~ 1 tcf gas
- ~ 24 Mtoe
- ~ 40 Mt coal

Coal competitive for existing and new build power

**Existing coal plant competitive in dispatch**

- **SRMC ($/MWh)**
  - Gas: 30
  - Coal: 20
  - IGCC (Coal): 10
  - Nuclear: 5
  - Hydro: 2

**New build coal competitive, conventional power gen significantly cheaper than renewables**

- **LRMC ($/MWh)**
  - Coal: 50
  - IGCC (Coal): 40
  - Nuclear: 35
  - Hydro: 30
  - Wind: 100

**Legend**

- $10/tonne Carbon Tax
- Vari. O&M Comp
- Fuel Component

Notes: Coal @ $1.50/mmbtu, Gas @ $4.50/mmbtu, IGCC @ $0.50/mmbtu, Nuclear $0.32/mmbtu

Sources: Black & Veatch, Gas Turbine World Handbook, Uranium Information Centre, IEA – Renewables for Power Generation
Coal is abundant and widely spread.

- **North America**: 223 bt
- **Latin America**: 22 bt
- **Europe**: 52 bt
- **Russia**: 147 bt
- **China**: 96 bt
- **India**: 82 bt
- **Indonesia**: 3 bt
- **Australia**: 45 bt

**Total World**: 897 bt

**Legend**
- Bituminous
- Sub-bituminous

Source: IEA Statistics – Coal Information 2003, Proven Recoverable Reserves, excludes Brown Coal/Lignite
Coal technology continuing to evolve

Efficiency of Coal-Based Power

Coal Technology Roadmap

- 1990: Conventional pf
- 2002: Supercritical
- 2005-15: Ultra supercritical
- 2015: Gasification (IGCC)
- 2025-50: Hydrogen economy?

Sources: IEA, Black & Veatch Cost Estimates
Coal has a future

Cons
- Climate change issues
- Gas perceived as being a ‘clean’ fuel

Pros
- Competitive
- Abundant, stable supply
- Easy to store and transport
- Largest share of global generation

Conclusion
- Coal is relevant
- Substitution is not the answer
- Clean coal solutions being developed

Electricity and generation fuel demand 1999 = 100

<table>
<thead>
<tr>
<th>Year</th>
<th>Gas</th>
<th>Coal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>36%</td>
<td>18%</td>
</tr>
<tr>
<td>2020</td>
<td>32%</td>
<td>26%</td>
</tr>
</tbody>
</table>

CAGR (1999-2020)
- Electricity: 2.7%
- Gas: 3.8%
- Other Fuel: 1.5%
- Coal: 1.3%

Europe – imports flat or slight growth

- Overall demand declining, but imports growing slowly
- ETS & LCD* already influencing market
- EU subsidy reduction program driving reduced domestic coal
- Energy market convergence
  - Power generation growth from gas
  - Strong coal/gas competition
- Deregulation and liberalisation

* ETS – Emissions Trading Scheme (CO₂), LCD – Large Combustion Directive (NOₓ, SOₓ & particulates)

Sources: IEA Coal Information 2003, IEA Coal Information 2001
US import growth to continue

- Continued decline in US East production
- US West continues to grow
- Imports competitive with US West coal into coastal markets
- Imports continue to grow

Sources: National Mining Association, Barlow Jonker & McCloskey's Coal Stats, Hill and Associates
Asia - Strong demand growth

- Increasing flexibility in coal purchasing
  - China penetration
  - Spot purchases
- Lack of pipeline gas alternatives
- No domestic energy supplies in key importing countries
- Nuclear concerns
- Slowly embracing deregulation
- Environmental consideration on the rise
- Japan only Kyoto Annex B country
- Japan decline assumes large expansion in nuclear capacity?

Sources: IEA Coal Information 2001, IEA Coal Information 2003, Barlow Jonker
What role will China play?

- Strong power demand & GDP growth
- Industry efficiency improvements
- Poor safety record, government closure of TVEs
- Large domestic coastal trade
- New domestic coal supply long distance from key coastal domestic markets

Notes: * Jan – April 2004 Annualised
Source: Barlow Jonker, McCloskey’s Coal Stats
India imports growing

Imports growing from a low base

- Domestic production 290Mtpa steam coal
- 71% of production has CV < 5000 kcal/kg & ash > 22%
- Washability issues
- 29% of all coal mined transported further than 1000km

Low power consumption per capita

<table>
<thead>
<tr>
<th></th>
<th>TWhr/capita</th>
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<tbody>
<tr>
<td>India</td>
<td>0.49</td>
</tr>
<tr>
<td>China</td>
<td>1.02</td>
</tr>
<tr>
<td>Korea</td>
<td>5.25</td>
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</tbody>
</table>

Source: Barlow Jonker, IEA Report - Coal in the Energy Supply of India
Rapid Indonesian growth; is it sustainable?

- Lack of exploration
- Declining high quality reserves
- New supply is further inland
- Lack of infrastructure
- Domestic demand growth

Source: Barlow Jonker, IEA
Seaborne Energy Coal – Continuing Growth

• Seaborne energy coal will remain an important part of global fuel mix
  – Competitive economics
  – Supply security
  – Technological advancements
• Growing Pacific market
• Sustainable and valuable Atlantic market
• Some potential upside?
  – Impact of strong Chinese domestic demand?
  – Potential for Indian economic growth?
  – Sustainability of Russian exports?
  – Long-term direction of Indonesian bituminous coal exports?