

# **Gasification: The Enabling Technology**

**State Clean Energy-Environment Technical Forum  
IGCC & Carbon Storage  
Part 1: Technology**

James Childress  
Executive Director  
Gasification Technologies Council

# GTC Mission

- Promote greater use of gasification technologies in environmentally superior manner.
- Priority Activities – Educate & Inform
  - **Industry** – customers (and their customers)
  - **Government** –
    - Federal level on national priorities & policies
    - State level officials in the U.S. affecting siting decisions for gasification-based plants

# The Message: It's Not Just IGCC

- Gasification is a commercial technology, widely used around the world and is poised for significant worldwide growth.
- IGCC cleanest coal/residue-based alternative for power generation, reducing natural gas dependency for electricity.
- Gasification also opens the way for coal to compete with natural gas and petroleum to produce value added products.
  - Chemicals
  - Fertilizers
  - Fuels (pipeline gas & F-T liquids)
- Gasification adds value to U.S. coal reserves and other “distressed” fuels/feedstocks.
- Implications for: National Energy Security, Fuel Diversity, Geographical Conversion Diversity

# World Gasification Survey: Summary Operating Plant Statistics 2004

**117** Operating Plants

**385** Gasifiers

Capacity~**45,000** MWth

Feeds

Coal **49%**, Pet. Resid. **36%**

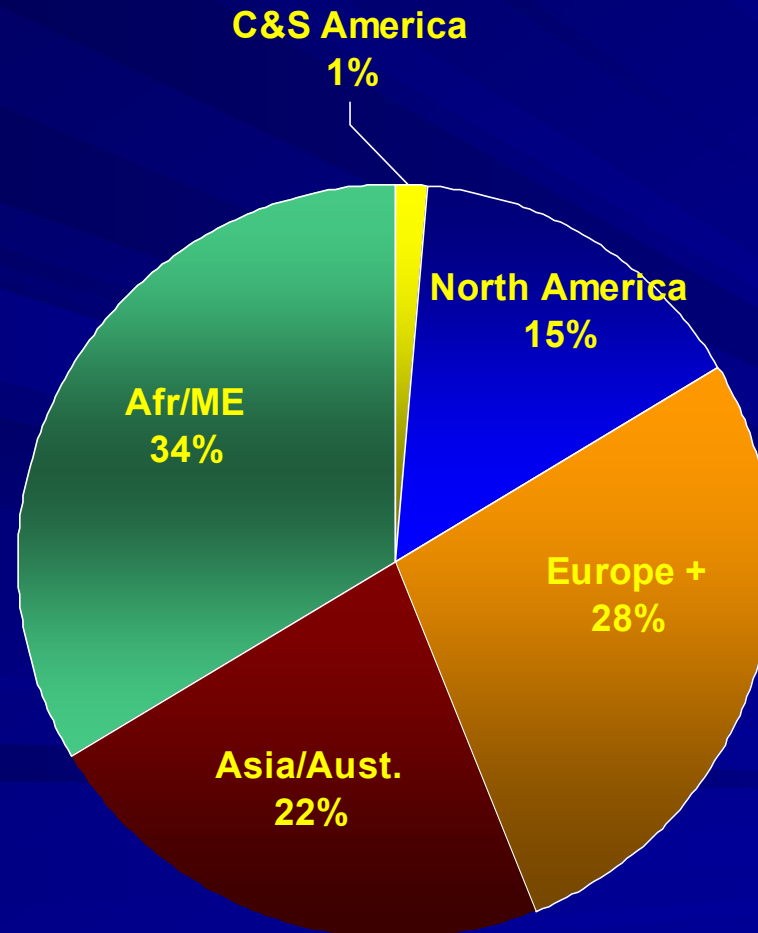
Products

Chemicals **37%**, F-T **36%**, Power **19%**

Growth Forecast **5% annual**

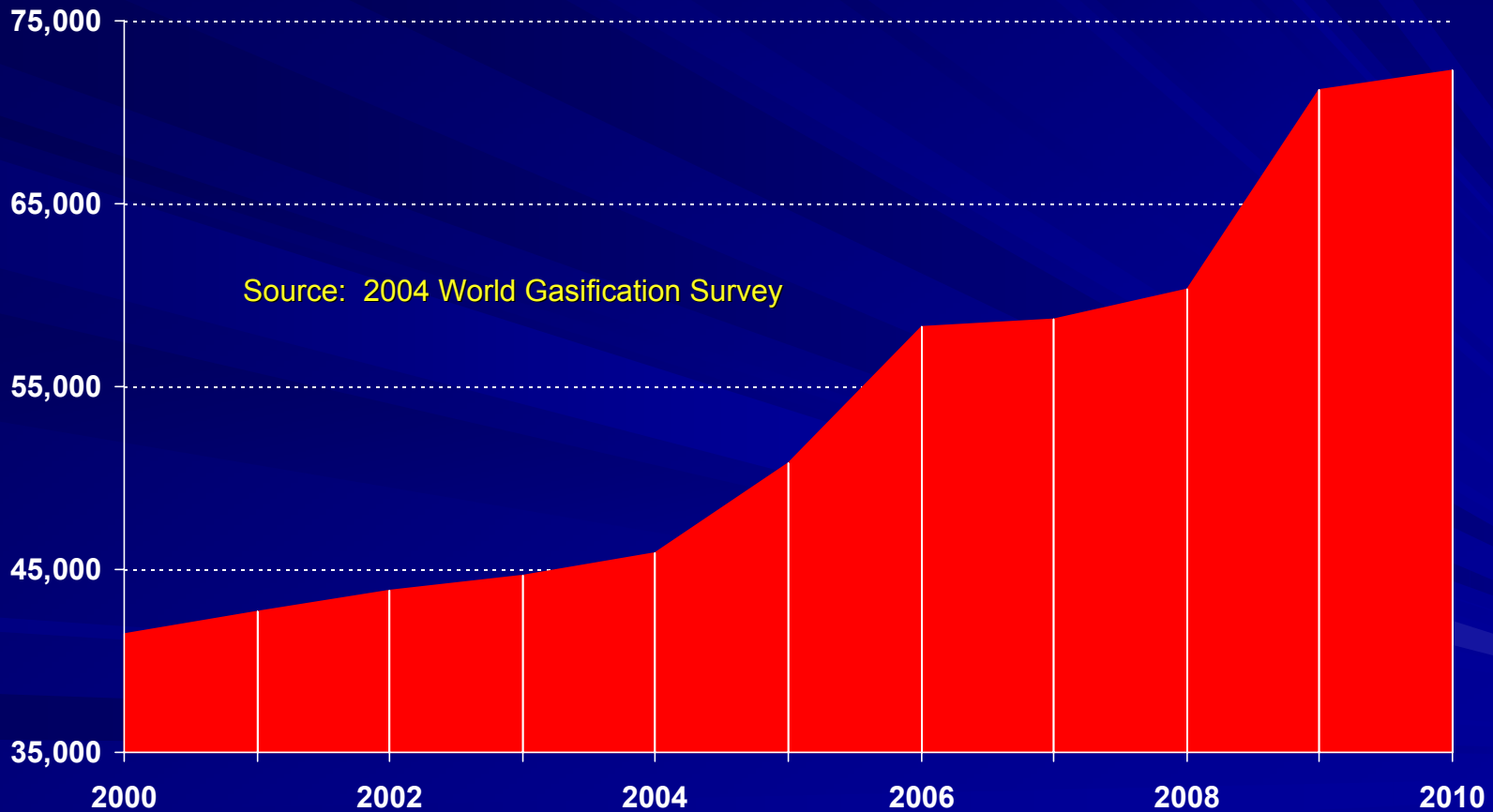
# Geographical Distribution of World Gasification Capacity, 2004

(MW<sub>th</sub> Equivalent)



# World Gasification Capacity Growth 2000-2010

(MWth Equivalent)



# U.S. Gasification Drivers

- High natural gas & petroleum prices affecting transport, power and manufacturing sectors
- Increasing demand for clean electricity from coal w/expectations of CO<sub>2</sub> limits
- Demand for cleaner, non-petroleum fuels (refinery H<sub>2</sub>, F-T diesel)
- Strong technology providers, alliances & guarantees (ConocoPhillips, GE Energy, Shell, Siemens)
- Federal & state financial & regulatory incentives

# What is the current technological status of IGCC?

- Demos of 1990's running in commercial mode (Wabash, Polk, Nuon)
- Polk plant first dispatched on TECO system
- Basis for plants now in development
- Latest IGCC, Negishi, fully commercial plant



# What is the current technological status of IGCC/carbon capture and sequestration (CCS)?



**Great Plains**



**Pernis**

# What are the key outstanding issues related to using carbon capture with IGCC? With geologic sequestration?

- Cost, not technology
- Suitable geologic formations
  - EOR lowest threshold + revenues
- Proven long term retention of CO<sub>2</sub>/Liability
- CO<sub>2</sub> Concentration not an issue with gasification to products w/shift; done today commercially
- Issue with IGCC, “H<sub>2</sub> Ready” Turbine
  - BP Carson Refinery

# What are the environmental implications of IGCC?

## Part 1

<b>Pollutant</b>	<b>IGCC Bituminous</b>	<b>Subcritical PC Bituminous</b>	<b>Subcritical PC Subbituminous</b>
<b>NOx</b>	0.049	0.06	0.06
<b>SO<sub>2</sub></b>	0.043	0.086	0.065
<b>PM/PM<sub>10</sub></b>	0.007	0.012	0.012
<b>VOC</b>	0.0017	0.0024	0.0027
<b>CO</b>	0.03	0.10	0.10

All emissions in lb/MMBtu. IGCC NOx based on 15 ppmvd/15% O2 and with no SCR. An SO2 removal of 87% reflects a very low coal sulfur content (0.22%).

Source: S. Khan, U.S. EPA

# What are the environmental implications of IGCC?

## Part 2

<b>Parameter*</b>	<b>PC Plant</b>	<b>IGCC Plant</b>	<b>% less for IGCC</b>
<b>Solid waste, bituminous coal, tpd</b>	1,090	430	60
<b>Solid waste, subbituminous coal, tpd</b>	480	280	42
<b>Solid waste, lignite, tpd</b>	2,080	1,600	23
<b>Plant makeup water, gpm</b>	9,340	6,030	35
<b>Wastewater discharge, gpm</b>	2,910	1,960	33

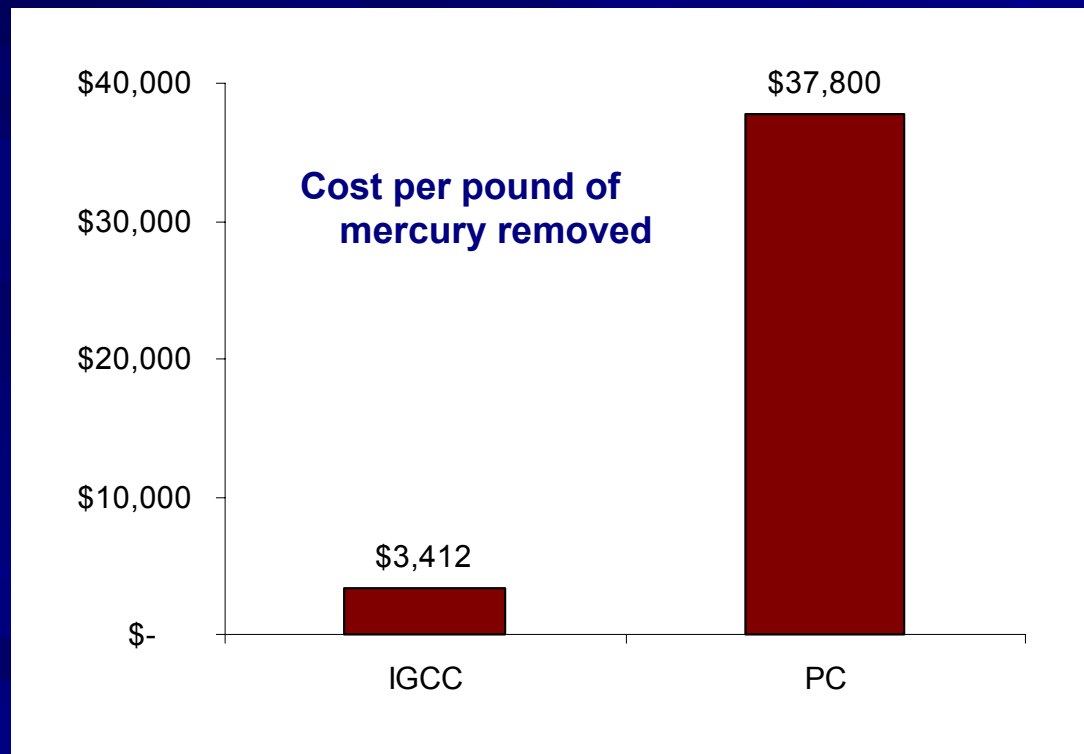
Note: gasification slag included in solid waste; only recovered sulfur considered non waste.

Source: S. Khan, U.S. EPA

# What are the environmental implications of IGCC?

## Part 3

### Comparative Cost of Hg Removal

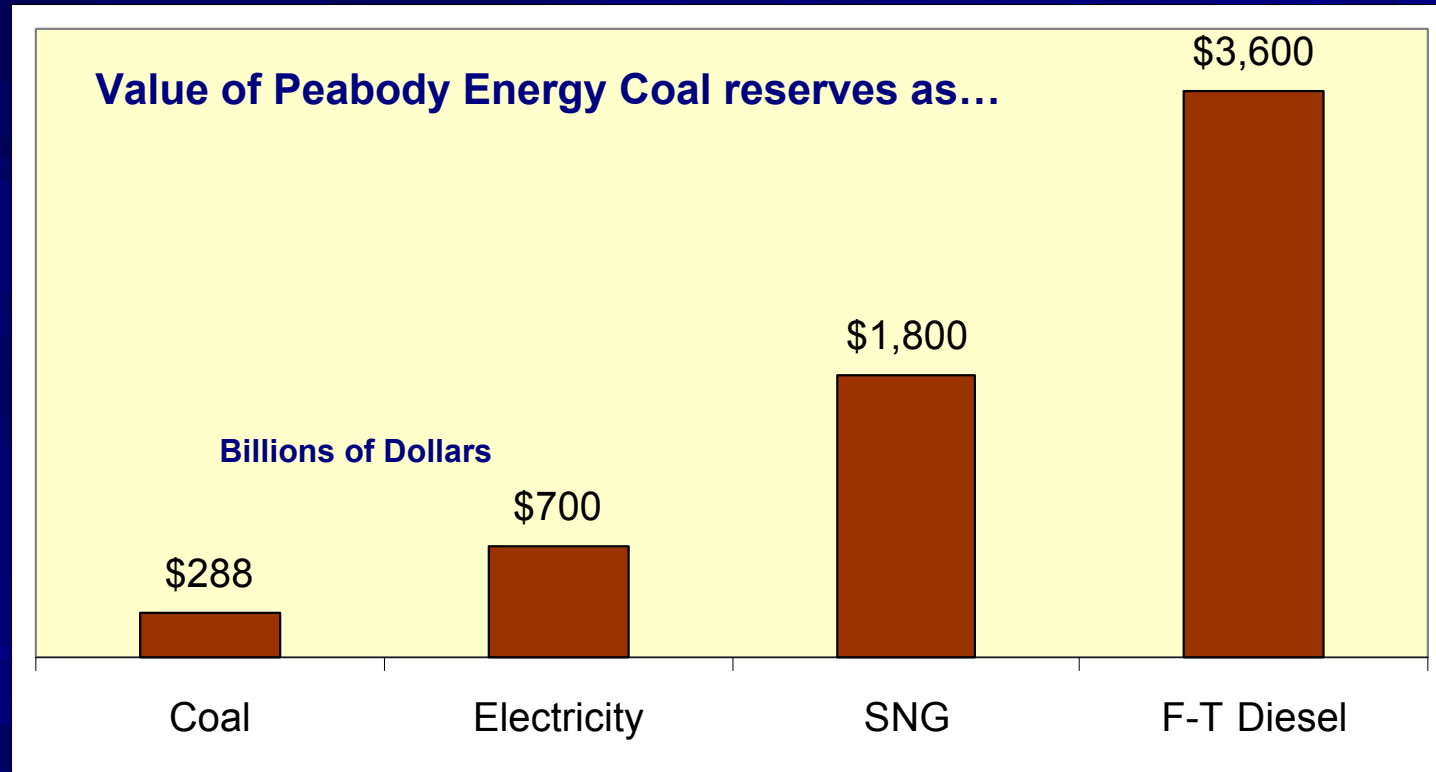


# What are the economic implications of IGCC and of IGCC/CCS?

<b>Parameter</b>	<b>IGCC Plant</b>	<b>PC Plant</b>
<b>CO<sub>2</sub> capture, %</b>	91	90
<b>Unit output derating, %</b>	14	29
<b>Heat rate increase, %</b>	16.5	40
<b>Capital cost increase, %</b>	47	73
<b>COE increase, %</b>	38	66

Source: S. Khan, U.S. EPA

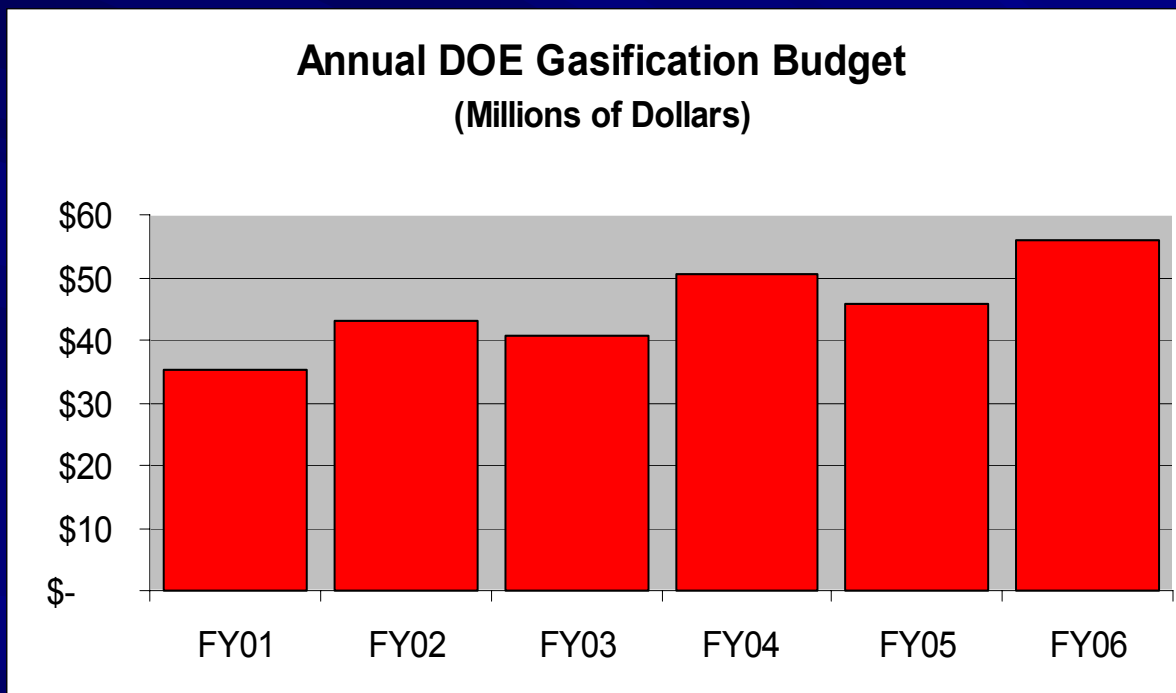
# What are the economics of IGCC co-production (electricity & other products such hydrogen, Fischer-Tropsch fuels)?



Source: Peabody Energy

# Which Federal Agencies are facilitating R&D and implementation of IGCC?

## DOE Fossil Energy R&D Program





# Which Federal Agencies are facilitating R&D and implementation of IGCC?

- EPACT -- ~\$5.4 billion authorized for cost sharing, grants, investment tax credits
- 80% Loan Guarantees
- +50 cent/gallon tax credit – F-T diesel from coal
- F-T Offtake agreements with DoD?

# GTC Activities Assisting States

- Resource for papers, contacts, information to state government personnel
- Workshops for state, local personnel dealing with gasification siting issues
  - Bismarck, ND. June 28-29
    - “Gasification 101”
    - Environmental Permitting Issues
    - PUC Perspectives & Approaches
    - Incentives – Financial & Regulatory
    - Expenses Reimbursed
- Go to <http://www.gasification.org>

# Questions?

For further information: <http://www.gasification.org>

or

Google “gasification”

Mark your calendars



October 1-4

2006 Gasification Technologies Conference

Washington, DC



# WASHINGTON, D.C.

[www.gasification.org](http://www.gasification.org)

Gasification – The Enabling Technology

*Save the Dates*

**OCTOBER 1-4**

**JW MARRIOTT HOTEL**

# Gasification TECHNOLOGIES 2006 C O N F E R E N C E

[www.gasification.org](http://www.gasification.org)