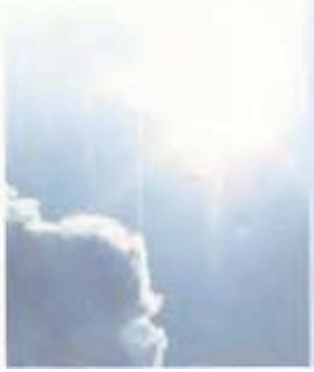
EASTMAN GASIFICATION SERVICES COMPANY

~ 30% - 40% Less Water Usage with IGCC

WATER CONSUMPTION ESTIMATE –IGCC VERSUS PC AND FBC PLANTS[1]

	CONVENTIONAL PC-FIRED PLANT WITH ADVANCED POLLUTION CONTROLS	FBC PLANT	IGCC PLANT
Water Consumption, gallons/MWh	600 – 660	570 - 625	360 – 540

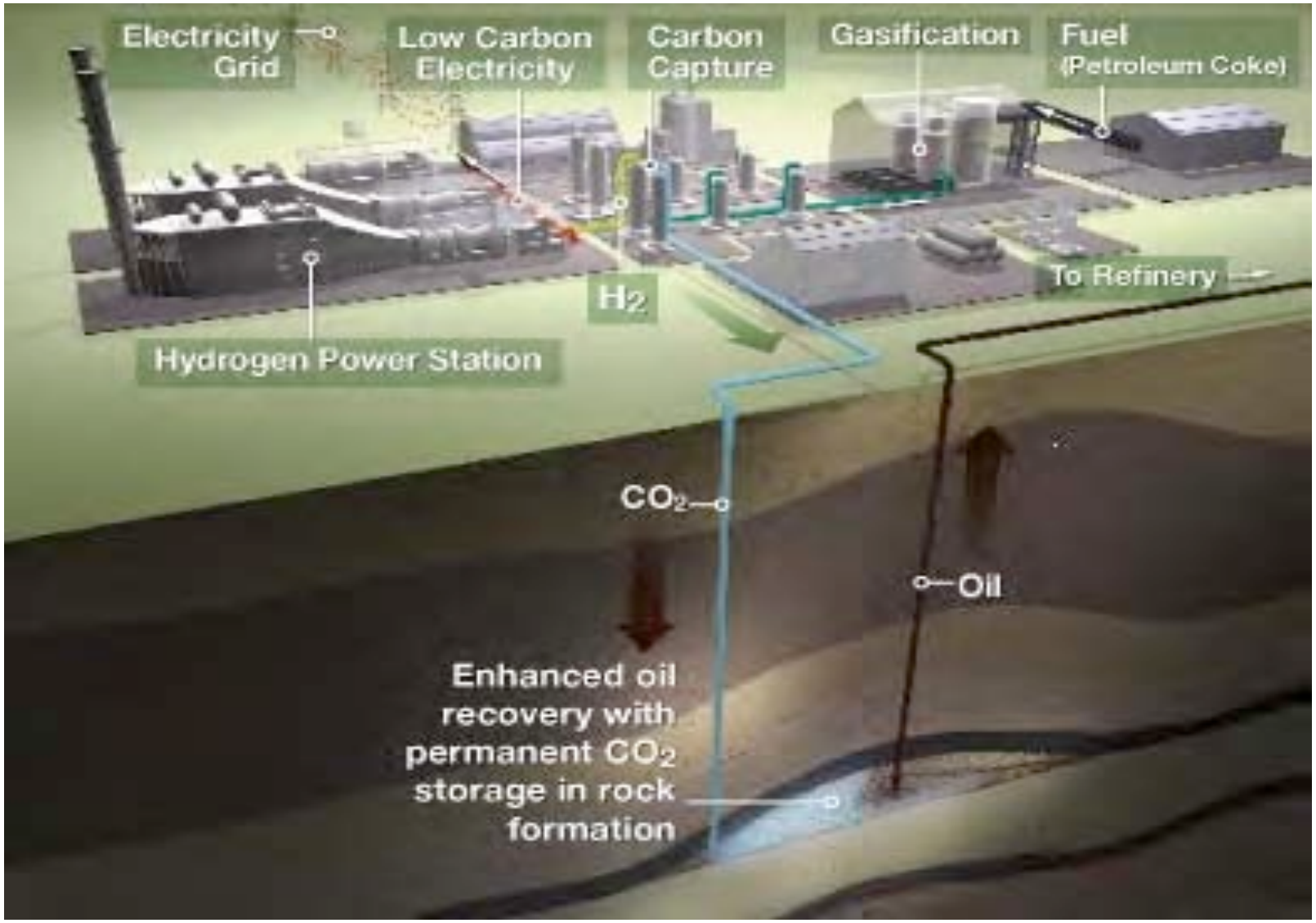
DOE Report "Major Environmental Aspects of Gasification-Based Power Generation Technologies", December 2002



EASTMAN

COMMERCIALLY OPERATING IGCC PLANTS

BP's Proposed 500 MW IGCC Plant in Carson, CA to Produce Hydrogen for Electric Generation and Carbon Dioxide for Enhanced Oil Recovery

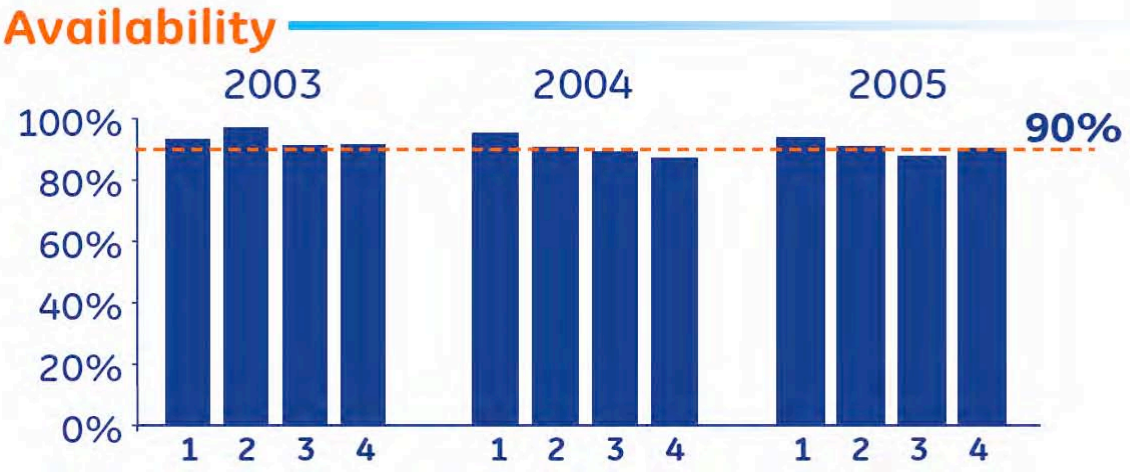


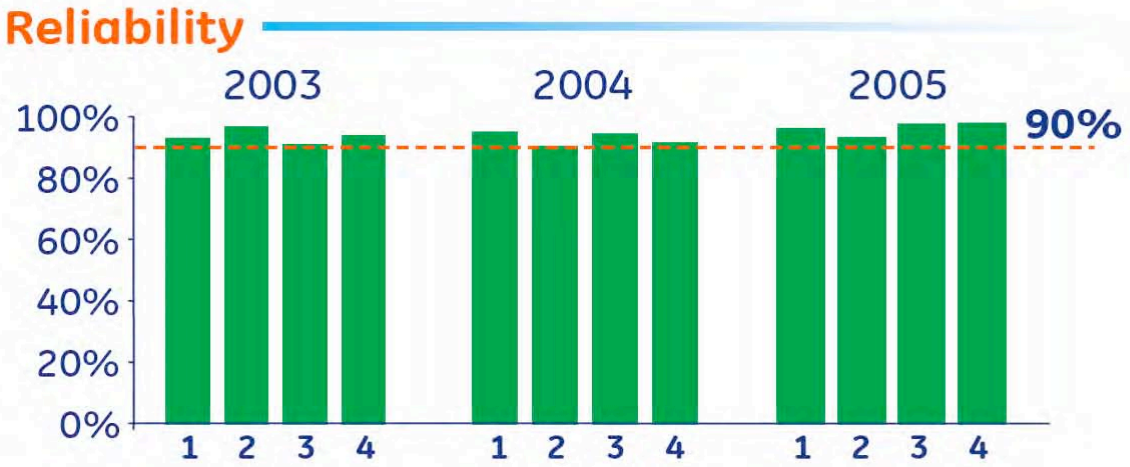
Availability & Reliability – Solids Gasification in China

GE Technology in China Four Coal Plants

Availability = (1-(unplanned outage +planned outage) /8760)*100%

Reliability = (1-(unplanned outage) /8760)*100%





imagination at work

- **Source: Commercial Experience of GE's Gasification Technology in China by Qianlin Zhuang, GE Energy, Presented at GTC, Oct 3, 2006**

Sub-Bituminous Coal Gasification

Performing today. Preparing for tomorrow.

ConocoPhillips offers fuel flexible E-Gas Technology options to our clients.

Even after 10 years at Wabash River, half of the tonnage ever processed with the E-Gas Technology is Powder River Basin sub-bituminous coal.

Almost half of the coal gasified for power in the United States has been sub-bituminous coal.

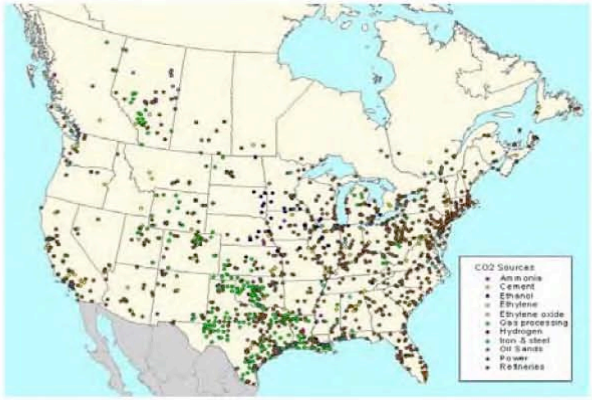
ConocoPhillips | E-Gas™ Technology for Gasification

Source: **ConocoPhillips E-Gas Technology 2006,**
by **Phil Amick,** ConocoPhillips, presented at GTC, Oct. 2, 2006

Sequestration Capacity: In Right Places?

Adequate Capacity in U.S.

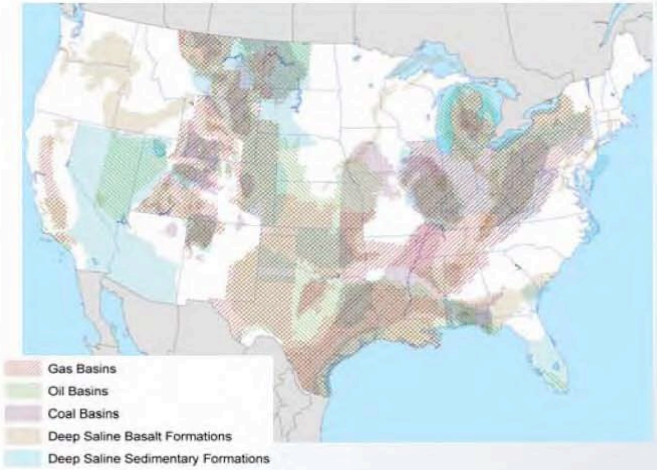
FutureGen ALLIANCE



2,082 Large Sources (100+ $ktCO_2/yr$) with Total Annual Emissions = 3.8 $GtCO_2/yr$

- 1,185 electric power plants
- 447 natural gas processing facilities
- 154 petroleum refineries
- 53 iron & steel foundries
- 124 cement kilns
- 43 ethylene plants
- 9 oil sands production areas
- 40 hydrogen production
- 25 ammonia refineries
- 47 ethanol production plants
- 8 ethylene oxide plants

~ 100 Years



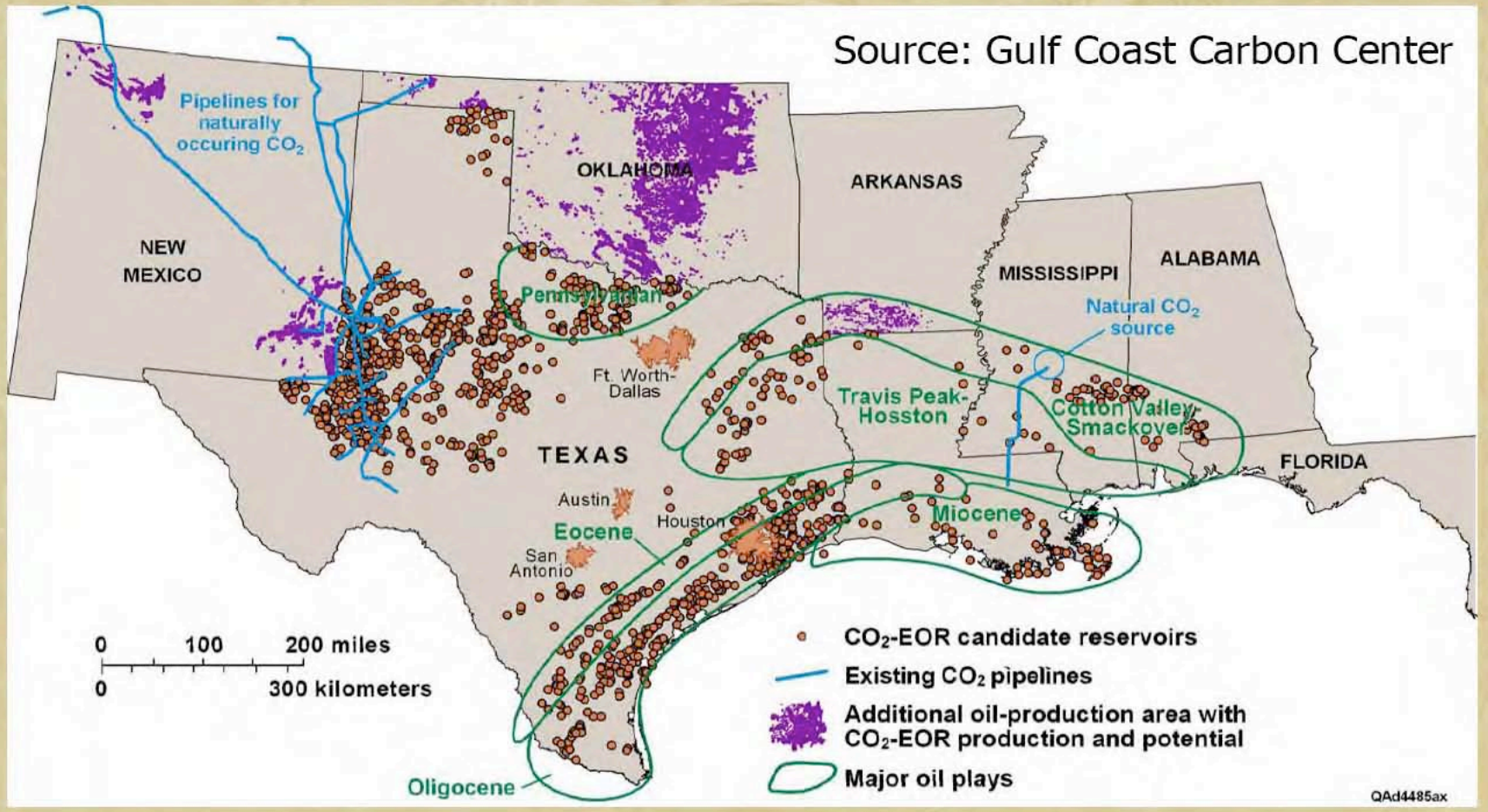
3,800+ $GtCO_2$ Capacity within 330 US and Canadian Candidate Geologic CO_2 Storage Reservoirs

- **3,730 $GtCO_2$ in deep saline formations (DSF)**
- 65 $GtCO_2$ in deep unmineable coal seams with potential for enhanced coalbed methane (ECBM) recovery
- 40 $GtCO_2$ in depleted gas fields
- **13 $GtCO_2$ in depleted oil fields with potential for enhanced oil recovery (EOR)**

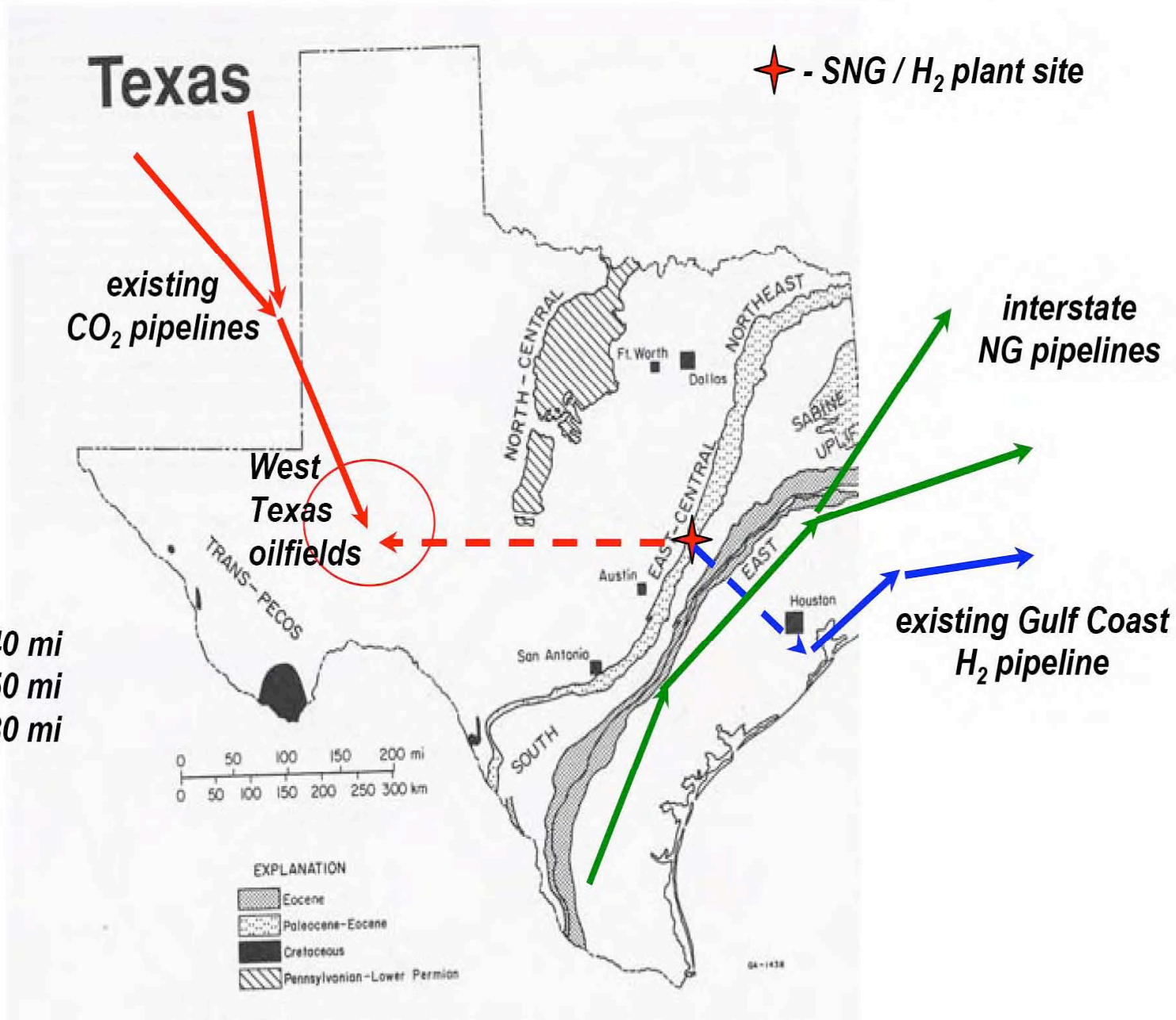
www.FutureGenAlliance.org

- Source: [Status and Schedule for the FutureGen Plant] by **Mike Mudd,** FutureGen Alliance, Presented at GTC, Oct. 4, 2006.

Inventory of Sinks with Economic Offset (EOR)



- Source: **What Next After "Carbon Capture Ready"?** by **Scott Tinker,** Bureau of Economic Geology, University of Texas, Presented at GTC, Oct. 4, 2006.



(Source: DOE report by Mitretek, “Polygeneration of SNG, Hydrogen, Power, and Carbon Dioxide from Texas Lignite”, NETL, Dec. 2004, page 8)

AMERICAN ELECTRIC POWER'S IGCC PLANS

COAL: AEP CEO Michael Morris previews company's plans for Ohio clean coal facility

Last year, American Electric Power Corp. announced that it would build a 1,000 megawatt coal-fired power plant, equipped with state-of-the-art gasification technology to remove pollutants. During a speech before the National Coal Council in Washington, D.C., Morris explains the progress his company has made with the integrated gasification combined cycle (IGCC) facility it wants to build in Ohio. He also talks about the factors driving AEP's decision, including new interest in the utility sector from General Electric Co., plus the belief that the federal government will someday limit carbon dioxide emissions.

Transcript December 13, 2005

Michael Morris:

"…So when we looked at coal and said what is it that will allow coal to be built going forward? It had to be a project that would address itself to be ever changing, ever increasing in stringent control that is, environmental requirements that are going to face coal going forward. **When we look at a plant that's going to have a 40 year physical life we are absolutely convinced that gasification technology is the right way to use coal** in a base load model….A couple of very important and interesting things happened along the way, as we got to that decision that helped us make that decision, probably the singularly most important issue was that General Electric Corporation bought the technology from ChevronTexaco that allowed for someone with engineering technique, with construction management and project management and most importantly the corporate ability to stand behind what they built. I think that made the gasification technology available to us as an industry …

So the decision with GE in the loop made it considerably easier for us to go forward with we know we have a base load need. We know that coal is the fuel. **We believe that gasification technology is the best ...We know the environmental rules are going to continue to get more stringent, not less. We know that this plant is going to have a 40 year life. And during that period of time greenhouse gas, carbon capture control, will become a worldwide reality. We're convinced of that.** Coal itself, the low sulfur varieties, are going to continue to see price pressure as each of us chase after that unique ton of coal. And if you can't buy that unique ton of coal you're going to have to buy NOX, SOX and/or someday mercury credit. And with all of that in front of us, believing that all of those prices were going to go up, that led to what we think is a very rational decision…."

(Source: E & E TV – 12/13/05)


Thank you for your attention!
SNG to Gas Pipeline
CO_2 for Enhanced Oil Recovery
DGC, Beuhlah, North Dakota, USA

APPENDIX

E-Gas™ Gasification Feedstock Experience and Gasifier Scale-up

1975 Pilot

36 TPD

1979
Proto 1 - 400 TPD

1983
Proto 2 - 1600 TPD

LGTI 1987–1995
2,400 TPD

Sub-Bituminous
Rochelle Mine

Wabash
1995 - 2006
2,600 TPD

Bituminous IL #6 coal
Petcoke – Multiple refineries.

For 2010 Start-up
E-Gas™ Technology Commercial Offerings

Bituminous
Sub-Bituminous
Petcoke

ConocoPhillips

- Source: Development Experience with the Mesaba Energy Project: Permitting and Environmental Review, by **Robert Evans,** Excelsior Energy, Presented at GTC, Oct. 2, 2006.

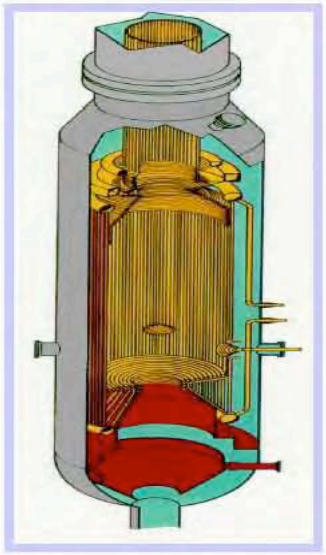
Shell Oil Gasification vs. Shell Coal Gasification

liquid refinery residues,
natural gas

SGP

coal, lignite,
petroleum coke

SCGP



Differences:

non-slagging condition	slagging condition
refractory lined gasifier	membrane wall gasifier
liquid/gas feed system	dry feed system
fired tube boiler	water tube boiler
soot water handling	solid slag handling

- Source: **Shell Coal Gasification Process: Technical Overview** by **Pete Parker,** Shell Global Solutions, Presented at GTC, Oct. 4, 2006

Reference Plant … Enhanced Coal Envelope Program Initiated

Leveraging from initial Reference Plant product

- Gasification & heat recovery technology
- Process & power island designs
- Integrated plant models & cycle optimization
- RAM modeling

Economically optimizing for PRB

Working with potential launch customer

From Energy Information Administration, Quarterly Coal Report, October 2006

imagination at work

9$ #

- Source: **GE Business Overview on Gasification Activities** by **Ed Lowe,** GE Energy, Presented at GTC, Oct. 2, 2006