



**Indiana Center for Coal Technology Research**  
Located in the Energy Center at Discovery Park, Purdue University

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# **INDIANA'S GROWTH AND COAL DEVELOPMENT**

Minerals matter

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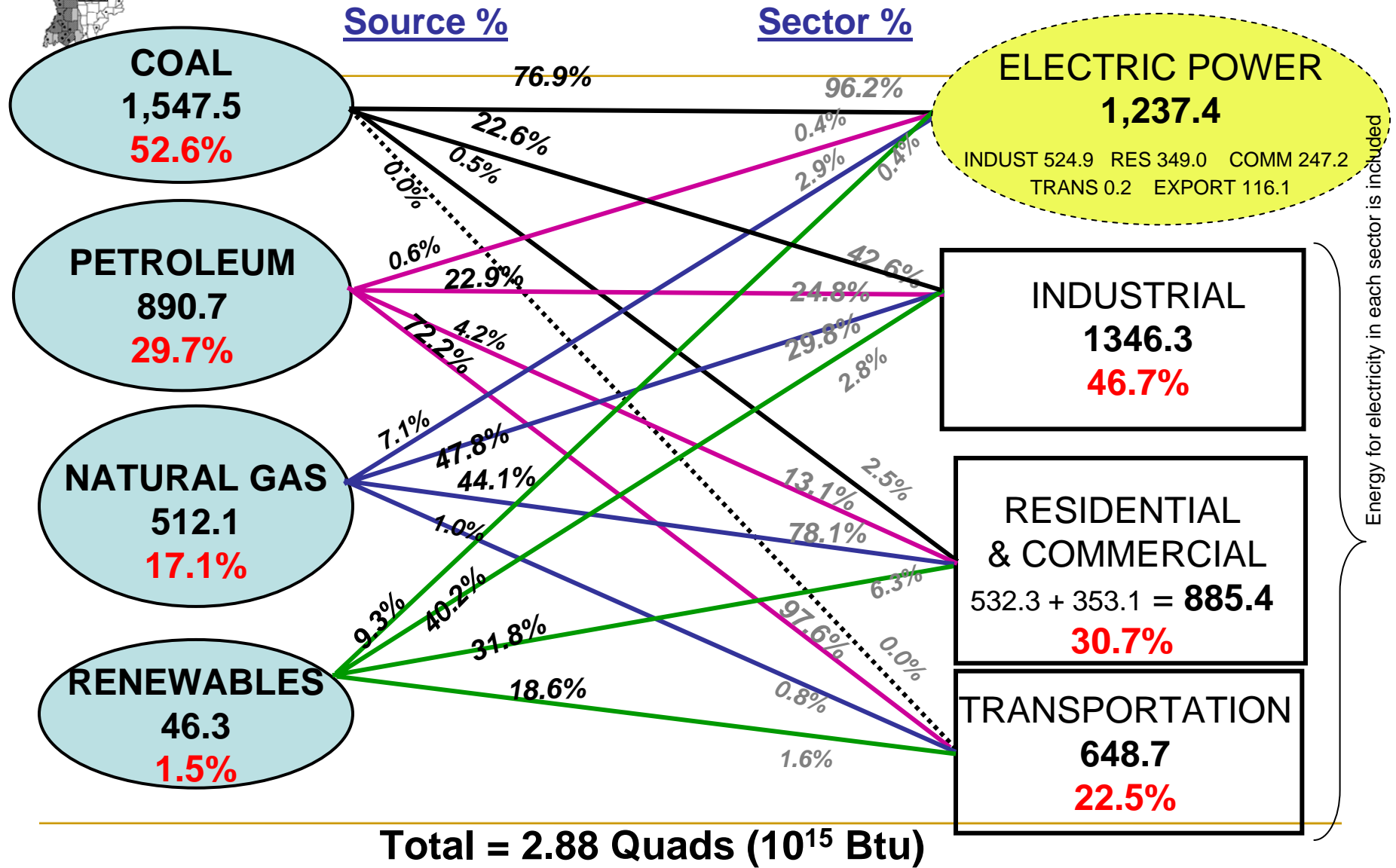
[mirwin@oed.lg.in.gov](mailto:mirwin@oed.lg.in.gov)

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National Minerals Education Conference, Bloomington, Indiana - June 25, 2007

# Indiana Primary Energy Consumption, Source & Sector, 2002

(Trillion Btu,  $10^{12}$  Btu)



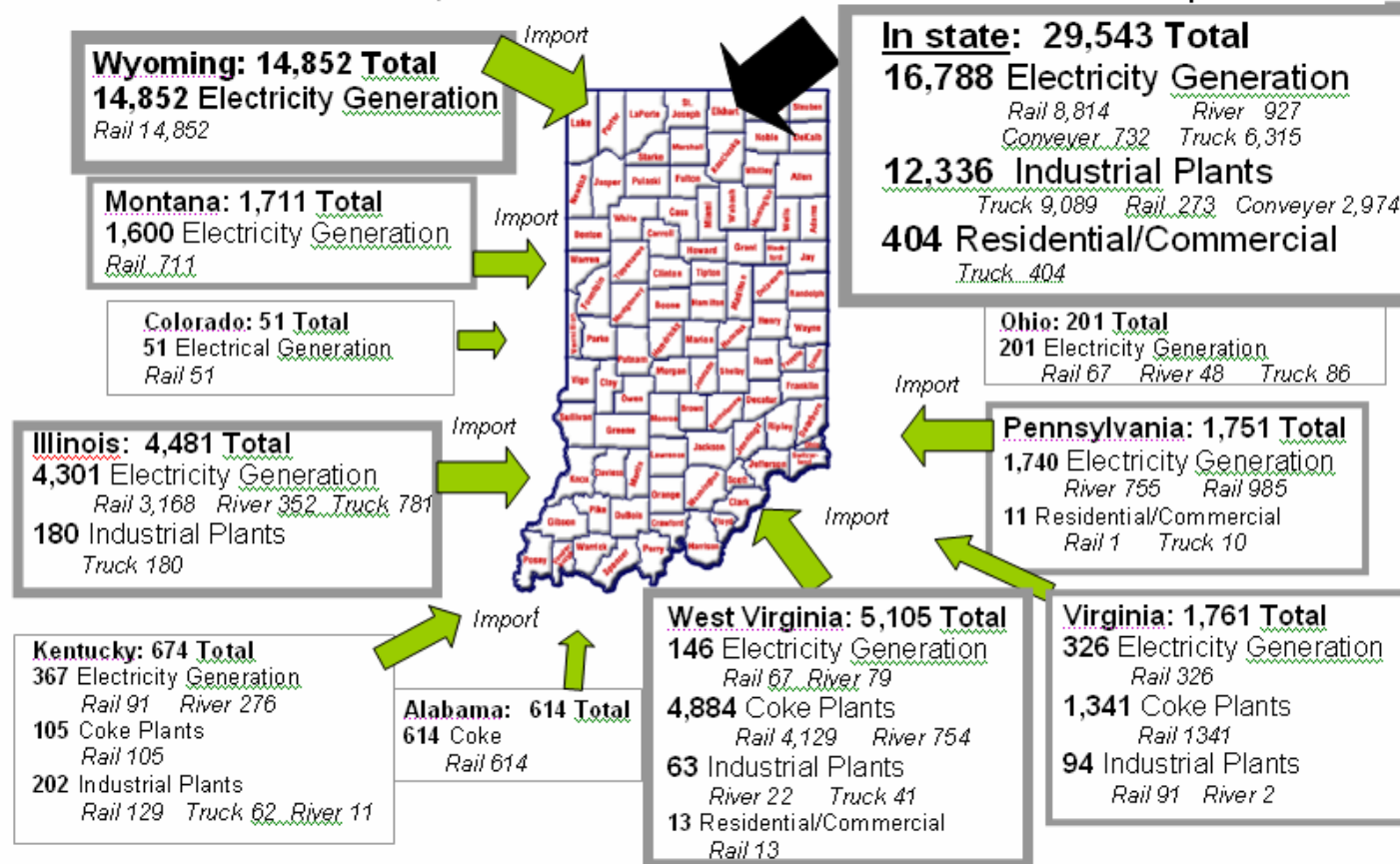
Net inter-state flow of electricity/losses = -116.1



# COAL'S CURRENT SOURCES

## Coal by Destination State in 2004 - Indiana

State Total of 60,744 Thousand short tons & Methods of Transportation



Source: [http://www.eia.doe.gov/cneaf/coal/page/coaldistrib/d\\_in.html](http://www.eia.doe.gov/cneaf/coal/page/coaldistrib/d_in.html)

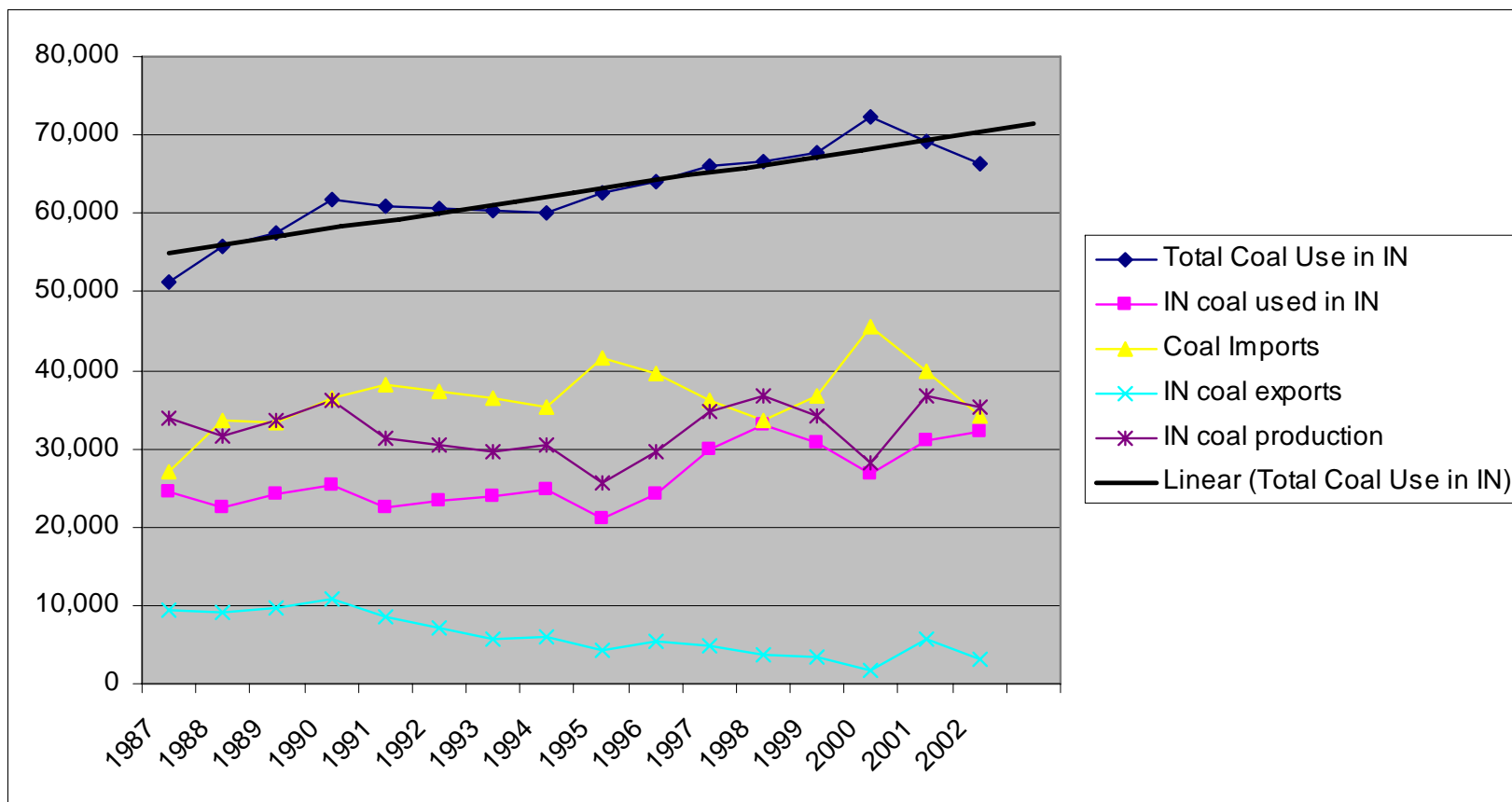
**State Totals:** **40,481 Electricity Generation**  
**6,944 Coke Plants, 12,875 Industrial Plants**  
**429 Residential/Commercial**

Source: Indiana Coal Report 2006; Figure 3.4.



# COAL USE TREND

Indiana coal consumption growing much faster than  
Indiana coal production





## Coal Answer to the emissions problem? Increasing the use of electricity focuses the emissions issue back to the Utility, rent pollution control when you buy electricity.

### Coal Use Grows While Emissions Decline

Coal Used for Electricity Has Tripled  
Since 1970 While Emissions Have Been Significantly Improved

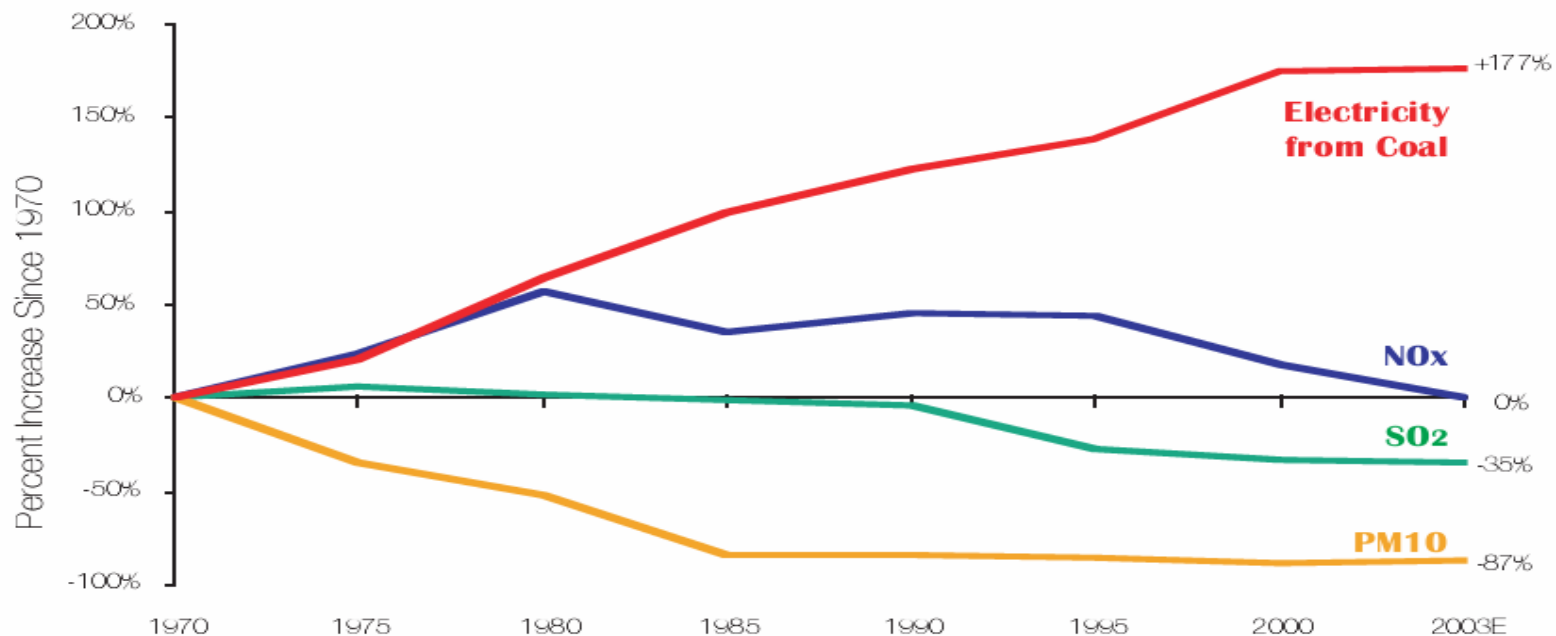


Figure ES.2 Source: EPA National Air Pollutant Emission Trends Dec 2004; EIA Annual Energy Review 2003 (September 2004)



# COAL'S IMPACT

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- Currently, coal directly adds \$750+ million and **2,836 jobs to our Indiana's economy** (includes aggregate industry).
- This vastly understates coal's contribution to economic development:
  - Coal unlike petroleum or natural gas has its entire economic impact within the states borders.
- Coal is mined, washed, transported, consumed and the waste is recycled / or disposed within the state each phase generating jobs and revenues streams.
- The coal dollar multiplies faster and farther than any other industrial economic activity.
- One ton of coal generated \$59.59\* of activity within the state regardless of how the coal is used.
  - (A \$2 billion economic impact and 11,000 total direct and indirect employment)
- Major reduction on SOx & NOx taking place
- Scrubbers & CCT being considered for and implemented both allow for increased Indiana coal use.
- As Scrubbers come on line the amount of aggregate increases, you need both

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\* Expanding the Utilization of Indiana Coals, page 20

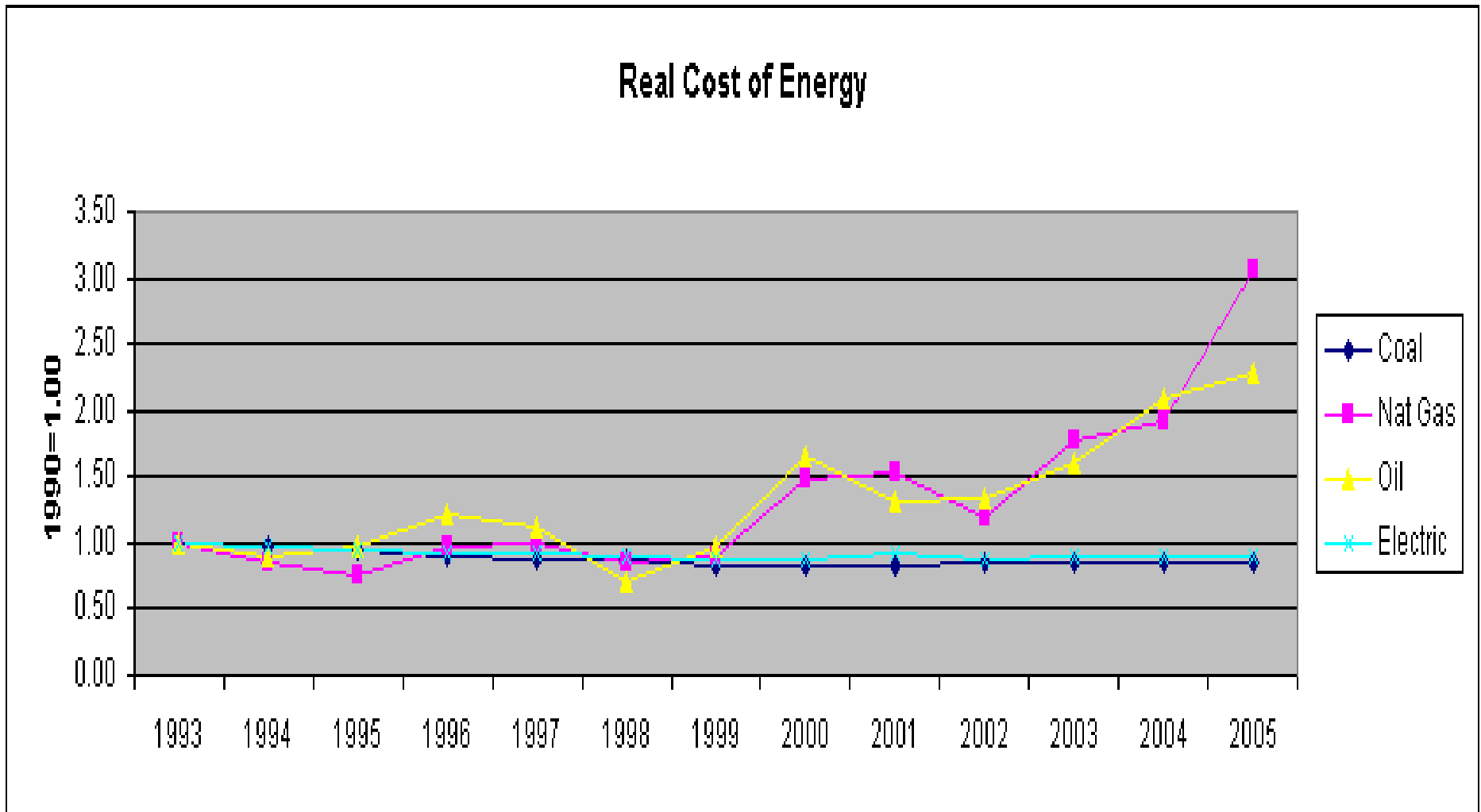


Coal prices are relatively stable in real terms while other forms continue to rise.

**In Indiana coal = electricity**

Low energy price helps the economy of the state.

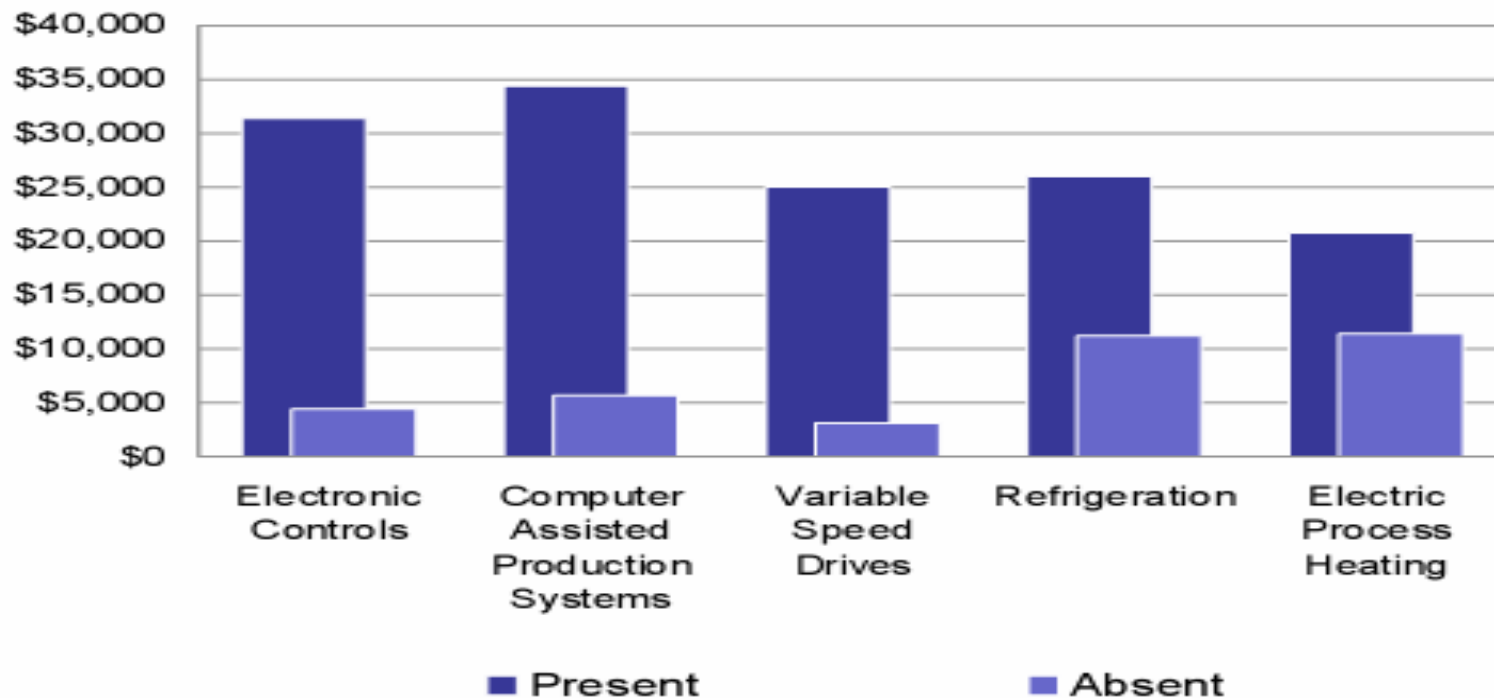
If we have a least cost option, use it.





As the society's reliance on electronic equipment for everything from e-commerce to sophisticated industrial controllers, grows, so does the importance of reliable power supply.

- **The more technologically advanced we become, the more the basics apply.**
- **ELECTRONICS MEAN ELECTRONS, ELECTRONS MEAN ELCTRICITY, ELECTRICITY MEANS COAL**
- Average cost of one-hour outage by selected industrial equipment and process.
- Digital equipment versus absents of digital equipment

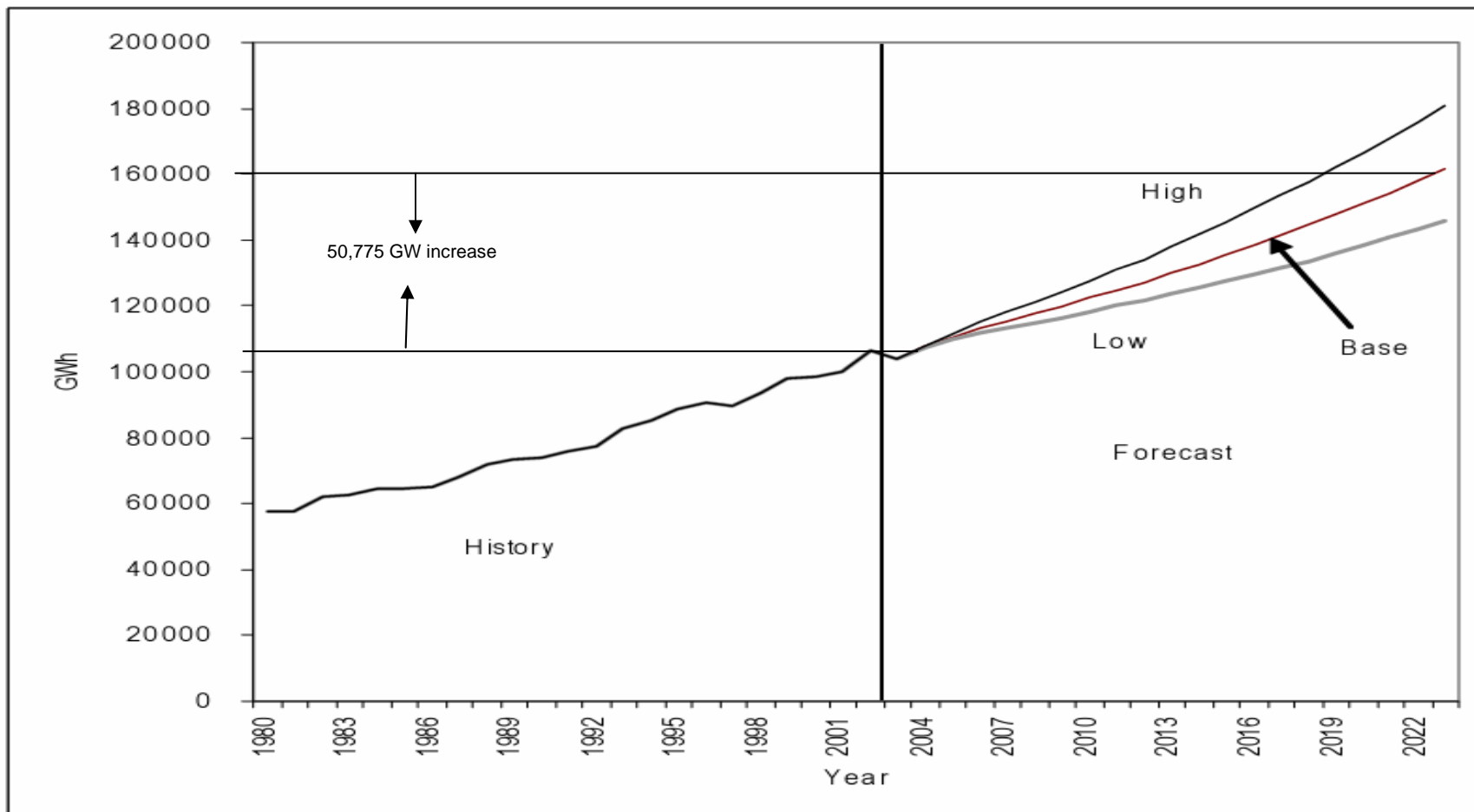




# Indiana electric requirement by scenario

## 45.9% increase in electric demand in next 17 years

### SUFG





Economic Growth From  
**Hoosier Homegrown Energy**



Indiana's Strategic Energy Plan



energy.IN.gov

2006

## GOALS



### **TRADE CURRENT ENERGY IMPORTS FOR FUTURE INDIANA ECONOMIC GROWTH**

- Importing energy exports growth potential
- New plants bring new jobs
- Reduce energy dependency and increase reliability



### **PRODUCE ELECTRICITY, NATURAL GAS AND TRANSPORTATION FUELS FROM CLEAN COAL AND BIOENERGY**

- Build needed new power plants using 'clean coal' technology
- Make gas from coal versus importing natural gas
- Unlock biomass and build on biofuels success



### **IMPROVING ENERGY EFFICIENCY AND INFRASTRUCTURE**

- Create new tools and incentives
- Support flex-fuel fleets
- Strengthen/expand energy infrastructure (including rail)



## WHAT ABOUT THE FUTURE?

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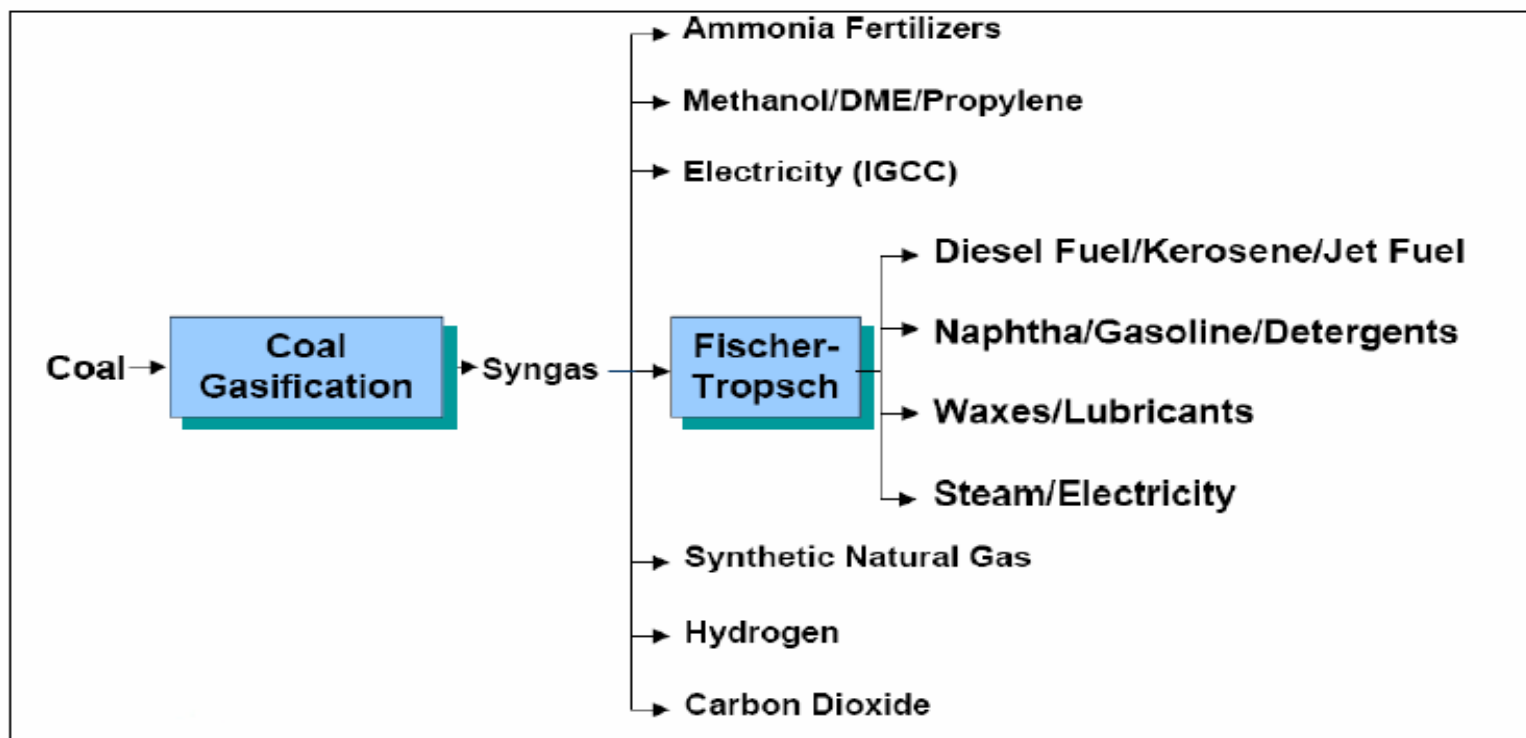
- Import Substitution
  - Increase Coal Exports
  - Increase “coal by wire”
  - All these solutions affected by likely CO2 legislation, other coal use environmental challenges, if we assume the status quo will persist.
  - So: What to do?  
Enter CCTR: objective to “increase use of Indiana coal in an economically and environmentally sound manner”
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# How to Get There?

## Convert Coal to a Usable Resource

### Potential Coal-Derived Products



Source: GTI Gasification Symposium, December 2, 2004

[http://www.gastechnology.org/webroot/downloads/en/1ResearchCap/1\\_8GasificationandGasProcessing/LepinskiSmall.pdf](http://www.gastechnology.org/webroot/downloads/en/1ResearchCap/1_8GasificationandGasProcessing/LepinskiSmall.pdf)



From the gasification basics several products are available to be made.

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- The basic process described above requires varying amounts of hydrogen. CH<sub>4</sub> is methane and is the basic product of coal gasification.
- To this you add Oxygen and the result is syngas: **2H<sub>2</sub> + CO**.
- Syngas is the building block for coal based alternate energy production.
- The Syngas can yield different products by adding Hydrogen and CO.

This is the N, in **(2n+1)H<sub>2</sub>+nCO yields C<sub>n</sub>H<sub>2n+2</sub> + nH<sub>2</sub>O**

- Changing the value of N changes the end product:

Chemical	Product	N value	H/C ratio
CH <sub>4</sub>	methane	N=1	4.0
C <sub>3</sub> H <sub>8</sub>	propane	N=3	2.67
C <sub>8</sub> H <sub>18</sub>	gasoline	N=8	2.25
C <sub>16</sub> H <sub>34</sub>	diesel fuel	N=16	1.89

  - The further one processes Syngas the lower the H/C ratio.
  - We are already well along in the Hydrogen economy.
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## Wabash River

One of the Cleanest Coal Fired  
Power Plants in the World

Gasification operations require more space than the original power plant

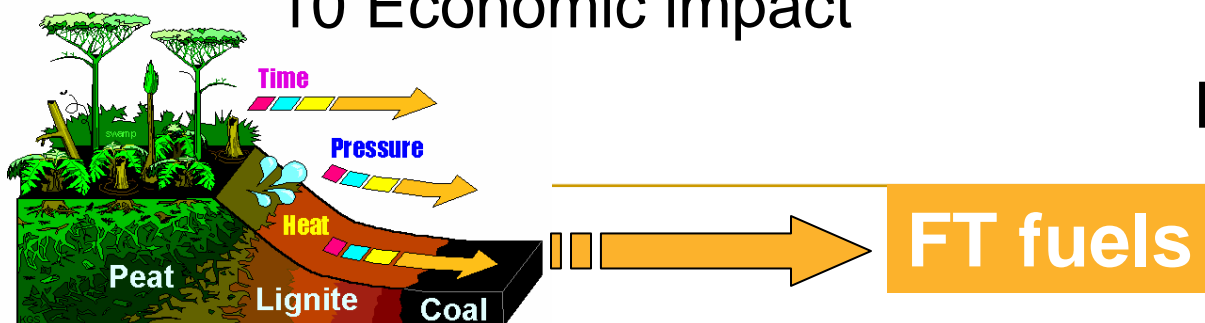




# CRITERIA FOR NSA CRANE FEASIBILITY STUDY – CTL FACILITY

## 10 Criteria

- 1 Coal & natural gas availability for 10,000 B/D FT fuel
- 2 CO<sub>2</sub> sequestration potential
- 3 Land/real-estate requirements
- 4 Transportation infrastructure (rail, roads & waterways)
- 5 Electricity transmission lines & available power
- 6 Gas & oil pipelines
- 7 Water requirements & resources
- 8 Waste disposal/environmental issues
- 9 Labor force requirements/availability
- 10 Economic impact



B/D = Barrels per Day



# CTL Economic Impact

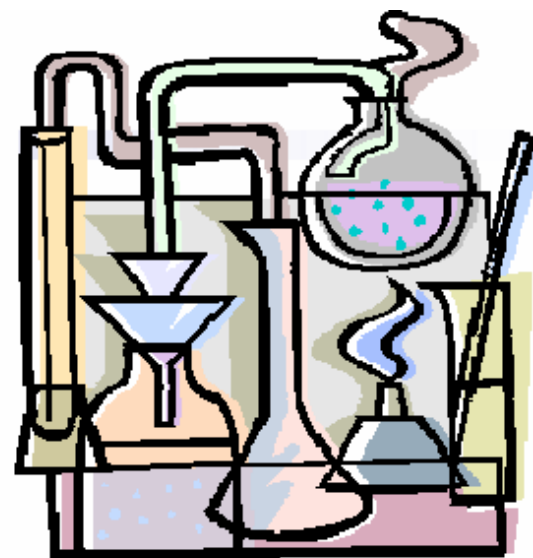
## What in it for us

The overall economic impact of mining 1.8 Million Tons of extra coal is over **\$108 Million per year**



The estimated value of 10,000 B/D production (daily production of over 5,500 barrels of diesel, 4,400 barrels of naphtha, 1,200 MWh & 180 Tons of elemental sulfur) **exceeds \$266 Million per year.**

**Minerals mining has the highest multiplier of any industry.**





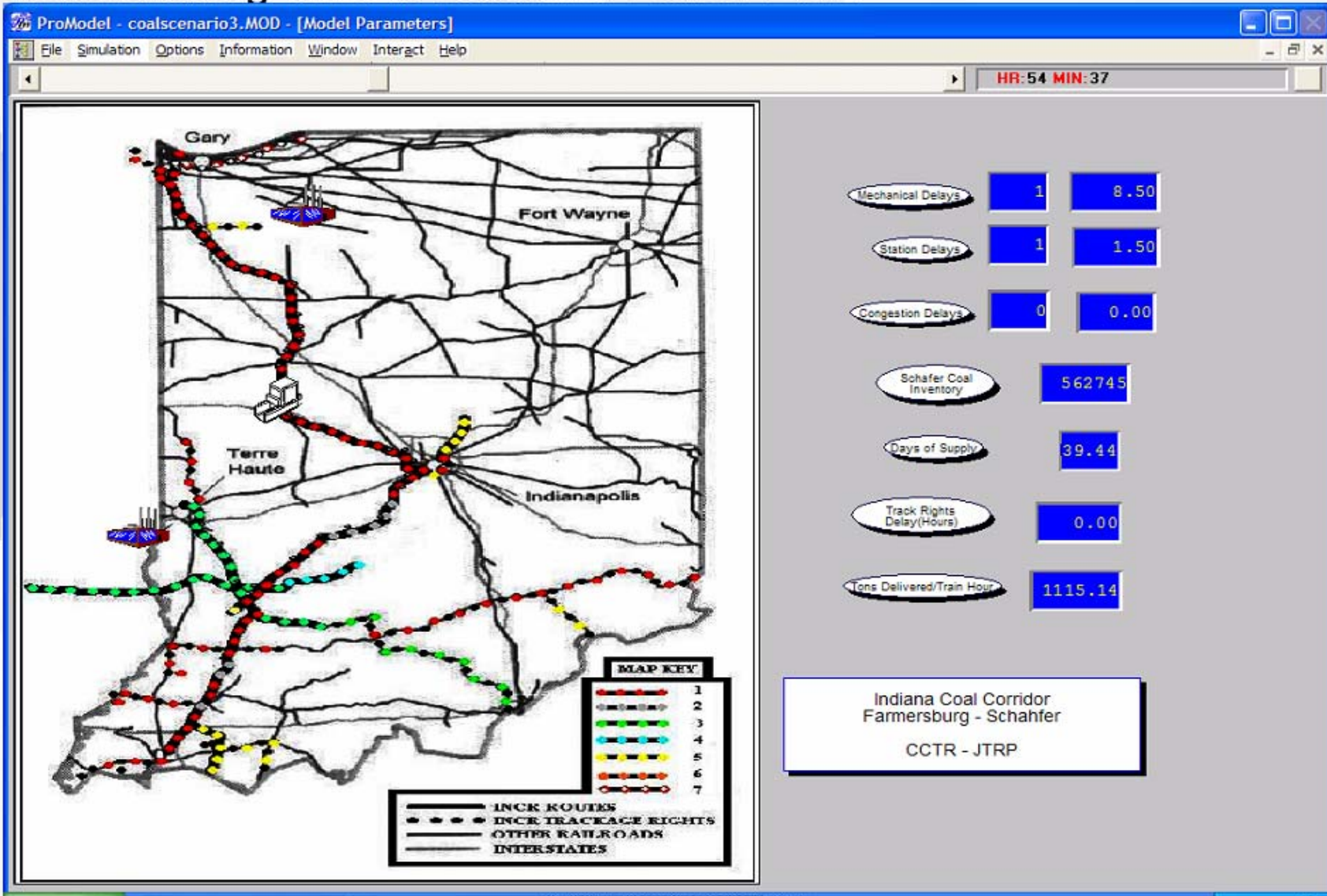
## KEY COAL ELEMENTS IN THE PLAN

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- Common denominator of all thrusts is coal to syngas- allows less expensive removal of CO<sub>2</sub>
  - CO<sub>2</sub> discussion is **Political Science** not Chemical or Environmental Science
  - Syngas use to be encouraged includes:
    - IGCC
    - F/T
    - Ammonia to fertilizer
  - ✓ Interesting Fact: 1 ton of coal would generate \$125 revenue if converted to electricity, \$180 if converted into transportation fuel, with a lower capital investment!
  - ✓ Interesting Question: Then how come we're not up to our necks in Coal to Liquid plants?
    - \$3.9 billion and 5 years, (30,000 bpd) if you already have the land permitted and zoned for major industrials.
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# Scenario 3: Indiana Coal Corridor

## Farmersburg Mine to Schahfer Power Plant

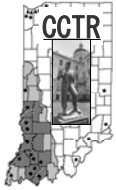




## WHAT NEEDS TO BE DONE NATIONALLY?

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- Major result of the Lugar Energy Security Summit:
  - Create a variable subsidy for alternative fuels that varies with the price of crude oil (CCTR Study)
    - Subsidy would depend on the current price of crude and the cost of alternative fuel production
    - Subsidy would kick in whenever crude price dropped below alternative fuel cost; no subsidy when crude price above cost
    - All this is coming next session: bill to be introduced by Senator Lugar.
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## CONCLUSION

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- Now is a very good time to be producing coal and aggregate in Indiana, and considering expanding corporate presence in Indiana
  - Coal is the answer to the energy and environmental issues, not the problem.
  - We have the pieces:
    - Edwardsport, Wabash, Crane Naval, Indiana Gasification Inc.
    - Coal mines, refinery capacity, Geological structure, natural gas pipelines, rail system and the electric grid system;
    - Indiana is close to the goals of \$1 billion DOE FutureGen project, and we did not submit a proposal.
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## Indiana Center for Coal Technology Research

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- We welcome visits.

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