



Gasification Technologies Council Workshop on Gasification Technologies

**Martin Considine
Vice President - Technology
Tampa, Florida
March 3, 2006**

- Why BTU Conversion?
- What is BTU Conversion?
- Opportunities for Peabody



Why BTU Conversion ?



Coal: Cornerstone to America's Energy Security

World Oil Reserves May Have Peaked

Growing Gas Demand Requires Unrealistic Imports

America is Short on Oil & Gas & Very Long on Coal

U.S. Coal is the Cornerstone to U.S. Energy Security

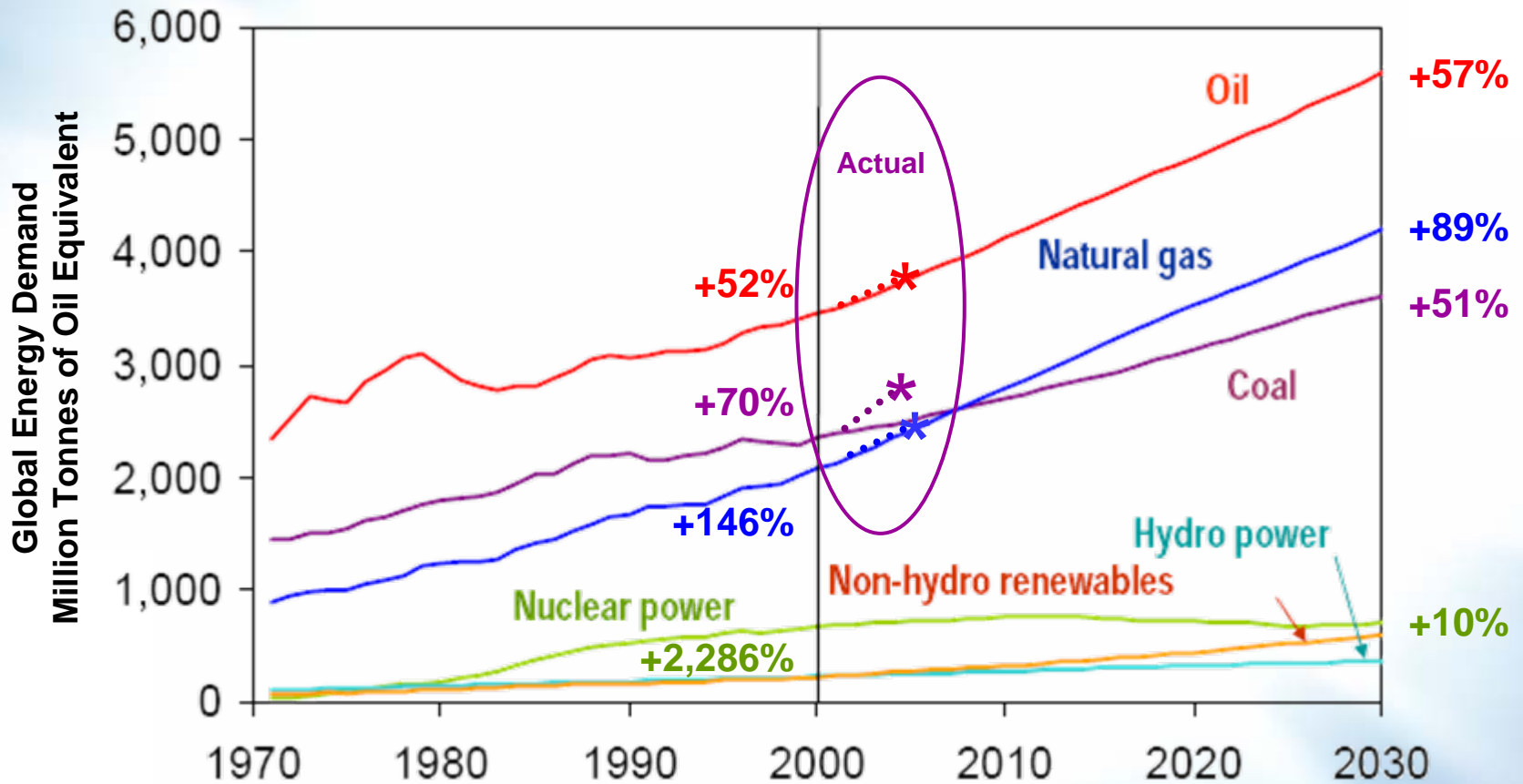
...For Advanced Power Generation

...For Substitute Fuels: Gasoline, Natural Gas & Hydrogen

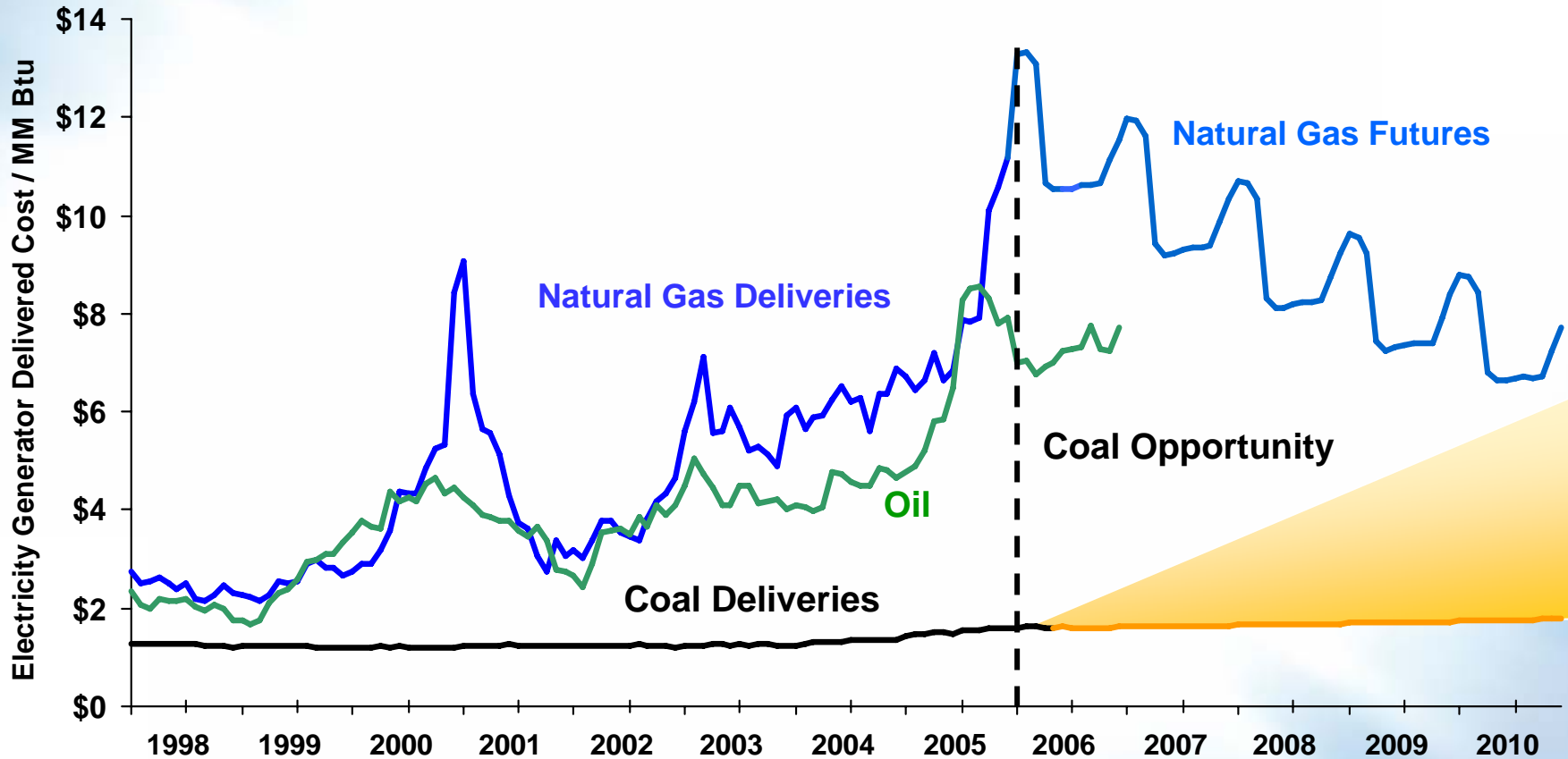
...For the Reindustrialization of America

...For Environmental Improvements

Coal Resources Are Meeting Higher Demand



High Oil and Gas Prices Magnify Coal's Competitive Advantage

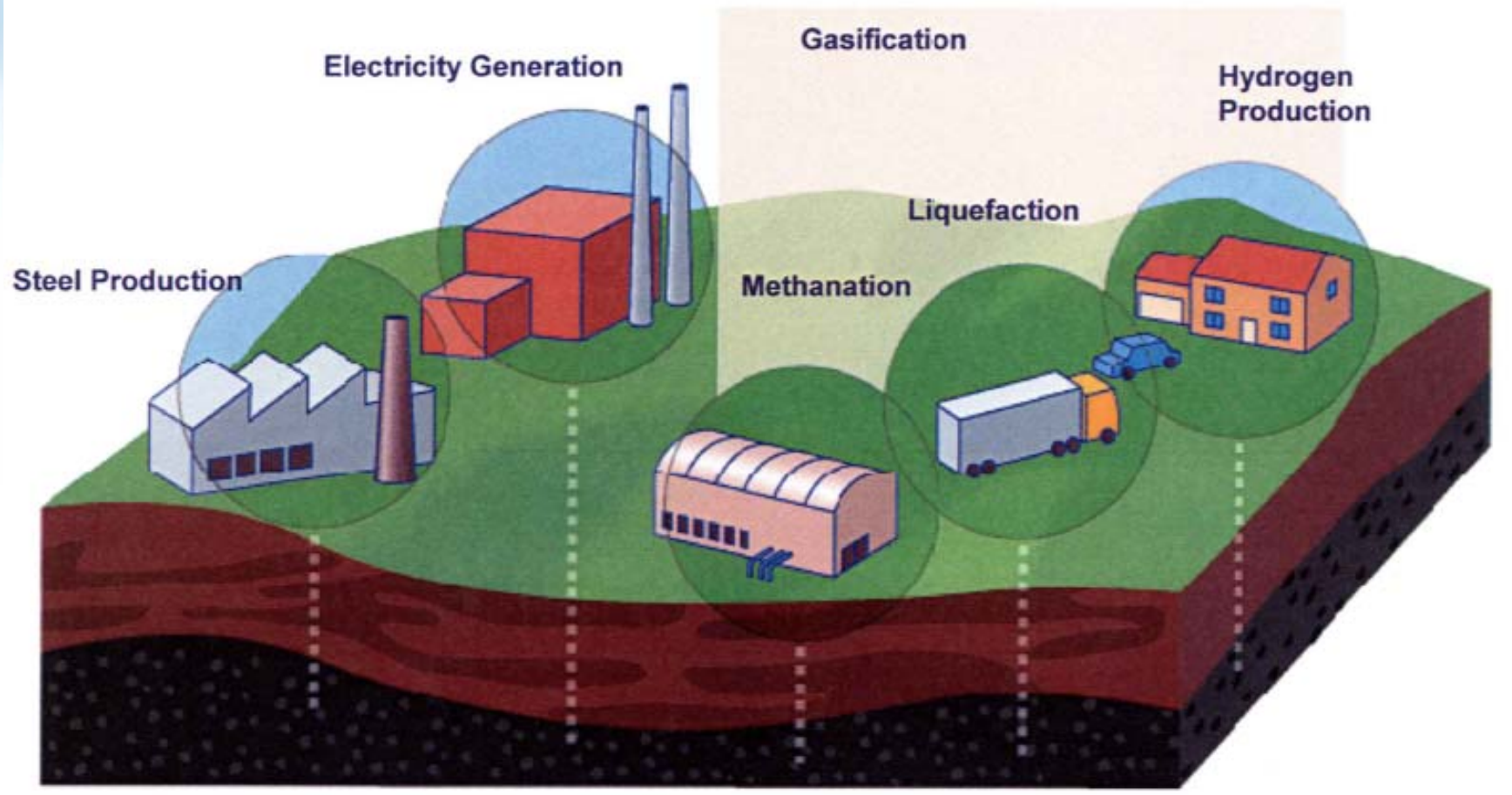


Delivered cost of fossil fuel at steam electric utility plants.

Source: Platts Fossil-Fuel Receipts at Steam-Electric Utility Plants through June 2005. EIA November 2005 Short-Term Energy Outlook, July – November 2005. NYMEX HH Futures December 2005 – December 2010, ino.com on Dec. 2, 2005.

Coal's Long-Term Markets Expanding from Two to Five

Emerging Markets Include Gasification, Liquefaction & Hydrogen







- Product demand is outstripping supply
- Crude prices have doubled
- Natural gas supply has challenges
- Hurricane impact on USGC refineries
- Domestic coal supply is plentiful
- Gasification has numerous applications
- Security of supply is a priority

ENERGY FOR THE 21ST CENTURY

COAL

Today's technologies can convert U.S. coal into:


-  **Clean Electricity** to power growing cities.
-  **Transportation Fuels** to keep our economy moving.
-  **Natural Gas** to warm homes and families in winter.
-  **Hydrogen** to energize fuel cells of tomorrow.

Yeah... coal can do that.

Today, coal fuels more than 50% of U.S. electricity. America has the largest coal reserves in the world... and greater use of this clean and affordable fuel can reduce our reliance on foreign oil and liquefied natural gas.

Peabody Energy (NYSE: BTU) is the world's largest provider of coal to fuel 21st Century energy solutions.

CoalCanDoThat.com





What is BTU Conversion ?

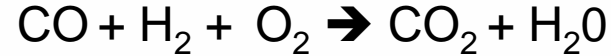
- Gasification is a controlled partial oxidation of fuels, such as coal, to produce primarily carbon monoxide (CO) and hydrogen (H₂), called syngas; rather than complete combustion to carbon dioxide (CO₂) and water (H₂O).



- Since the gasification process occurs in an oxygen-limited state, many bad actors, such as sulfur compounds, are converted to more easily handled compounds (such as hydrogen sulfide) that can be treated in a process stream, rather than more difficult compounds (such as SO_x) that have to be treated as flue/stack gas streams in conventional combustion processes.
- Other bad actors (such as NO_x, particulates, mercury, heavy and light metals) can also be treated relatively easily, compared to conventional combustion processes.
- Additionally, carbon (in the form of carbon dioxide) can be extracted relatively easily (at high pressure) from the syngas prior to its use. This carbon dioxide can be used either beneficially (such as in enhanced oil recovery) or sequestered.
- Due to the high reaction temperature and reduced oxygen environment, other organic contaminants (tars, oils, PCBs, furans) are generally destroyed in the gasification process
- Once produced, syngas is a valuable product for use as an industrial fuel, for energy (as in IGCC), and for other chemical applications.

What Can You do with Syngas ?

- Combustion:
(for fuel)



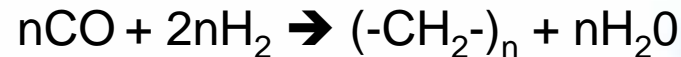
- Water Gas Shift:
(for hydrogen and CO₂ recovery)



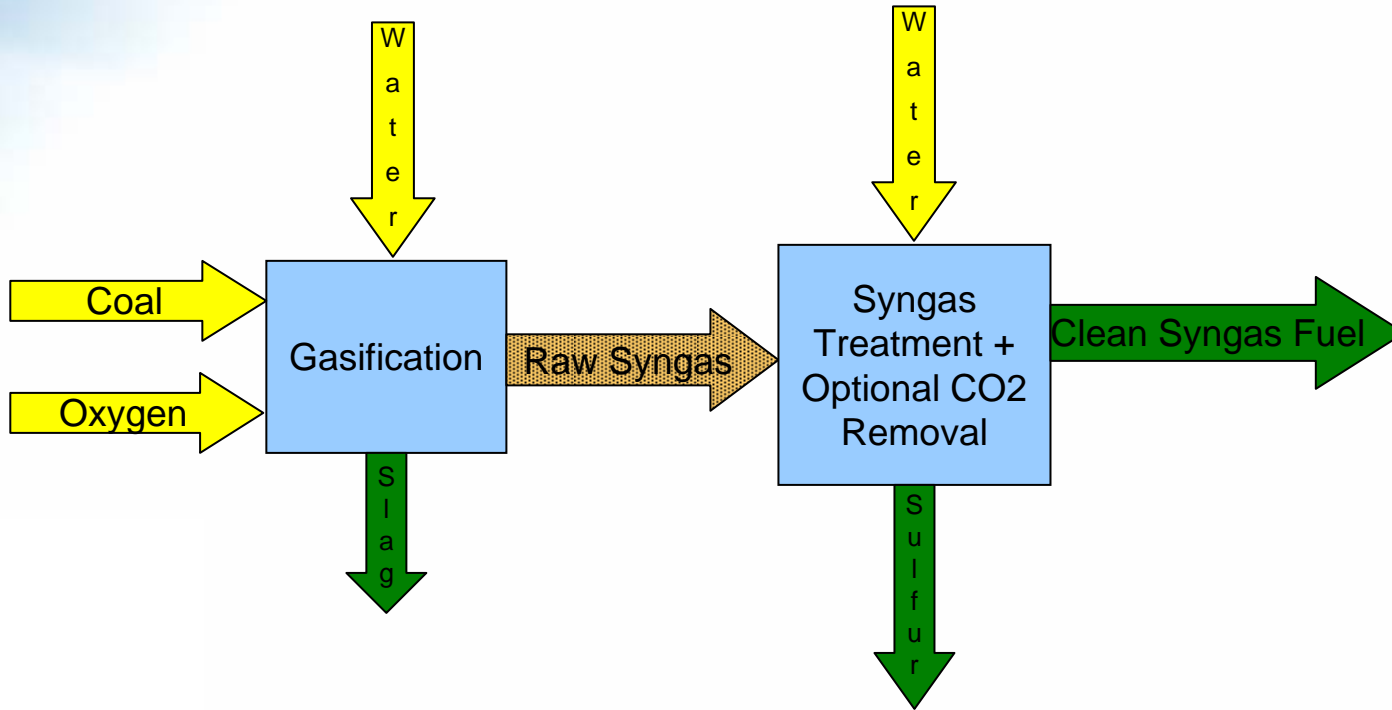
- Methanation:
(for SNG)



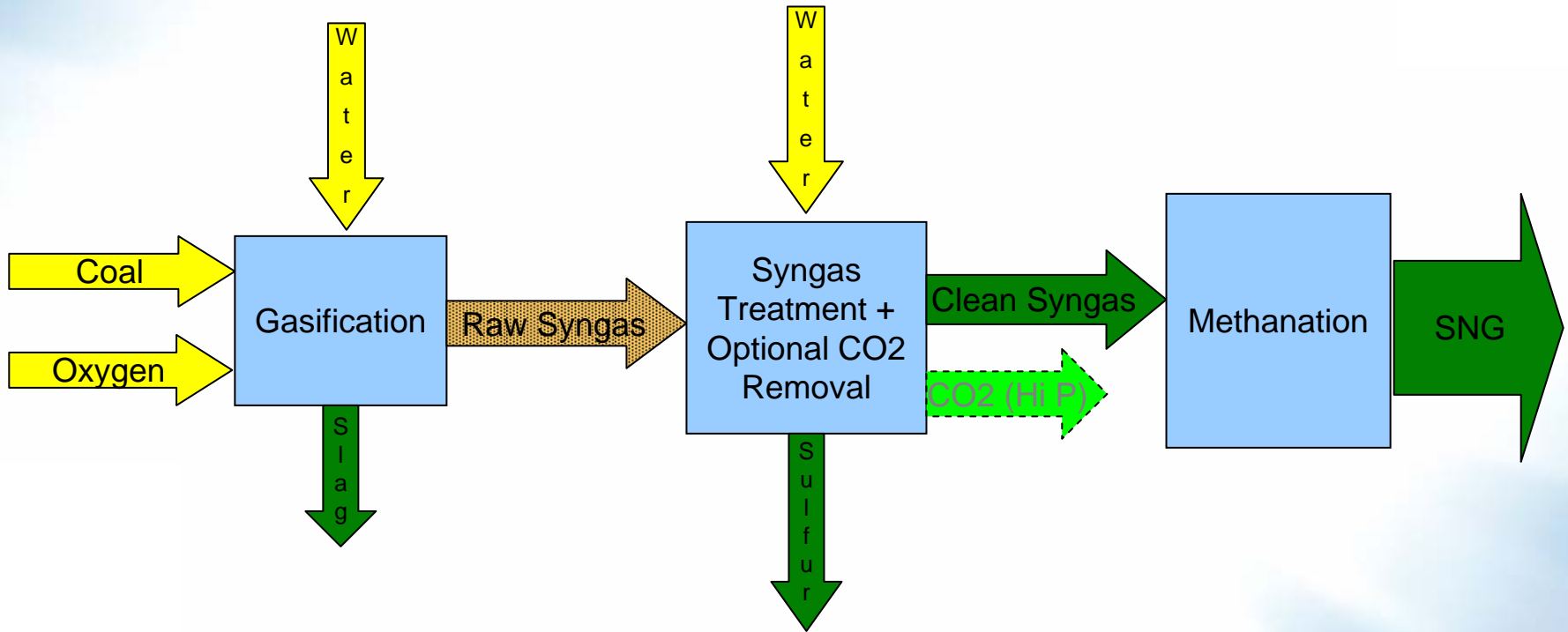
- Fischer-Tropsch:
(for diesel and naphtha)



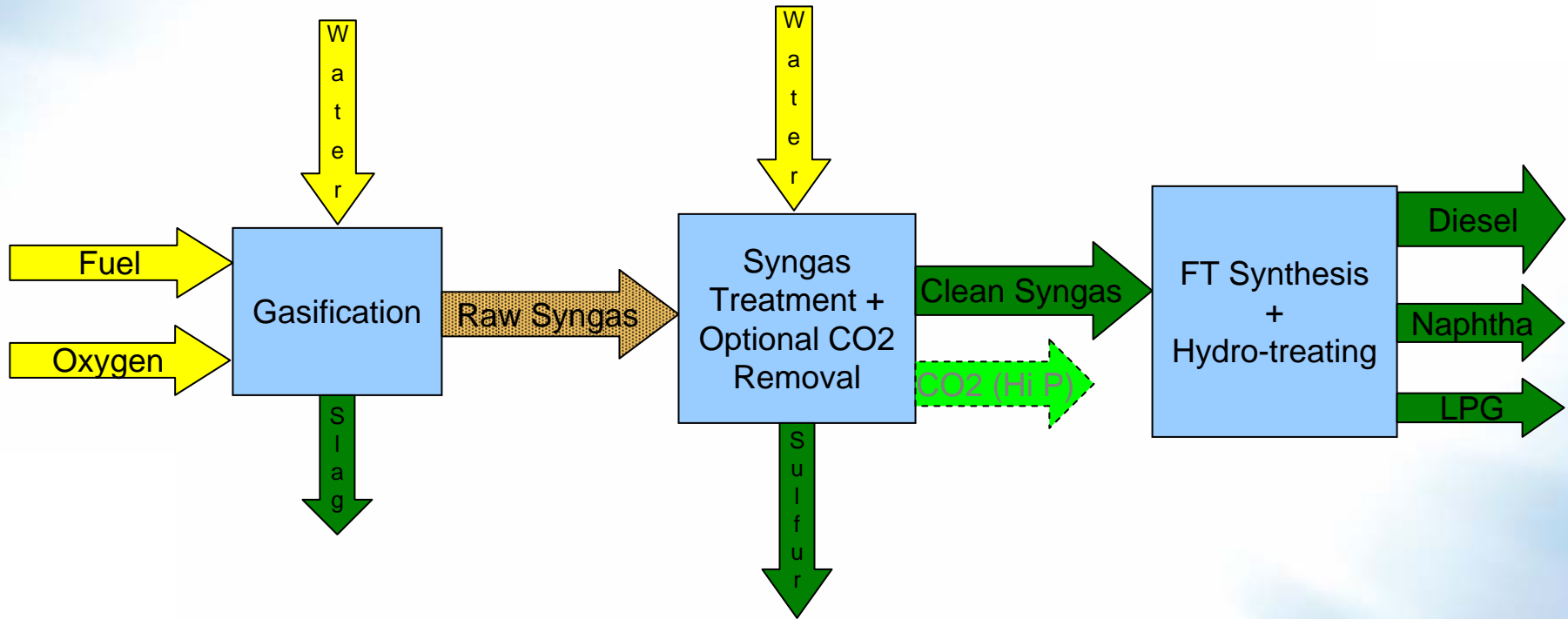
+ hydro-treating / refining

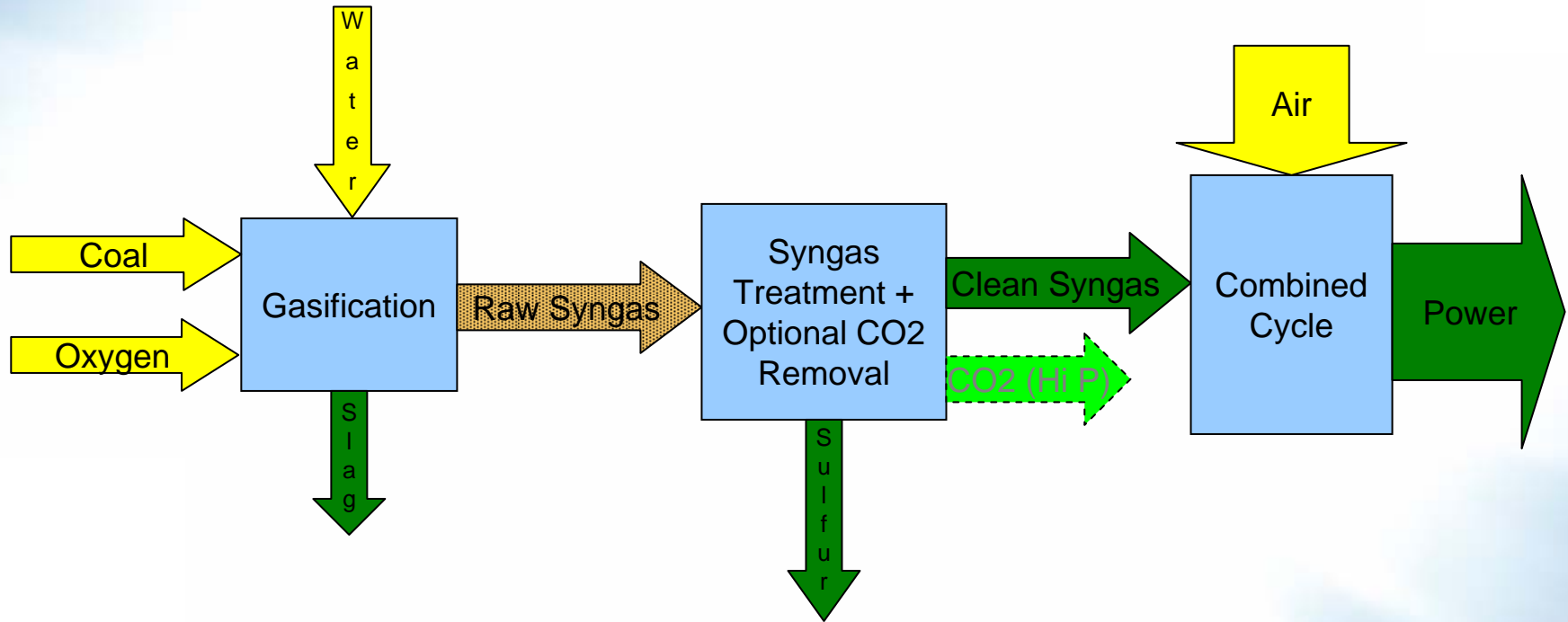


Coal Gasification to Synthetic Natural Gas (SNG)



Coal Gasification to Fischer-Tropsch (FT) Liquids







Gasification Projects will Involve Long Lead Times and Large Capital Commitments

Indicative Btu Conversion Project Characteristics

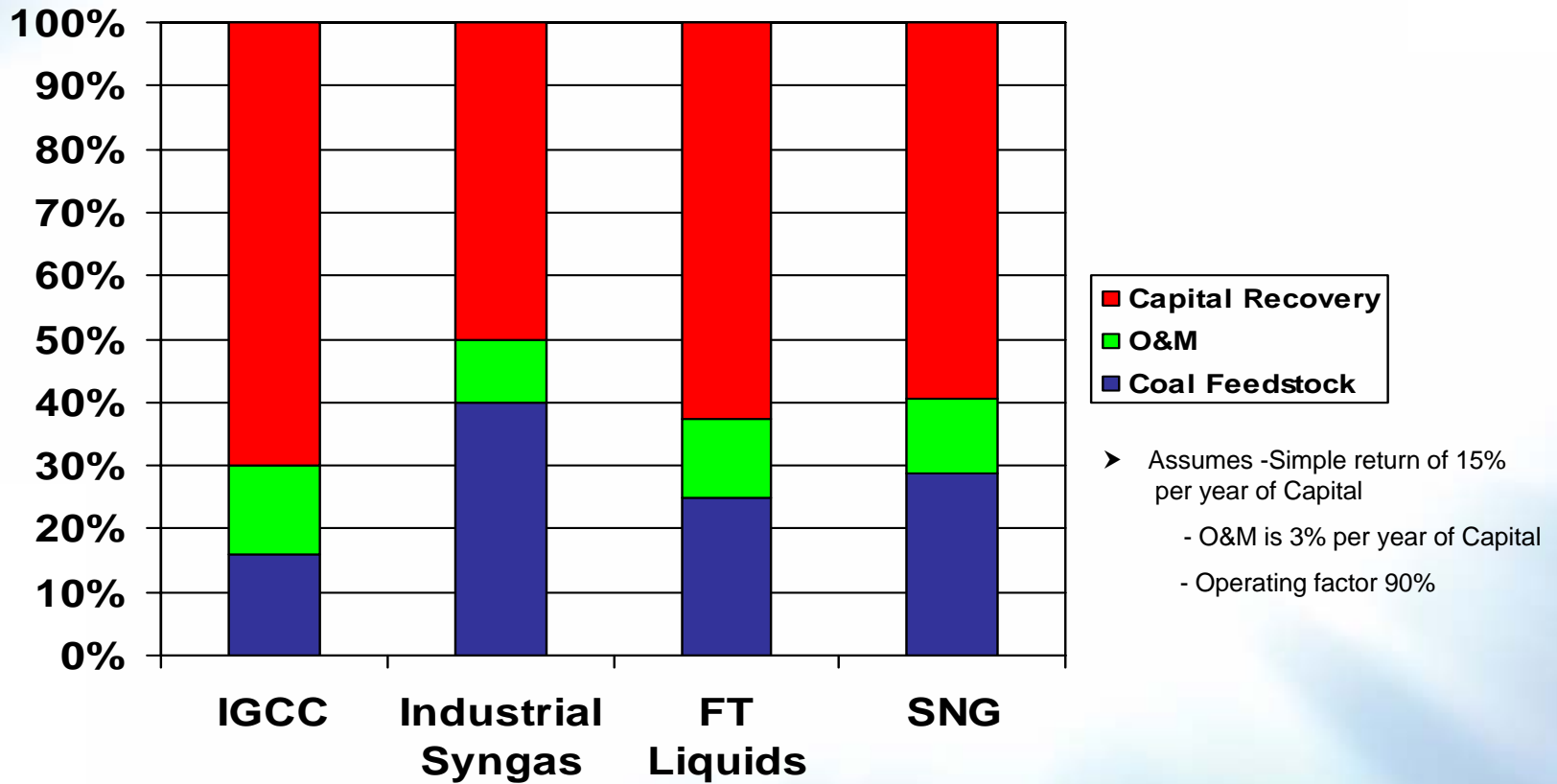
	Industrial Syngas	Synthetic Natural Gas	IGCC Power	Fischer Tropsch Liquids
Project Size (units of output)	4,000 - 10,000 mcf d equivalent	100,000 mcf d	600 MW	40,000 - 80,000 bpd
Coal Usage (MMTPY)	0.1 - 0.2	3	2	15
Total Project Lead Time (Yrs)	2 - 2 ½	5 ½ - 6	6 - 7	7 - 9

- Large and expandable coal reserve base
- Large acreage of land
- Large source of water for process and cooling
- If Fischer-Tropsch – near major terminals/refineries
- If Fischer-Tropsch – near waterways
- If Fischer-Tropsch – near military bases
- If SNG – near natural gas and CO₂ pipelines
- If IGCC – near transmission lines
- Conducive permitting process
- State and local support
- Good roads and rail lines
- Available technical workforce

- Capital Costs
- Coal Cost
- O&M Cost
- Development Cost
- Financing Availability / Costs / Rates
- Product Revenues
- Co-product Revenues
- By-product Revenues
- Product Off-take Agreements

All Gasification Technologies are Extremely Sensitive to Coal Costs and Capital Required

BTU Conversion Cost Breakdown By Application





Opportunities for Peabody

- Coal to Syngas (Industrial)
 - Targeted for 30% ownership in Econo-Power International (EPIC)
 - PRB & Illinois Basin coal transformed into low-Btu gas at \$4 to \$5 per mm Btu



- Natural Gas is the current fuel of choice for industrial users and independent power producers
- Pricing of natural gas is over \$9.00/mm BTU and projected to increase over the long term
- High Natural Gas price volatility is especially difficult for small and mid size industrials to deal with
- Fuel consumers are searching for a solution as a competitive advantage
- Other than EPIC's gasification system, no fuel gas technology is commercially viable for small to mid size plants in North America

- Boiler fuel for existing natural gas boilers
- Boiler fuel as stoker replacements (saves customer expenditure on air pollution control upgrades)
- Kiln fuel (cement, minerals, etc.)
- Process furnaces
- Ethanol plants (boilers and power generation)
- IGCC

- Coal to Synthetic Natural Gas (Pipeline)
 - Agreement with Arclight to evaluate Illinois location for pipeline-quality gas
 - ConocoPhillips & Fluor participating in technology & plant design
 - Pipeline-quality natural gas competitive at \$6+ per mm BTU



Photo of Dakota Gasification Company's Great Plains Synfuels Plant

- Coal to Hydrogen
 - Goal: Generation & hydrogen; near-zero emissions; CO2 sequestration
 - Alliance includes Southern Company, AEP, Huaneng
 - Initial cost estimate at \$950 million; \$700 million from DOE







- Plan to go to single grade fuel by 2015
- DOD wants to procure 300,000 BPD of fuel from unconventional domestic sources (with best near term prospect coal gasification to FT liquids)
- Type of fuel (73.5% jet, 15.1% ground, 7.9% marine, 3.5% heating)
- Launch 1st plant by 2011 – Build 10 by 2021
- Cost of plant \$2.5B, 30,000 BPD of product, workforce – 1,000

- Simplification and clarification of the permitting process, with time certainty (coal mines, gasification facilities, transmission/pipeline right of ways, water rights)
- Access to markets (product/CO₂/natural gas pipelines, transmission access)
- Product price certainty (to some level)
- Government assistance (loan guarantees, enterprise zones, investment tax credits, other tax incentives)

ENERGY FOR THE 21ST CENTURY

COAL

Today's technologies can convert U.S. coal into:

-  **Clean Electricity** to power growing cities.
-  **Transportation Fuels** to keep our economy moving.
-  **Natural Gas** to warm homes and families in winter.
-  **Hydrogen** to energize fuel cells of tomorrow.

Yeah... coal can do that.

Today, coal fuels more than 50% of U.S. electricity. America has the largest coal reserves in the world... and greater use of this clean and affordable fuel can reduce our reliance on foreign oil and liquefied natural gas.

Peabody Energy (NYSE: BTU) is the world's largest provider of coal to fuel 21st Century energy solutions.

CoalCanDoThat.com

