CO\textsubscript{2} and Indiana’s Infrastructure: Turning Problems into a Resource

“Coal, Steel, and the Industrial Economy”
COAL BRIEFING
Purdue Calumet, Hammond, Indiana

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Indiana Center for Coal Technology Research

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Are We Using Too Much Energy?

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Energy</th>
<th>GDP</th>
<th>Energy/GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>6%</td>
<td>25%</td>
<td>33%</td>
<td>.758</td>
</tr>
<tr>
<td>ROW</td>
<td>94%</td>
<td>75%</td>
<td>67%</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Do the Math

US population consumes 5.26 times the energy of the average person in the rest of the World; But we produce 7.7 times the goods and services of the Rest Of the World.

The USA only 67% of the energy per unit of GDP as does the rest of the world. We are the model of energy efficiency (only Japan and Lichtenstein are better).

Per capita energy is of no value to measure, to reduce your per capita consumption you need only add population.

It is what you do with the energy that matters.

33% of the world has never used a telephone:
40% of China population have no electricity or indoor plumbing:
50% of the population of the world is on a subsistence economy:

How do you compare the energy us of a Bushman in the Kalahari trying to feed his family with a Hoosier farmer who uses his 255 acres to feeds 150 people?

It's not how much you use, it is what you do with it.
## How Important is Manufacturing to Indiana?

### Manufacturing as % of Indiana’s GDP

<table>
<thead>
<tr>
<th></th>
<th>1997 GDP</th>
<th>2006 GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durable Goods</td>
<td>18.1%</td>
<td>20.5%</td>
</tr>
<tr>
<td>Non-Durable Goods</td>
<td>10.2%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Total Manufacturing</td>
<td>28.3%</td>
<td>30.5%</td>
</tr>
</tbody>
</table>

- In 1997 Indiana’s 18.1% durable goods as part of GDP was the highest in the nation. (2006 Indiana ranked 3\textsuperscript{rd})
- 2006 Total Manufacturing of 30.5% is highest in the nation.
- Your CO\textsubscript{2} Footprint is large if you live in Indiana because we are a Manufacturing State: CO\textsubscript{2} and Energy use measurements do not account for where the final product is consumed.

**Indiana is a manufacturing state**

Indiana’s industrial sector provides about 1/3 of the state GDP & consumes nearly 1/2 of total energy

*Source: Indiana Business Review, Spring 2008*
# Indiana Primary Energy Consumption
## Source & Sector, 2006

<table>
<thead>
<tr>
<th>Source</th>
<th>Trillion Btu’s</th>
<th>Source %</th>
<th>Sector %</th>
</tr>
</thead>
<tbody>
<tr>
<td>COAL</td>
<td>1,547.5</td>
<td>76.9%</td>
<td>96.2%</td>
</tr>
<tr>
<td>PETROLEUM</td>
<td>890.7</td>
<td>22.6%</td>
<td>0.4%</td>
</tr>
<tr>
<td>NATURAL GAS</td>
<td>512.1</td>
<td>0.6%</td>
<td>29.5%</td>
</tr>
<tr>
<td>RENEWABLES</td>
<td>46.3</td>
<td>18.6%</td>
<td>42.6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sector</th>
<th>Trillion Btu’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRIC POWER</td>
<td>1,237.4</td>
</tr>
<tr>
<td>INDUSTRIAL</td>
<td>1,346.3</td>
</tr>
<tr>
<td>RESIDENTIAL &amp; COMMERCIAL</td>
<td>885.4</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>648.7</td>
</tr>
</tbody>
</table>

Net inter-state flow of electricity/losses = -116.1

**Total = 2.88 Quads (10^{15} Btu)**

75% of energy imported

[http://www.eia.doe.gov/emeu/states/state.html?q_state_a=in&q_state=INDIANA](http://www.eia.doe.gov/emeu/states/state.html?q_state_a=in&q_state=INDIANA)

[http://www.eia.doe.gov/emeu/states/sep_use/total/pdf/use_in.pdf](http://www.eia.doe.gov/emeu/states/sep_use/total/pdf/use_in.pdf)
2006 COAL DESTINATION: INDIANA

Coal Destined for Indiana: 72,346 (Thousand short tons) & Methods of Transportation

Wyoming: 11,927 Total
- 11,686 Electricity Generation
  - Rail 11,686
  - Industrial 240
- 240 River

Montana: 2,226 Total
- 2,226 Electricity Generation
  - Rail 2,226

Utah: 164 Total
- 164 Industrial

Colorado: 153 Total
- 109 Electricity Generation
  - Rail 109
  - 44 Industrial

Illinois: 6,450 Total
- 5,347 Electricity Generation
  - Rail 4,672
  - River 428
  - Truck 589
- 761 Industrial Plants
  - Rail 675
  - Truck 86

Kentucky: 1,371 Total
- 882 Electricity Generation
  - Rail 530
  - River 352
- 489 Industrial Plants
  - Rail 392

Alabama: 946 Total
- 944 Coke
- Rail 944

West Virginia: 7,942 Total
- 2,111 Electricity Generation
  - Rail 1,114
  - River 968
  - Truck 589
- 4,634 Coke Plants
  - Rail 4,163
  - River 420
  - Truck 51
- 1,197 Industrial Plants
  - Rail 949
  - River 246

Ohio: 195 Total
- 188 Electricity Generation
  - Rail 73
  - River 96
  - Truck 19
- 7 Industrial Plants
  - Truck

Pennsylvania: 546 Total
- 475 Electricity Generation
  - Rail 223
  - River 251
- 68 Industrial Plants
  - Truck

Virginia: 670 Total
- 670 Coke Plants
- Rail

Wyoming: 11,686 Coke Plants
- Rail

6,140 Coke Plants
5,932 Industrial Plants

Source: http://www.eia.doe.gov/cneaf/coal/page/coaldistrib/coal_distributions.html
Real Cost of Energy

![Graph showing the real cost of energy for different energy sources from 1990 to 2007. The graph indicates a significant increase in the cost of natural gas and oil, with coal and electricity showing relatively stable costs.]
The New Economy and Alternate Energy

- Wind turbines
- Transmission Lines
- Gasifier
- CO₂ Pipelines
- Light Rail
- Ethanol
- BioDiesel
- How do you build these without Steel and Aluminum?
- You cannot build an economy without steel
- You cannot make steel without coal
Steel Production and Air Quality

One impact of Importing Steel:
Northwest Indiana
– Indiana Steel Industry operating at 83% capacity in 2008 yet no Ozone Action days.

Import steel from India, China, Russia:
Can they make the same air quality claims?
(Has ArcelorMittall or US Steel ever been asked to halt operations so Chicago can run its marathon?)
CO$_2$ Emissions from Coal

Different rank coals produce different amounts of CO$_2$ lbs/Million Btu (MBtu)

**CO$_2$ lbs/MBtu from Coal**

U.S. averages:

- 227.4 for anthracite
- 216.3 for lignite
- 211.9 for sub-bituminous

205.3 for Indiana bituminous

Source: http://www.eia.doe.gov/cneaf/coal/quarterly/co2_article/co2.html
Global Warming or Cooling? Depends on Where you Start your Analysis

Sun, Temperature, CO₂ Correlations or Cause and Affect

Climate Sensitivity Reconsidered

- The IPCC’s 2007 climate summary overstated CO₂ impact on temperature by 500-2000%
- CO₂ will add little more than 0.6 degrees F. to global mean temperature by 2100, if at any at all
- Not one of the above variables, whose product is climate sensitivity, can be measured directly
- The IPCC’s value for the three keys is taken from 4 published articles not 2,500
- “Global Warming” stopped 10 years ago, and surface temperature have been falling for 7 years

Source: Christopher Monckton, Physics and Society, August 2008
Climate Sensitivity Reconsidered

- Not one of the computer models used by the IPCC predicted this cooling period
- The IPCC inserted a table into the scientists’ draft overstating the effects of the ice-melt by 1000%
- It was proved 50 years ago that predicting climate more than 2 weeks ahead is impossible
- Mars, Jupiter, Neptune’s largest moon, and Pluto warmed at the same time as Earth
- In the past 70 years the Sun was more active than at almost any time in the past 11,400 years

Source: Christopher Monckton, Physics and Society, August 2008
We must get the Science Right or we shall get the Policy Wrong

Problem

We have a need for lots of Coal
  We produce heavy manufactured products used elsewhere,
  We are responsible for producing the CO$_2$ that results from the production of goods demanded elsewhere.

We have real issues with CO$_2$
  Regardless of whether there is any legitimate environmental basis for the concerns or not.
  We are shipping out $1$ Billion a year to buy coal from other states and bring it to Indiana.
What would resolve the issue?
Use Indiana’s own coal in a way that would:
1) Retain energy capital,
2) Create jobs for Hoosiers,
3) Leave the environment cleaner than it is now,
4) Reduce the cost of the goods manufactured in the state (especially steel).
5) **Make CO$_2$ a desirable resource rather than a problem.**

Ideas that are do-able now
Newport Chemical Munitions Depot to Newport Advanced Energy Development Center

Best Infrastructure in the US
- 765 kV, Water, Natural Gas pipeline, Railroad

US needs a gasification test center
- Plasma, Biomass, Cellulose

Wind Power supplemental grid power system
- Ready user for all syngas produced: Cayuga
- Underground Coal Technology
- CO₂ Capture Technology

Need an infrastructure planning center to reduce time and cost of implementing new technologies.
Develop an in-depth scenario involving new rail infrastructure development

USING INFRASTRUCTURE TO REDUCE AIR EMISSIONS

Infrastructure changes including the “missing links” will enable Indiana coal to be moved north but by-passing Terre Haute, Indianapolis and Chicago

Allows for the access of Indiana coal to the northwest region.

Connects Indiana’s North and South Ports via rail.

Increase Indiana coal export market potential
Extensions & Existing CO₂ Pipelines in Relation to Gasification Projects
Southwest/Northwest Indiana Economic Development Plan

Future Idea Areas
Indiana Coal Production Potential:
A) Indiana coal to make coke:

- reducing cost of steel production, reducing air emissions in the region 2.1 million tons
- NiSource coal replacement potential 6.8 million tons

TOTAL Indiana Coal Potential 8.9 million tons

Producing 8.9 million tons of coal adds:

- 742 direct mine workers*
- 2967 Ancillary workers* employment to South West IN

Total added annual economic activity in South West Indiana $530.3 million*
Estimated cost of the Indiana/Illinois order rail line $ 50.0 million

B) Newport Military Base transfer to Indiana/Purdue University:
1. Biomass to Energy test site
2. Wind Energy gasification supplement site
3. Provide syngas to Cayuga making it more usable during peak demand times

*EXPANDING THE UTILIZATION OF INDIANA COALS