

Gasification: The Enabling Technology

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

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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%**

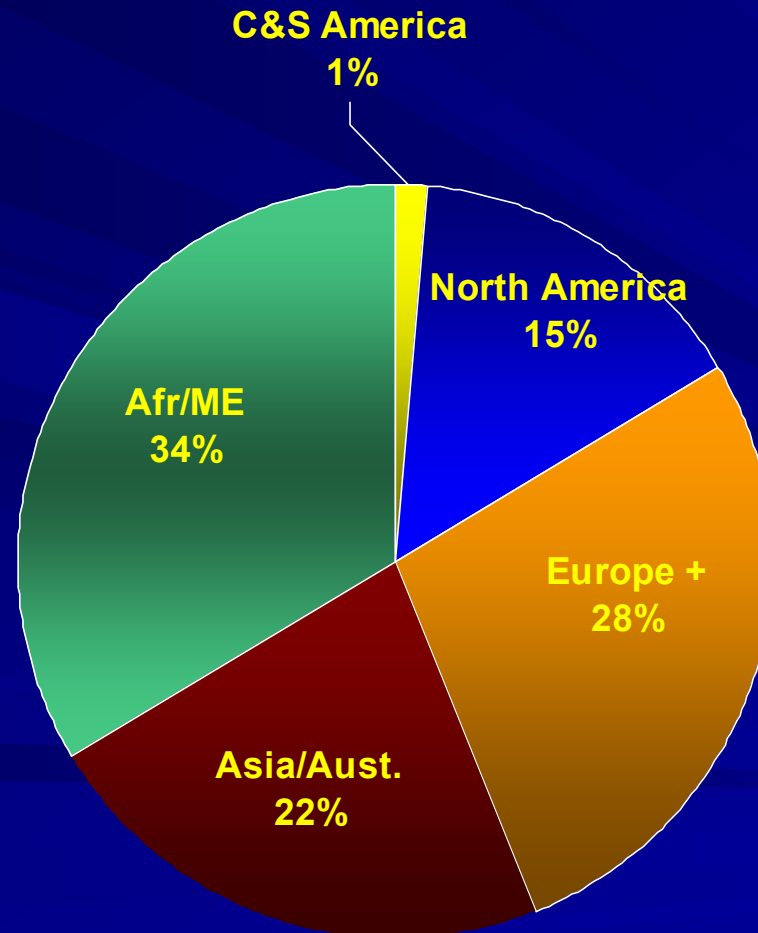
Products

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

Growth Forecast **5% annual**

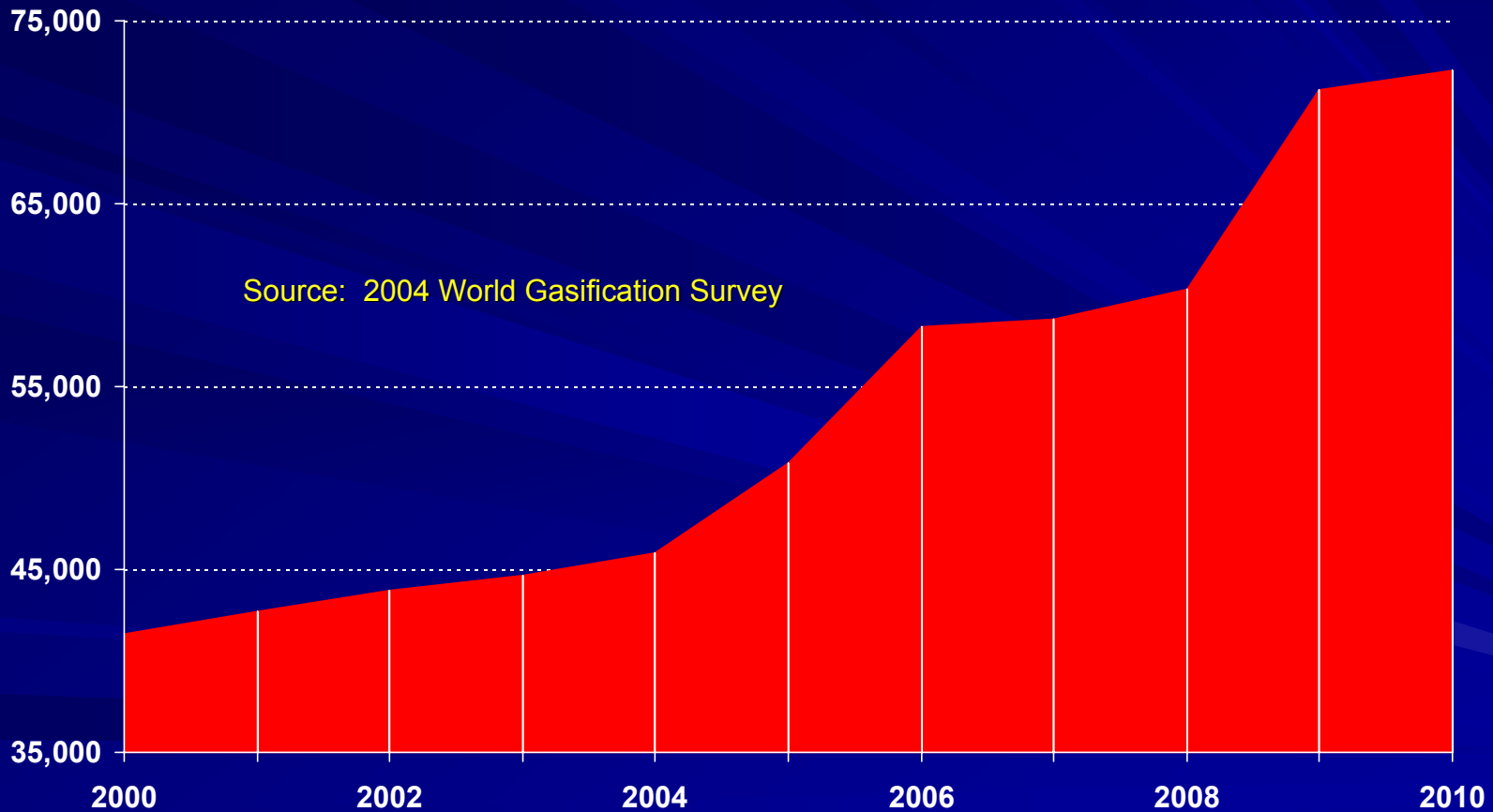
Geographical Distribution of World Gasification Capacity, 2004

(MW_{th} 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 CO₂ limits
- Demand for cleaner, non-petroleum fuels (refinery H₂, 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 CO₂/Liability
- CO₂ Concentration not an issue with gasification to products w/shift; done today commercially
- Issue with IGCC, “H₂ Ready” Turbine
 - BP Carson Refinery

What are the environmental implications of IGCC?

Part 1

Pollutant	IGCC Bituminous	Subcritical PC Bituminous	Subcritical PC Subbituminous
NOx	0.049	0.06	0.06
SO₂	0.043	0.086	0.065
PM/PM₁₀	0.007	0.012	0.012
VOC	0.0017	0.0024	0.0027
CO	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

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

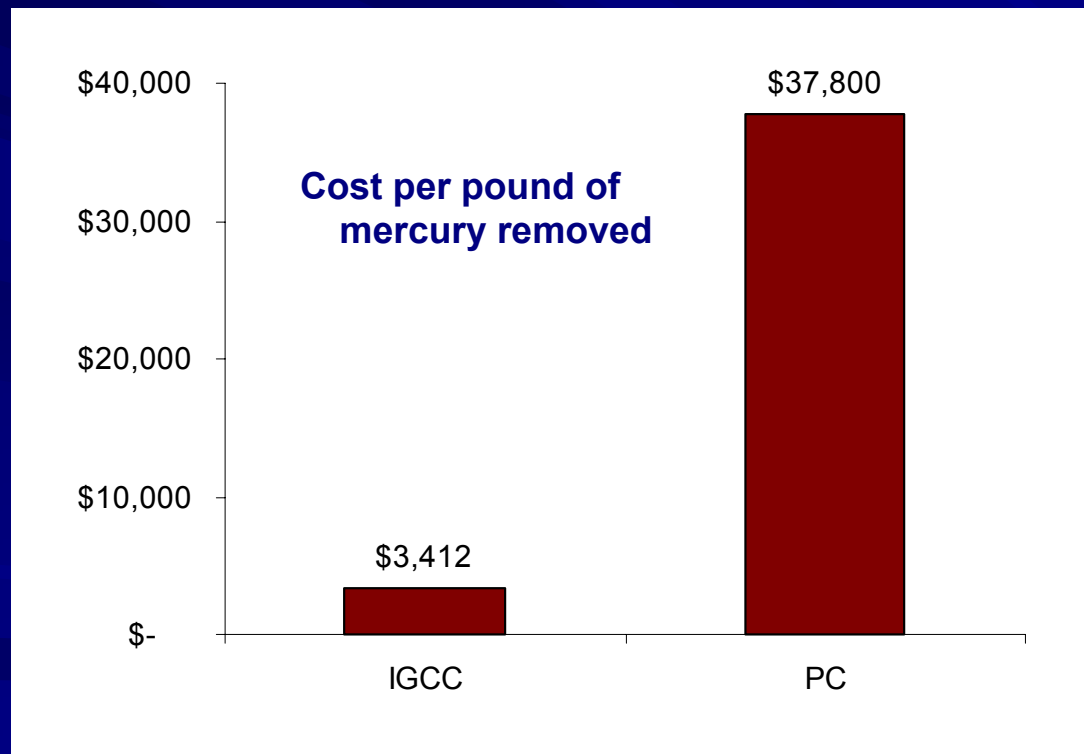
Note: gasification slag included in solid waste; only recovered sulfur considered non waste.

Source: S. Khan, U.S. EPA

What are the environmental implications of IGCC?

Part 3

Comparative Cost of Hg Removal

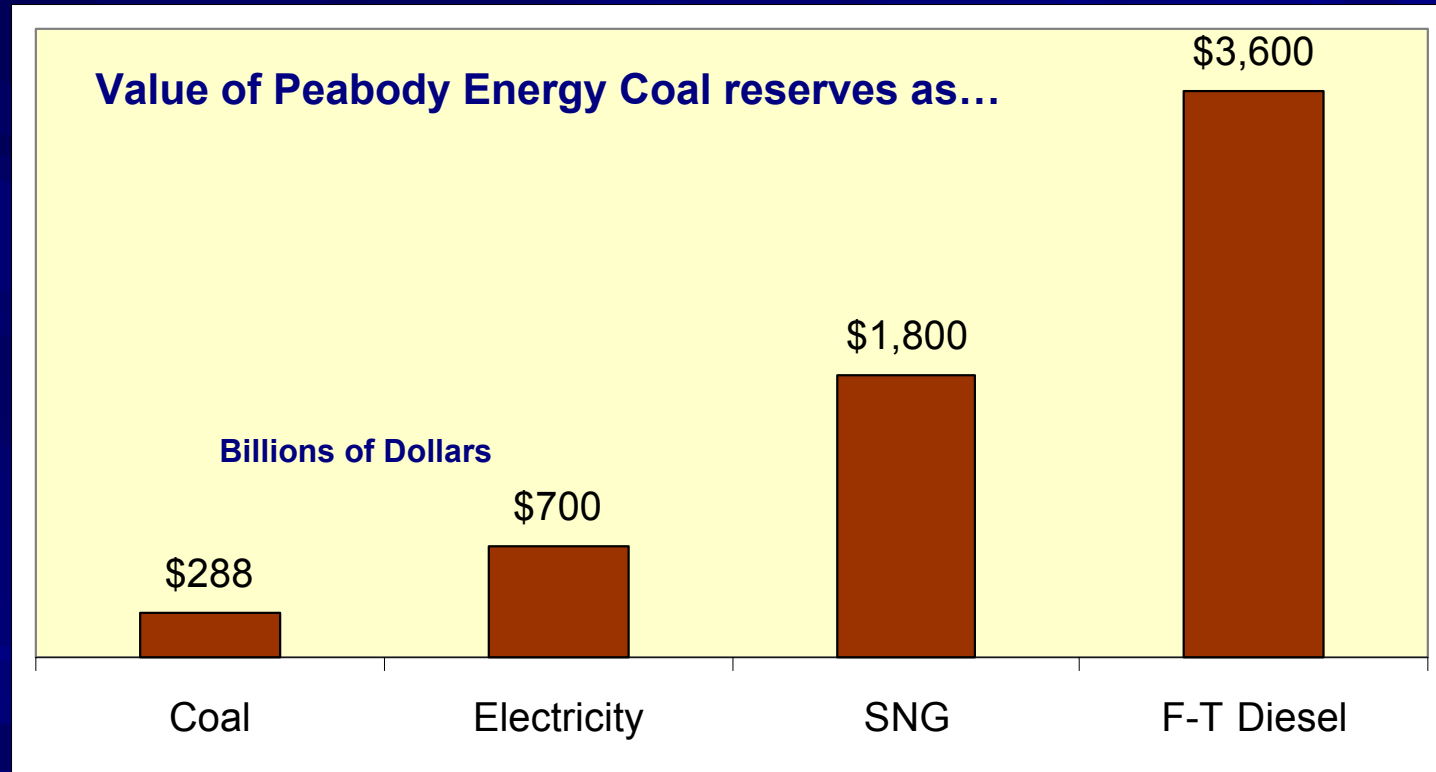


What are the economic implications of IGCC and of IGCC/CCS?

Parameter	IGCC Plant	PC Plant
CO₂ capture, %	91	90
Unit output derating, %	14	29
Heat rate increase, %	16.5	40
Capital cost increase, %	47	73
COE increase, %	38	66

Source: S. Khan, U.S. EPA

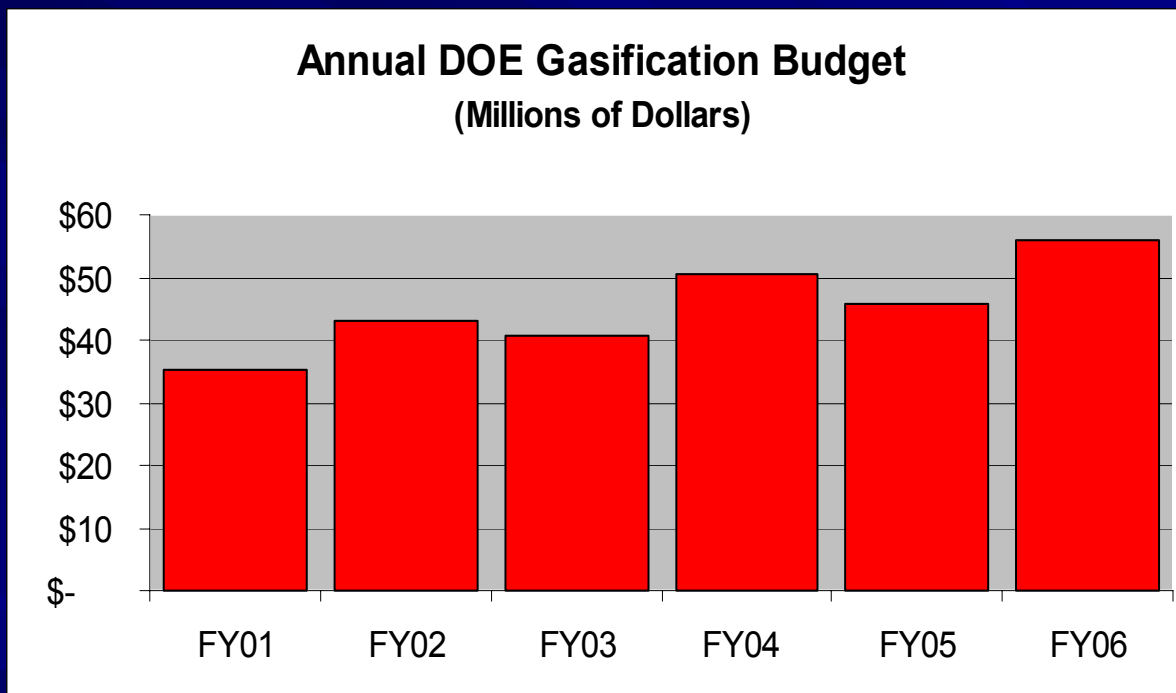
What are the economics of IGCC co-production (electricity & other products such hydrogen, Fischer-Tropsch fuels)?



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

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Save the Dates

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