Indiana Center for Coal Technology Research

Located in The Energy Center at Discovery Park, Purdue University

Coal Essentials for the Future

Marty W. Irwin

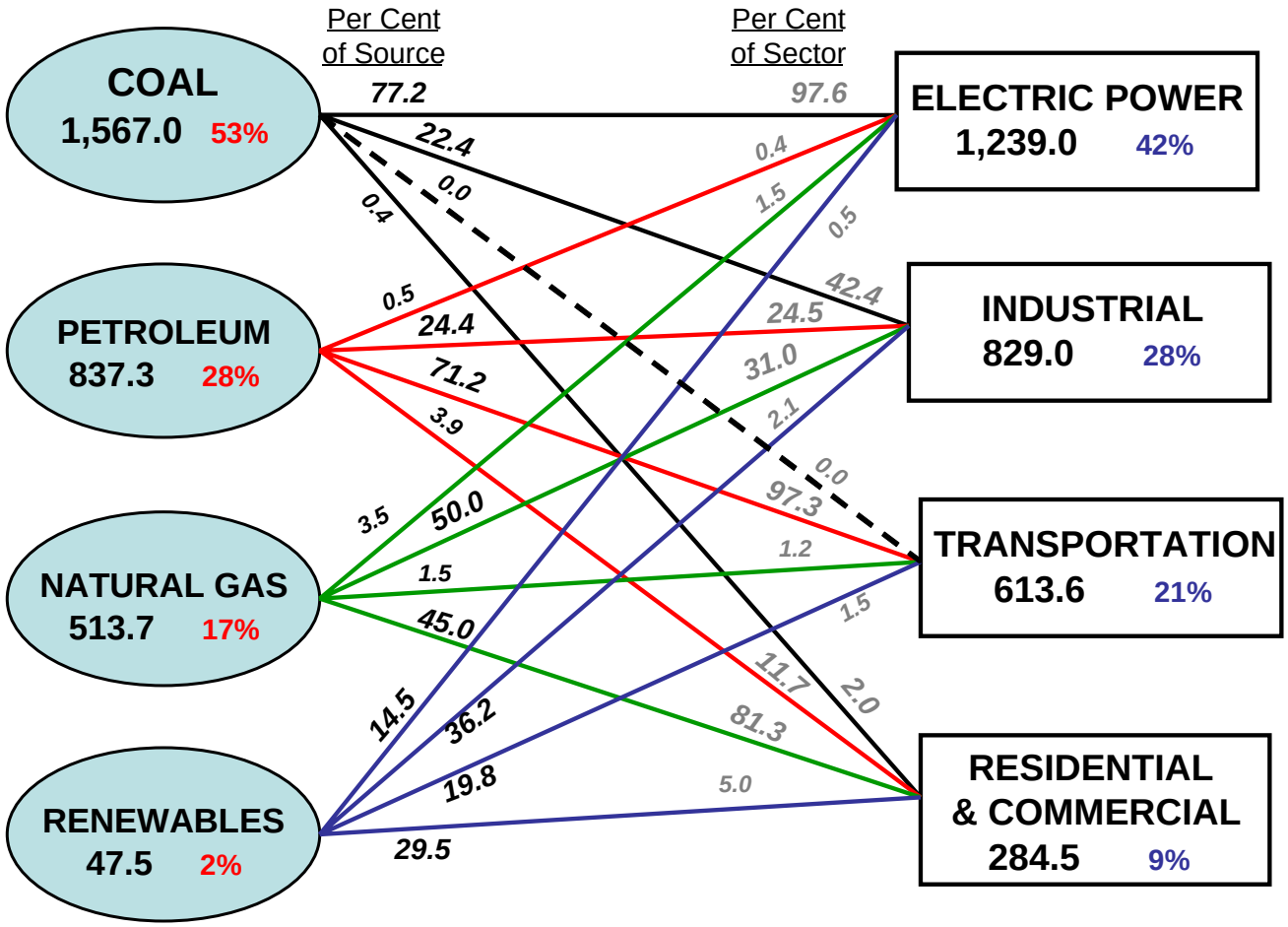
CCTR Advisory Panel Meeting
West Lafayette
August 30, 2006

Current CCTR Projects

Topic	Topic	Institution & Location	Total Budget	Contact Person & Contract Dates
6-CTR001	Energy Outreach Program	CCTR, Purdue Office of Energy and Defense Development	$179,417	M.W. Irwin April 1, 2006 ~ March 31, 2007
6- CTR002	Coal To Liquids	Coal Transformation Laboratory, Purdue West Lafayette	$150,000	F.T. Sparrow April 1, 2006 ~ March 31, 2007
6-CTR003	Clean Coal Technologies	PEMRG, Purdue, West Lafayette	$150,000	Ronald Rardin April 1, 2006 ~ March 31, 2007
6-CTR004	Indiana Coking Coals	Purdue Calumet Hammond	$100,000	Robert Kramer April 1, 2006 ~ March 31, 2007
6-CTR005	Coal Transportation	Purdue North Central Westville	$ 25,000	Tom Brady April 1, 2006 ~ December 31, 2006
CCTR06-01	Coal Characteristics	IGS, Indiana Geological Survey, Bloomington	$100,000	Maria Mastalerz July 1, 2006 ~ June 30, 2008
CCTR06-02	Indiana Coal Fines	REMA, R Mourdock Inglefield	$111,980	Richard Mourdock August 1, 2006 ~ May 30, 2007

Where We Are ~ Primary Energy Use

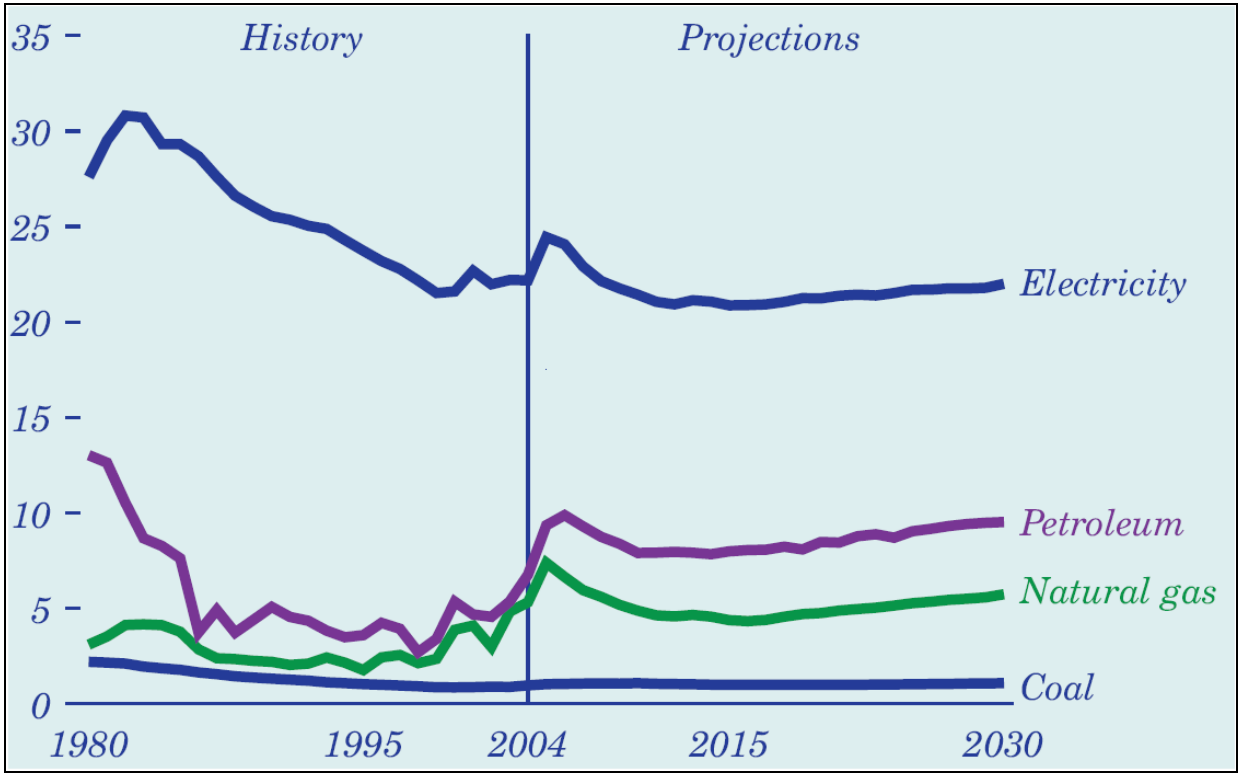
(2001 Trillion Btu)



Data Source: http://www.eia.doe.gov/emeu/states/_states.html

Relatively Stable Low Coal Prices

1980-2025 (2004 $/MBtu)

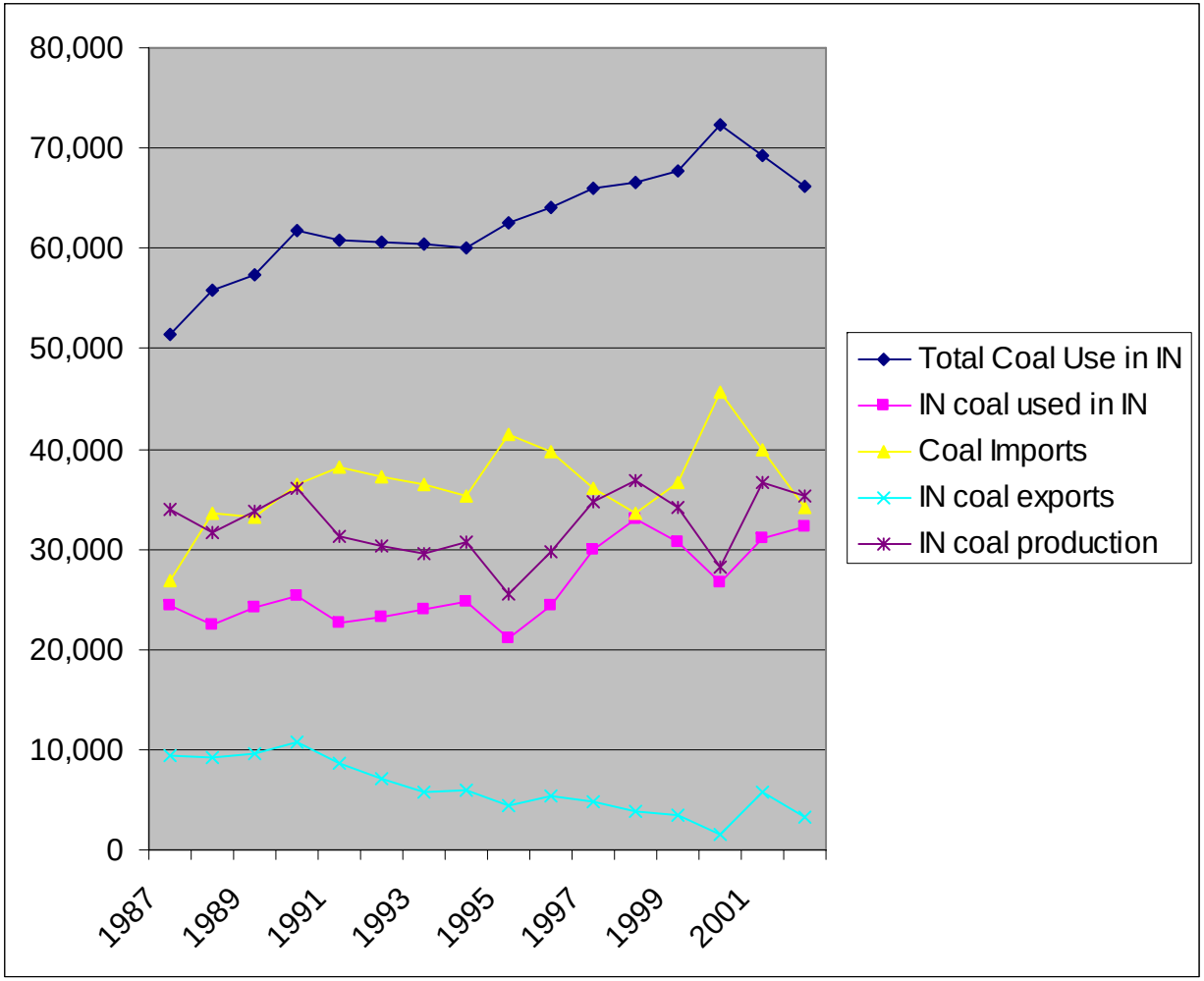


Low energy price helps the economy of the state.
If we have a least cost option, let's use it.

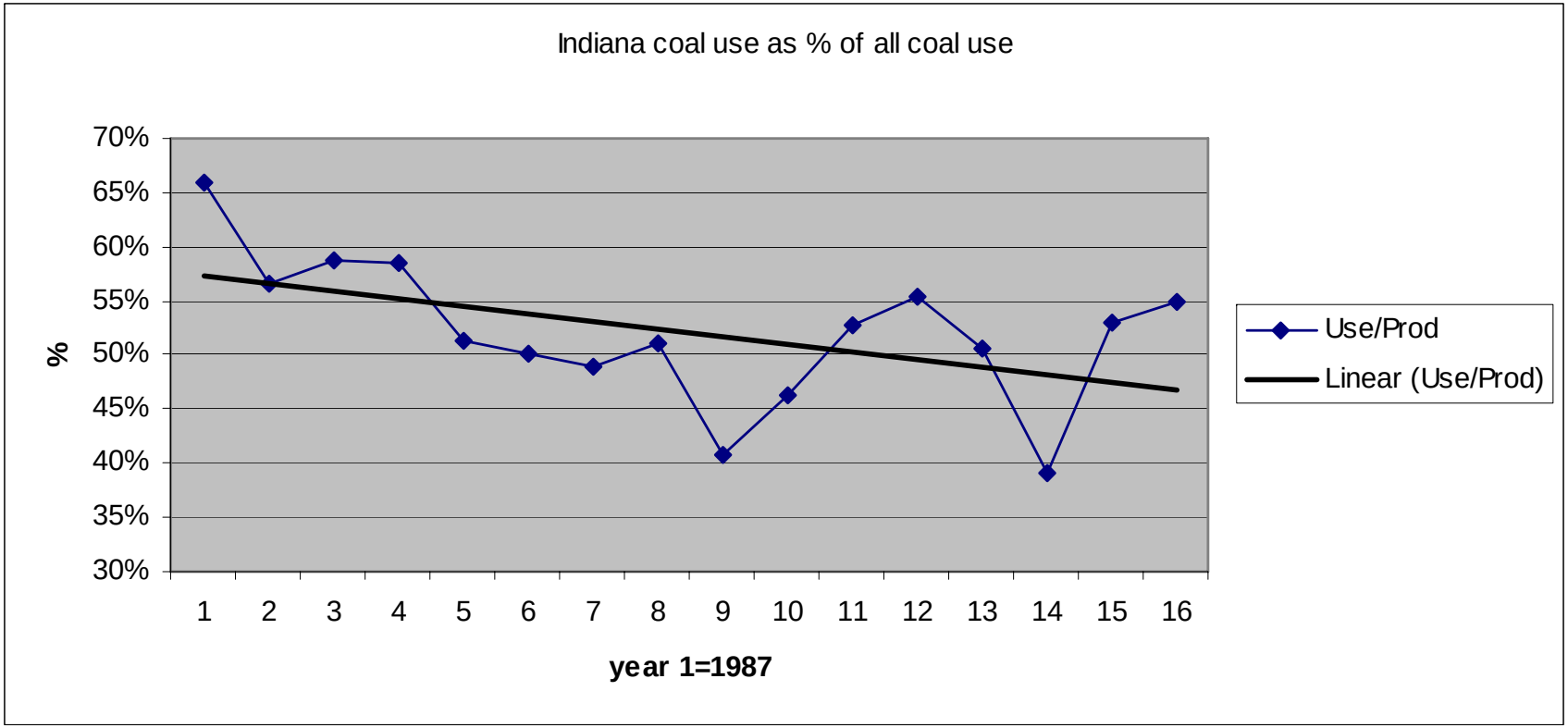
Source: EIA Annual Energy Outlook 2006, http://www.eia.doe.gov/oiaf/aeo/index.html

Coal use Trend

(000 tons)

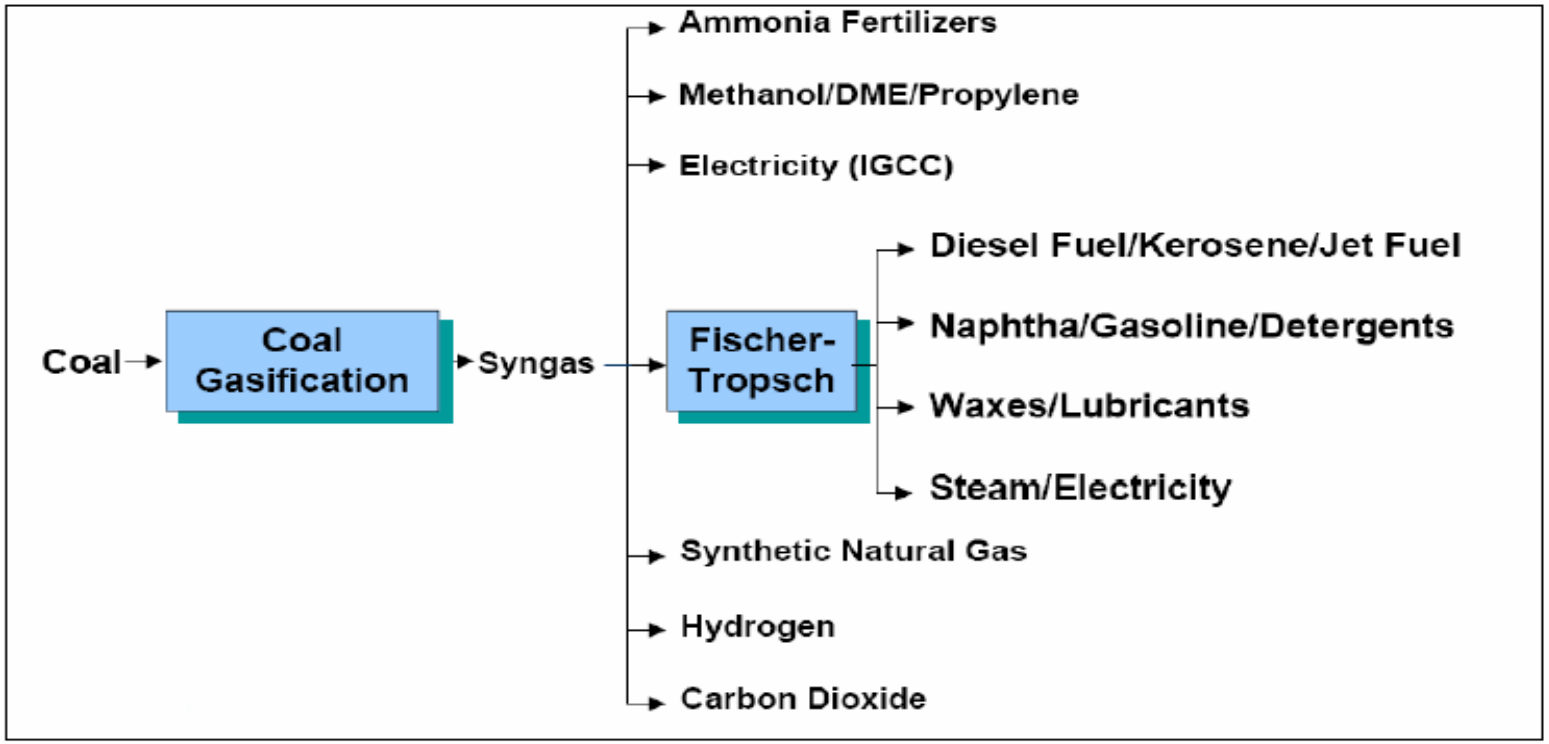


Indiana Coal Production is Not Keeping Pace with its Coal Consumption



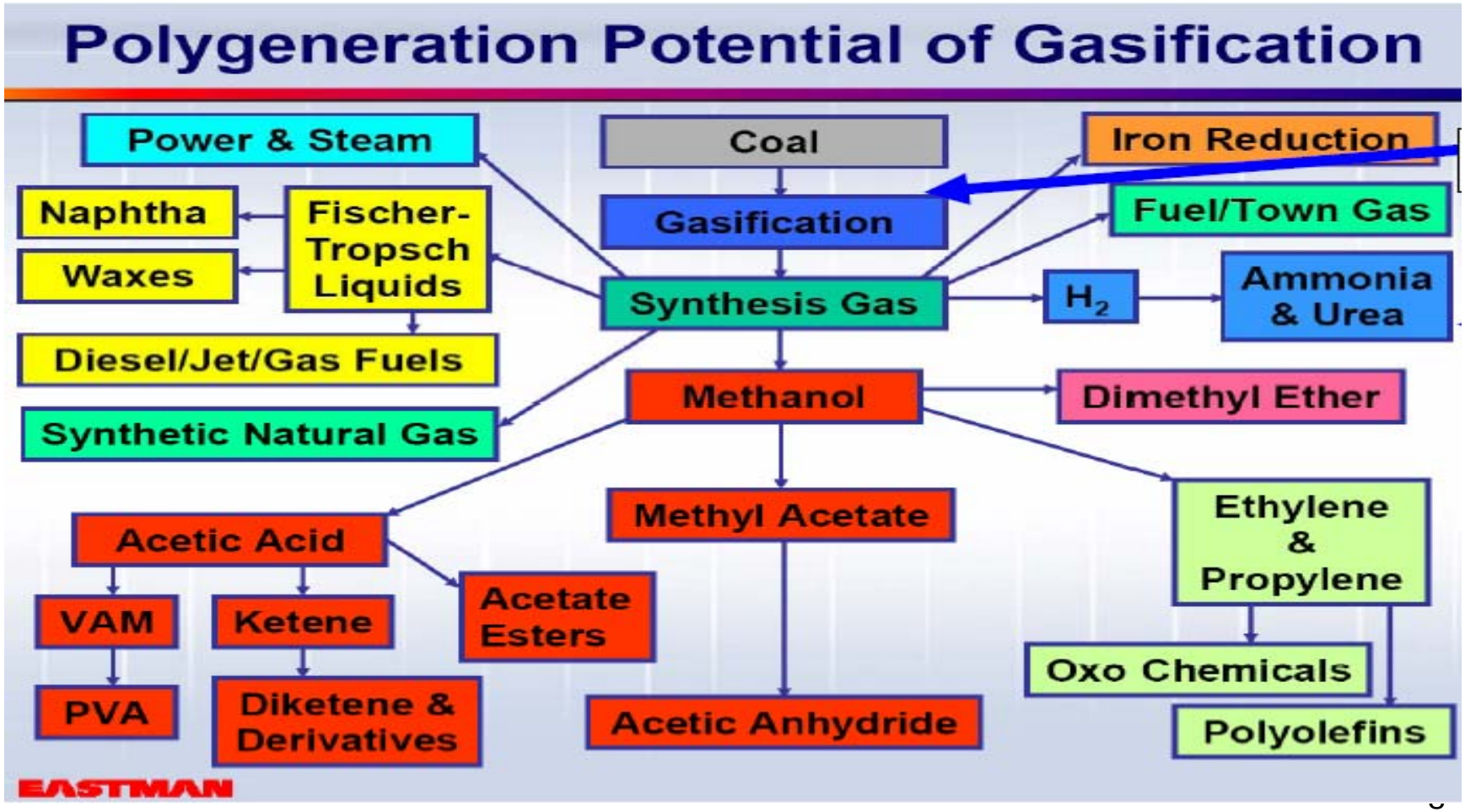
How to Get There?
Convert Coal to a Usable Resource

Potential Coal-Derived Products



Source: GTI Gasification Symposium, December 2, 2004
http://www.gastechnology.org/webroot/downloads/en/1ResearchCap/1_8GasificationandGasProcessing/LepinskiSmall.pdf

Options After Gasification



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 ratio of CO/H2 can be adjusted to yield different products by adding Hydrogen.
- This is the N, in **(2n+1)H2+nCO yields CnH2n+2 + nH2O**
- For example: change the value of N changes the end product.

Chemical	Product	N value	H/C ratio
CH4	Methane	N=1	4.0
C3H8	Propane	N=3	2.67
C8H18	Gasoline	N=8	2.25
C16H34	Diesel fuel	N=16	1.89

- The further one processes Syngas the lower the H/C ratio.
- All based on the same syngas, 2H2 + CO.

Indiana's Future ~ 1

Indiana's energy and economic come back will be outlined in the Hoosier Homegrown Energy Plan.

CCTR will work with the Indiana Office of Energy and Defense Development Group to detail how Indiana's economy, quality of life and well being will once again be built on home grown energy.

New technologies will allow us to fully utilize our high sulfur coal, create new, homemade synthetic gas from coal and convert it into motor fuels and unleash our ingenuity on the goal of increased energy efficiency.

Indiana's Future ~ 2

Some of the new, high paying jobs in our community will be in mining, and in energy operations and management. Purdue and Indiana Universities, Indiana State, IVY Tech, Vincennes University and others, will train highly skilled engineers to run sophisticated, computer driven power plans and private sector energy systems while others will manage coal mines and sequestration programs and energy distribution networks.

Purdue's Energy Center will become a national center in clean coal technology, hydrogen and renewable energies. Indiana will build new coal gasification, coal processing, facilities, creating clean power and energy from local coal and shale and biomass resources. New technologies, opportunities and challenges will emerge.

CCTR Next Meeting

Tuesday, November 21, 2006

Purdue Calumet
Energy Efficiency and Reliability Center

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Hammond, IN 46323-2094
Dr. Robert Kramer, Director
219-989-2147