



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

ENERGY SUMMIT FOR SOUTHWESTERN INDIANA

INDIANA COAL IS **ECONOMIC DEVELOPMENT**

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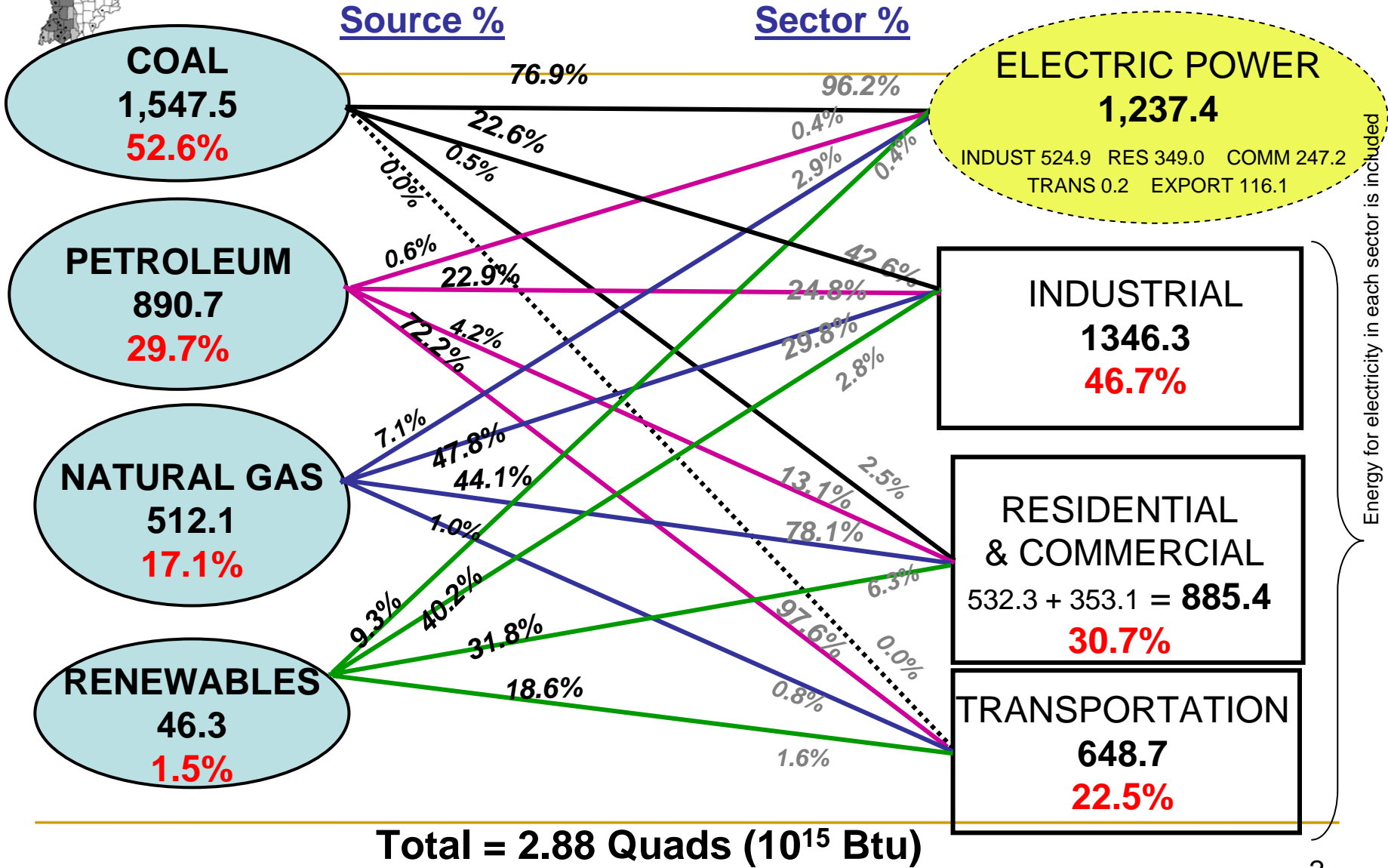
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Indiana Primary Energy Consumption, Source & Sector, 2004

(Trillion Btu, 10^{12} Btu)



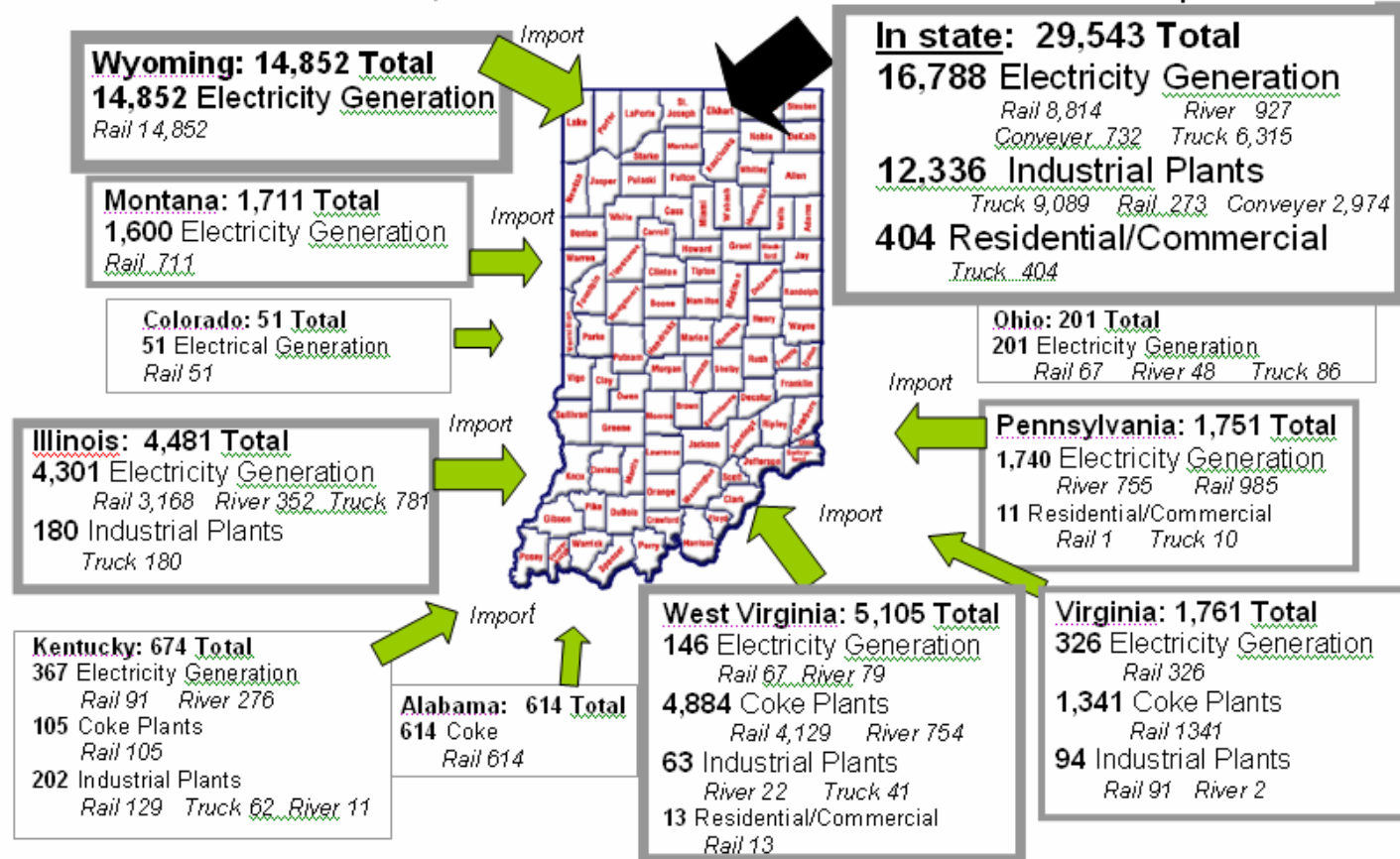
Net inter-state flow of electricity/losses = -116.1



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

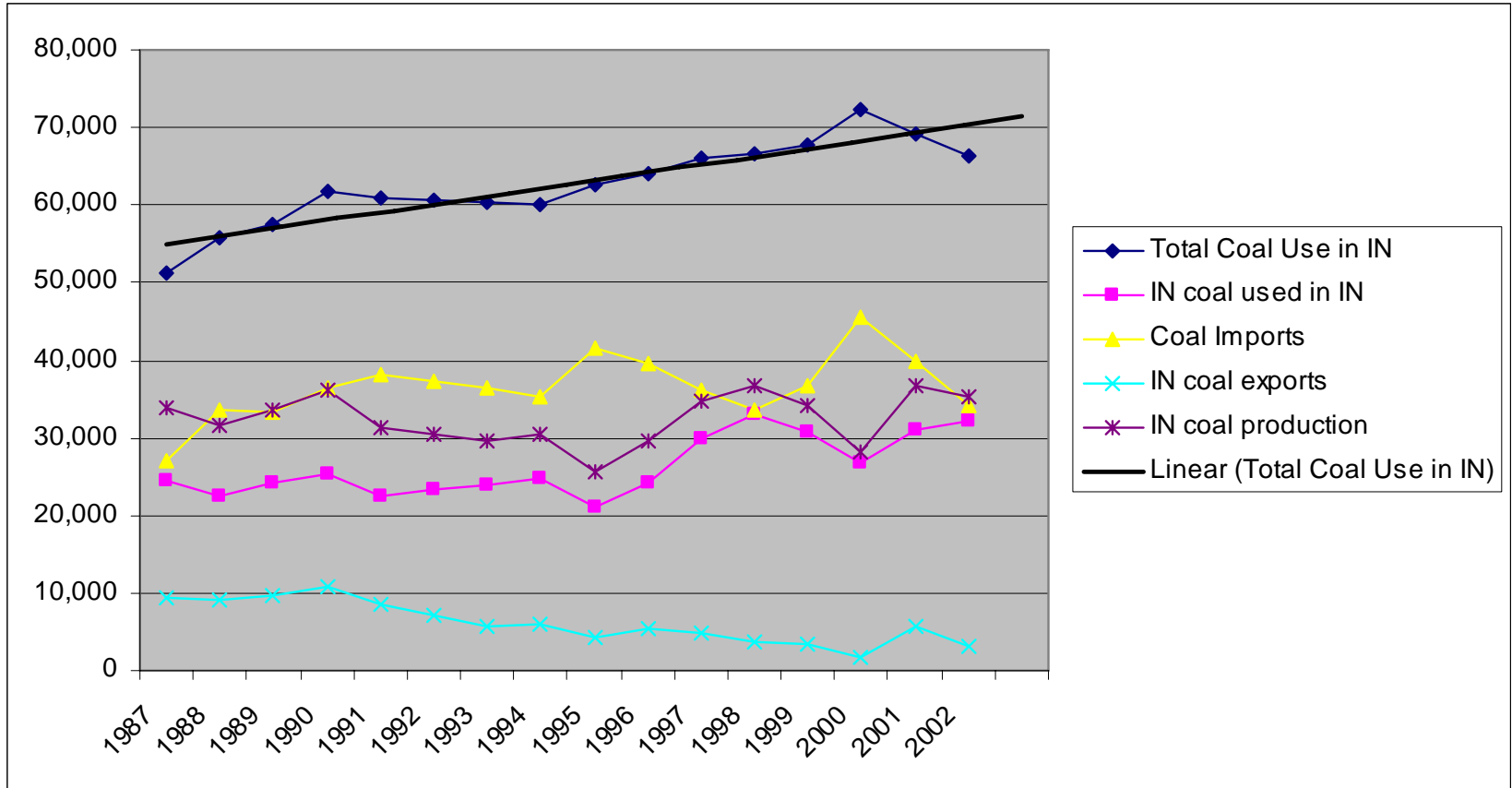
State Totals: **40,481** Electricity Generation
6,944 Coke Plants, **12,875** Industrial Plants
429 Residential/Commercial

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

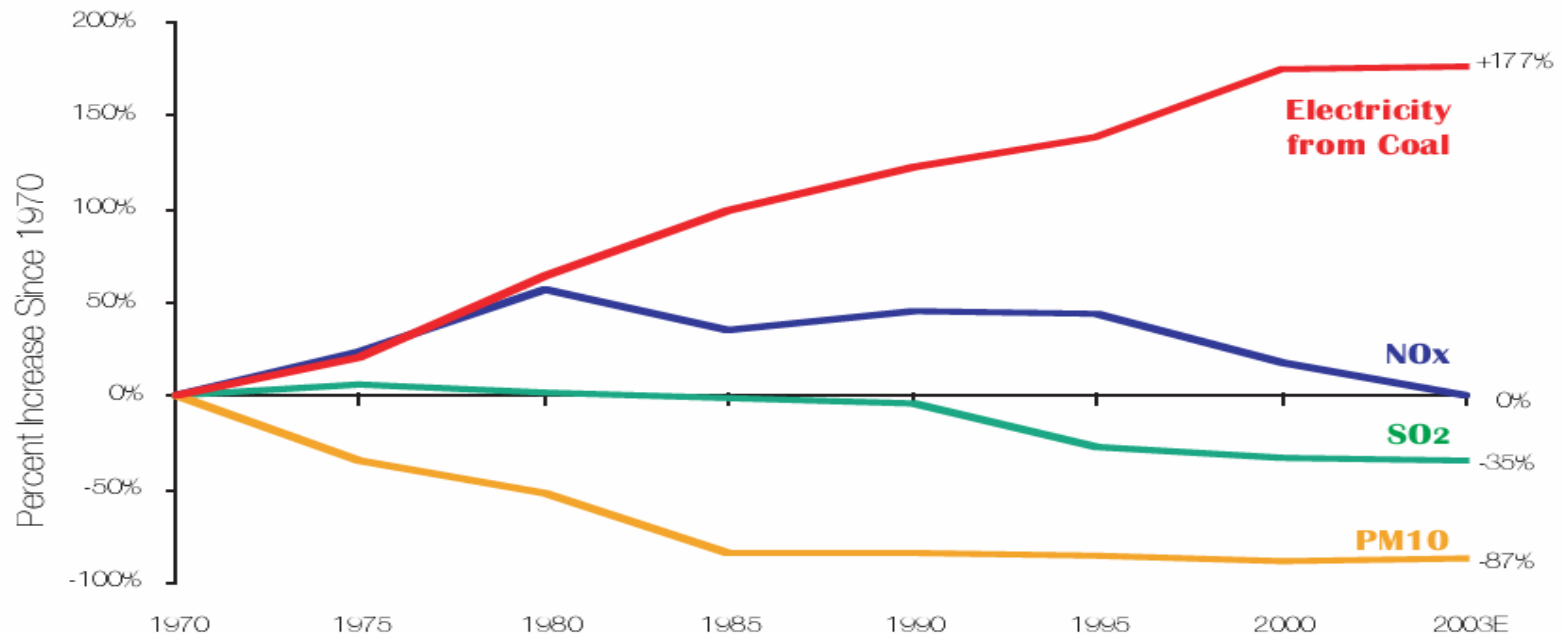


Figure ES.2 Source: EPA National Air Pollutant Emission Trends Dec 2004; EIA Annual Energy Review 2003 (September 2004)

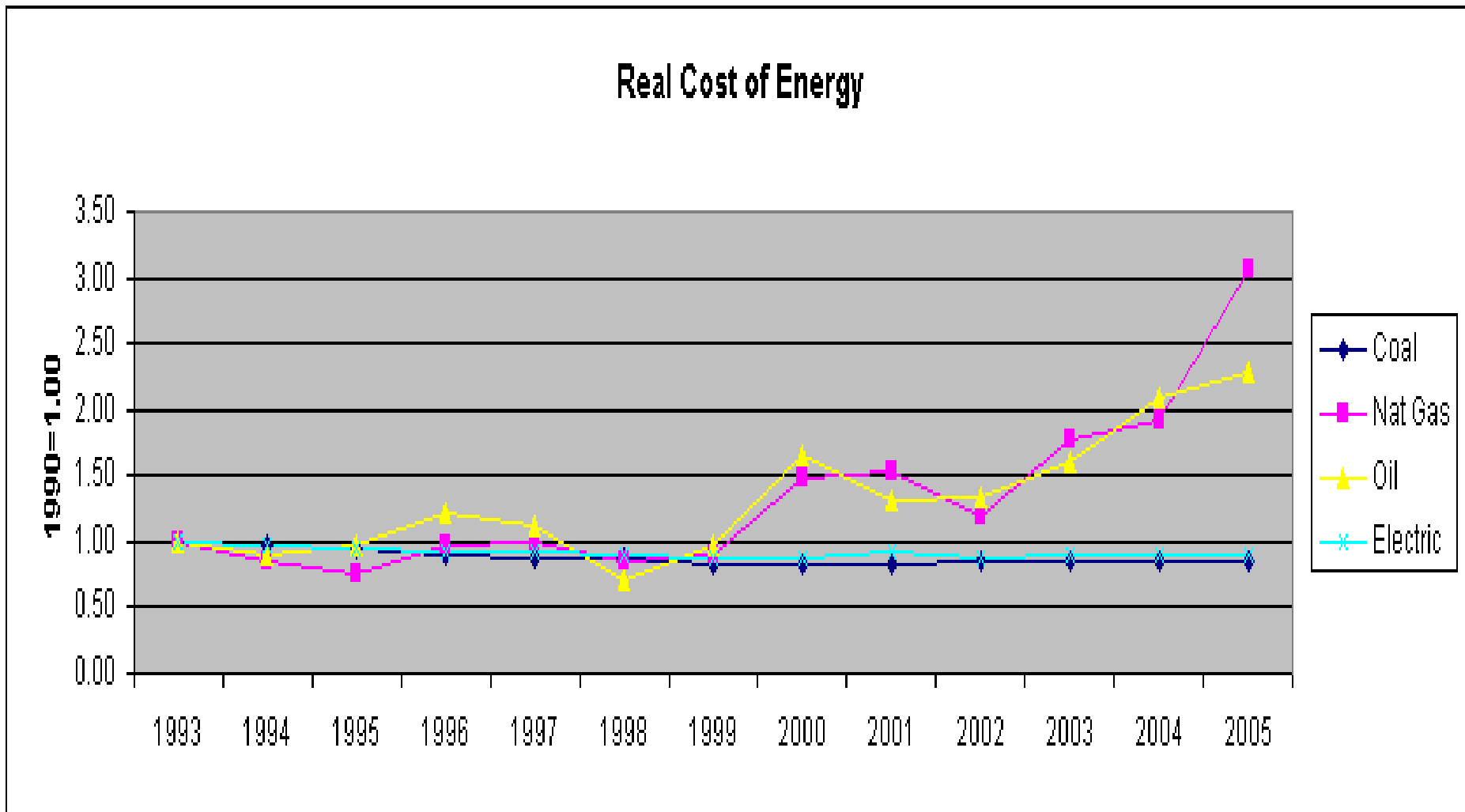


Coal prices are relatively stable in real terms while other forms continue to rise.

In Indiana coal = electricity

Low energy price helps the economy of the state.

If we have a least cost option, use it.

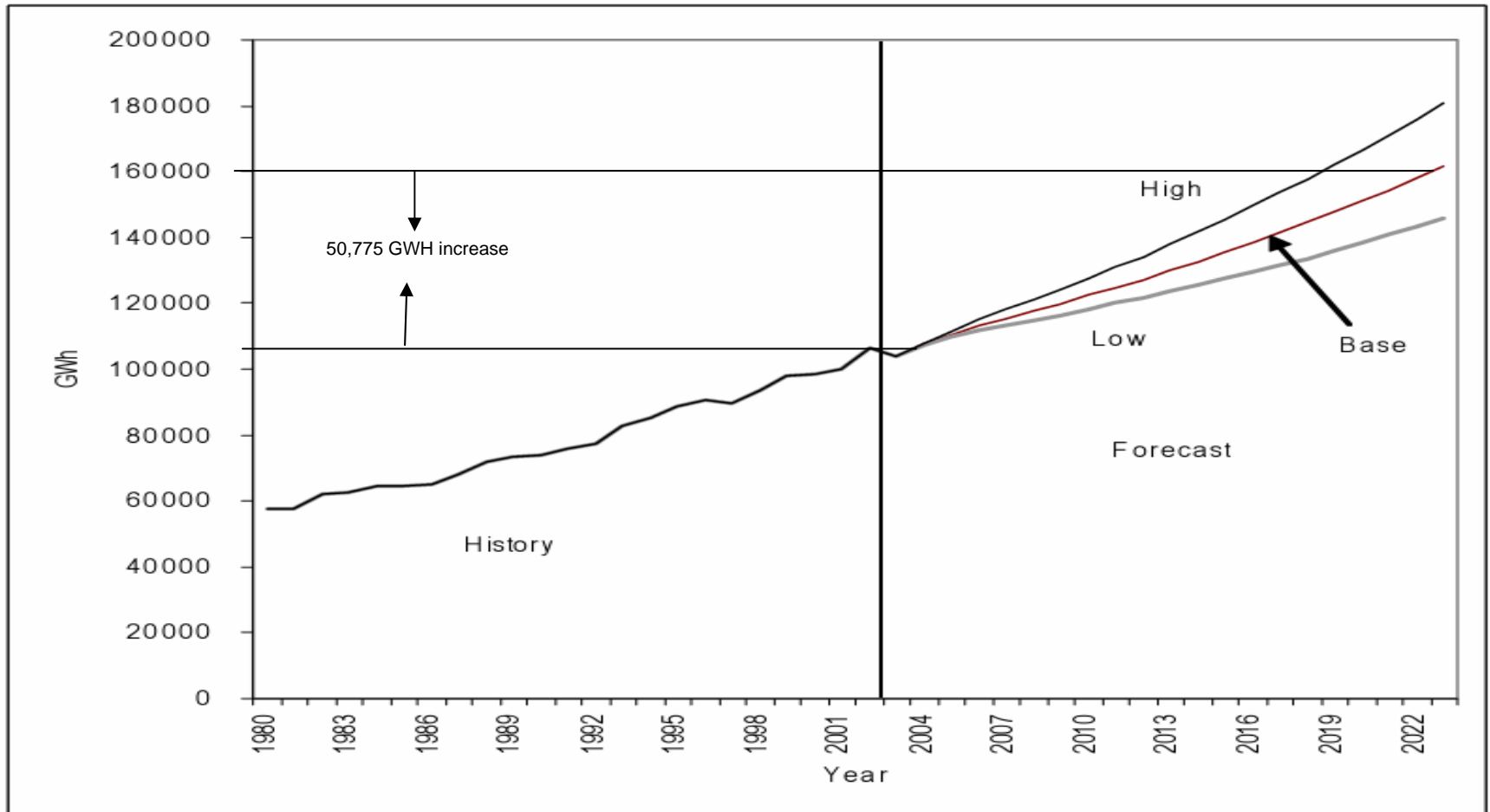




Indiana electric requirement by scenario

45.9% increase in electric demand in next 17 years

SUFG





COAL'S IMPACT

- 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

* Expanding the Utilization of Indiana Coals, page 20



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?

- 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”



CCTR ACTIVITY

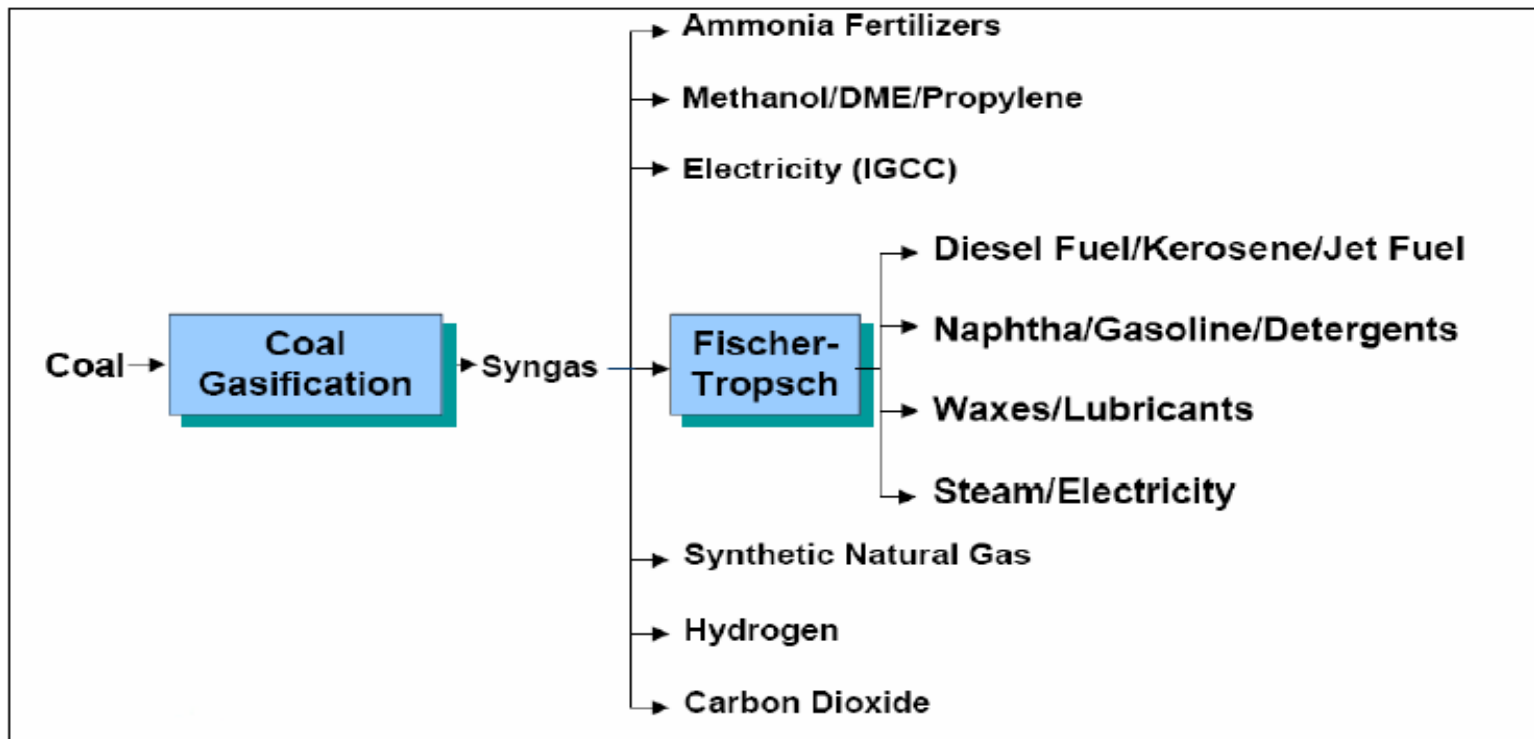
- **Coal Characterization**: Best use of the Indiana coal reserves.
 - **Coal Fines**: Methods to clean and convert the coal waste to energy.
 - **Coal To Liquids**: Evaluate technologies for coal conversion.
 - **Synfuel Park**: Assess the theoretic placement on coal conversion technologies based on the needs and the use of the final product.
 - **Coking Coal**: Develop a method of using Indiana coal to make coke for the steel industry.
 - **Coal Transportation Infrastructure**: Study of the need to alter the States infrastructure so as to allow the use of Indiana coal in the northern parts of the state.
 - **Coal Combustion**: Develop new means of burning coals in boilers that will lower emission and higher efficiency.
 - **Crane Coal to liquids study**: Feasibility of placing a coal to liquids facility within the Crane military facility.
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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



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

- The basic process described above requires varying amounts of hydrogen. CH₄ is methane and is the basic product of coal gasification.
- To this you add Oxygen and the result is syngas: **2H₂ + 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)H₂+nCO yields C_nH_{2n+2} + nH₂O**

- Changing the value of N changes the end product:

Chemical	Product	N value	H/C ratio
CH ₄	methane	N=1	4.0
C ₃ H ₈	propane	N=3	2.67
C ₈ H ₁₈	gasoline	N=8	2.25
C ₁₆ H ₃₄	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.



Wabash River

One of the Cleanest Coal Fired
Power Plants in the World

Gasification operations require more space than the original power plant





CTL Economic Impact

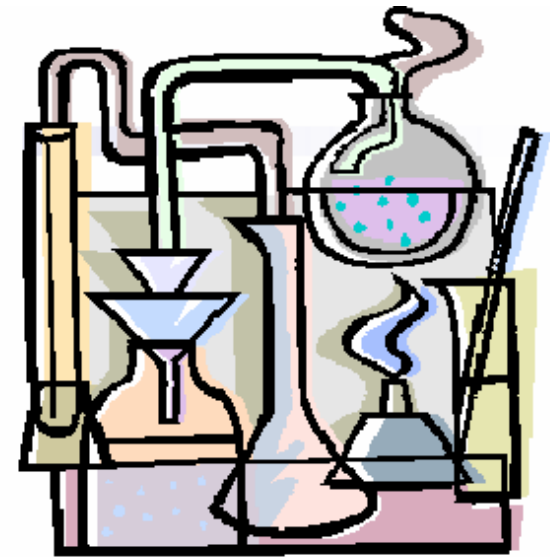
What in it for us

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.**

Mining has the highest multiplier of any industry.



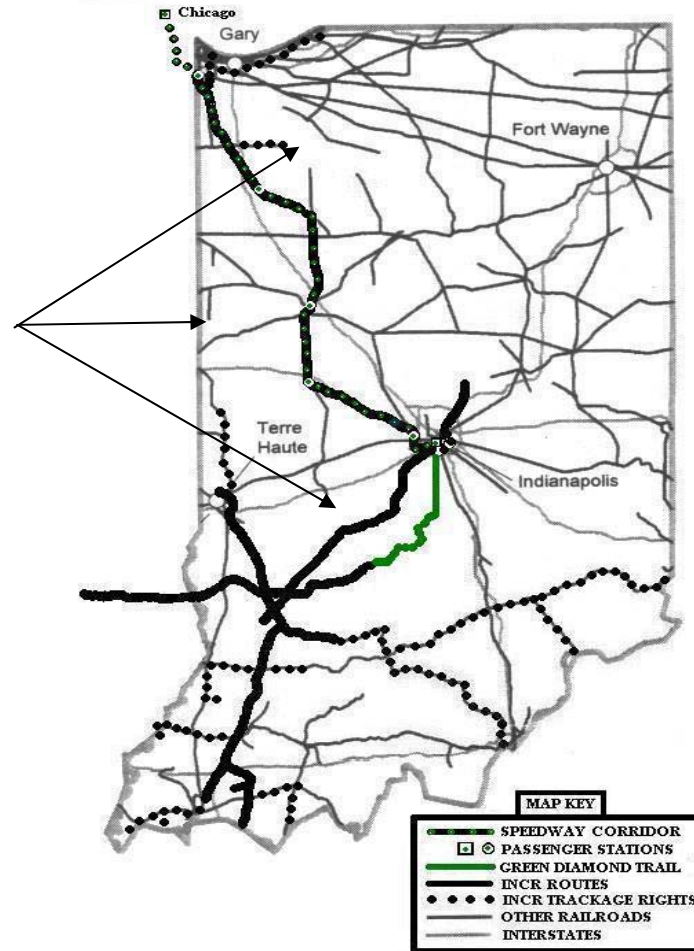


Develop an in-depth scenario involving new rail infrastructure development

Infrastructure changes including the “missing Links” will enable Indiana coal to be moved north but bypassing Terre Haute, Indianapolis and Chicago

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

As little as 17 miles of new track will cut the time needed to move coal by **HALF**





CONCLUSION

- 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

Located in the Energy Center at Discovery Park, Purdue University

- We welcome visits.

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