INDIANA UTILITY REGUALTORY COMMISSION

JUNE 15, 2005

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E-Gas Technology for Coal Gasification

CONFIDENTIAL EXCHANGE OF INFORMATION

Today's Agenda

- **E-Gas Technology**

  Technology history & Future Improvements

  Gasification 101

  Cost & Performance

  Environmental Benefits

- **Summary / Q&A**

GASIFICATION TECHNOLOGY PROCESS HERITAGE

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Global Energy acquired Dynegy's Gasification Assets in January 2000

GLOBAL ENERGY

DYNEGY

NGC changed its name to Dynegy in June 98

NGC

NGC Corporation Purchased Destec from Dow in June 1997

DESTEC ENERGY

Spun off from Dow in 1989, built Wabash River

DOW

Developed Technology, Proto Plants & LGTI 1973 - 1989

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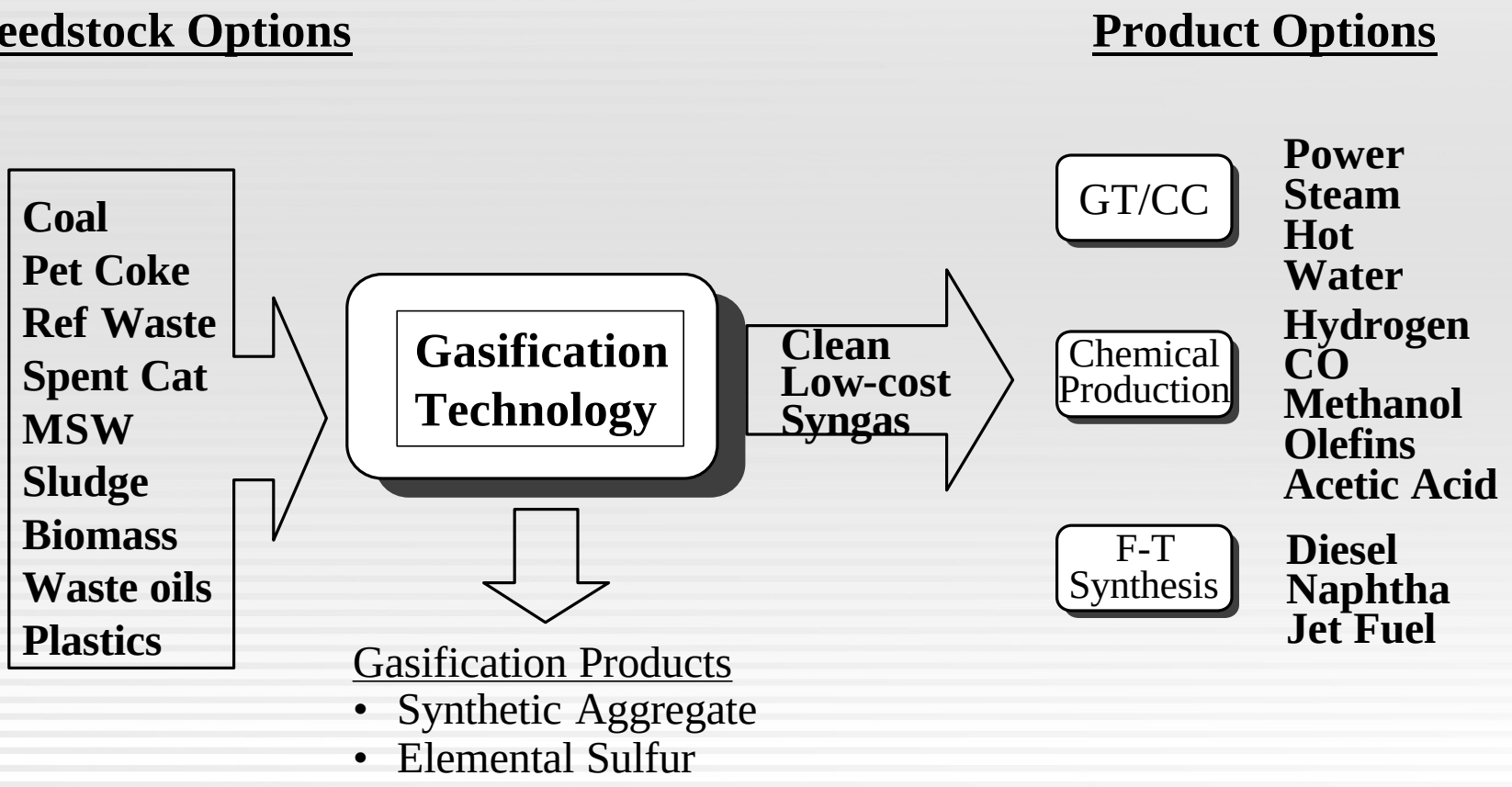
Multi-Fuel, Multi-Product Gasification Technology



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Technology

E-Gas History

Gasification 101

Future Improvements

Cost & Performance

Environmental Benefits

Wabash Facility Location

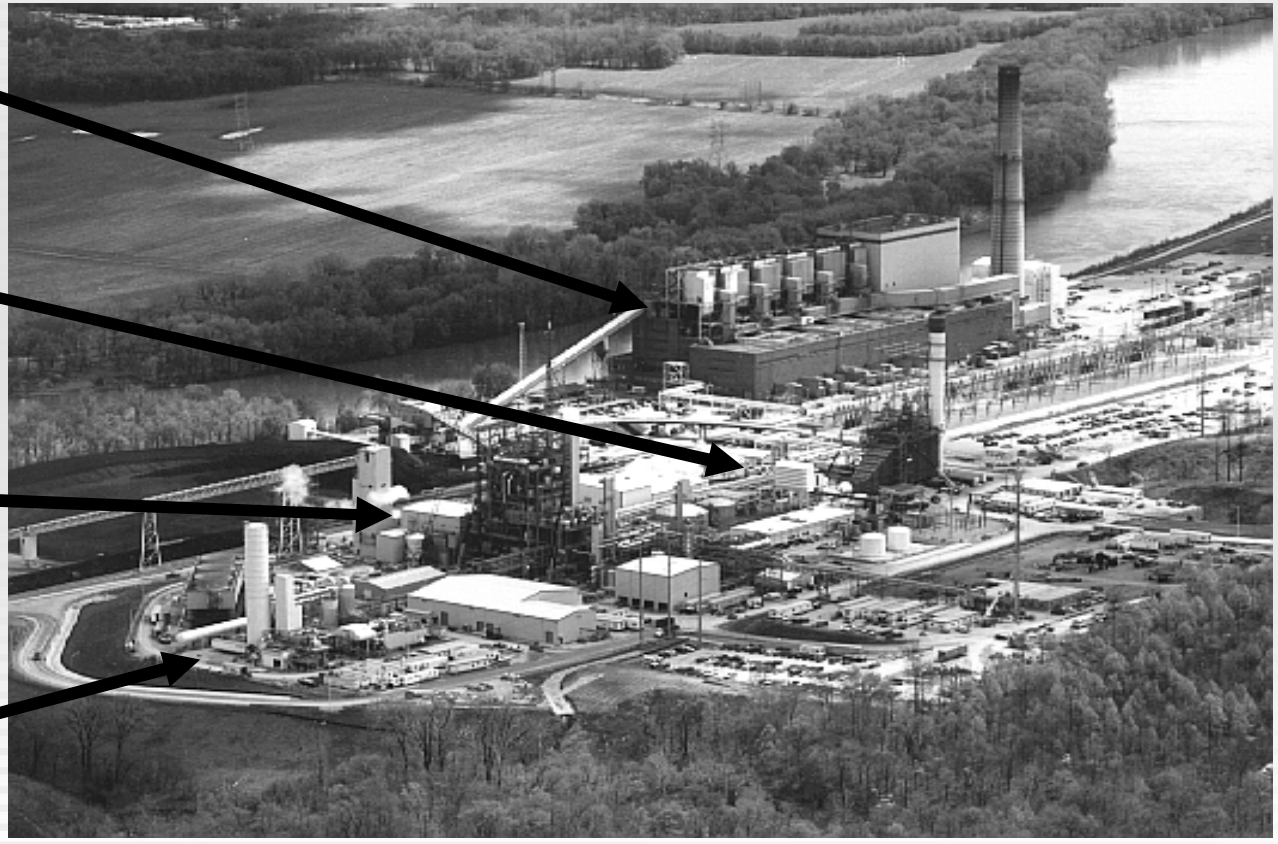
1995–2000: 2,500 TPD Bituminous Coal
2000–2004: 2,000 TPD Petroleum Coke

Steam Turbine

Combustion Turbine

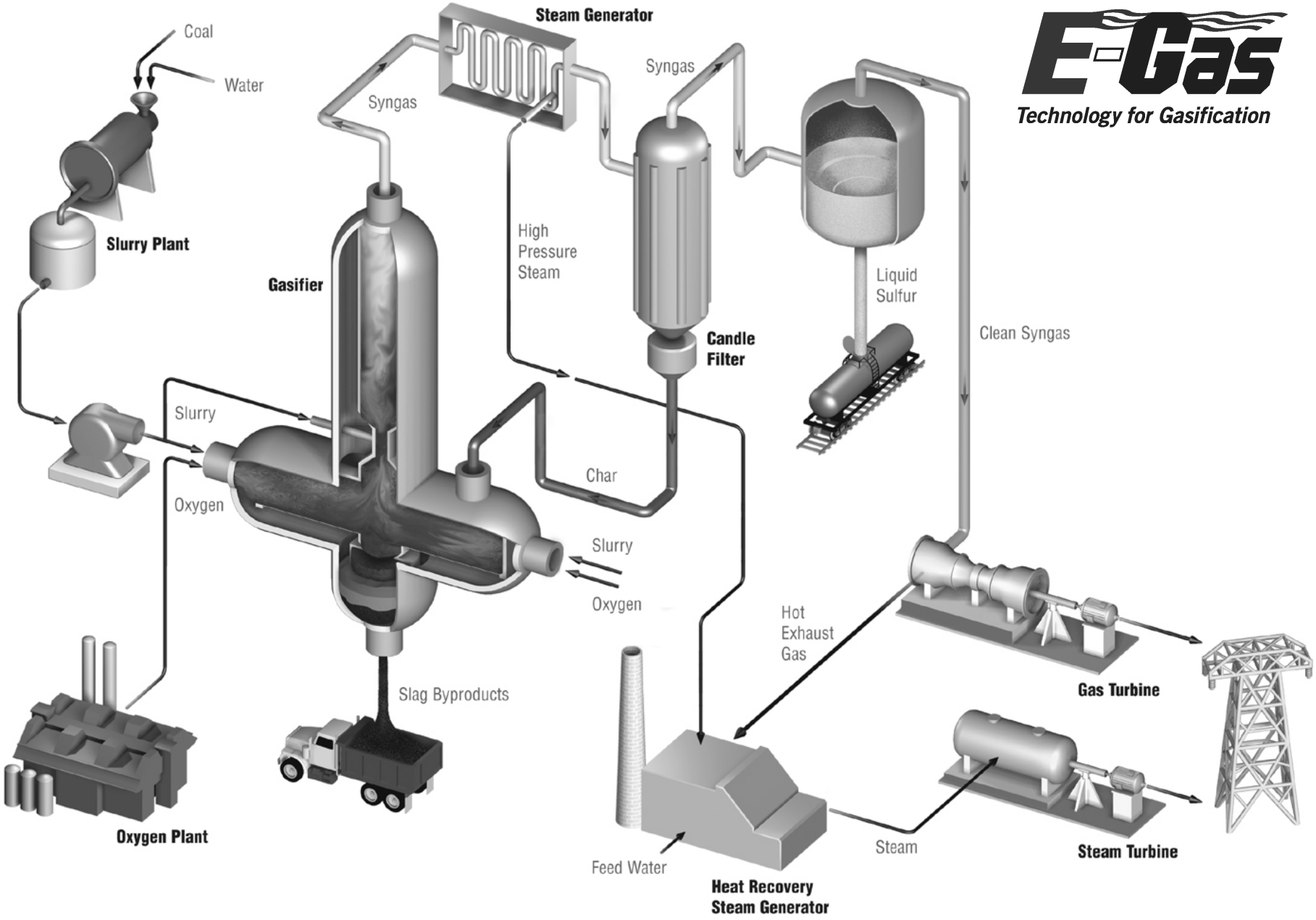
Gasification Plant

Oxygen Plant

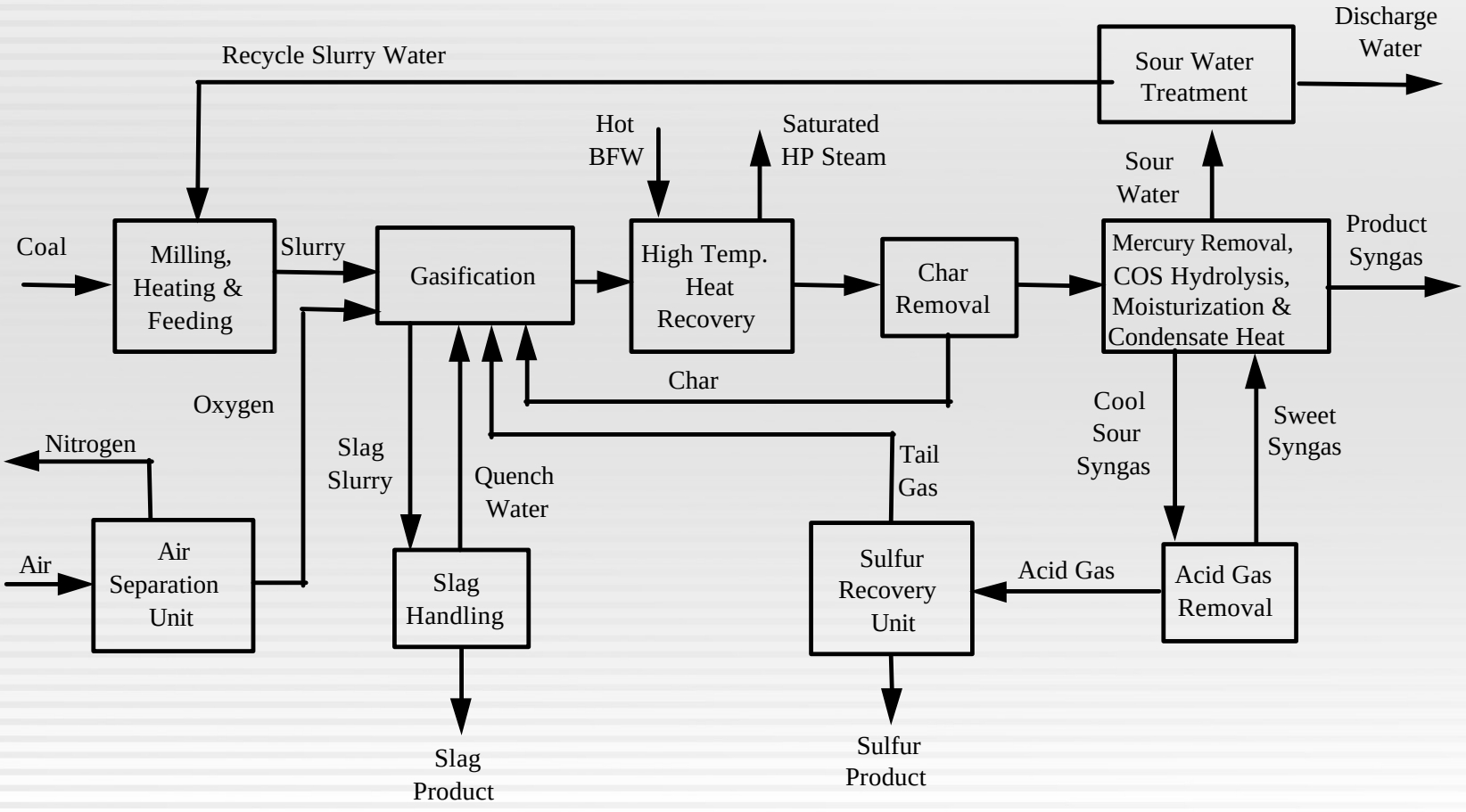


Wabash River Project Overview

- Coal Gasification Combined Cycle Repowering
- 262 MWe Net Output by repowering 100 MW 1953 PC Unit
- Operational since 1995
- Bituminous Coal and Petcoke, up to 7 % S
- Heat Rate Improved by 20% (~ 8900 Btu/kWh HHV)
- Cleanest Coal/Coke Fired Power Plant in the World
- Highest demonstrated petcoke throughput of any gasifier


E-Gas
Technology for Gasification
Steam Generator
Coal
Water
Syngas
Syngas
Slurry Plant
Gasifier
High
Pressure
Steam
Candle
Filter
Liquid
Sulfur
Clean Syngas
Slurry
Char
Oxygen
Slurry
Oxygen
Hot
Exhaust
Gas
Gas Turbine
Slag Byproducts
Oxygen Plant
Feed Water
Heat Recovery
Steam Generator
Steam
Steam Turbine

Gasification Process



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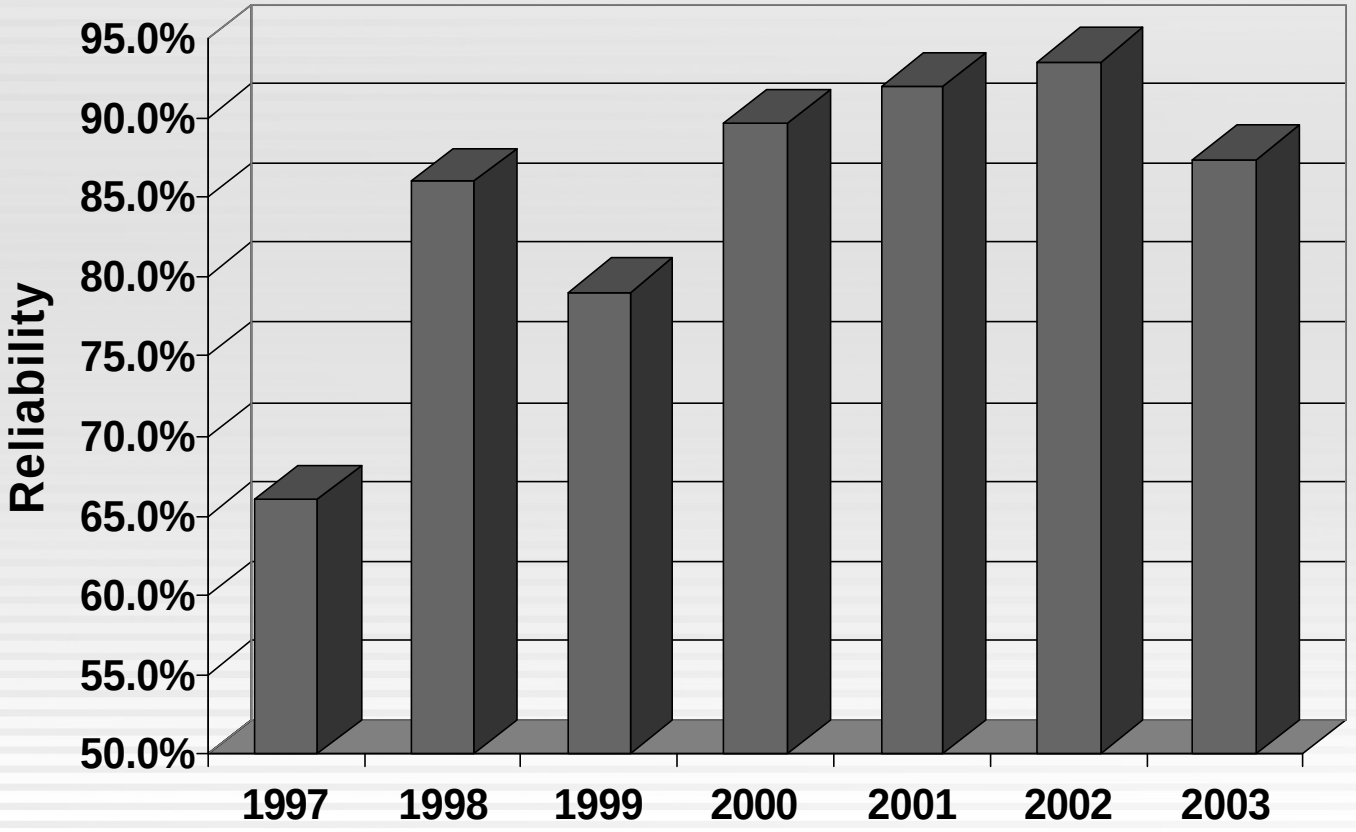
Maturity of E-Gas Technology at Wabash

$$\text{Reliability} = 1 - \frac{\text{Forced Outage Hours}}{\text{Period Hours}} \times 100\%$$



Availability

For a SINGLE TRAIN Gasification-Power Generation Tandem - **Coal**

January
February
March
April — > 91% Availability

May — 21 day planned outage

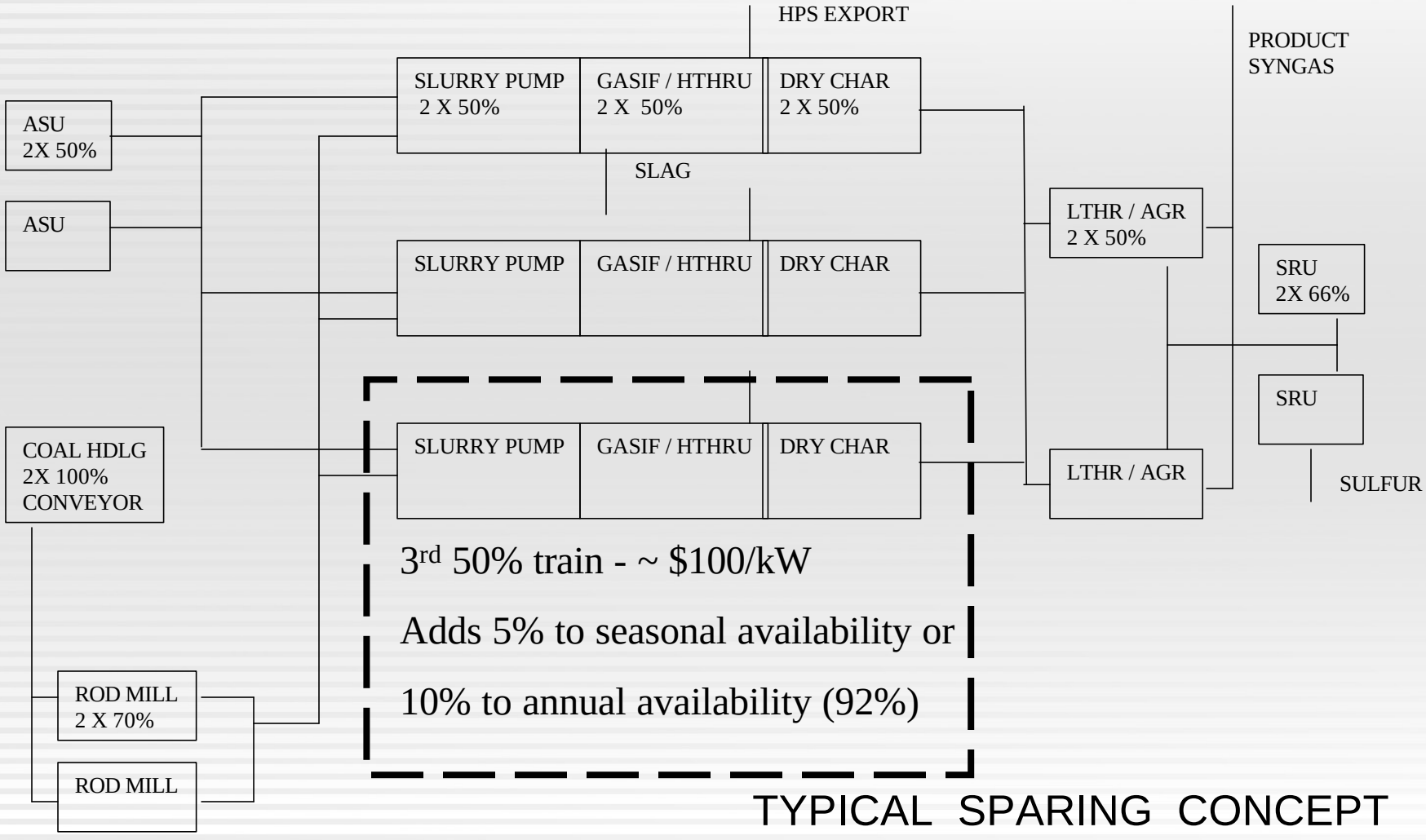
June
July
August
September
October — > 91% Availability

November — 21 day planned outage

December — > 91% Availability

80% Annual Availability

Availability Analysis



TYPICAL SPARING CONCEPT

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RAISE THE BAR

R oadmap
CURC/EPRI/DOE Roadmap Goals Progress

A dvanced Gasifier
Full Slurry Quench, Cyclone & Lessons Learned

I ntegrated Air Separation Unit & Gas Turbine
Reduces Cost and Station Use

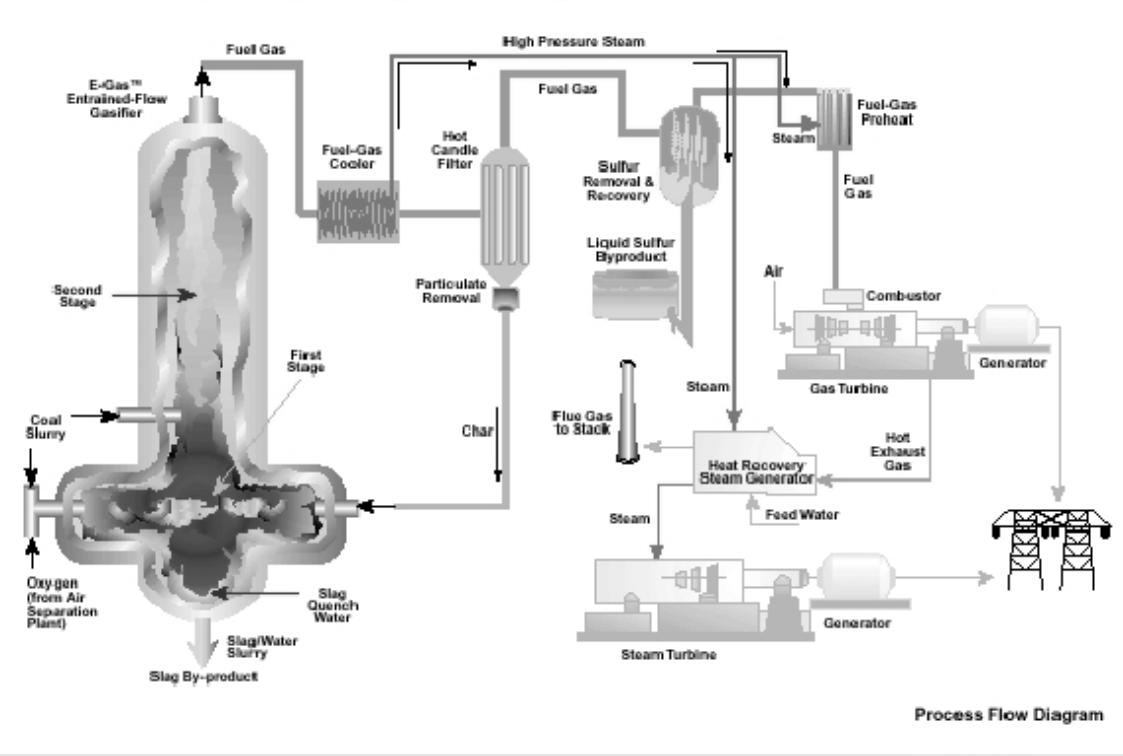
S equestration Adaptable Plant

E nvironmental Performance
Lower SOx, NOx and Particulate Emissions

T hermal Efficiency
Heat Rate Improved 500 Points from Average of Wabash and Polk

H g
90% + Mercury Removal

E conomies of Scale
Larger Plant at 30% Lower $/kW



B est Commercially Available Gas Turbine
Combustion Turbine Commercial Evaluation

A vailability
Multiple train plant will have > 90% availability

R eplicable Model
Standard Configuration for Multiple Sites

The Mesaba Energy Project

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E-Gas Availability based on Wabash Historical Data

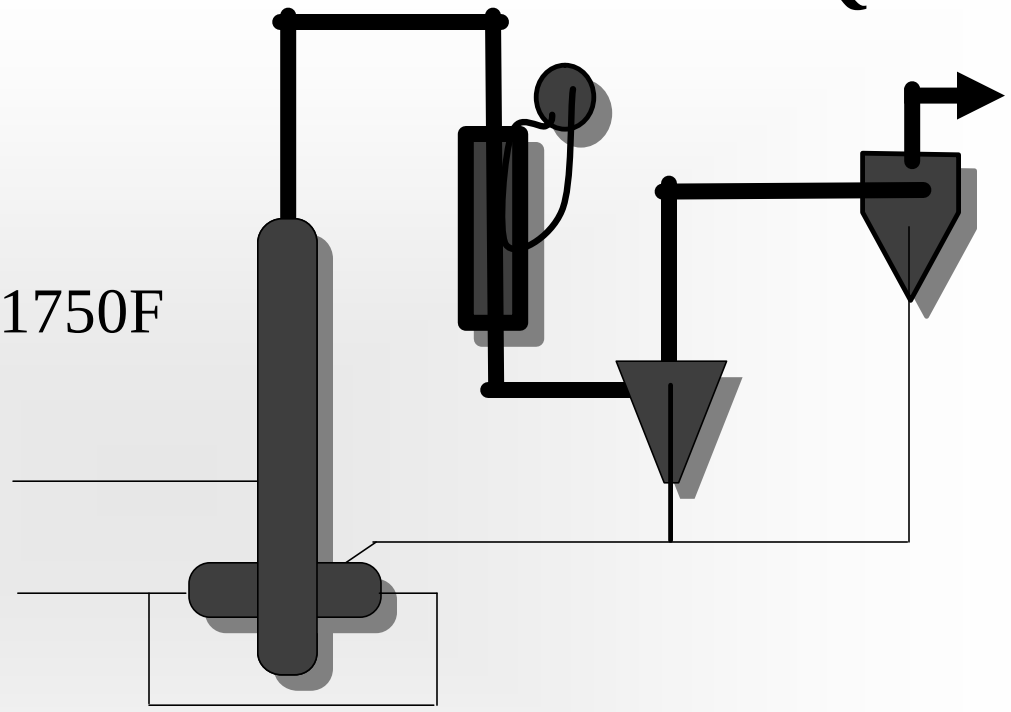
Wabash Historical Basis	2 - 50% Gasification Trains	3 – 50% Gasification Trains
Overall Annual Syngas Availability	81.3 %	92.7 %
Overall Annual Power Availability	79.7 %	90.9 %
Peak Period Power Availability	89.8 %	94.9 %

E-Gas Availability based on Projected Future Technology Improvements

FUTURE	2 - 50% Gasification Trains	3 – 50% Gasification Trains
Overall Annual Syngas Availability	86.7 %	94.4 %
Overall Annual Power Availability	84.9 %	92.5 %
Peak Period Power Availability	91.9 %	95.8 %

Full Slurry Quench

FSQ



~75/25 Slurry Split

Syngas Cooler inlet ~ 1550-1750F

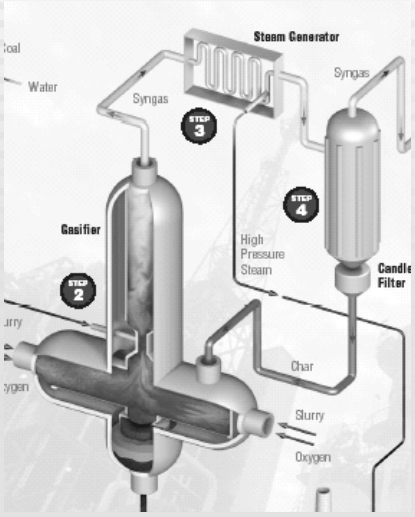
Cyclone / Candle Filters

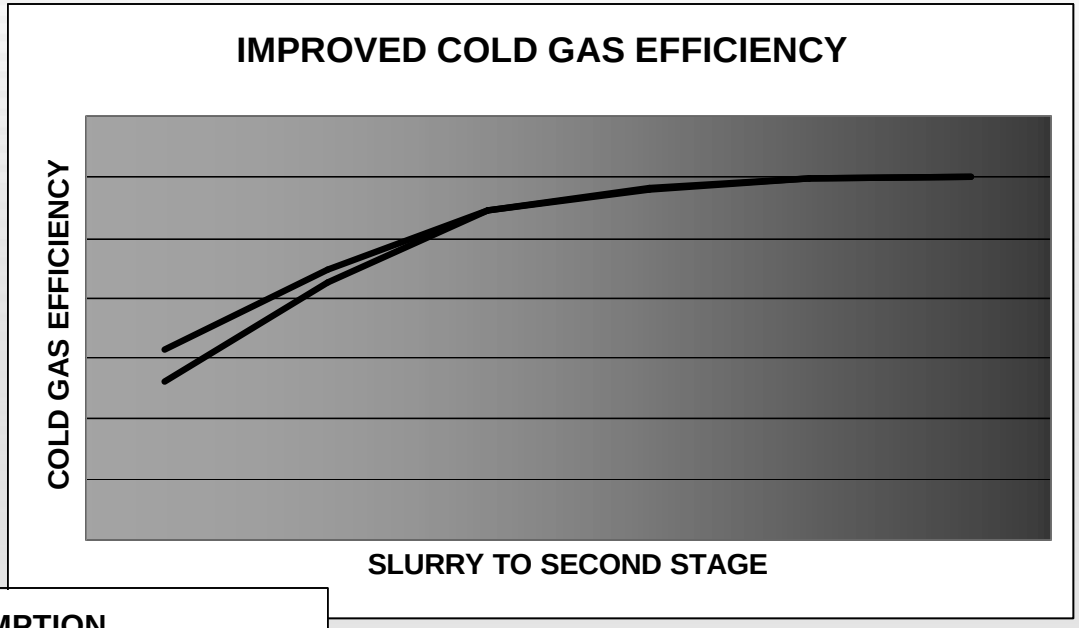
400 – 600 psig gasifier

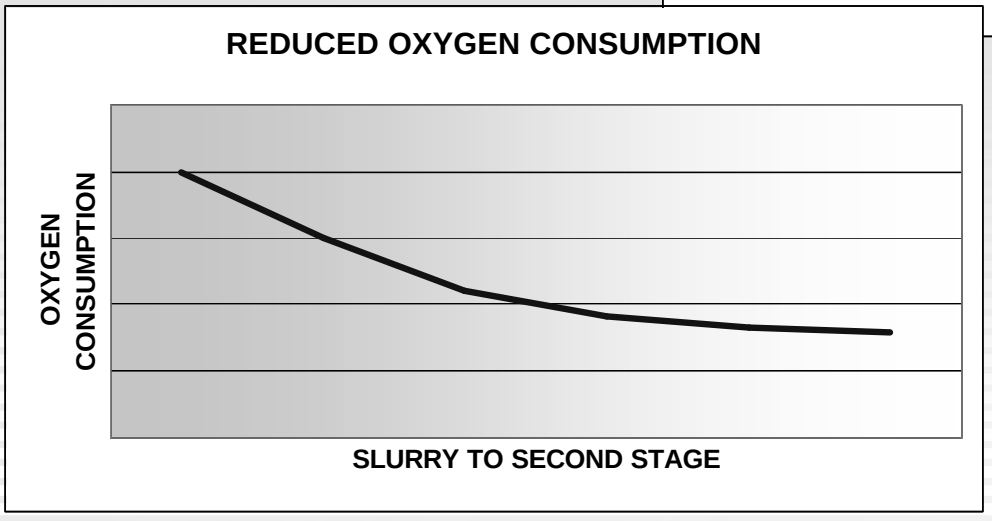
Over 1300 hours at 82/18 and higher demonstrated at Wabash

Current Commercial Template

TECHNOLOGY EVOLUTION







PSQ vs FSQ

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Figure 17 - Impact of Full Slurry Quench on Heat Rate of the Overall IGCC Efficiency Cycle

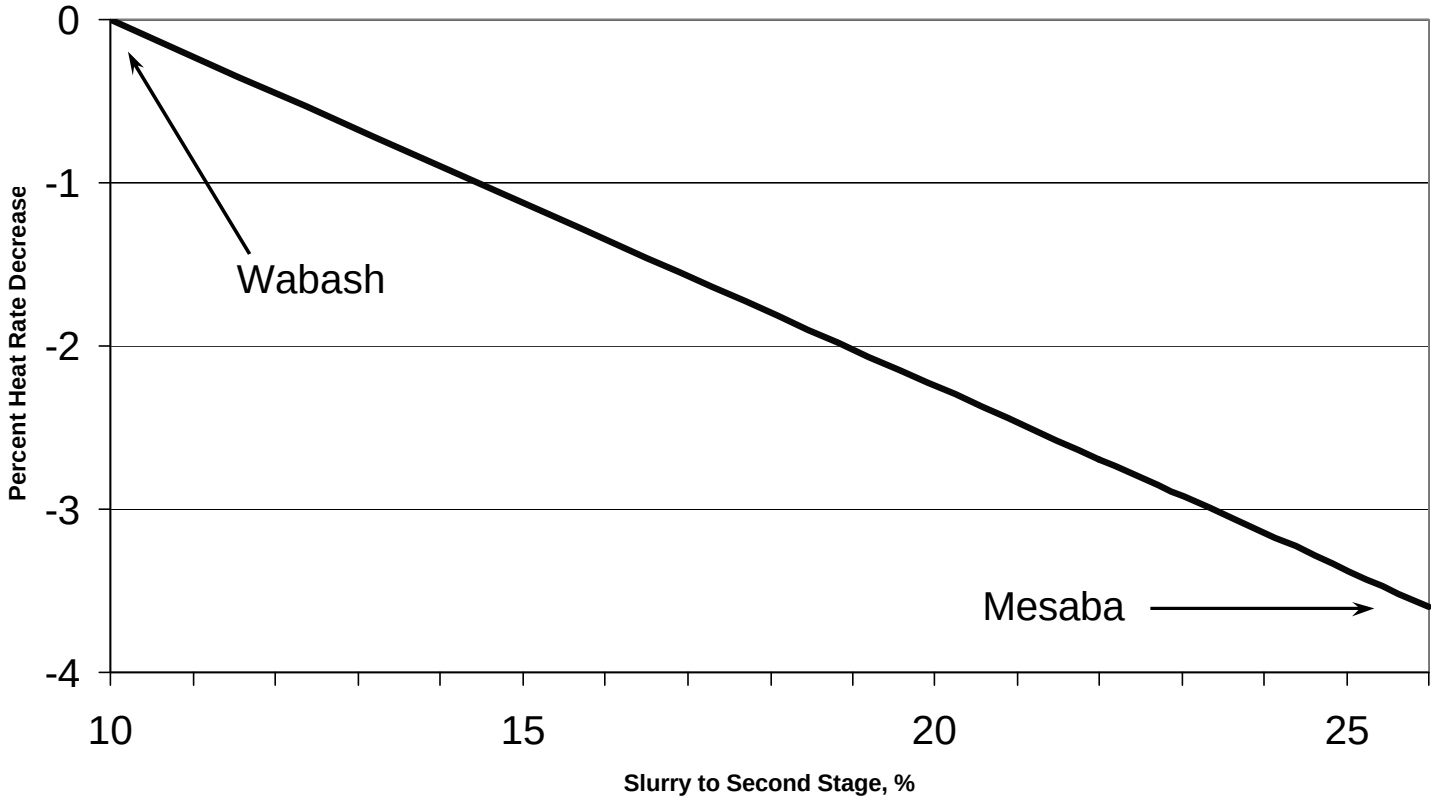


Figure 16 - Impact of Full Slurry Quench on Coal Conversion Efficiency in the Gasifier

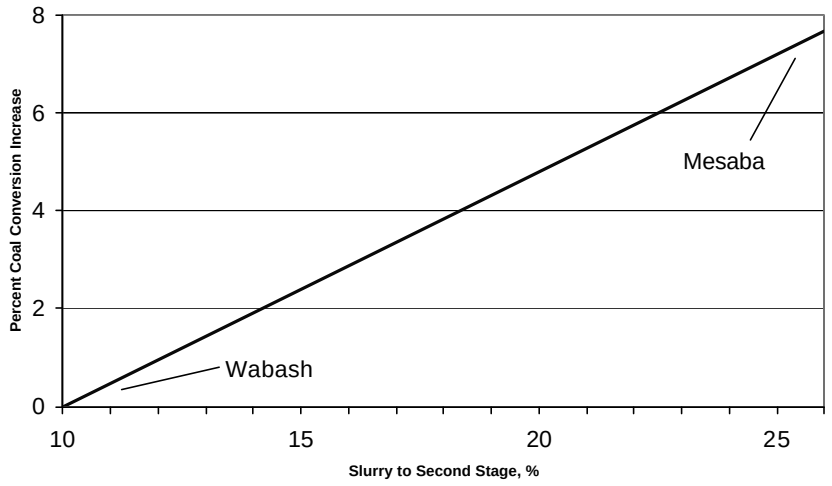
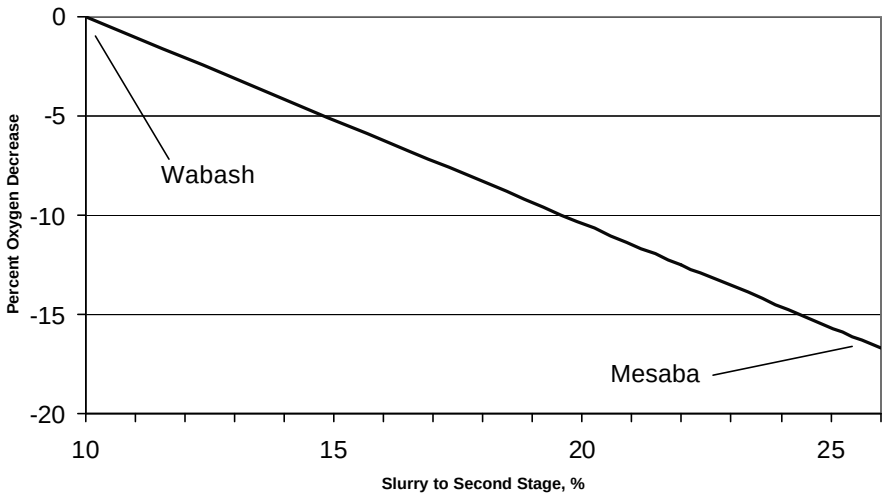


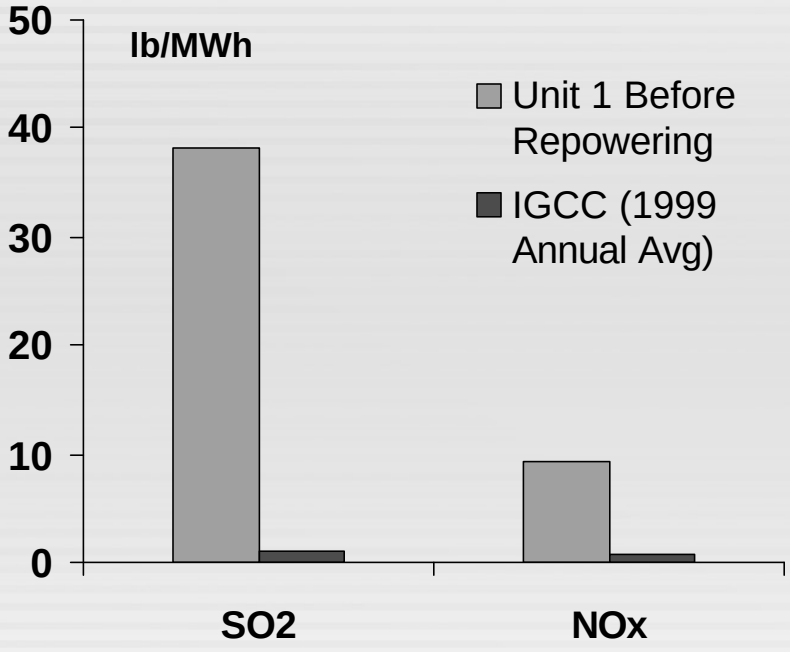
Figure 15 - Impact of Full Slurry Quench on Oxygen Consumption in the Gasifier

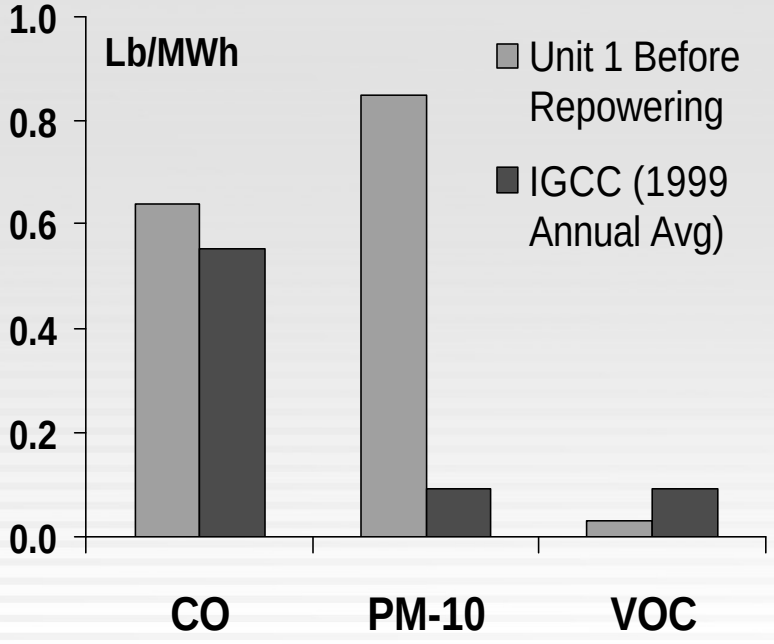


Current Commercial Design Features

Air Separation Unit	50 Year Old Technology, integration
Combined Cycle Plant	95% of US Generation 1997-2002
Gasification	Wabash ~40% novel technology. NP < 5%
Rod Mill	Same as Wabash & LGTI
Slurry Pumps	Same as Wabash & LGTI
Gasifiers	Same Vessel, increased use of 2nd stage
Syngas Cooler	Same as Wabash & LGTI
Particulate Removal	Wabash + Cyclone (demo under way)
Gas Clean Up	Common Refinery Technology + COS from Wabash, Mercury removal
Steel/Piping/Wire	Economy of Scale

Repowering Emissions Comparison





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Wabash Emissions Comparison

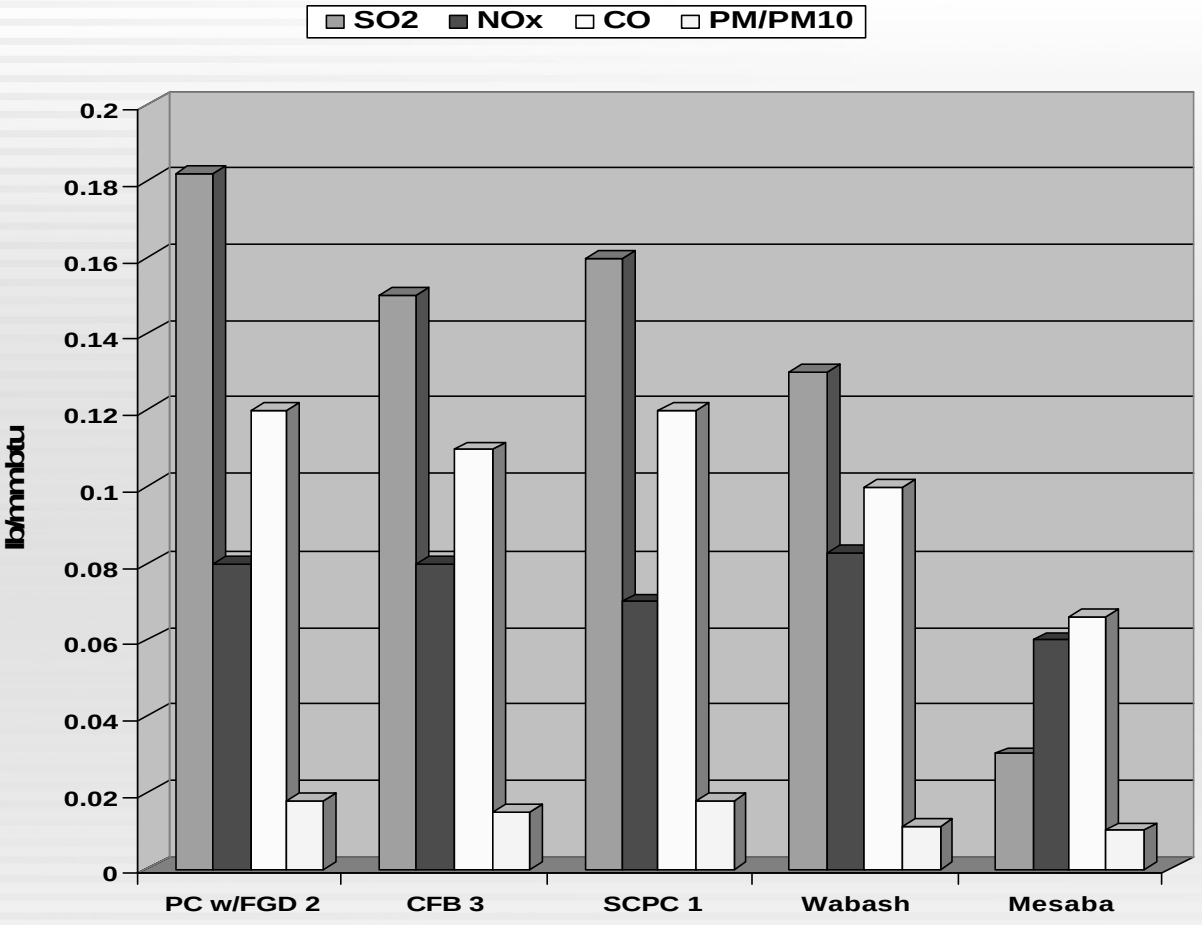
Emissions, lb/MWh

	SO2	NOx	CO	PM-10	VOC
Unit 1 before Repowering	38.2	9.3	0.64	0.85	0.03
IGCC (1999 annual avg.)	1.075	0.75	0.555	0.09	0.09
Emissions Reduction TPY	**5,505**	**1,179**	**(83)**	**101**	**(25)**

Comparing 100 MW PC unit running 35% availability and 262 MW IGCC running 75% availability

(5.6 X more megawatt hours produced)

Coal Plant Emissions Comparison



(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.

Coal Fired Power Plant Emissions: LB/MMBtu

Lb/MMBtu	Supercritical Pulverized Coal (SCPC) [1], [4]	PC with ESP & FGD [2], [4]	CFB [3], [4]	Mesaba IGCC
SO_2	0.160	0.182	0.150	0.030
NOx	0.070	0.080	0.080	0.060
VOC	0.004	0.0004	0.004	0.003
CO	0.120	0.120	0.110	0.066
PM/PM10	0.018	0.018	0.015	0.01
Hg (lb/10^{12} Btu)	2.3	2.2	4.0	0.5

[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)

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[4] Electric Utility Steam Generating Unit Hg Test Program, EPA, October 1999.

Coal Fired Power Plant Solids Generation				
		PC with		
Tons per Year	**SCPC[1]**	**ESP & FGD[2]**	**CFB[3]**	**Mesaba IGCC**
Ash	83,047	243,060	0	0
Synthetic Gypsum	101,384	450,643	-	-
Slag	-	0	0	181,004
Total, TPY 531 MW (net) Basis, 90% Capacity Factor	**184,431**	**693,703**	**695,580**	**181,004**

Pollutant Removal Advantages

Mercury Removal

- 90-95% removal utilizing carbon beds

Carbon Dioxide

- Gasification is carbon capture friendly

Solid Byproducts – not Wastes

- Sulfur - 99.99% pure
  - 100,000+ tons sold at Wabash
  - Equivalent to 400,000,000 lbs of SO_2

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

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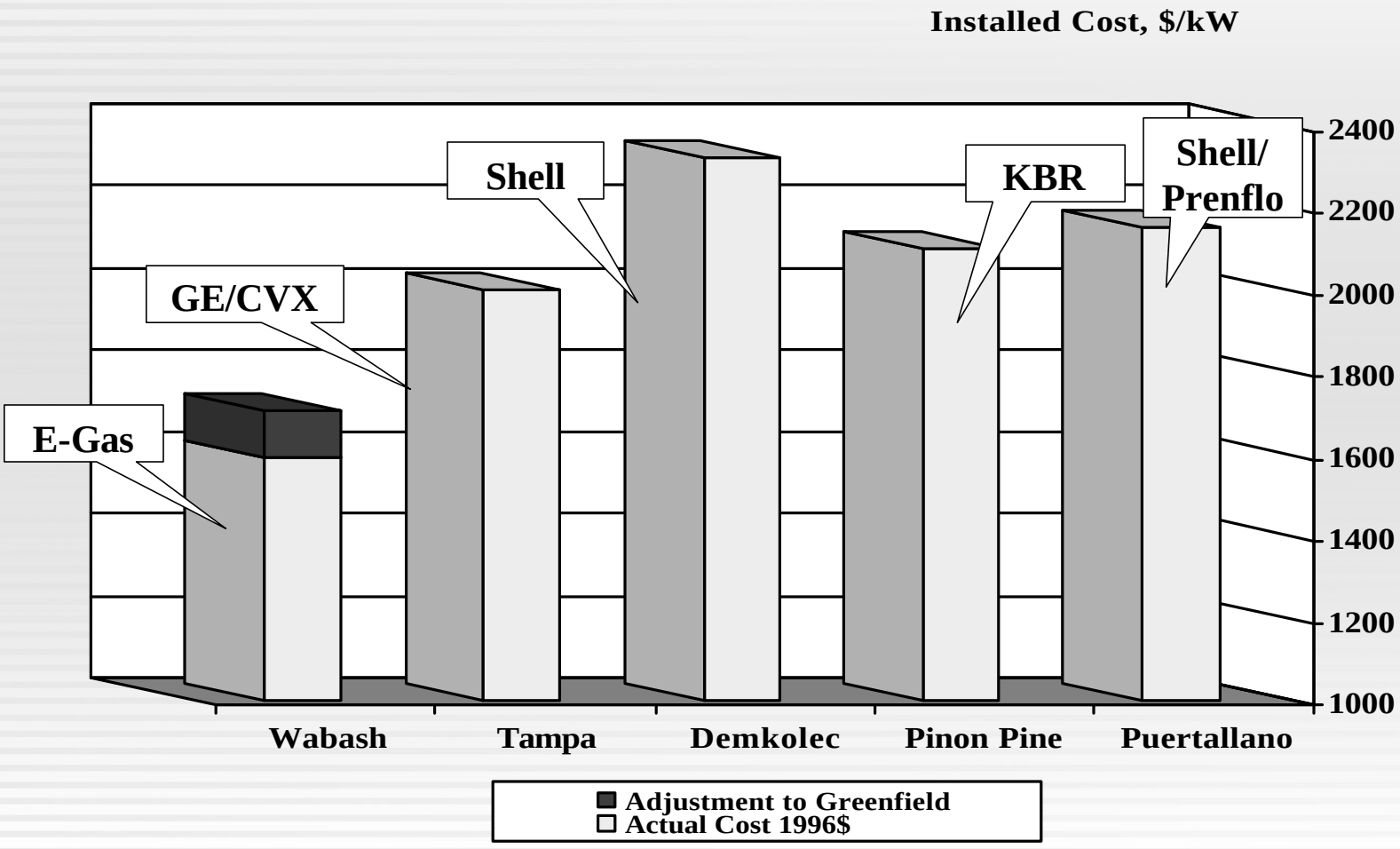
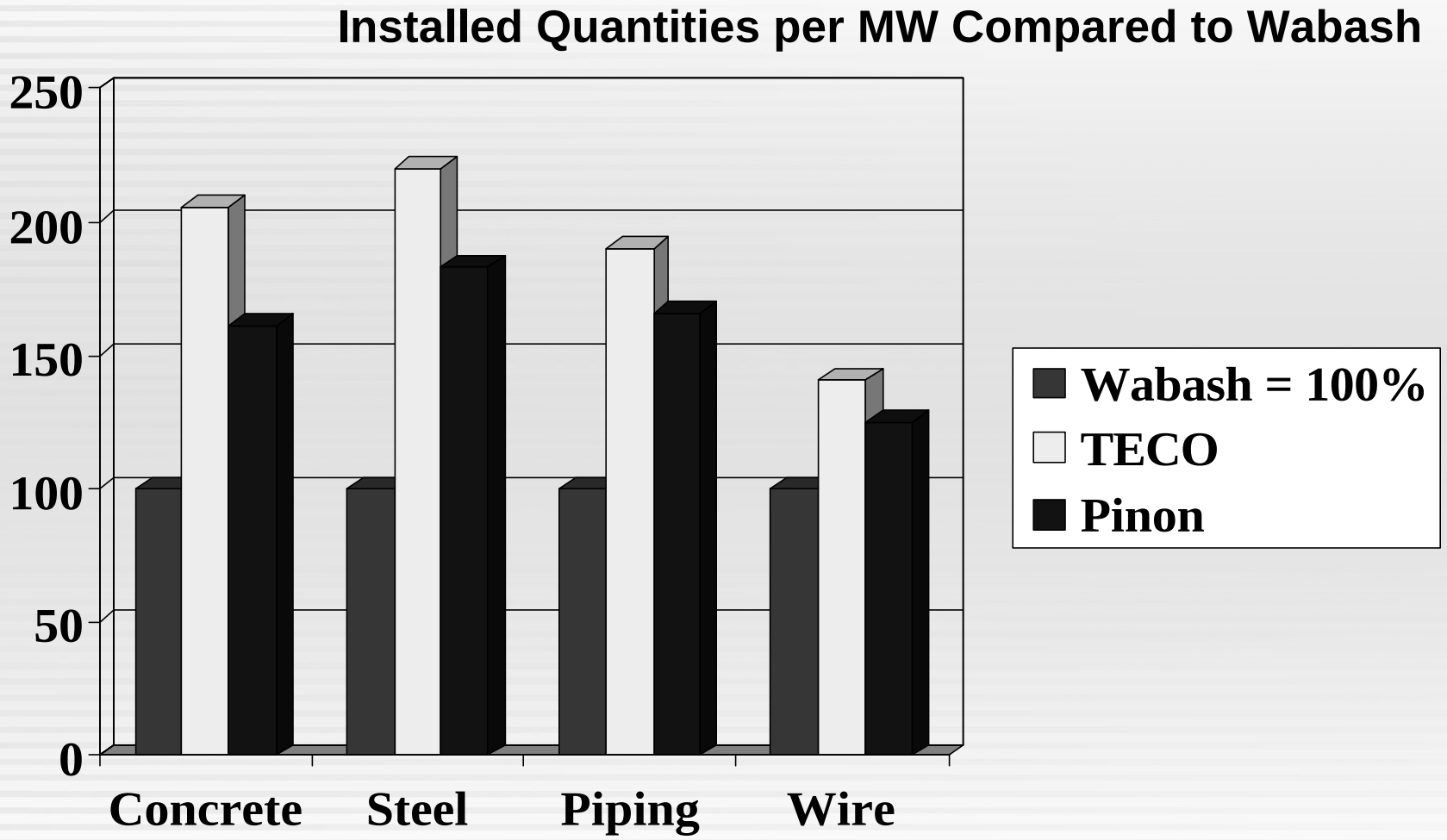
INSTALLED COSTS OF FIRST GENERATION COAL FIRED IGCC



Reported Costs through 1996

E-Gas = Compact Design



E-Gas = Compact Design

COMPARISON OF INSTALLED QUANTITIES PER MEGAWATT

	WABASH Greenfield	POLK	PINON
Concrete (Cu. Yd. / MW)	87	180	140
Steel (Tons / MW)	11	25	21
Piping (LF / MW)	622	1180	1035
Cable (LF / MW)	6231	8800	7820

EGAS TECHNOLOGY GASIFICATION PROCESS

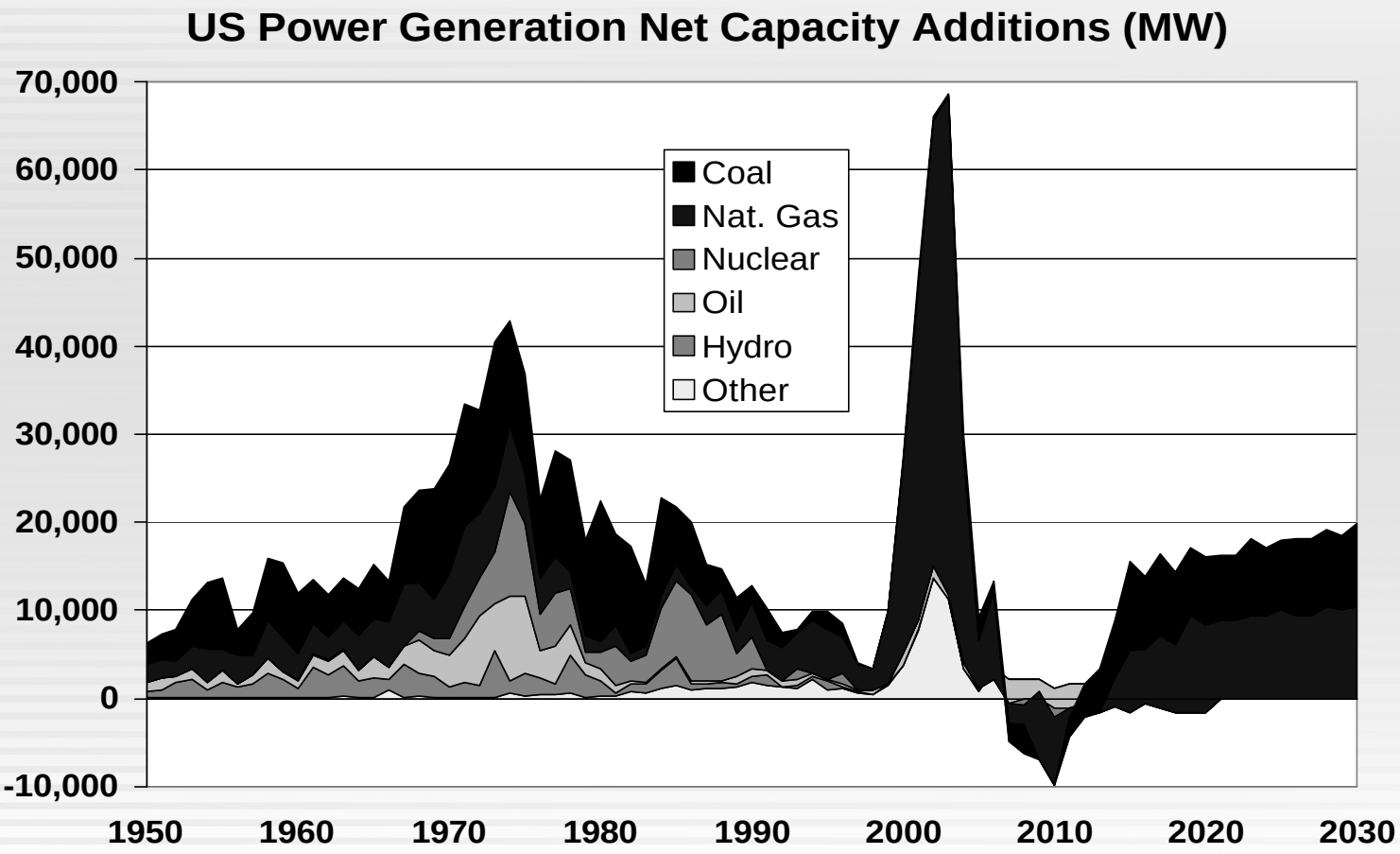
CAPITAL COST ADVANTAGE

- Smaller heat recovery unit
  - 25% of the weight of radiant types
  - not stacked, reduces height of gasifier structure
- Efficient two stage process reduces oxygen demand
- Proprietary low profile slag removal system
  - continuous, no lock hoppers
  - reduces height of gasifier structure

Advantages of the E-Gas Technology

- Patented slurry-oxygen mixer facilitates high carbon conversion.
- Proprietary low profile slag removal system avoids expensive, structure-elevating and maintenance-prone lock hoppers.
- Patented two-stage design improves heating value of the gas and energy efficiency.
- Unique firetube syngas cooler minimizes the size and cost of the heat recovery system and results in high conversion efficiencies for both thermal and chemical energy.
- Dry solid particulate removal and recycle system improves thermal efficiency and consolidates the solid effluent from the process in one stream, namely the slag leaving the first stage gasifier.

Natural Gas May No Longer be the Fuel of Choice



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