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# Clean Coal and Co-Production Potential

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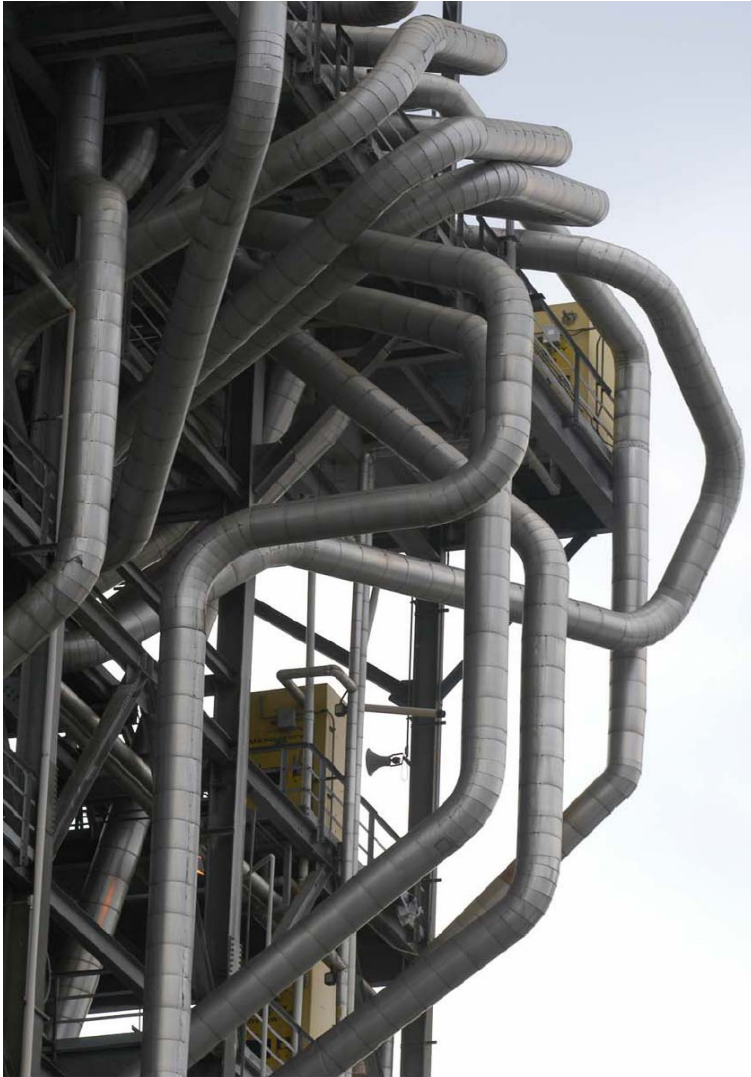
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## Clean Coal For Transportation Fuels Workshop

*Purdue University*  
West Lafayette, IN  
December 2, 2005

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# Outline

1. ConocoPhillips
2. E-Gas Technical Heritage
3. Gasification Process
4. LGTI experience at Dow
5. Wabash Experience
6. Environmental Benefits of Gasification
7. FT Liquids Experience

# ConocoPhillips Introduction

- **NYSE: COP**
- **Eighth largest publicly owned energy company worldwide—based on oil & gas reserves**
- **Third largest integrated energy company in the United States**
- **Second largest refiner in US, 5<sup>th</sup> in world**
- **World's leading producer of petroleum coke**
- **Headquartered in Houston**

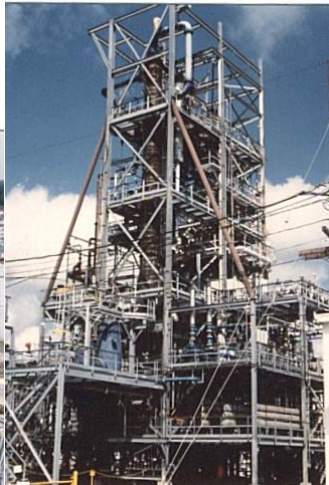


# E-Gas Gasification Commercial Feedstock Offerings and Gasifier Scale-up

**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 - 2005  
2,600 TPD

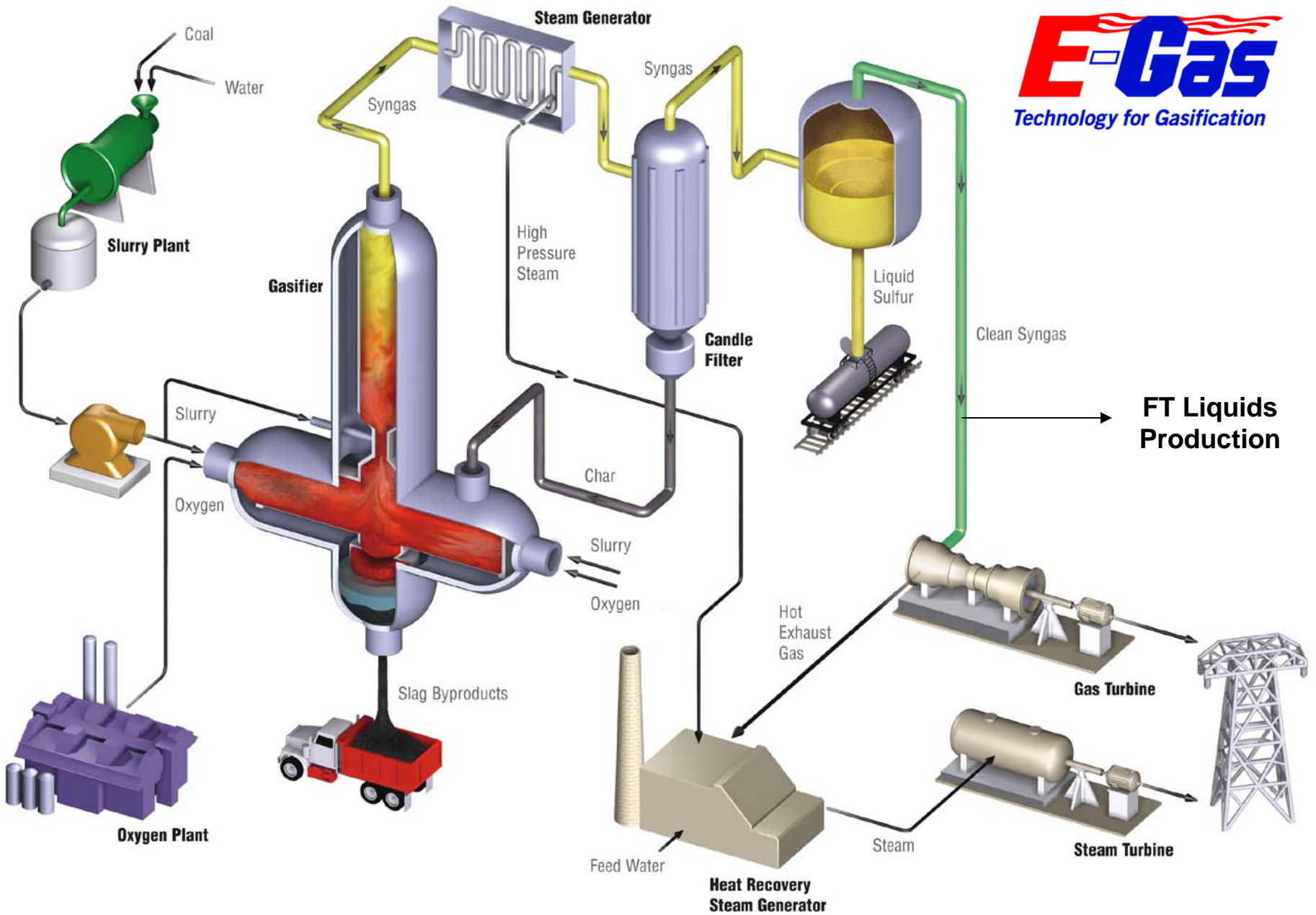


Bituminous IL #6 coal  
Petcoke – Multiple refineries.

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

**Bituminous**  
**Sub-Bituminous**  
**Petcoke**





# LGTI Summary

- Operated 1987 – 1995 at Dow Chemical's Louisiana Division under Synfuels Corporation Contract
- Over one third of the coal-to-power gasification in U.S.
- Supplied Syngas to two Siemens Westinghouse W501D5 turbines
- 2400 TPD sub-bituminous coal feed (1.5 X scale-up)
- Over 3.7 million tons of sub-bituminous coal processed
- Included significant testing of dry particulate removal system and petroleum coke and bituminous coal (second stage only)

# Wabash River



## **One of the Cleanest Coal Fired Power Plants in the World**

1.7 million tons of bituminous

1.3 million tons of petcoke

- 2500 TPD bituminous coal feed
- 262 MW Net output
- Operational since 1995 at Cinergy's Wabash River Plant
- SG Solutions LLC now owns Syngas Plant, ConocoPhillips provides professional services on site

Source: SG Solutions, LLC



# Wabash River IGCC

Gasifier

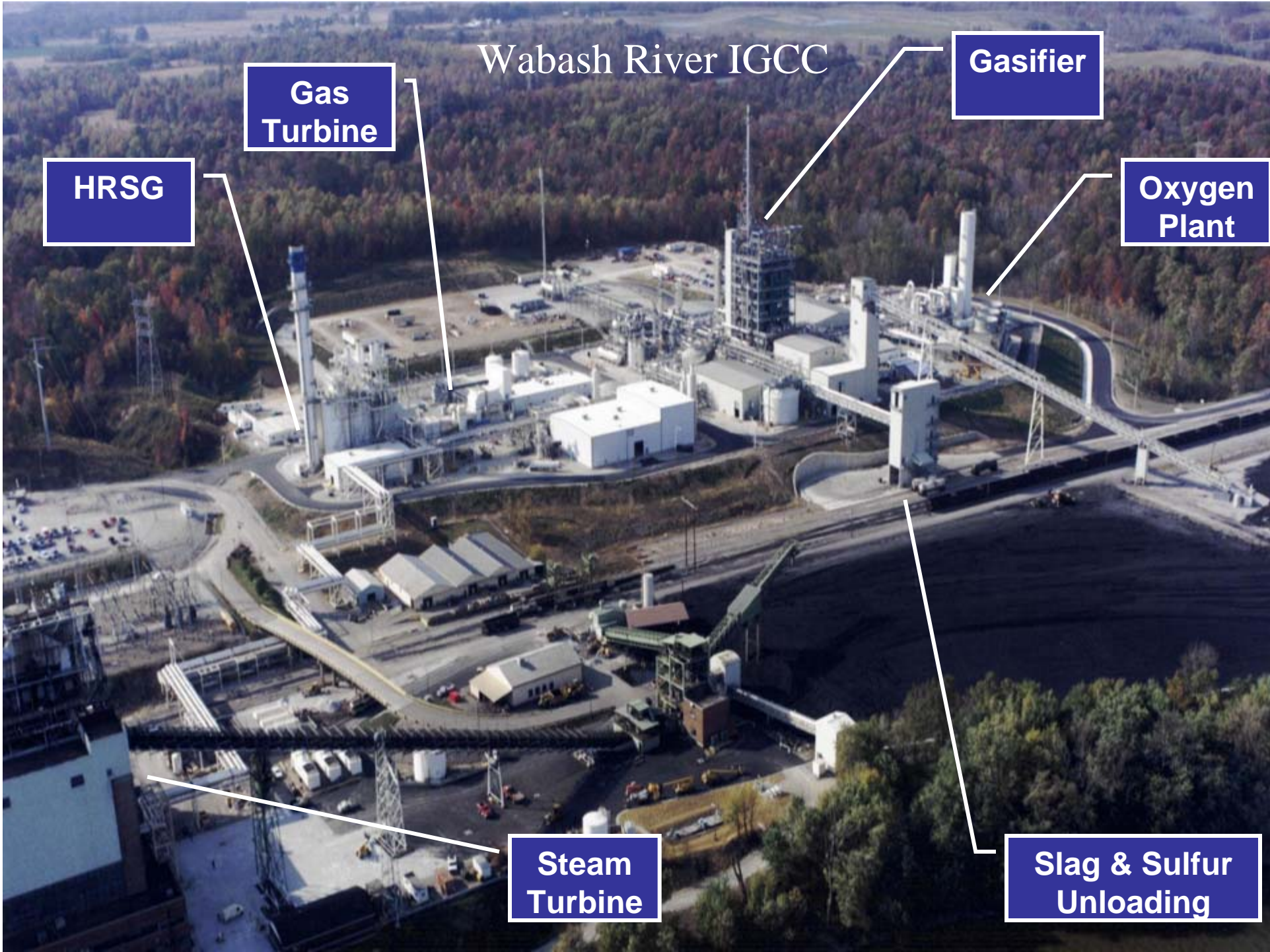
Oxygen Plant

Gas Turbine

HRSG

Slag & Sulfur Unloading

Steam Turbine





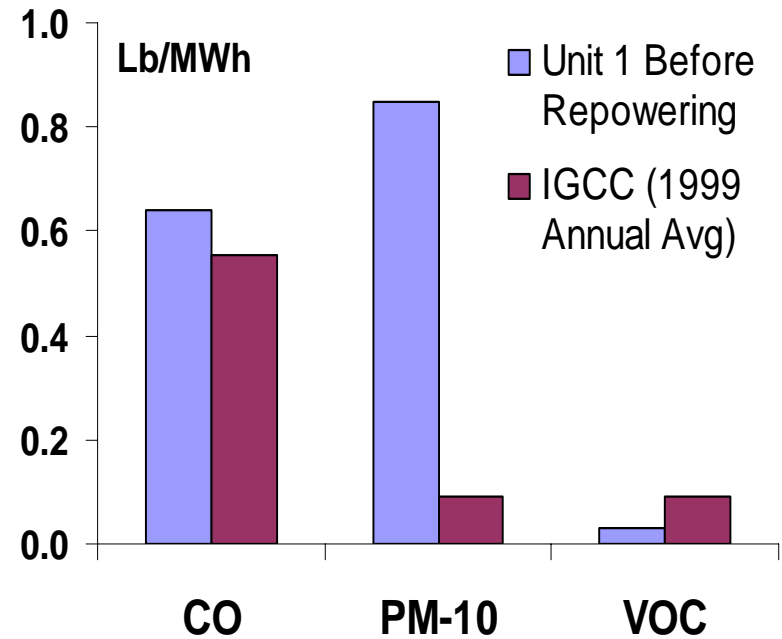
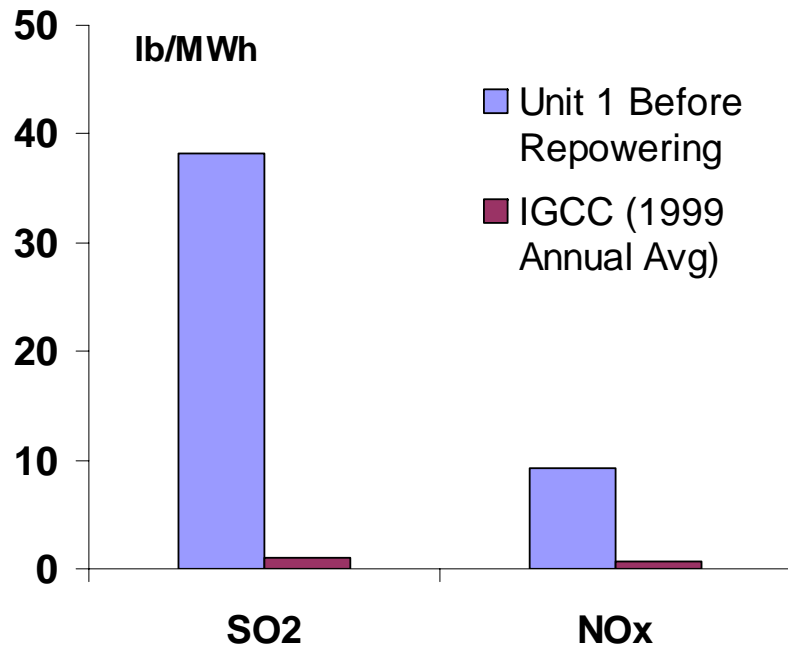
# Wabash Emissions Comparison

Emissions, lb/MWh

	<u>SO2</u>	<u>NOx</u>	<u>CO</u>	<u>PM-10</u>	<u>VOC</u>
Unit 1 before Repowering	38.2	9.3	0.64	0.85	0.03
IGCC (1999 annual average)	1.075	0.75	0.555	0.09	0.09
<b>Emissions Reduction TPY</b>	<b>5,505</b>	<b>1,179</b>	<b>(83)</b>	<b>101</b>	<b>(25)</b>

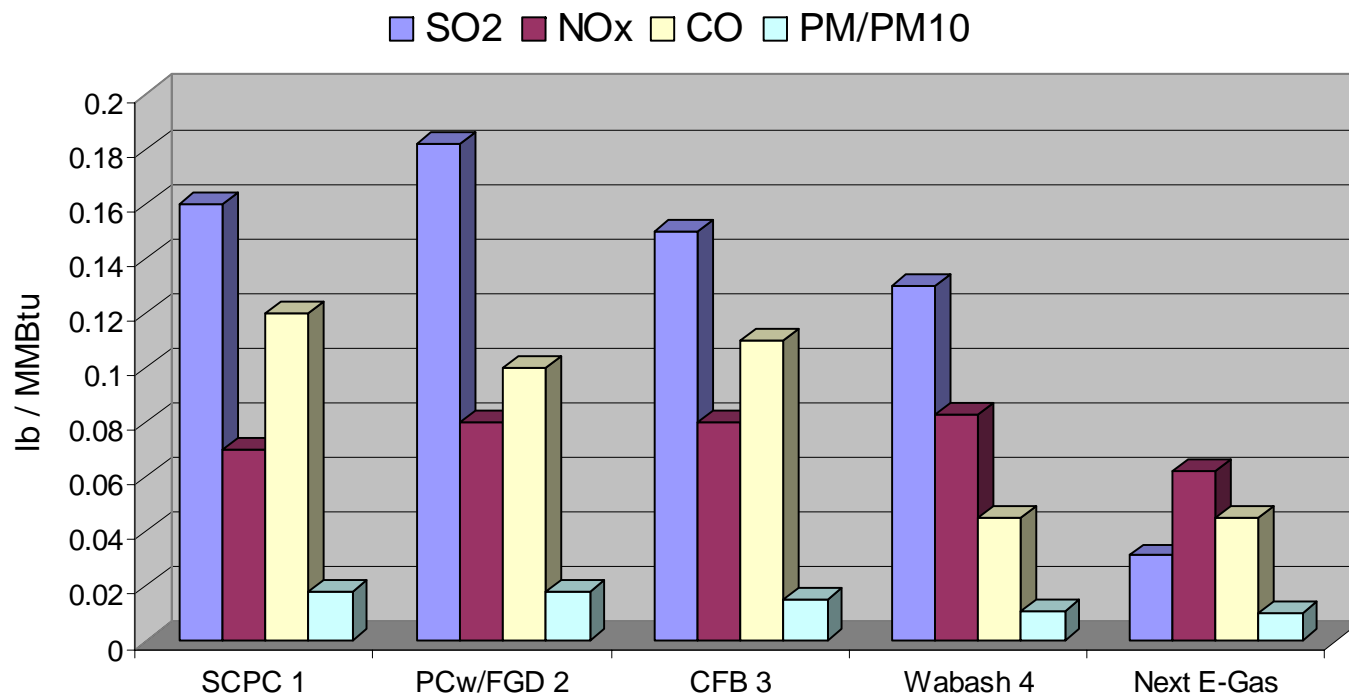
**Comparing 100 MW PC unit running 35% availability and 262  
MW IGCC running 75% availability  
(5.6 X more megawatt hours produced)**

# Repowering Emissions Comparison



Source: Wabash River Repowering Project, 1999 average reported to IDNR

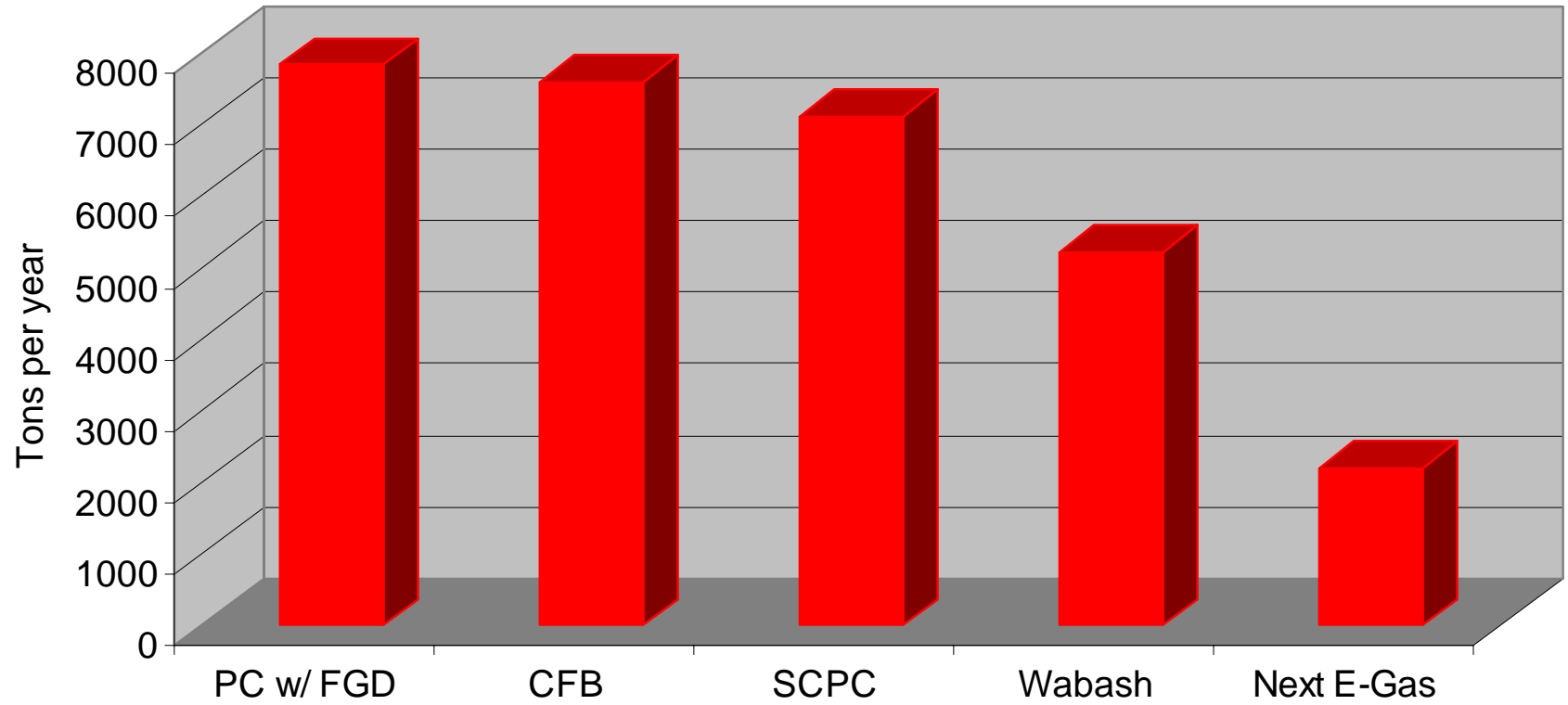
# Comparative Emissions of Coal Based Power Plants



- 1) Wisconsin Electric Power SCPC information from April 2003 Draft Environmental Impact Statement, Elm Road Generating Station, Volume 1, Public Service Commission of Wisconsin & Department of Natural Resources, Table 7-11, p. 155 (Pittsburgh No. 8 coal)
- 2) Evaluation of IGCC to Supplement BACT Analysis of Planned Prairie State Generating Station, May 11, 2003. Prepared by Donald J. Wilhelm SFA Pacific, Inc. for Prairie State Generating Company, LLC.
- 3) Supplemental Information for PSD Permit Application, March 25, 2003, Prepared by Earth Tech, Inc. for Indeck - Elwood, LLC.
- 4) Wabash River Repowering Project, 1999 average reported to IDNR



# Total Air Emissions From Coal Power Plants



From references cited in previous slide.  
All plants scaled to 550 MW at 90% annual capacity factor.

# Pollutant Removal Advantages

## Mercury Removal

- 90-95% removal utilizing carbon beds

## Carbon Dioxide

- Gasification is the most cost effective method for CO<sub>2</sub> removal

# Solid Byproducts – not Wastes

- Sulfur - 99.99% pure
  - 100,000+ tons sold at Wabash
  - 400,000,000 equivalent lbs of SO<sub>2</sub>



- Slag - Black, glassy sand like material
  - Inert, passes TCLP & UTS
  - Asphalt
  - Construction backfill
  - Landfill cover

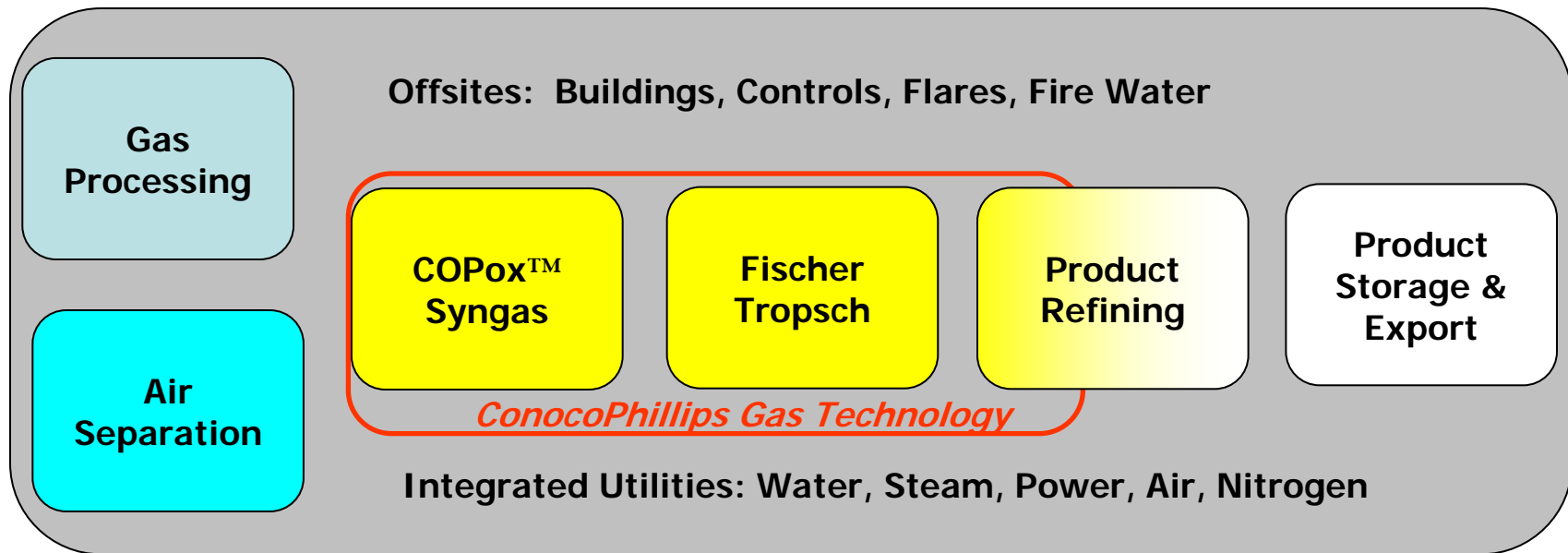




# ConocoPhillips GTL History

- 1997 – Started R&D with DuPont
- 1999 – Conoco Spin-off from DuPont
  - World class R&D Organization/Facility in Ponca City
- 2001 – Commit 400 BPD Demonstration Plant
- 2002 – Conoco & Phillips Petroleum Merge
- 2003 – Start up GTL Demonstration Plant
- 2003 – COP Acquisition of E-Gas Technology

# ConocoPhillips Gas-to-Liquids Technology



Demonstration Plant  
*Ponca City, Oklahoma*







**Gasification**  
**Common Sense**  
**For Energy And**  
**The Environment**