Non-Renewable Energy
Part 2

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Bush Energy Plan

- 1000 New Coal Fired Power Plants < 20 yrs
- Exploration & Extraction
  - ANWR
  - Powder River
  - Green River
- $30 Billion in New Subsidies to Fossil Fuels & Nuclear Power
- $1 Billion for Alternatives
- Relaxation of Clean Air & Water Act Provisions
- No Action on Climate Change
- Minimal Conservation

The Air We Breathe...

EXXON
VALDEZ
53rd Worst Oil Spill

Oil Well Fires in Kuwait 1991

National Power Plant Impacts

<table>
<thead>
<tr>
<th>Health Effect</th>
<th>Incidence (cases per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>22,000</td>
</tr>
<tr>
<td>Hospital Admissions</td>
<td>21,650</td>
</tr>
<tr>
<td>Emergency Room Visits For Asthma</td>
<td>36,000</td>
</tr>
<tr>
<td>Major Attacks</td>
<td>38,200</td>
</tr>
<tr>
<td>Chronic Bronchitis</td>
<td>76,200</td>
</tr>
<tr>
<td>Asthma Maligns</td>
<td>1,074,000</td>
</tr>
<tr>
<td>Lost Work Days</td>
<td>3,196,000</td>
</tr>
</tbody>
</table>
Power Plant Deaths in USA

- ~500 coal-fired power plants in United States
- 51 in open violation of NSR
- 5,650 deaths/year
- 138,500 asthma attacks
- 100,000 could be avoided if plants obeyed the law
- Other ~450 coal-fired power plants responsible for 18,450 deaths/year
- 70 EPA lawsuits and all enforcement actions suspended by Bush Justice Department

New Source Review Case Study

Emissions from Coal Use

- Percent of U.S. Electric Industry Emissions from Coal
- Projected Worldwide CO₂ Emissions from Coal Use

Northeast Pollution Transport

- Northeast Pollution Transport

World-Wide Resources of Coal

- Coal > 200 year supply
IGCC vs. Conventional Coal Plants

- An IGCC places the chemical plant in the front end of plant.
- In contrast, a conventional coal plant is less efficient because it places a chemical plant at the back end, attempting to capture pollutants after combustion and much dilution.

IGCC: What is it?

- Chemical conversion of coal to synthetic gas for combustion in a modified gas turbine
- Inherently cleaner process because:
  - Coal is not combusted.
  - Pollutants are removed with greater efficiency because clean-up occurs while syngas volume is relatively small compared with flue gas.

Solid Waste and Water Use

- **Solid Wastes**
  - Less Volume: IGCC produce about half the solid wastes of conventional coal plants.
  - Better Form: IGCC solid wastes are less likely to leach toxic metals than fly ash from conventional coal plants because IGCC ash melts and is vitrified (encased in a glass-like substance).
- **Water Use**
  - Less Water: IGCC units use 20%-50% less water than conventional coal plants and can utilize dry cooling to minimize water use.
Carbon Dioxide – CO₂

- Up to 100% of the carbon in syngas can be captured at IGCC plants with commercially available technology.
- Carbon capture at IGCC plants is significantly easier and much more economic than at conventional pulverized coal plants and more economic on a $/ton basis than at natural gas plants.
- Even without carbon capture and sequestration, IGCC plants are more efficient than conventional coal plants and emit less CO₂.

Air Emissions

- IGCC has fewer air emissions than a conventional supercritical pulverized coal plant (SCPC)

<table>
<thead>
<tr>
<th>Air Emissions</th>
<th>SCPC IGCC</th>
<th>% Increase due to SCPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur Dioxide</td>
<td>0.15</td>
<td>0.03</td>
</tr>
<tr>
<td>Nitrogen Oxide</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>0.12</td>
<td>0.03</td>
</tr>
<tr>
<td>VOC</td>
<td>0.0035</td>
<td>0.0017</td>
</tr>
<tr>
<td>Hg</td>
<td>1.1E-06</td>
<td>5.6E-07</td>
</tr>
<tr>
<td>PM</td>
<td>0.018</td>
<td>0.011</td>
</tr>
<tr>
<td>Sulfuric Acid Mist</td>
<td>0.01</td>
<td>0.0005</td>
</tr>
</tbody>
</table>

Notes: Elm Road Wisconsin permit limits issued by WDNR January 2004, expressed as percentages.

Cost of Electricity in $/MWh

Source: EPRI, 2004

IGCC Costs are Close to Conventional Coal Plants

- IGCC may cost slightly more than conventional plants (SCPC) but costs much less when carbon is reduced.

| Source: EPRI, 2004 |

Barriers to Deployment

- Power Industry Culture
  - This is a chemical plant. Power companies understand combustion, not chemical units.
  - Perceived technical and financial risk.
- Why build an IGCC if you can get a permit for a conventional coal plant?  
  - Is IGCC BACT?  
    [BACT = Best Available Control Technology]

Who’s problem is it?

As each fuel source is depleted, what will be the effect on the rate of use of the remaining energy sources?
Climate Change

"Posing a threat, said by some scientists to be 'second only to global nuclear war', climate change is perhaps the biggest survival challenge humankind has ever faced."

-- One World Net

"Fossil fuel combustion is demonized as humanity's primary contributor to the alleged potential for apocalyptic climate change. Curtailing fossil fuel use will trigger 'wrenching transformation of society'."

-- Fossil Fuel Institute

Monthly averages of the concentration of CO₂ at Mauna Loa, Hawaii, since 1958

Changes in land, sea, and global mean surface temperature due to business-as-usual greenhouse gas emissions
Projected CO$_2$ Concentrations

Extreme Global Warming

Change in Temperature by the 2050s, relative to present day, northern winter

Alternative Energy Future?
$ 3,196,359,886,853

$ Billions per Year to Import Fossil Fuels

Superconducting Electrical Transmission

Emission Reduction Benefits far Exceed Costs

We do not face an energy crisis
We face a crisis of imagination