Coal Exploration Activity
Northeast BC

Barry Ryan and Bob Lane
Ministry of Energy, Mines and Petroleum Resources
The danger of absolutes

Gas is clean          Coal is dirty

Don’t confuse
Dirty                Zero Emission
(Smoke, SO2, NOx)    with    (CO2 greenhouse gas)

Modern coal fired power plants can reduce/eliminate

Smoke (ash)    use electrostatic collectors
SO₂ gas        use scrubbers
Nitrous oxides use temperature control and catalysts
Some basic comparisons fossil fuels and greenhouse gases

Considering efficiencies

- A house using natural gas for heating
  Emits 7 tonnes CO2 per year

- A house using electricity from coal for heating
  Emits 23 tonnes CO2 per year

- A car emits 3 tonnes of CO2 per year

Warning these are only very rough estimates
Coal rank (how old do you look) and use

- **Subbituminous**
  - High volatile
  - Medium volatile
  - Low volatile

- **Bituminous**
  - Thermal coal
  - PCI coal
  - Weak coking coal
  - coking coal
  - PCI
  - PCI

- **Semi anthracite**
  - PCI
  - smelting
  - Thermal coal

Temperature

20 C

200 C

Rank

Electricity

Coke

Heat
Coal Why all the interest

Where have coal prices come from where are they going

Thermal coal

- Low heating value
- High heating value

Coking Coal

- Hard coking coal
- Weak coking coal
- Pulverized coal injection PCI coal

Coal

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<td>Price (US dollars per ton FOB)</td>
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<td>85</td>
<td>90</td>
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Graph shows the price trend of different types of coal from 1982 to 2009.
Most BC coal is exported for making coke

Why coke

Have to reduce iron oxide to make steel

By formula: \(2\cdot \text{Fe}_2\text{O}_3 + 3\cdot \text{C} \rightarrow 4\cdot \text{Fe} + 3\cdot \text{CO}_2\)

By weight: \(319.4 + 36 \rightarrow 223.4 + 132\)

coke ratio Kg coke / ton hot metal \(\frac{36}{223.4} = 161\) kg/thm  CO2 kg/thm\(=591\)

Actual ratios are in the range of 600 kg/thm other than natural gas this is still the most efficient process for making steel

The role of coke

- Heats iron ore
- Supports iron ore
- Provides permeably pathways for gas (goes up) molten iron (goes down)
- Reduces iron ore

Don’t forget the ash It catalyzes C to CO reactions

High contents of Ca Mg Fe K Na reduce coke strength increase coke reactivity (bad)
A primer tests on coal and coke

Thermal coal

Coal and heat Remember the customer pays for useable heat

Lab tests on dried coal (1%-4% water) Shipped coal (8-10% water)

In laboratory heat from steam is recovered (Gross heat value)

In a power plant this heat escapes (Net heat value)

Making coke

Using coal to make predictions about performance in coke ovens and blast furnaces

Applicable rank window -- Vitrinite reflectance

Will the coal stick together -- FSI (Free swelling index)

How fluid will it get over what temperature range Gieseler Plastometer ddpm

Will it swell in the process expansion contraction Audibert-Arnu Dilatometer

Will the coke react with CO Ash chemistry

Will it produce pressure during coking Sole Heated Oven

Using coke from moveable wall test ovens to predict performance in industrial coke ovens and blast furnaces various stability tests measurement of pressure CSR and CRI
History of Peace River Coalfield

- The first mention of coal in British Columbia 1793 Alexander MacKenzie records seeing coal in the Peace River Canyon.
- In 1903 Neil Gething rediscovered coal in the canyon and mined coal from the King Gething mine, some supplied troops building the Alaska Highway.
- His son Loyd Gething mined coal in the Smithers area for many years.
- The Hasler Mine operated from 1943-1945 but up to 1968 less than 100,000 tonnes mined.
- In 1968 Industry exploration started corresponding with first export coal contract for coking coal from SE BC (Kaiser Balmer mine) to Japan.
- In 1969 the Sukunka deposit was discovered.
- In 1981 Japan signed contracts to buy 115 mt of coal over 16 years from Quintette and Bullmoose mines.
- Infrastructure (town electrified, rail line, rail tunnels, and coal port) completed in November 1983 and first coal shipped from Ridley in January 1984.
- Quintette & Bullmoose mines operated until 2001 and 2003, respectively.
Northeast Region
Coal Exploration Summary

- Est. Expenditures: **$27.1 million** (vs. $3.6 million in ’04)
- Amount of Drilling: **94,000 m** (vs. 13,000 in ’04)
- Number of Major Projects: **16** (vs. 5 in ’04)
- Coking coal and PCI coal
- Re-evaluation of entire coal belt
- Junior companies raising bulk of exploration capital
- Investment for development coming from foreign/international coal &/or steel companies
Northeast Coal - Who’s Active?

- **Majors Companies:**
  - Elk Valley Coal Corporation
  - Kennecott Canada Exploration Inc. (Rio Tinto)
  - Canadian Dehua International

- **Juniors Companies:**
  - Western Canadian Coal Corporation
  - Hillsborough Resources Limited
  - NEMI Northern Energy & Mining Inc.
  - Pine Valley Mining Corporation
  - Cline Mining Corporation
  - First Coal Corporation
Northeast Coal – Advanced Exploration Projects

Belcourt N & S, Omega & Saxon N & S  
Horizon (Five Cabin)  
Falling Creek  
Hermann  
Pine Pass  
Goodrich Central-South  
Horizon (Five Cabin)  
Quintette (Babcock area)  
Trend (Roman Mtn)  
Wapiti  
Lossan  
Bri Dowling  
NEMI+WCC  
Hillsborough  
Kennecott  
Western Canadian Coal  
Falls Mountain Coal Company  
First Coal Corporation  
Anglo Coal  
Elk Valley Coal Corporation  
Northern Energy Mining Incorporated  
Hillsborough  
Cline Mining  
Canadian Dehua International
A primer on the coal formations that define Peace River Coalfield in northeast British Columbia

The two major formations outcrop in a number of fold trends constrained by major thrusts or reverse faults.
Operating Mines - 2005
Coal 27 million tonnes shipped Value in the ship over 2 billion dollars

BC Ministry of Energy, Mines and Petroleum
September 2005
Location of exploration projects and Mines

West Carbon Creek
Carbon Creek
Pine Pass
Carbon Creek
Willow Creek
Chetwynd
EriBowling
The rank of coal varies along trend and across strike from thrust block to thrust block.
Northeast Region – 2005
New Coal Mines

2004 Mine openings:
Willow Creek
Dillon (Burnt River)

2006 Mine openings:
Trend (January ’06)
Wolverine-Perry Creek

Proposed Mines in EA Review Process:
Brule (Burnt River)
## Summary some data Mines and advanced projects

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<th>Property</th>
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**Warning all numbers in this table are wrong to some degree**
Willow Creek Mine Pine Valley Mining

45 km W of Chetwynd; mining commenced July ‘04

Coal used for steel making
(PCI & coking coal)

Permitted for 0.9 million tonnes per annum
(to 2.2 Mtpa)

Load-out & full unit-trains in use in Feb ‘05

Wash plant completed in Oct 2005

Major exploration program on Pine Pass Property

Open pit & waste rock dumps; plant site & rail loadout.
Pine River and Pine River Coal Mine
Wash plant under construction summer 2005 Pine Valley Coal
Pine Valley Coal Pit area
Dillon Mine (Burnt River)
Western Canadian Coal

- 57 km S of Chetwynd
- Coal trucked 94 km to Bullmoose loadout
- Used for steel making (PCI coal)
- Permitted as small mine (240 Ktpa); rate increased to ~1 Mtpa with no increase in mine footprint
- EA review of adjacent Brule deposit (36 Mt) well underway
New coking coal mine! Southeast of dormant Quintette mine
\textit{Mines Act} permit issued in May ‘05 for a 240 Ktpa
Wash plant, 16 km of rail & loadout
~ 25 Mt resource in South & Extension blocks
Major exploration Roman Mountain block to establish additional reserves

\textbf{Trend Mine}

\textbf{NEMI Northern Energy & Mining Inc}

Looking north from Roman Mountain to Babcock
Roman Mountain looking east
Wolverine Mine
Western Canadian Coal

- Coking coal mine under construction; located in the Wolverine Valley west of Tumbler Ridge
- EA Cert. in Jan. ‘05 & Mines Act permit in Mar. ‘05
- Capital cost of > $240 million
- 2.4 million tonne per year open pit operation
- Perry Creek deposit has reserve of ~16 M tonnes
- EB deposit brings surface resource to ~25 M tonnes
- Hermann property hosts additional reserves
John Hogg & Gary Gould looking southward over site from ROM coal stockpile area; foundations for coal preparation plant & coal dryer (foreground); sed pond SP18, radial stacker area & top soil pile TSP1 (Oct. 19/05).
General Comments on
Major exploration projects
Belcourt North, Belcourt South, Omega, Saxon East & Saxon South
Belcourt Saxon Coal Limited Partnership

Views of the Belcourt North & Belcourt South properties. BSCLP’s conceptual mine plan: 8.7 million tpa coal operation with multiple open pits, 2 processing plants, road, rail, power infrastructure & est. cap. cost of $800 - $1300 million.
Horizon (Five Cabin)
Hillsborough Resources Limited

Coking coal project SW of Quintette mine site
Approved for bulk sample in 2006
Exploration programs planned for other tenures (i.e. Wapiti)
Anglo Coal to explore & develop several Hillsborough coal properties in NE

Hillsborough geologist Steve Gardner (left) with MEMPR geologist Barry Ryan & student Jenny Macauley
Idle Quintette plant site with reclamation in foreground; Big Windy pit; large rotary drill.
Babcock exploration
Rotary rig drilling from one of 12 sites on Kennecott’s Falling Creek property
Upper Gething coal medium volatile bituminous rank. Thick Brenda Seam
Pouring over maps and drill core with Michael Hunter of First Coal Corp.
Lossan Cline Mining Corporation

Adit built to access unoxidized coal from 5m thick No.1 Seam (Gething Fm).
Some personal observations

Hard rock exploration tends to look outwards
Find Deposit – How to get to boat – how to sell it

Coal exploration maybe should look inwards
Study market --- Decide how to get it to a boat -- Find the deposit

Kyoto Coal and Greenhouse Gases
Disconnect between Developing countries, Projected coal use and Sensitivity to climate change

Making steel The coke/blast furnace route is still the most efficient route in terms of CO2 emissions

Reserves of Gas, Oil, Uranium limited Reserves of coal immense Incentive and cost flexibility to increase use of CO2 sequestration
Thanks for your Attention.

Minerals North Conference
Mackenzie April 26-28, 2006