Victoria: An Energy Superpower

Competitive Exports to Asia

Competitive Power Production in Australia

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Latrobe Valley Brown Coal Resource

65Bt – estimated in-situ
33Bt – estimated as economic with a strip ratio of 1:1 or better

Source: Charlie Speirs CCV
Brown Coal, Conventional Gas and Coal Seam Gas Resources In Australia

Economic Recoverable Resources Brown Coal  33Bt; 300X10^9 GJ

Economic Recoverable Resources Conventional Gas + Coal Seam Gas  149X10^9 GJ

Sub-economic Recoverable Resources Conventional Gas + Coal Seam Gas  125X10^9 GJ

Source: ACOLA re gas reserves
Moisture content ranges between 48-70%
Ash content usually <5% (dry basis)

Low Ash, low Sulphur, Low Nitrogen, Low Trace Elements

Average Net Wet Specific Energy: 8.6 MJ/kg
Average Gross Dry Specific Energy: 26.6 MJ/kg

High Reactivity

Hydrogen 5%
Nitrogen & Sulphur 1%
Ash < 5%
Drying and Dewatering Technologies

- Atmospheric or pressurised drying with flue gas, fuel gas, inert gases, steam
- Atmospheric and pressurised drying may apply rotary kiln/tube, fluid bed or entrained flow processes
- Dewatering with fluid pressures at a range of temperatures
- Dewatering with mechanical pressures at a range of temperatures
- Mechanical shear
- Dewatering with a combination of fluid and mechanical pressures at a range of temperatures;
- Solvent dewatering
- Microwave drying
- Drying/dewatering in a cyclone
Exergen CHTD Autoclave

- Vertically mounted continuous autoclave
  - Removes 50% of the water from LV coal ex autoclave (before secondary de-watering)
  - Increases calorific value of the coal
  - Product suitable for processing for export or fuelling high efficiency power generation

- Very energy efficient
  - Incorporates heat recovery
  - Pressure supplied by hydrostatic head

- De-carboxylation reaction supplies heat at the bottom of the autoclave

- Easily scalable to commercial throughput
Direct Injection Coal Engine (DICE)

- Efficiency of 54% HHV @ 67MW by low speed diesel engines
  - 97 MW engine available
- Coal should be able to achieve a fuel cycle efficiency of 50% (sent out basis)
  - Black coal - DICE est. 620 KgCO₂/MWH
  - Brown coal – DICE est. 650 KgCO₂/MWh
  - Including coal processing - DICE est. 700 KgCO₂/MWh

Source Louis Wibberley CSIRO
DICE Fuel

Target specifications are:

- Specific energy > 13 MJ/ kg (HHV)
- Solids content > 45% w/w
- Max. particle size < 50 micron; mineral content < 1% dry basis; fly ash < 5 micron.
- shear thinning with a viscosity of <500mPa.s at a shear rate of 100/s
Dewatering for DICE

Hydrothermal dewatering is the optimum process for coal water fuel preparation of brown coal for the DICE because it simultaneously:

• reduces the moisture content of the coal to the required level;

• upgrades its energy content by de-carboxylation;

• reduces the concentration of some water-soluble ash forming constituents (ions) in the coal;

• leaves the aliphatic (high reactivity) structure of the brown coal largely intact; and,

• achieves these outcomes in very energy efficient manner with minimal greenhouse gas emissions.
Logistics Solution for Latrobe Valley Coal Export

- Exergen will process Latrobe Valley coal into a 50% moisture content slurry using its Continuous Hydrothermal Dewatering (CHTD) technology.

- Coal slurry will be pumped through a pipeline in the existing Esso Australia easement to vacant industrial land near Crib Point, and provided to collaborative partners for further processing.

- 10 Mtpa of upgraded coal bulk solid products can be exported through the under-utilised Crib Point port facility.
LV Brown Coal - Competitive Advantage

- Latrobe Valley brown coal <$1/GJ
- Potential slurry fuel at relatively low cost
- Natural gas in eastern states expected to be $8 - $12/GJ within the decade
- Gas imported as LNG in Korea and Japan >$15/GJ
- Enormous potential for competitive export of LV brown coal HTD-DICE to Asia and elsewhere.
Many Other Brown Coal Products

Gasification

   Hydrogen, Ammonia, Liquid Fuels, Petrochemicals, Fertilisers, Explosives

Dry Coal (lump and powder)

Char and activated carbon

Pyrolysis tars

Coal liquids

   Direct coal liquefaction
   Cat-HTR (Ignite Energy)
Key Issues for Victoria

Need to reduce greenhouse gas intensity of economy, particularly power generation – competitive advantage of HTD-DICE

Eventual replacement of Hazelwood and possibly Yallourn – competitive advantage of HTD-DICE

Expected large increase in natural gas prices in Victoria PLUS closure of Hazelwood (replacement with GCC), provides potential significant threat to power prices (wholesale <$40/MWh to >$100/MWh with high gas prices) – HTD-DICE could keep competitive pressures on lower power prices.
Key Issues for Victoria

Oversupply of black coal and consequently low prices for dry fuel – competitive pressure on dry coal products

Logistics of transport from Latrobe Valley to a port – competitive advantage of slurry pipeline

Expected large increase in natural gas prices in Victoria – competitive opportunity for gasification

High LNG price in Asia – enormous opportunity for slurry export from Victoria (HTD-DICE)
Summary

• Vast resource of low cost brown coal
• Very clean coal (low ash, low sulphur, low nitrogen, low trace elements, high reactivity)
• High moisture cause high greenhouse gas intensity in pf boiler power plant
• Many potential technologies for drying or dewatering
• Development of DICE will open enormous opportunities
  • Export slurry fuel to Asia
  • Low emissions power generation in Victoria
• Development of new petrochemical industries based on gasification
• Development of coal liquids for transport fuels