TAR SANDS
THE MAGIC SAND-PILE

In the north-eastern corner of Alberta, Nature has created the most fabulous “sandpile” in the world. Along the banks of the Athabasca River, 30,000 square miles of land contain billions of tons of oil-soaked sands. Tests have shown that these bituminous sands can yield an amazing number of valuable petroleum products. Your research, your plant methods, could unlock fully the oil reserves in this magic sandpile — authoritatively estimated to contain more than ten times all the oil reserves in the world.

The U.S. Bureau of Mines estimates Alberta’s oil-sands to contain 250 billion barrels of oil. 23 per cent of this oil can be made into high-octane aviation gasoline; 17 per cent into high quality motor gasoline. By-products include everything from road-surfacing to roofing products. The oil-recovery content is as high as 25 per cent—a yield of from 100,000 to 125,000 barrels per acre.

Here, in the tar-sands of Alberta, is an unique opportunity for industry—an opportunity and a challenge in the free land of free enterprise.
Alberta Crude Density and Type

Specific Gravity (water = 1)

API Gravity

Source: Alberta Energy, Enbridge, Alberta Energy and Utilities Board
The Drivers
Peak Oil
“Energy to Burn”
“The model that has worked so well for us is that the royalty structure for oil sands is ‘we give it away’ at a 1 percent… and share in the risk of these great ventures and great investments.”

Austin/2006
U.S. CRUDE OIL IMPORTS (TOP 10 COUNTRIES)

APRIL 2007

THOUSAND BARRELS PER DAY

CANADA 1,909
MEXICO 1,460
S.Arabia 1,458
Venezuela 1,182
Nigeria 891
Iraq 562
Algeria 530
Angola 514
Russia 269
Brazil 175

Source: EIA - April 2007 Import Highlights
Market Demand for Western Canadian Crude Oil – Actual 2007 vs 2015 Potential

Thousand Barrels Per Day

PADD V
(2,646)

PADD IV
(598)

PADD III
(7,990)

PADD II
(3,622)

PADD I
(1,627)

(Total 2008 refining capacity – All crts)

Potential demand for Western Canadian crts

Actual demand for Western Canadian crts

PADD: Petroleum Administration for Defense District
Some Dirt
“Equivalent land capability”
We invest today’s profits
in tomorrow’s solutions

The challenge of the 21st century is to meet the growing need for energy in ways that are not only profitable but sustainable. As our 2007 results show, we’re investing heavily in new technology and assets to safeguard the interests of our shareholders and future generations. In Canada we’re harnessing our global network of technical and financial expertise to unlock the potential of the vast Canadian oil sands deposit. In the USA we’re helping to build what will be the nation’s largest refinery. And we’re exploring a new generation of biofuels made from non-food sources. Difficult, yes. Impossible, no.

For more details on our 2007 results: www.shell.com/investor
“We concluded that the ad was misleading.”

Breached the code for Substantiation and Truthfulness: August 2008
SAGD: 80%
140,000 sq km

The Alberta Oil Sands
Next slide shows simulation of future development footprint based on development of existing leases.
A Water Emergency
A Collision Course

2-3 %
1.8 billion litres a day
Napthenic acids
arsenic
benzene
toluene
polycyclic aromatic hydrocarbons
ammonia
cyanide
lead
Area of oilsands tailings ponds 1974-2008
Figure 10 Suncor’s Tar Island Dyke (center of the photo) separates an oil sands tailings (upper right) from the Athabasca River.
Seepage from Tar Island Dyke

- Extraction/upgrading plant
- Tailings pond
- Tar Island Dyke
- Possible seepage of dyke construction water
- Possible deeper groundwater pathway
- Seepage water collection system
Energy Cannibalism
Steam Plants: EROEI
6 million homes a day
I hope that I don’t have the following conversation with my granddaughter twenty years from now:

“Grandpa, did you really do that?” “Do ‘what’, Masha?”

“Did you take natural gas from the Arctic down to Alberta to boil water to make steam to melt tar out of the oil sands, to use more natural gas to produce hydrogen to make the tar molecules into gasoline so North Americans could drive five tonne vehicles five kilometres to sports clubs to spend fifteen minutes riding stationary bikes; did you really do that, Grandpa?” “Ahhhh…, yes, Masha, I am afraid we did.”
20 Nuclear Reactors
Carbon Maker
Exhibit 1. Diesel Fuel WTT GHG Emission Profiles for Crude Oil-Specific Sources (Year 2005)

- **Domestic Crude Oil**, 13.5 kg CO$_2$E/MMBtu
- U.S. 2005 Average Mix, 18.4 kg CO$_2$E/MMBtu, 136% of Domestic Crude
- Imported Crude Oil, 21.4 kg CO$_2$E/MMBtu, 159% of Domestic Crude
- Venezuela & Canada Ultra-Heavy Oils, 32.9 kg CO$_2$E/MMBtu, 244% of Domestic Crude

**Percent of Domestic Crude WTT Diesel GHG Emissions**

0% 50% 100% 150% 200% 250%
Oil Sands CO₂ Emission Potential

Source: Strategy West
76 million homes a day
“We can never do merely one thing.”
Garrett Hardin
United States
Refinery Expansions and Conversions to Handle Alberta Bitumen

- **Wood River Refinery Conversion & Exp**, Borger, Texas
  - 495,000 bpd
  - $1.9 billion (US)
- **WRB Refining (ConocoPhillips & Encana)**, Roxana, Illinois
  - 115,000 bpd
  - $1 billion (US)
- **Tulsa Refinery Expansion**, Tulsa Oil, Tulsa, Oklahoma
  - 180,000 bpd
  - $3.2 billion (US)
- **Garyville Refinery Expansion**, Garyville, Louisiana
  - 600,000 bpd
  - $7 billion (US)
- **Port Arthur Refinery Expansion**, Motiva
  - 415,000 bpd
  - $2.4 billion (US)
- **Port Arthur Refinery Expansion**, Valero
  - 205,000 bpd
  - $3.8 billion (US)
- **Whiting Refinery Conversion**, Whiting, Indiana
- **Detroit Heavy Oil Expansion**, Detroit, Michigan
  - 115,000 bpd
  - $1.9 billion (US)
- **Toledo Refinery Conversion**, Toledo, Ohio
  - 131,000 bpd
  - $2.5 billion (US)
- **Lima Refinery Conversion**, Lima, Ohio
  - 146,000 bpd
  - $1.9 billion (US)
- **Hyperion Refinery**, Hyperion
  - 400,000 bpd
  - $4 billion (US)
  - Union County, South Dakota

**Total processing capacity**: 2,802,000 bpd

**Estimated investment**: $24 billion
Basic Conflict
Fossil Fuel Special Interests vs Young People & Nature (Animals)

Fossil Interests: God-given fact that all fossil fuels will be burned (no free will)

Young People: Hey! Not so fast! Nice planet you are leaving us!
We all want progress, but if you're on the wrong road, progress means doing an about-turn and walking back to the right road; in that case, the man who turns back soonest is the most progressive. C. S. Lewis