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PFBC and IGCC Power Generation Technologies -- Status and Opportunities

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**Conference Dates:**

July 16-18, 1996

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# **Advanced Coal-Fired** **Power Systems '96**

***Dan Brdar***     ***IGCC Product Manager***  
***Bob Reuther***   ***PFBC Product Manager***

***Morgantown Energy Technology Center***  
***July 16, 1996***

# Overview

- *Product Lines*
- *Product Goals*
- *Product Development Strategy*
- *This Year's Successes*
- *Barrier Issues*
- *Key Plans For Next Year*
- *Technical Status*
- *Market Opportunities*



# *Vision*

*Worldwide, Most New And Repowered Electric  
Generating Capability Will Use IGCC And PFBC  
Technologies Due To Their Superior Environmental  
Performance, Cost And Efficiency*

# *Product Lines*

*"The Future of Coal Based Power Generation"*

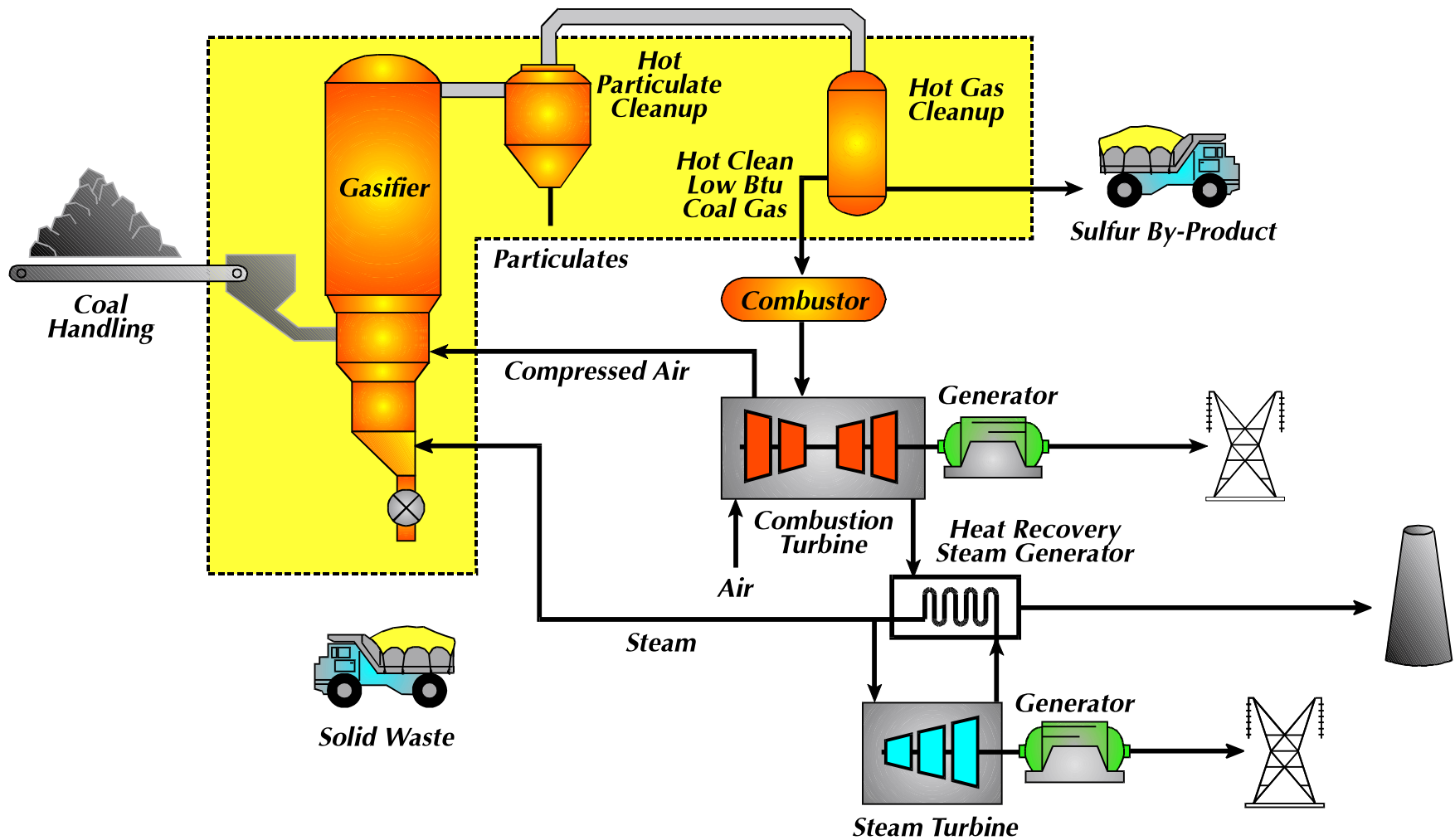


***IGCC***

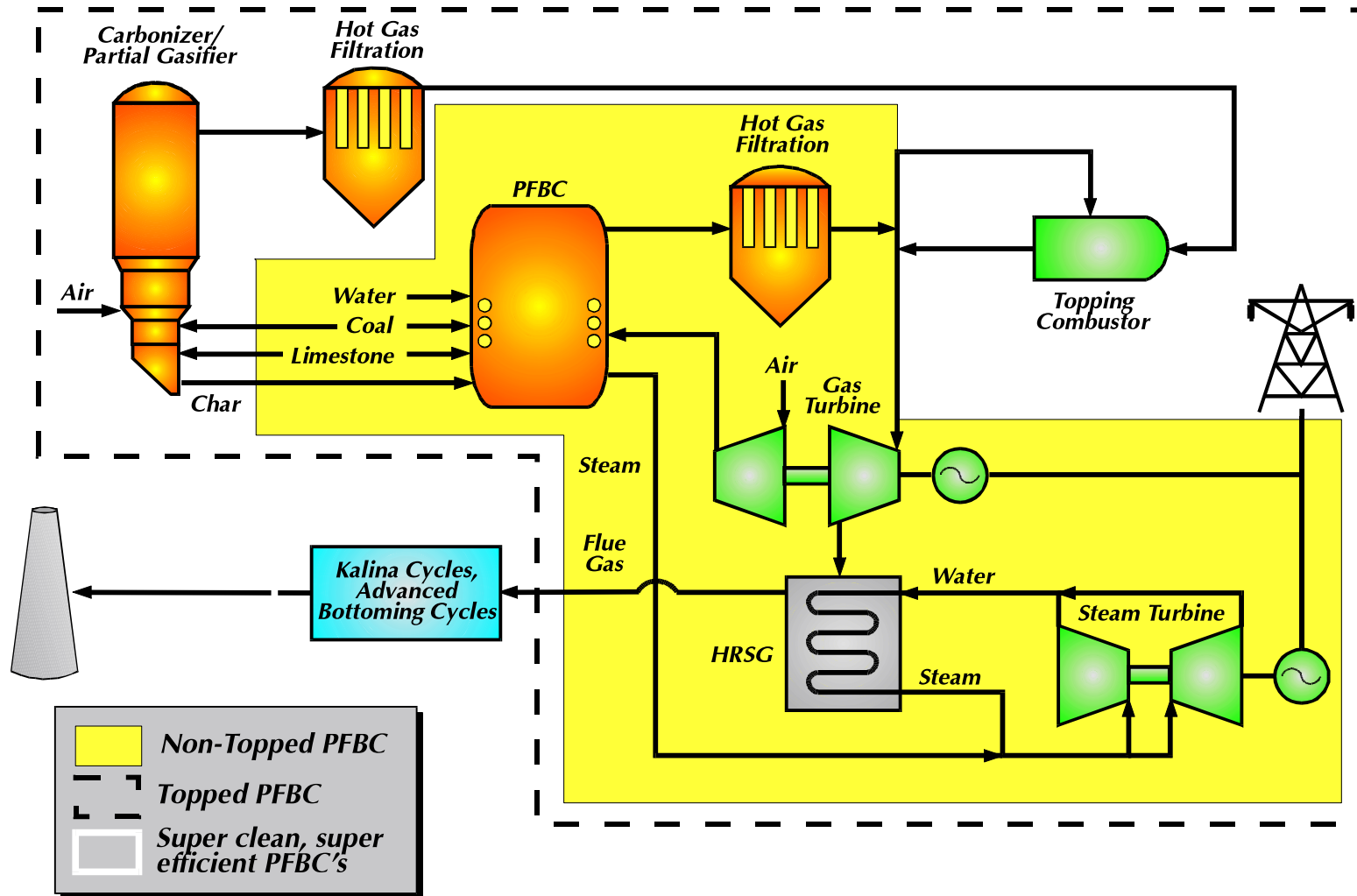


***PFBC***

# Integration Gasification Combined Cycle (IGCC)



# Pressurized Fluidized Bed Combustion (PFBC)



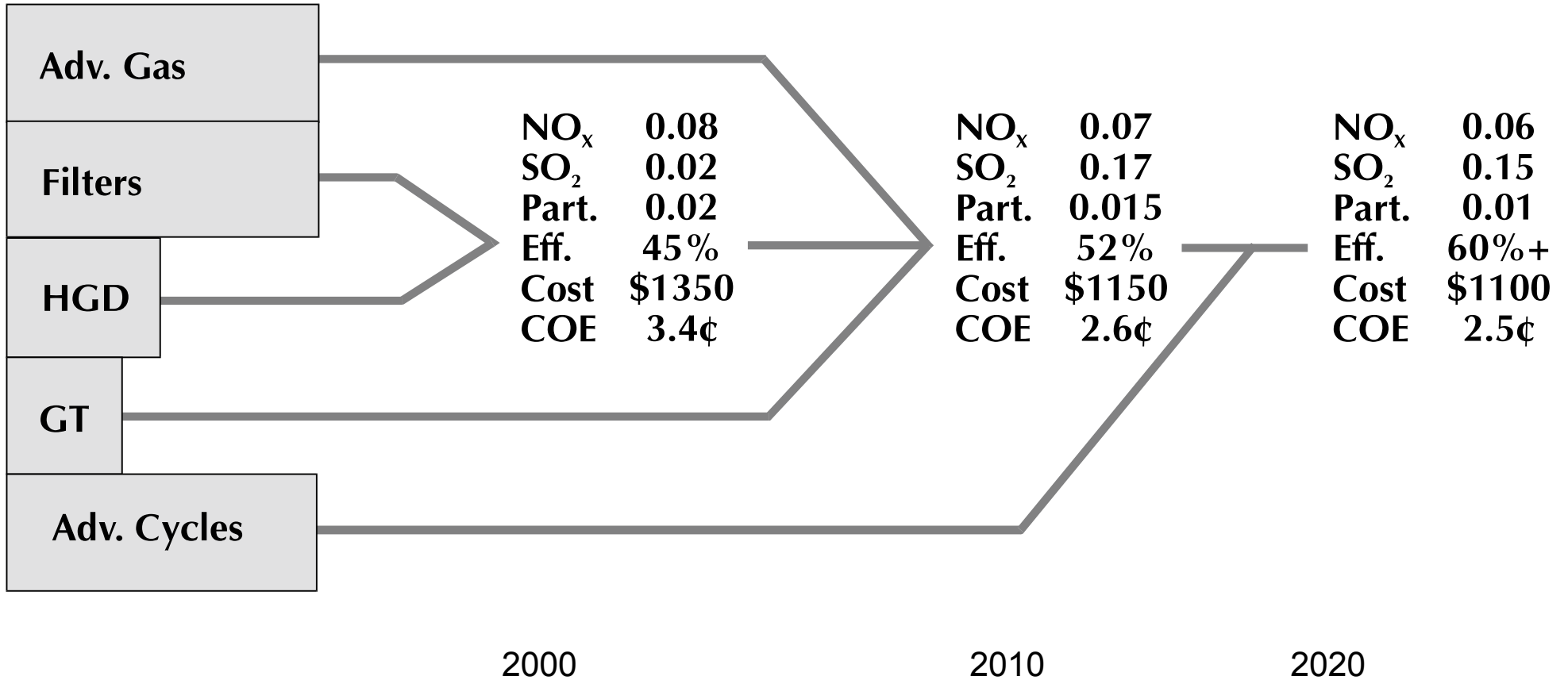


# Goals

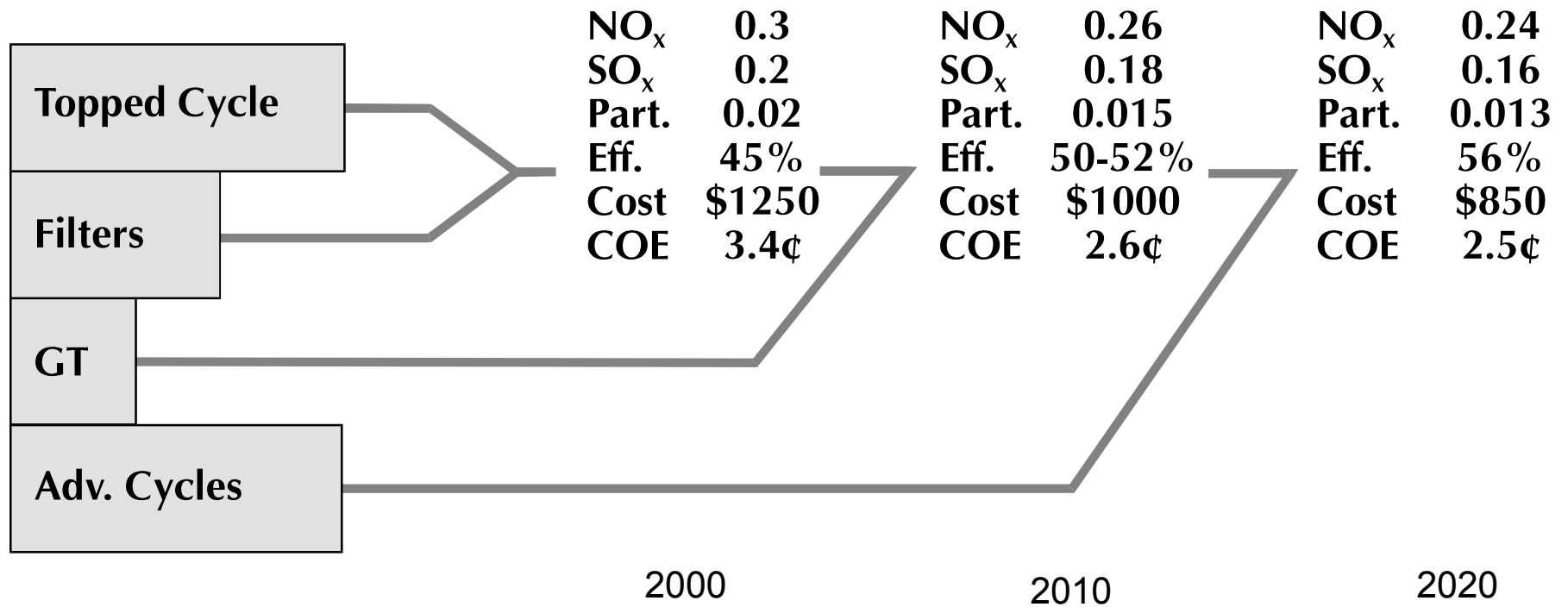
- ***Coal Based Power Systems***
  - ***Environmental Performance***
  - ***Efficiency***
  - ***Cost***



# IGCC Goals



# PFBC Goals



# Product Development Cycle

*METC  
In-House  
R&D*

**Concept  
Development**

**Subsystem / Component  
Advances**

**Cooperative Research and Development**

*Contractor  
R&D*

**Systems  
Studies**

**Bench  
Scale  
Tests**

**PDU / Pilot  
Scale  
Tests**

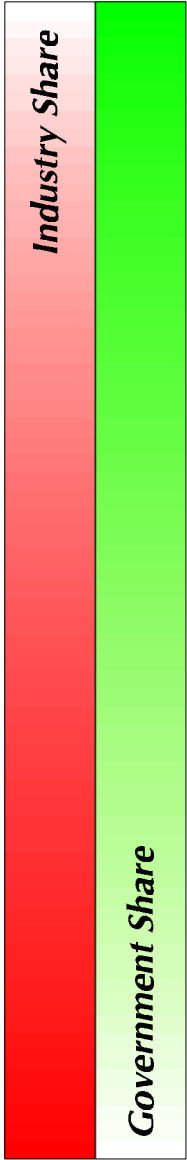
*Clean Coal  
Technology (CCT)  
Programs*

**Demonstration Plants**

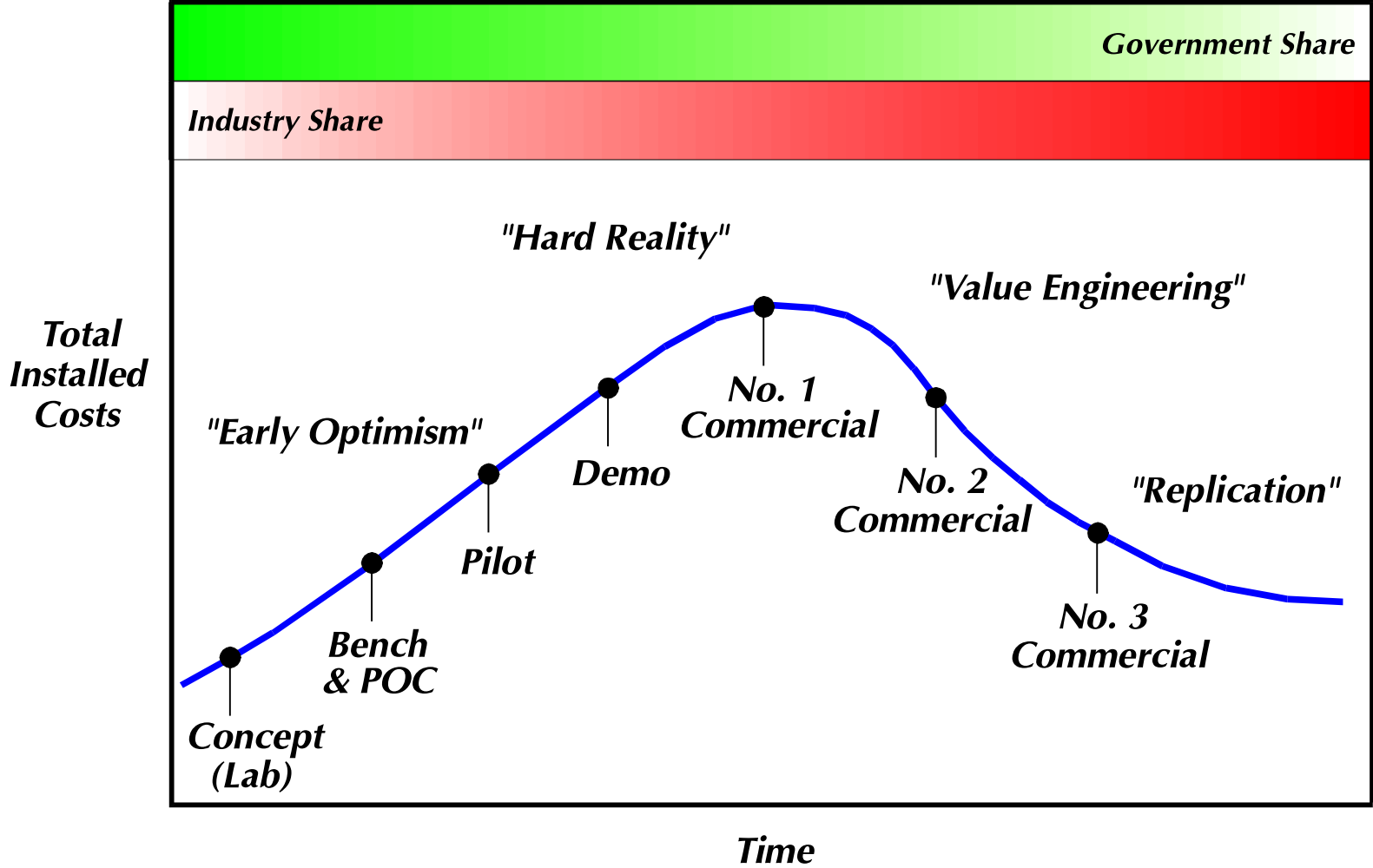
*Design/Operational  
Support*

*Product Improvement*

**Commercial Plants**



# Product Development Cycle



# ***Technical Status***

- ***Key R&D Activities***
- ***Product Development***
- ***Demos and R&D***

# ***Key R&D Activities***

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## ***Sorbents***

***ICCI  
GEESI  
METC  
RTI***

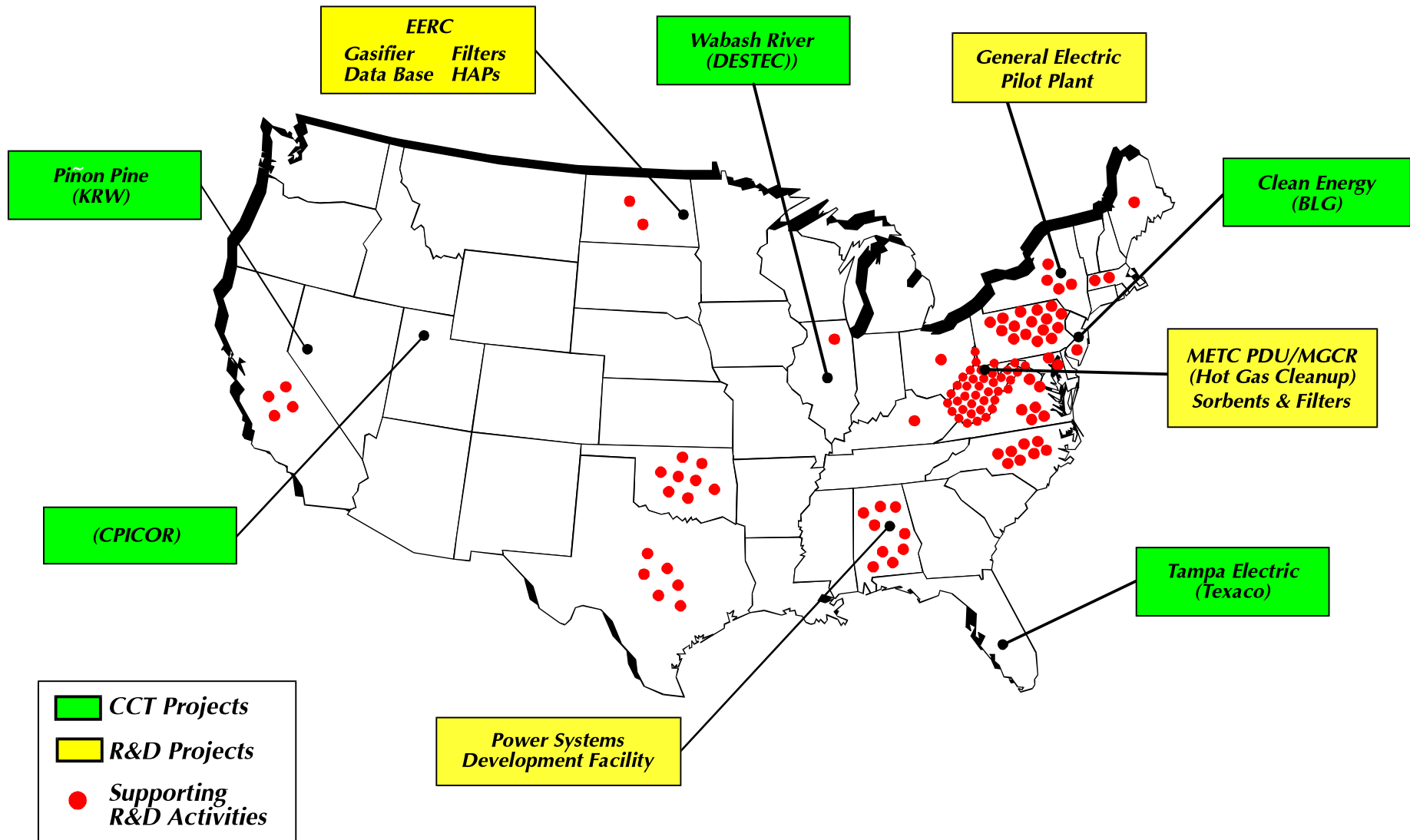
## ***Filters***

***EERC  
MGCR  
KARHULA  
METC***

## ***Air Toxics***

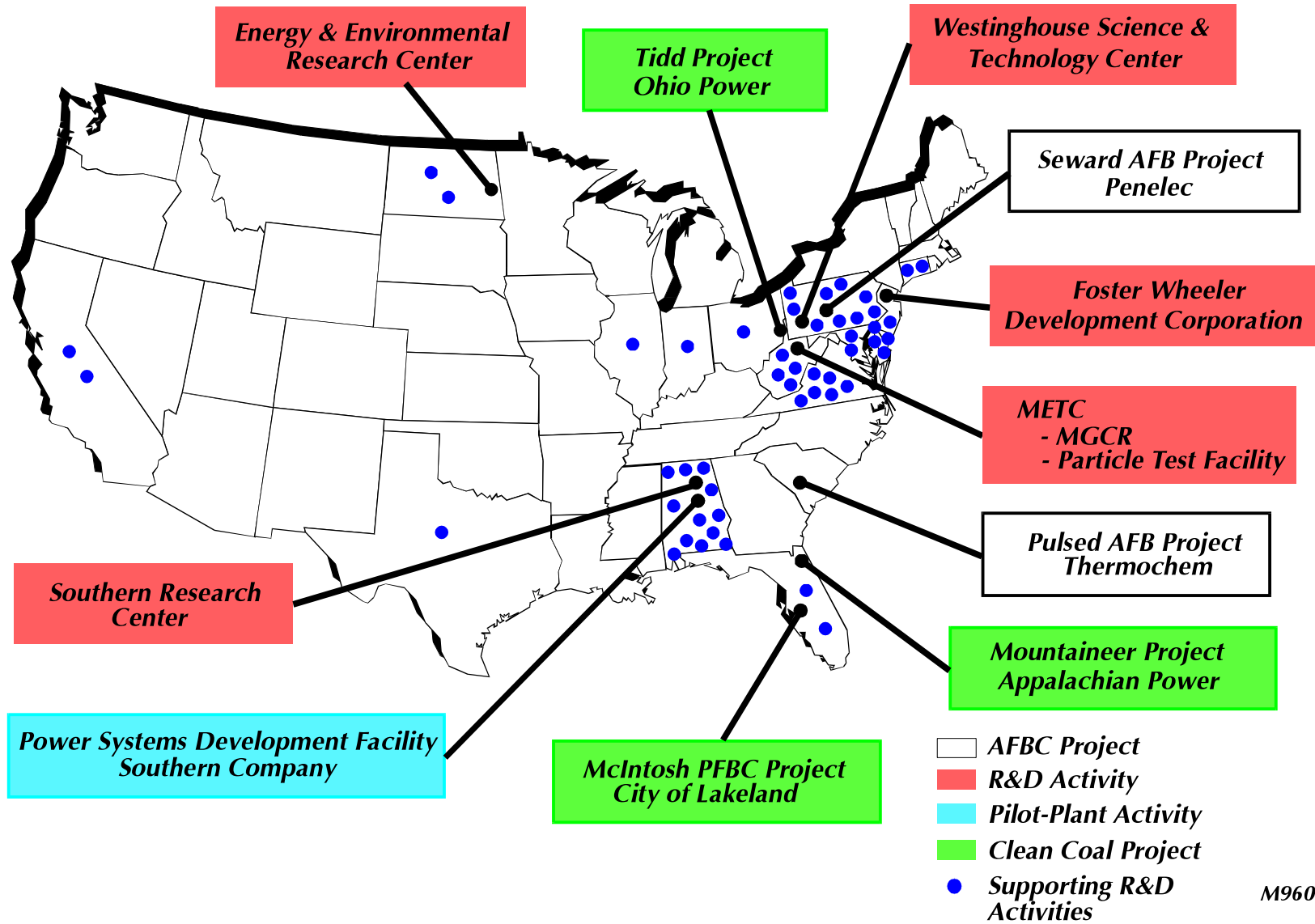
***LGTI  
AMES***

# IGCC Projects, Major R&D, Support

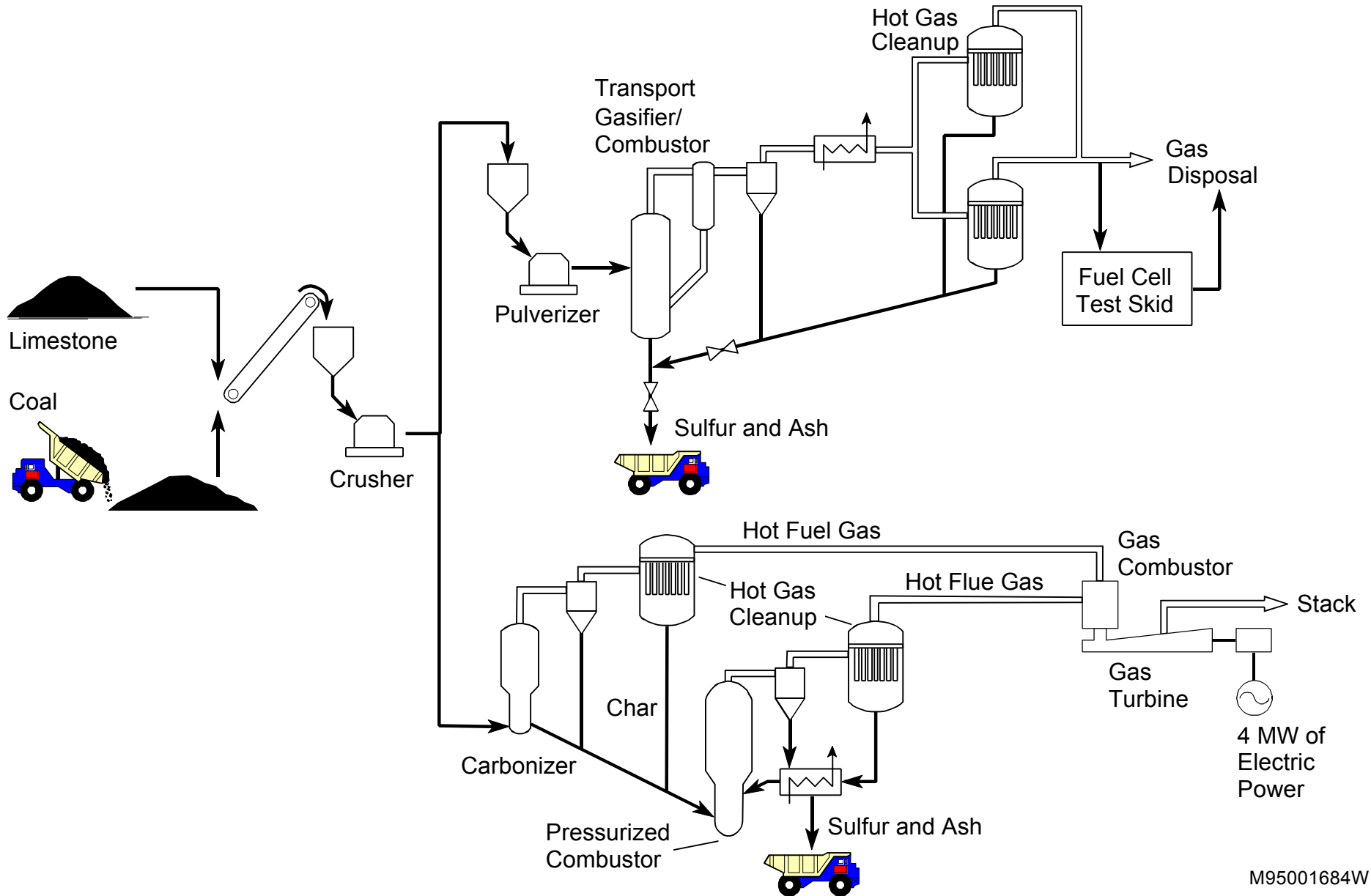


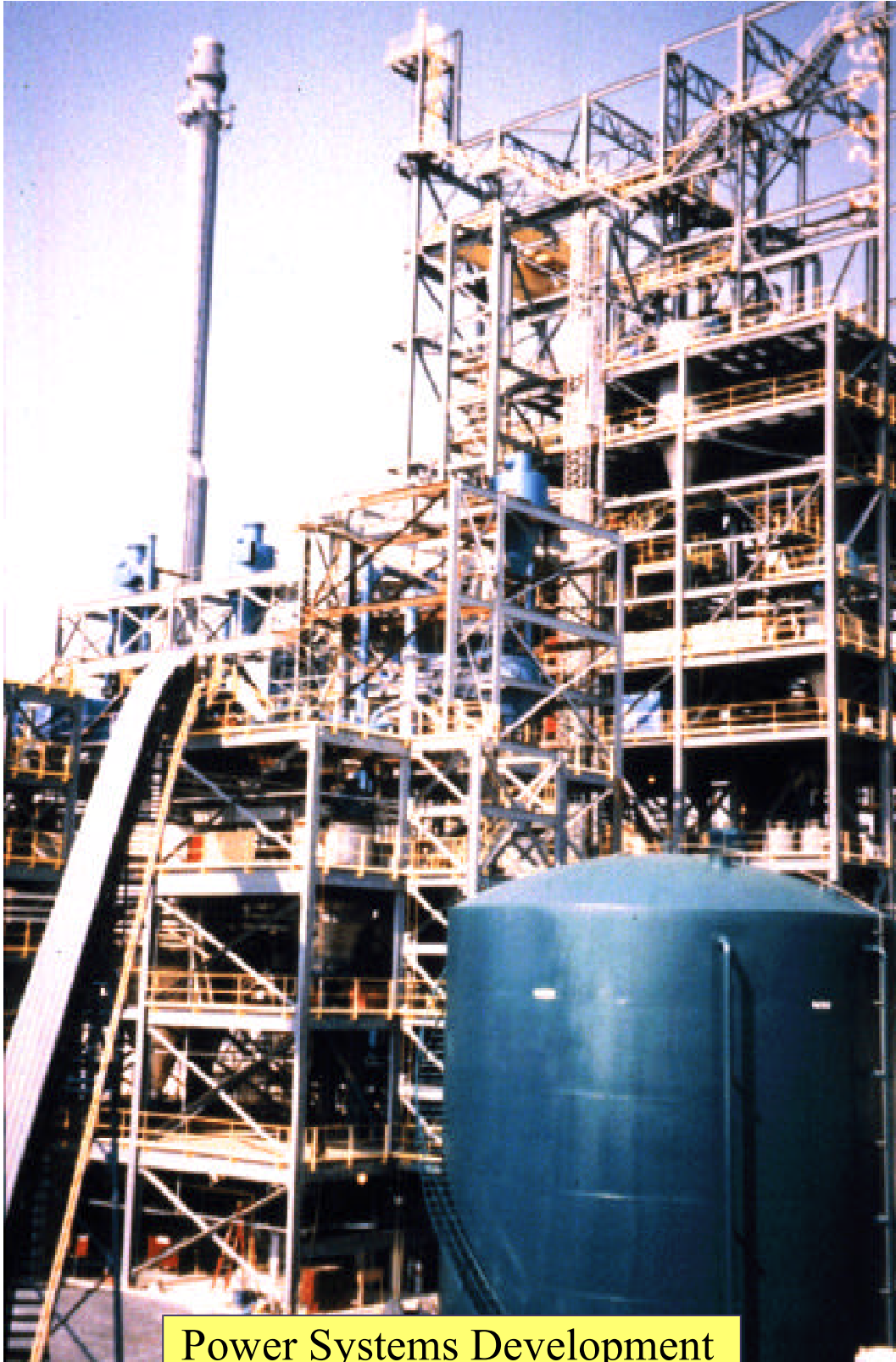


# PFBC Projects, Major R&D, Support



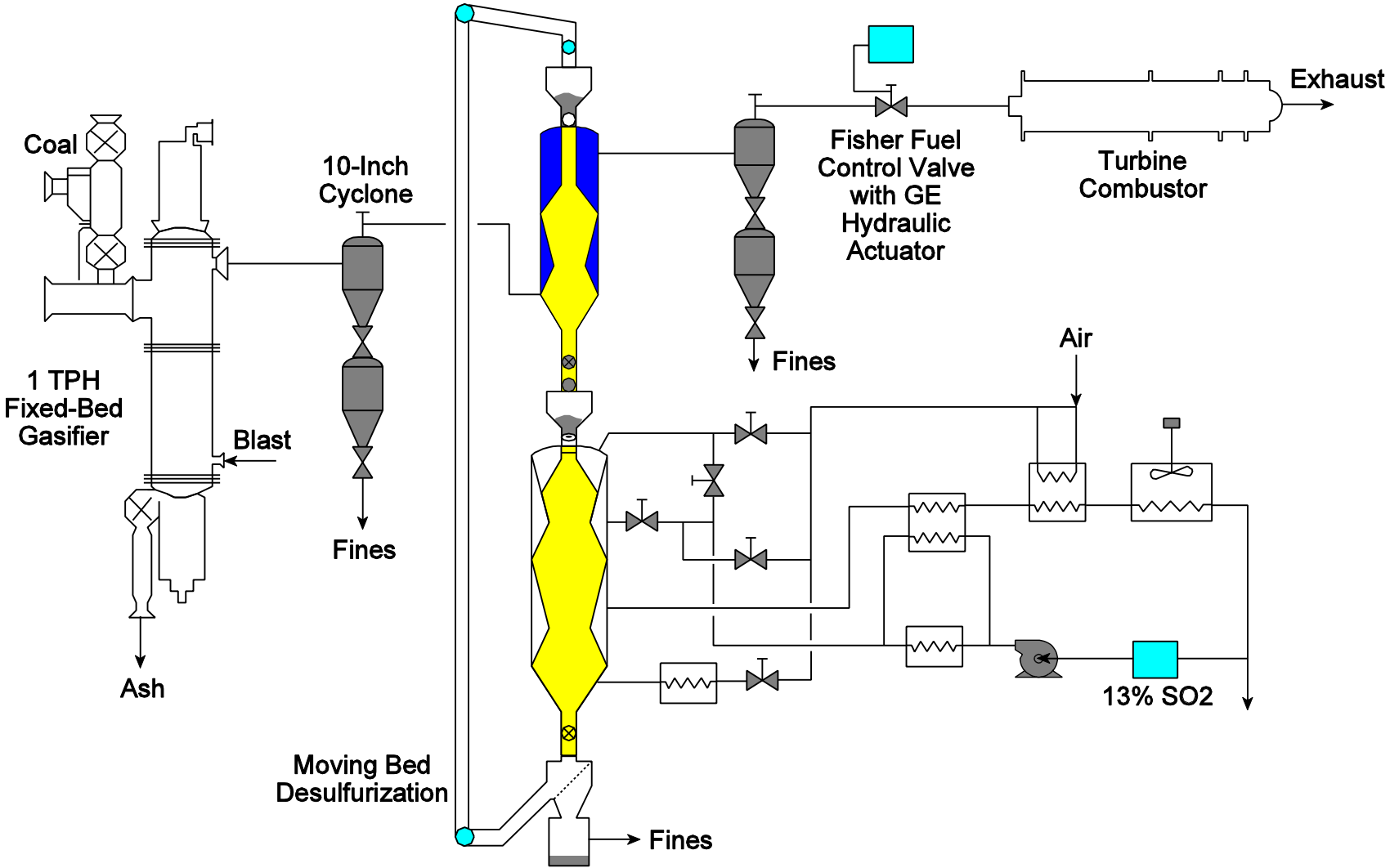
# Power Systems Development Facility Consists of Two Separate Reactor Systems

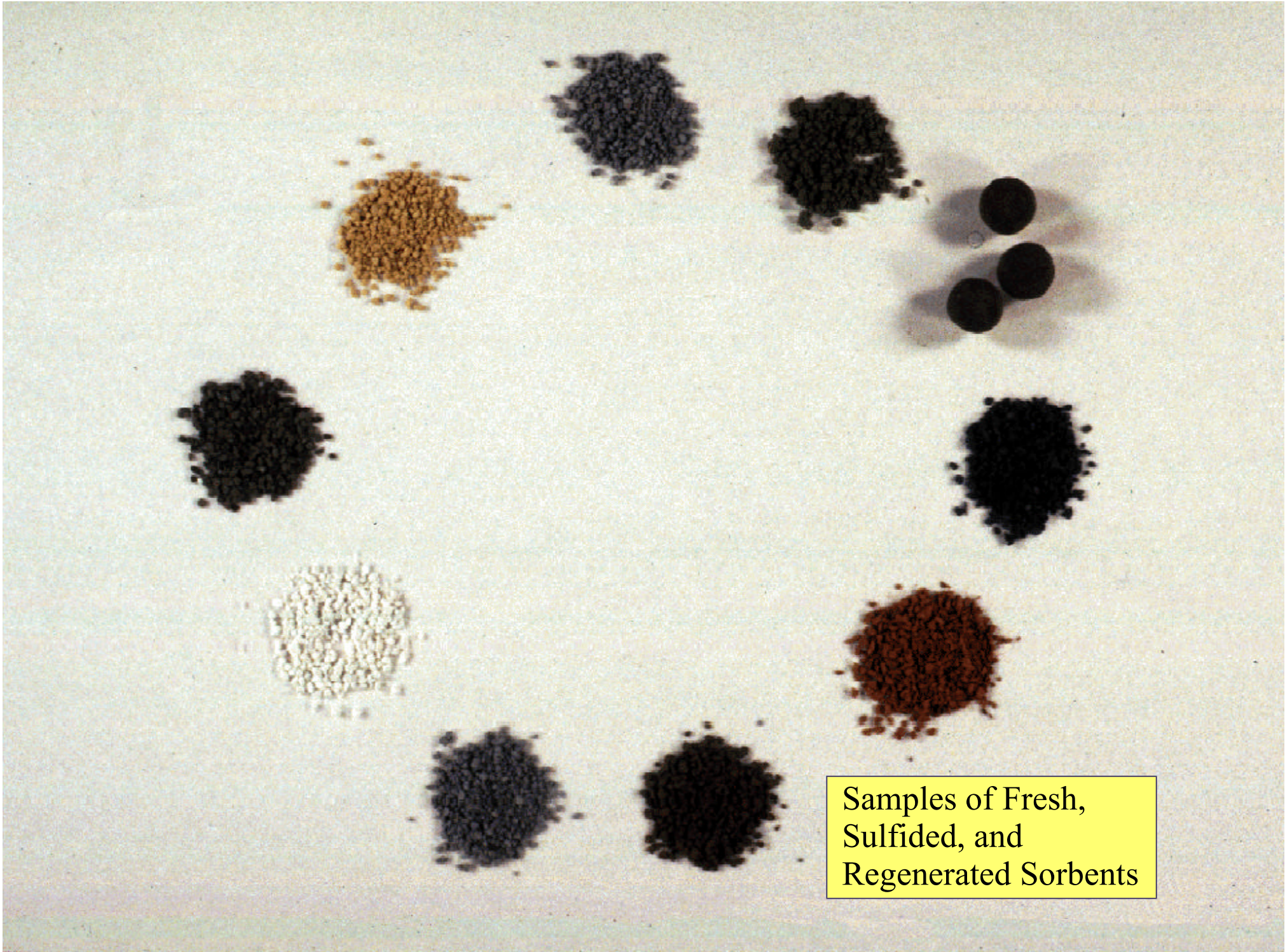




Power Systems Development  
Facility at Wilsonville, AL

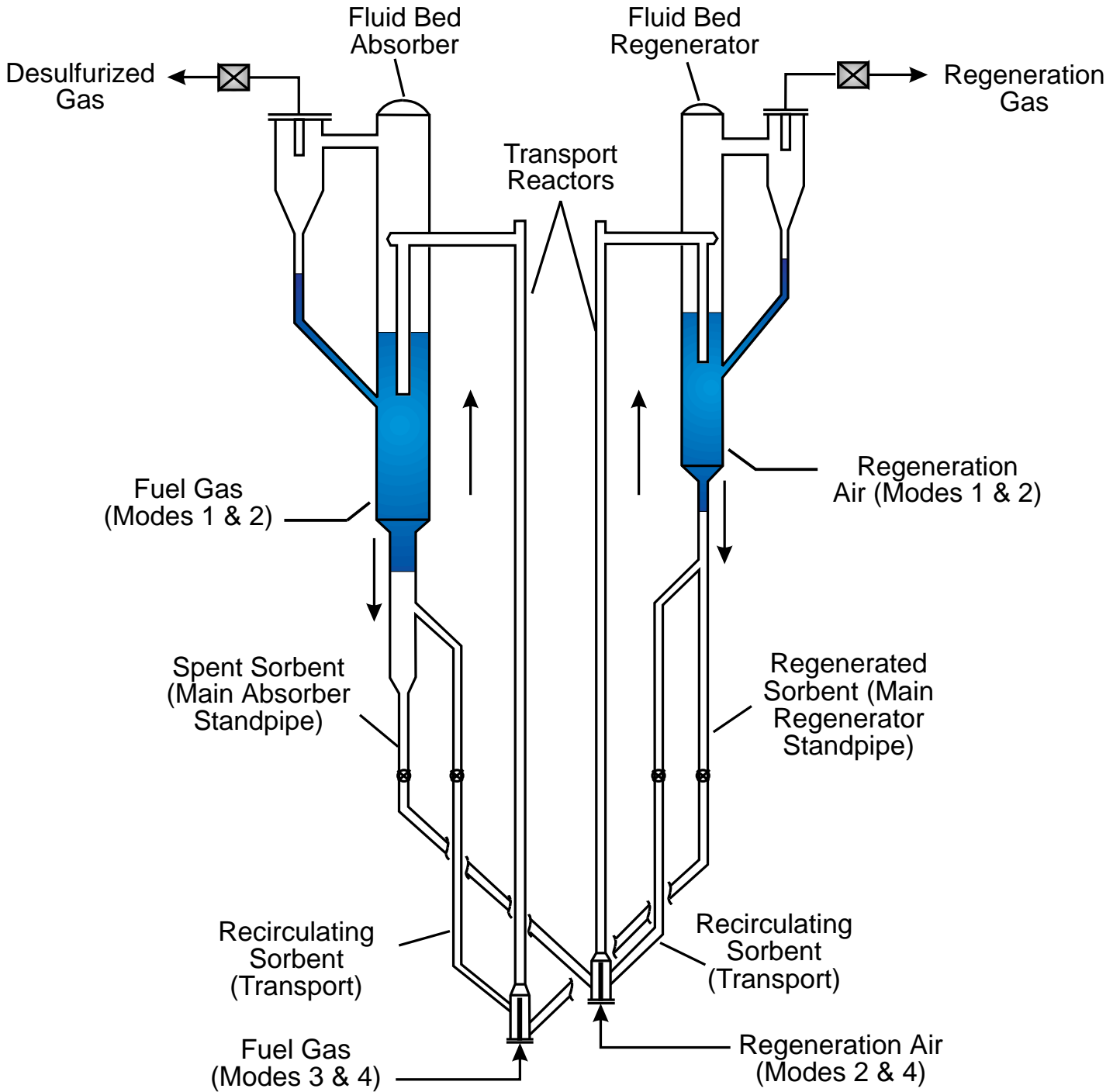
# GEESI Moving Bed Desulfurizer





Samples of Fresh,  
Sulfided, and  
Regenerated Sorbents

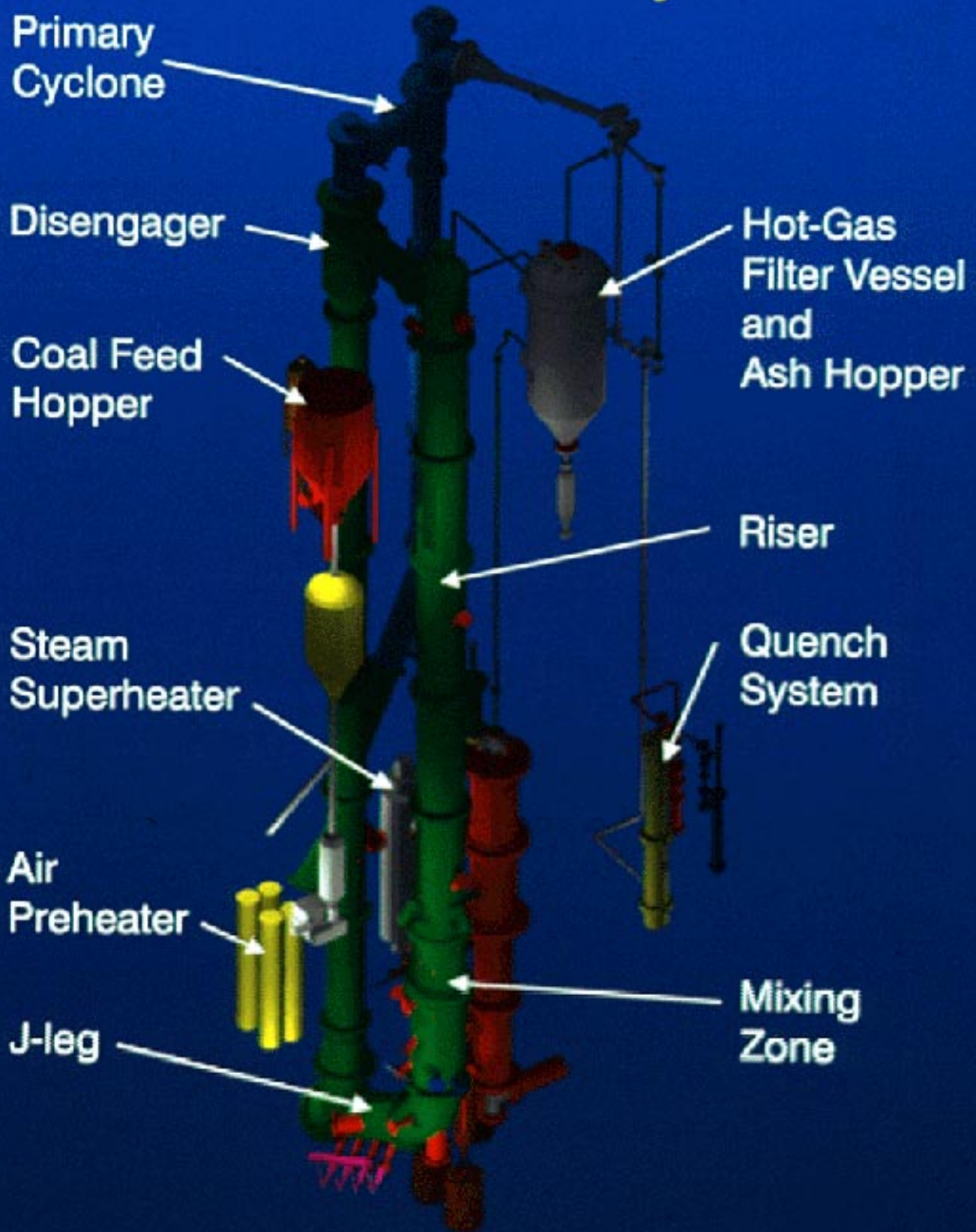
# *PDU Reactor Schematic*





METC  
Desulfurization PDU

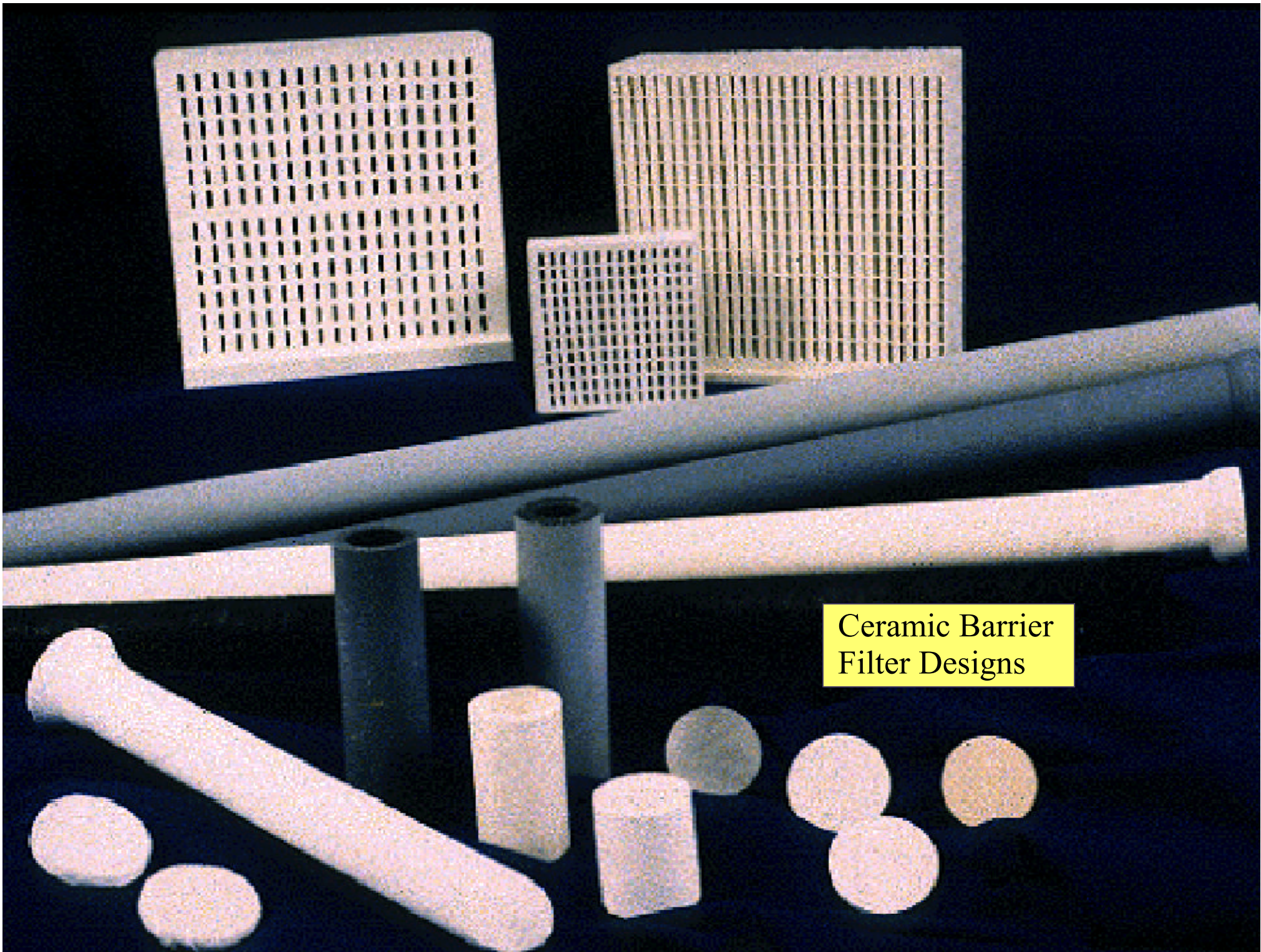
# Transport Reactor with Hot-Gas Filter System





UNDEERC  
Transport  
Reactor PDU



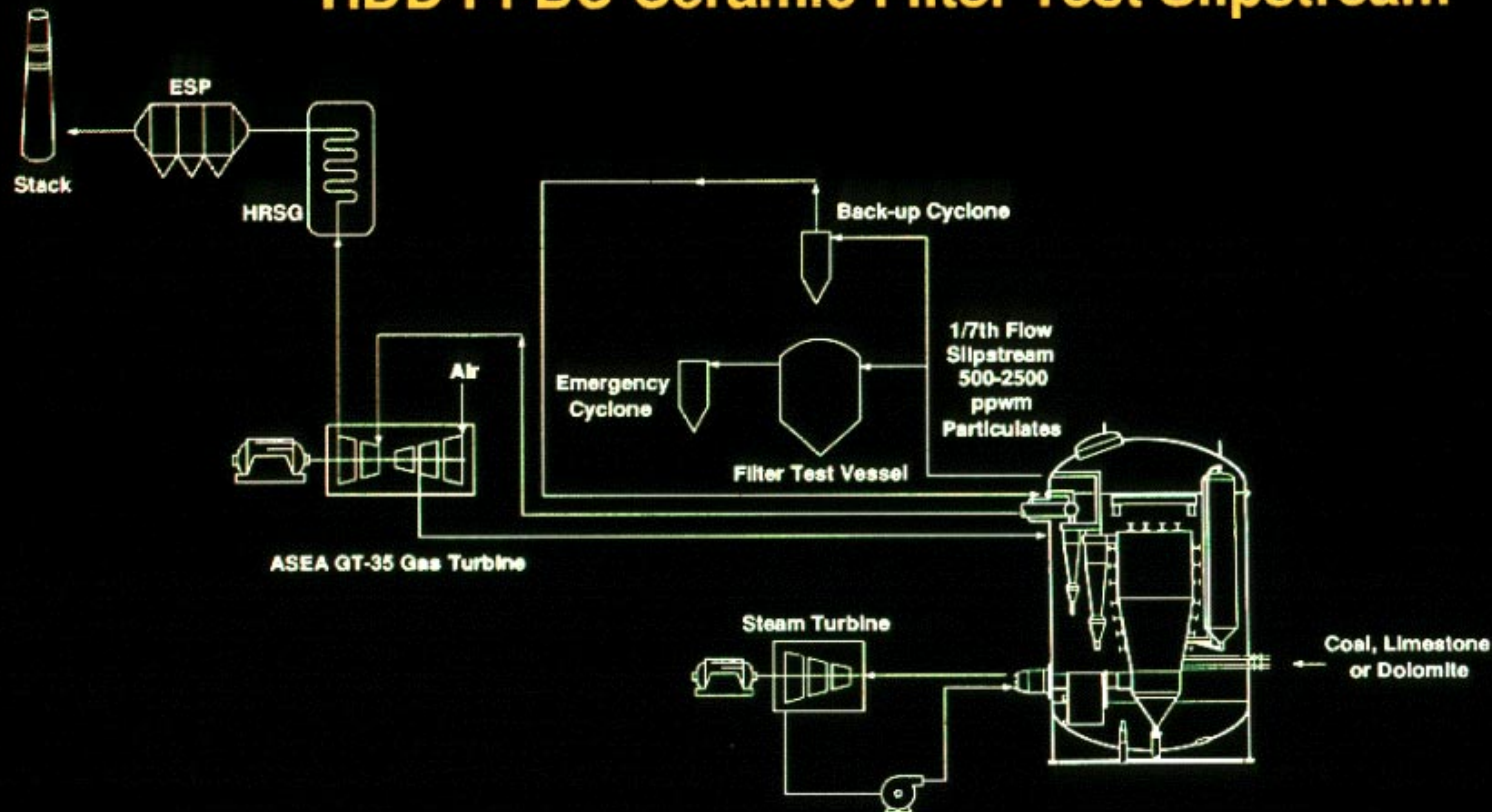


Ceramic Barrier  
Filter Designs

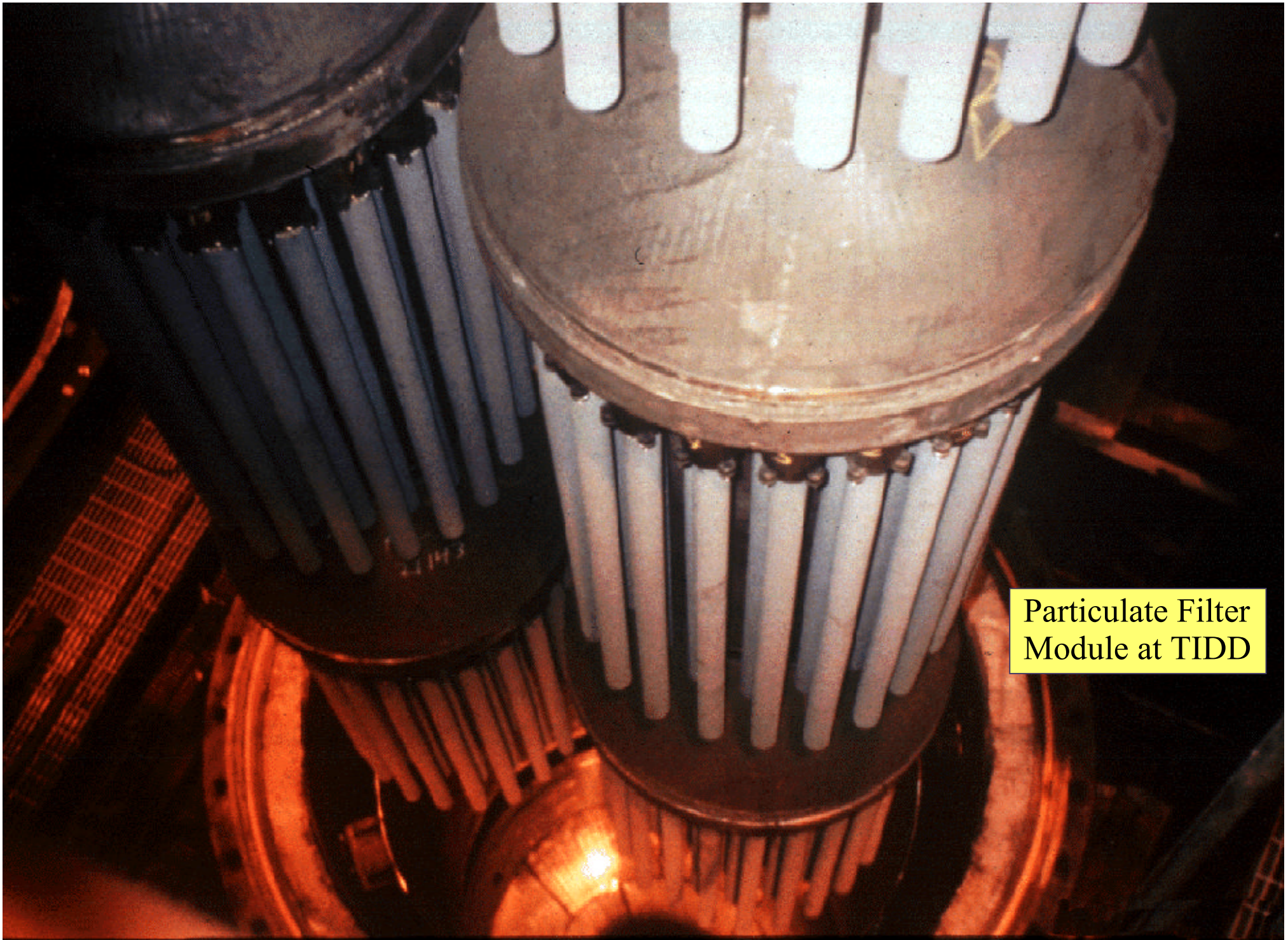


Westinghouse Cold Flow Filter Module

## TIDD PFBC Ceramic Filter Test Slipstream

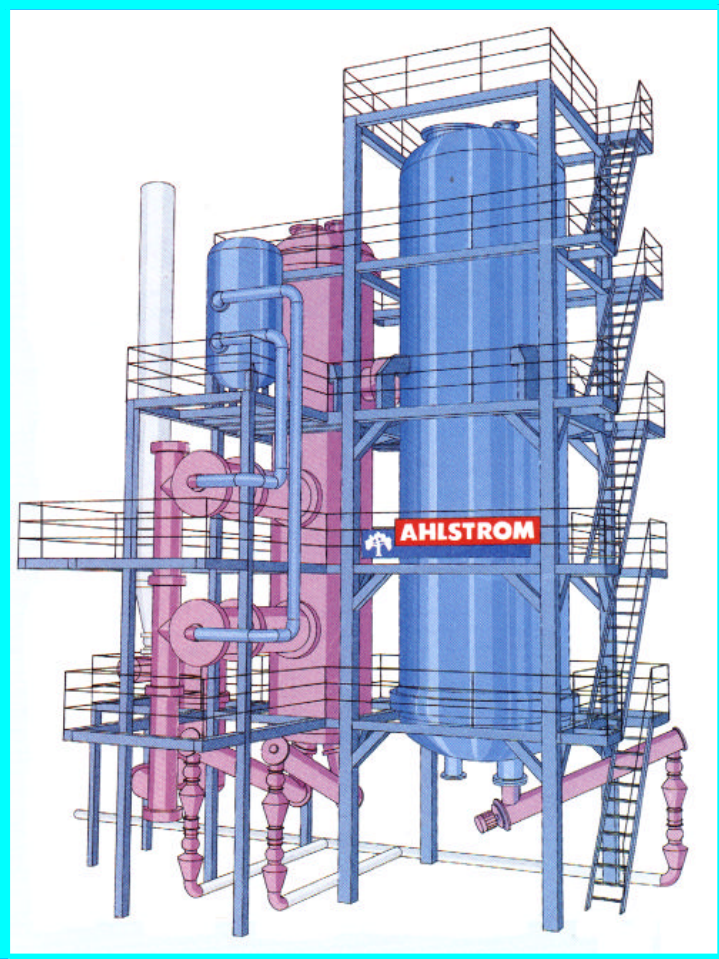


- Conduct large-scale engineering tests of ceramic filter systems for commercial 1st & 2nd Generation PFBC
  - Demonstrate 5,000 hours of operation
- \$20 million program separate from Clean Coal
- Test filters on 2nd & 3rd years of operation
- Westinghouse ceramic candle filters first system to be tested
- Potential for a different filter in 2nd test period



Particulate Filter  
Module at TIDD

# KARHULA

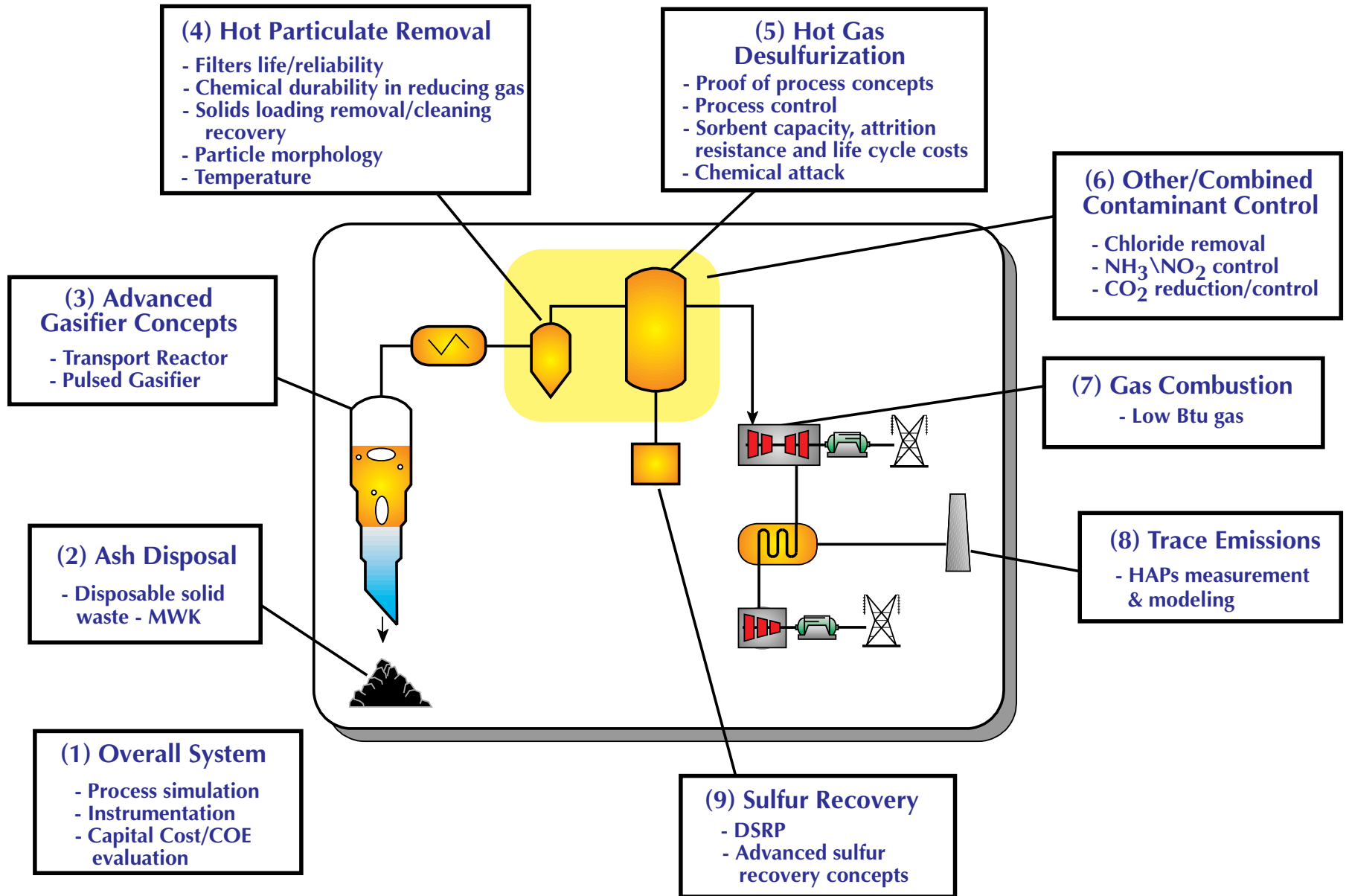


M96001848C

# ***Barrier Issues***

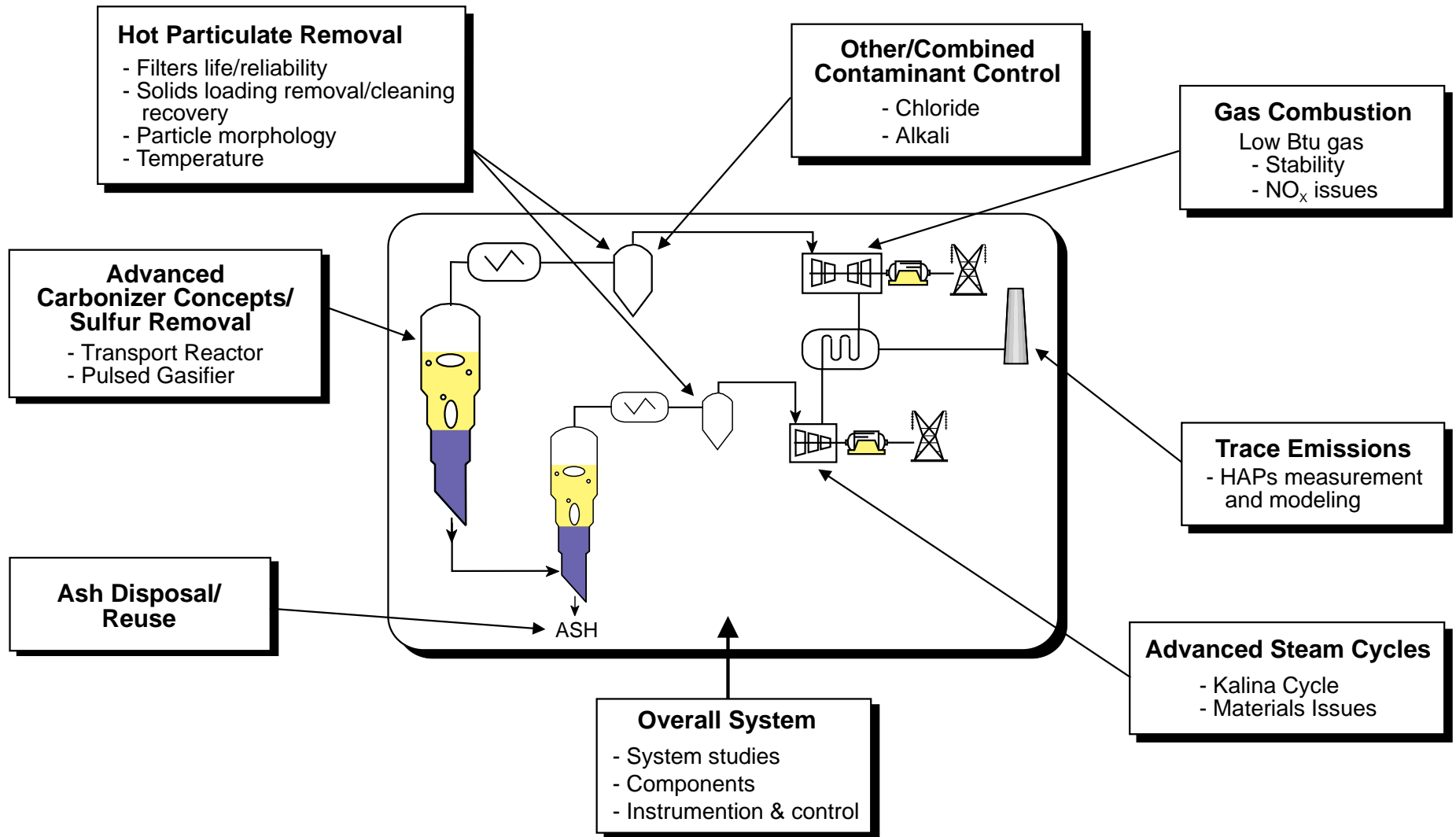
- ***Technical***
  - ***Filters***
  - ***CO<sub>2</sub>***
  - ***S and other gases***
  - ***Materials***
  
- ***Market***
  - ***Domestic capacity growth***
  - ***Capital cost***
  - ***Incentive for risk***

# IGCC R&D Issues





# PFBC R&D Issues



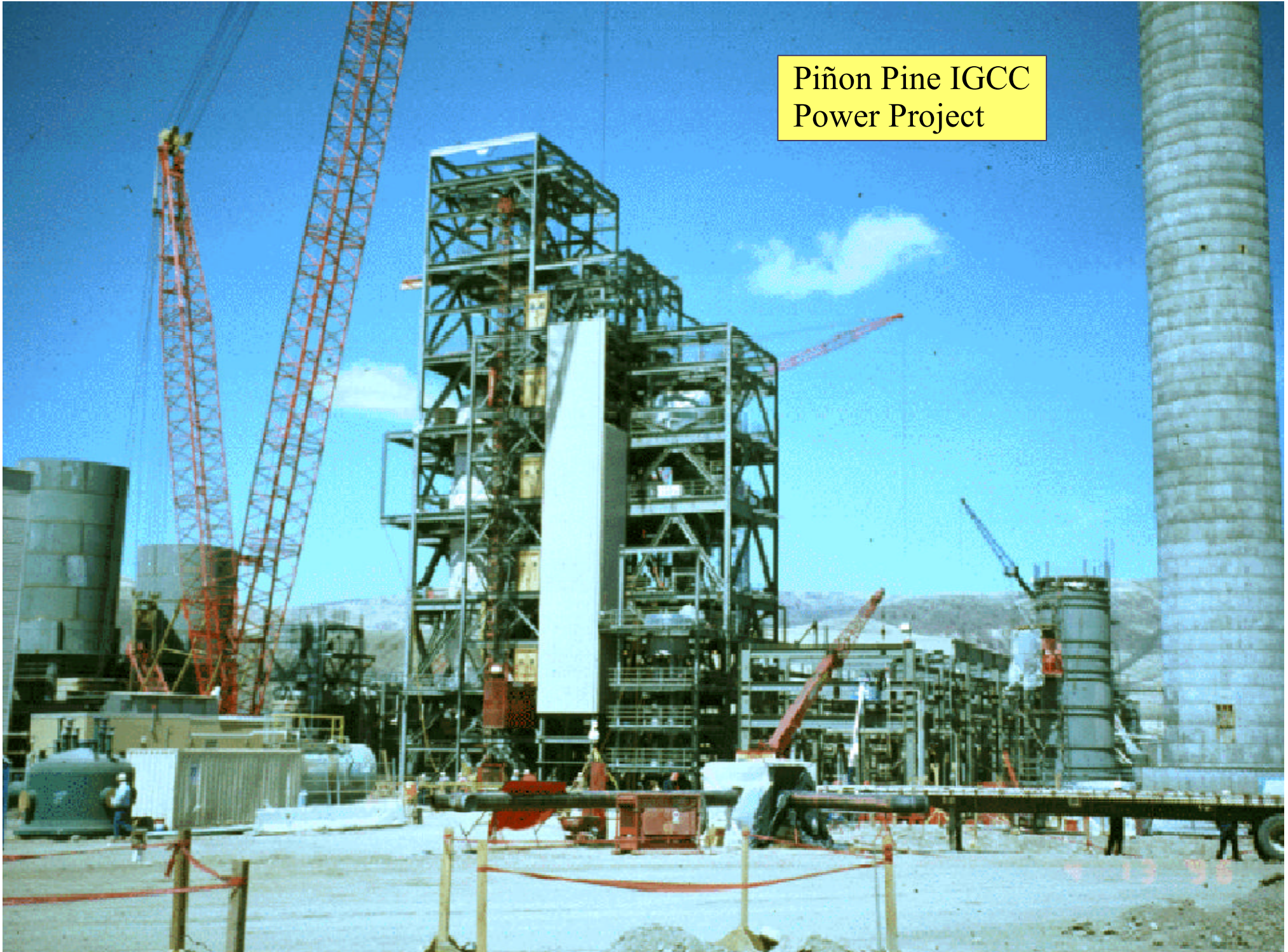
# *Key Plans*

- *Startups*
  - *Tampa*
  - *Piñon*
  - *PSDF*
- *Construction*
  - *Lakeland*
  - *Seward*
- *Testing*
  - *Filter Materials*

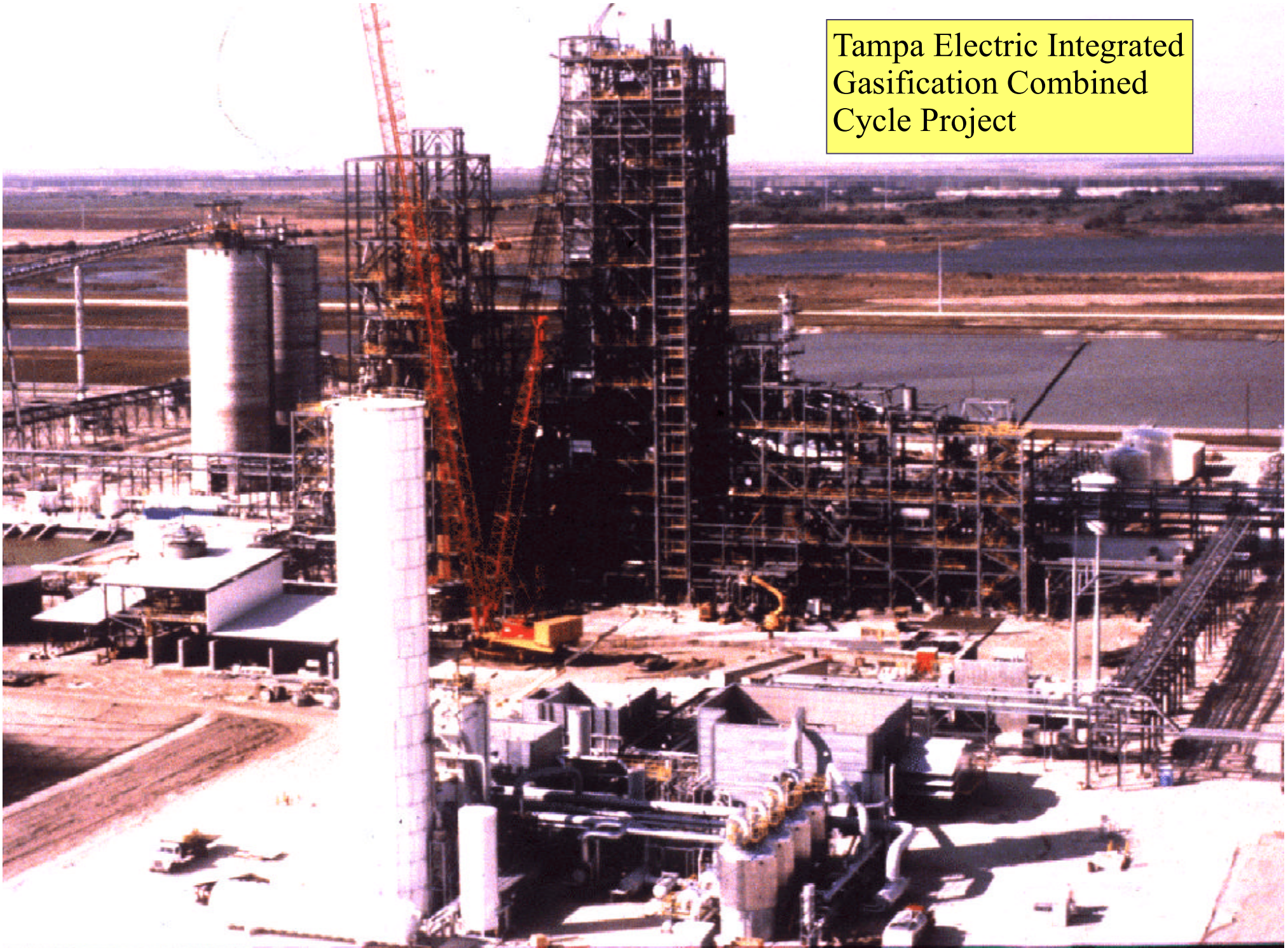


Wabash River Coal Gasification  
Repowering Project

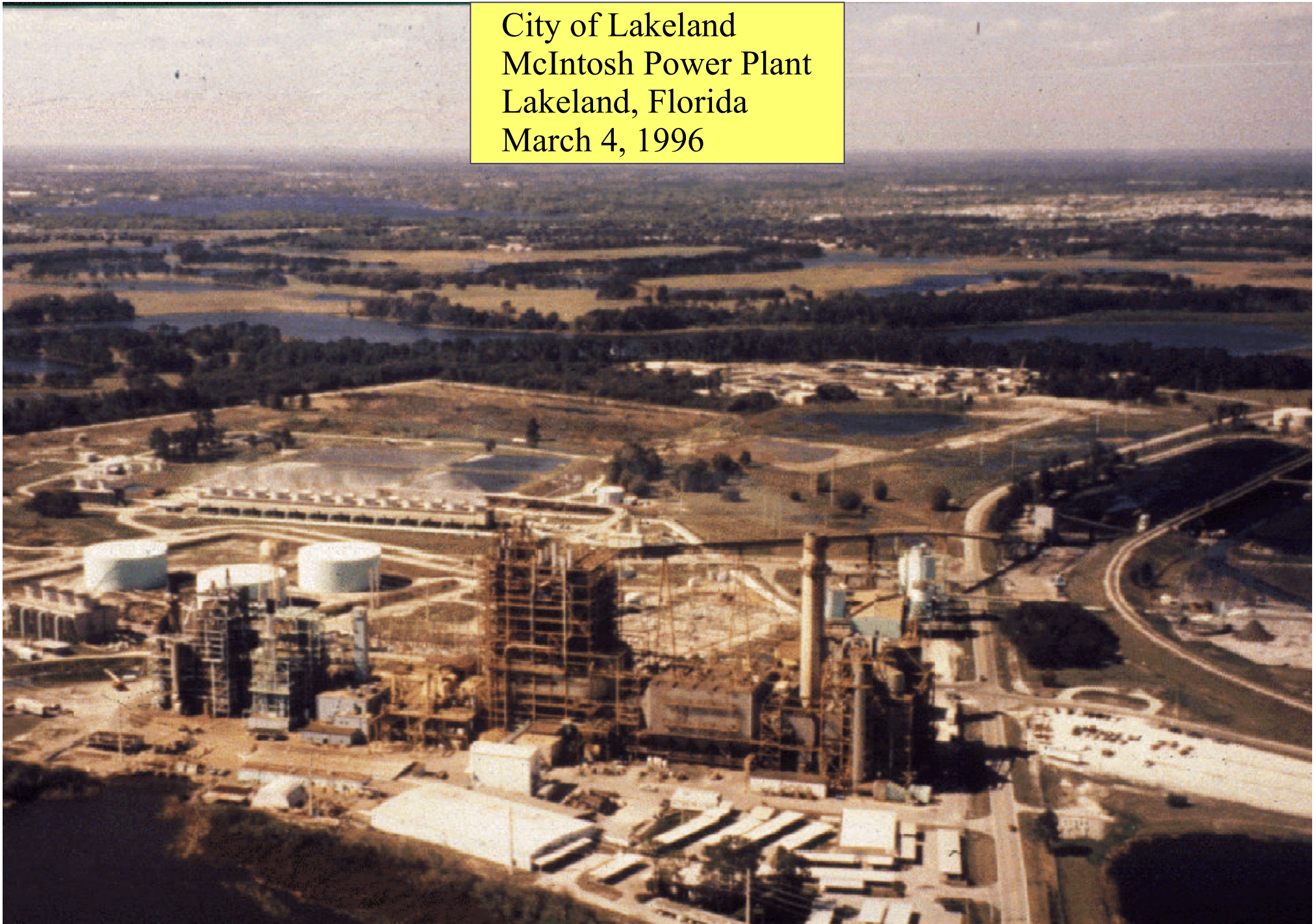
Piñon Pine IGCC  
Power Project



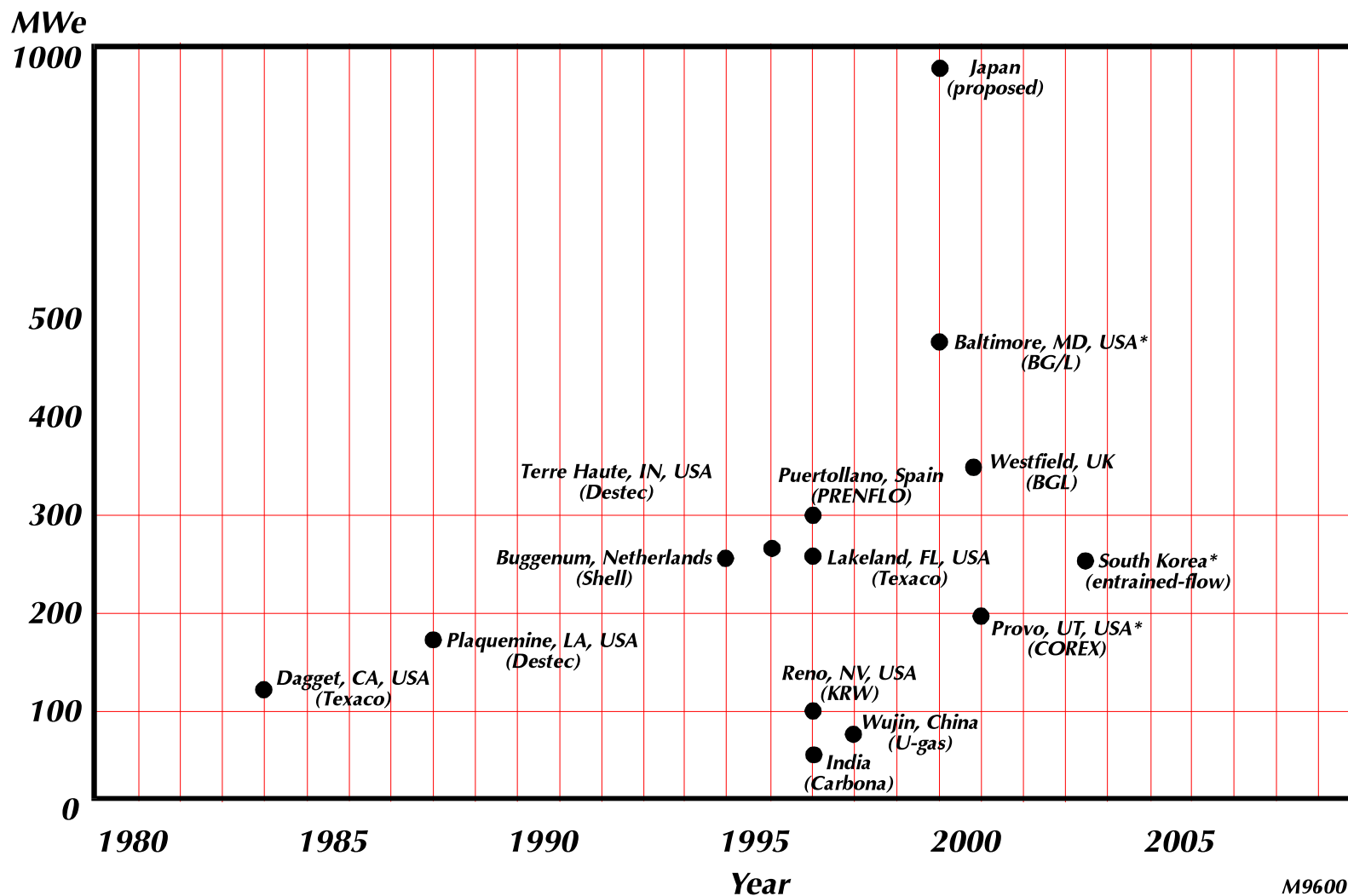
Tampa Electric Integrated  
Gasification Combined  
Cycle Project



City of Lakeland  
McIntosh Power Plant  
Lakeland, Florida  
March 4, 1996



# List of IGCC Projects in the World

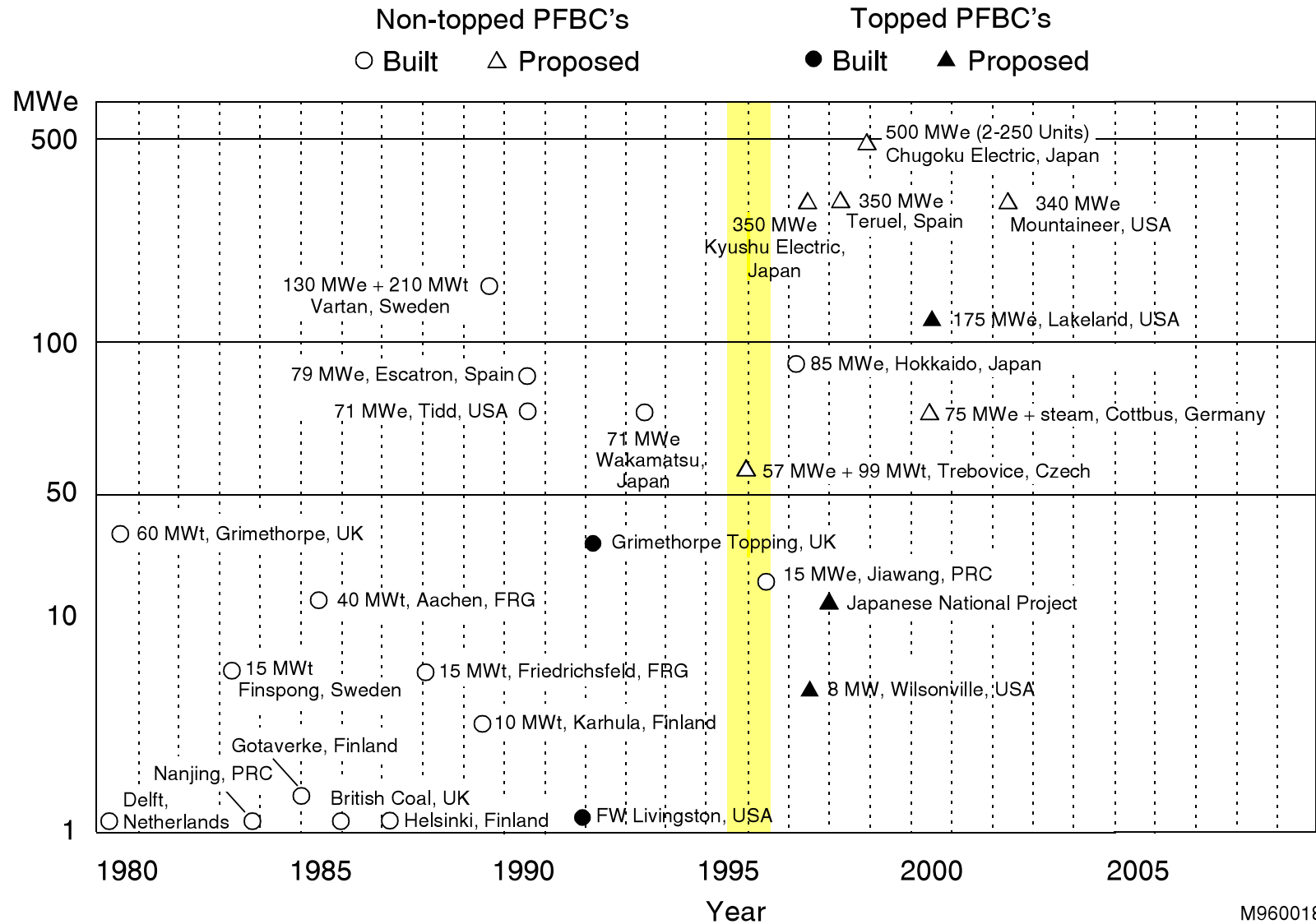


# ***IGCC Plants and Projects***

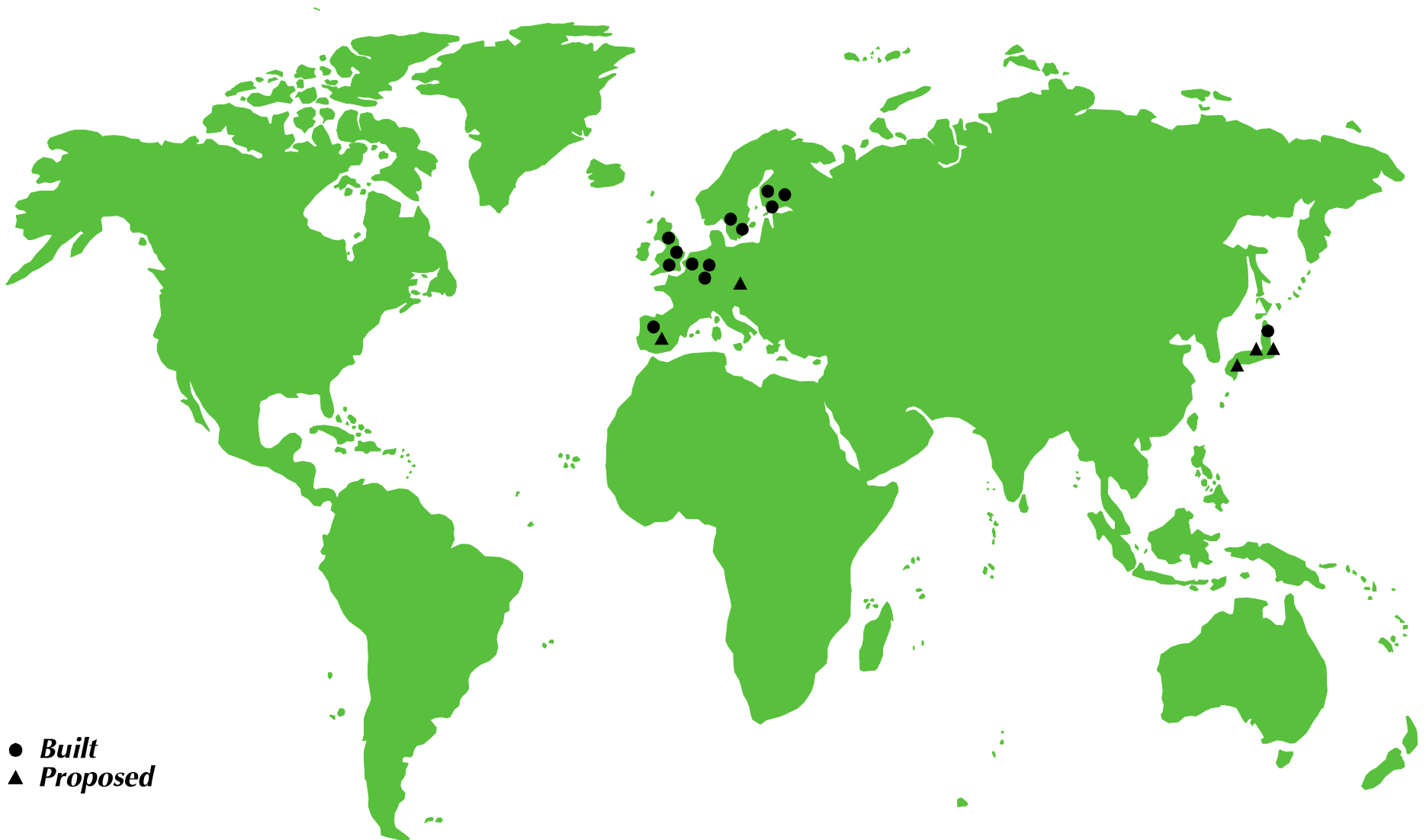




# List of PFBC Projects in the World



# ***PFBC Plants and Projects***



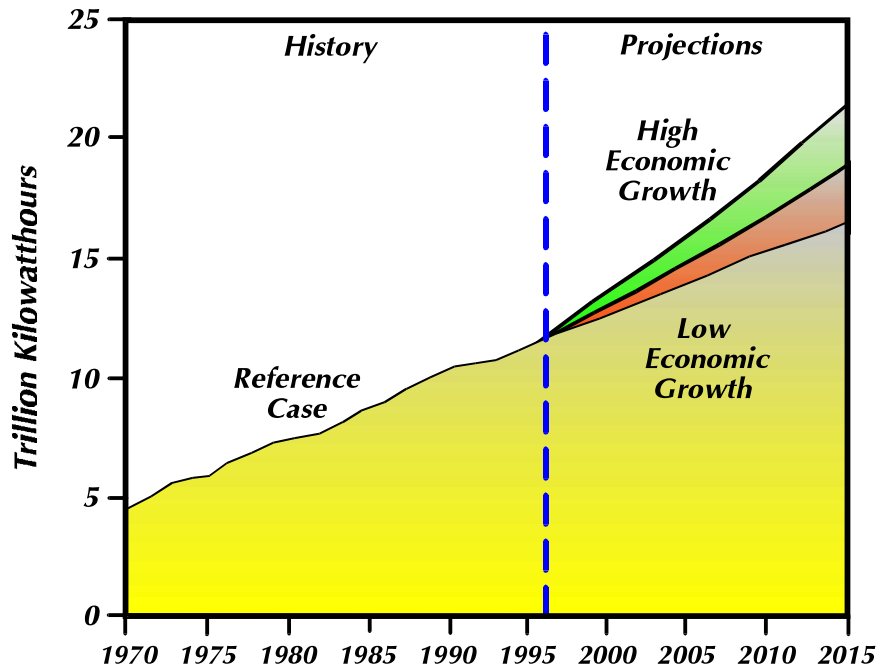
● ***Built***  
▲ ***Proposed***

# ***Marketplace Opportunities***

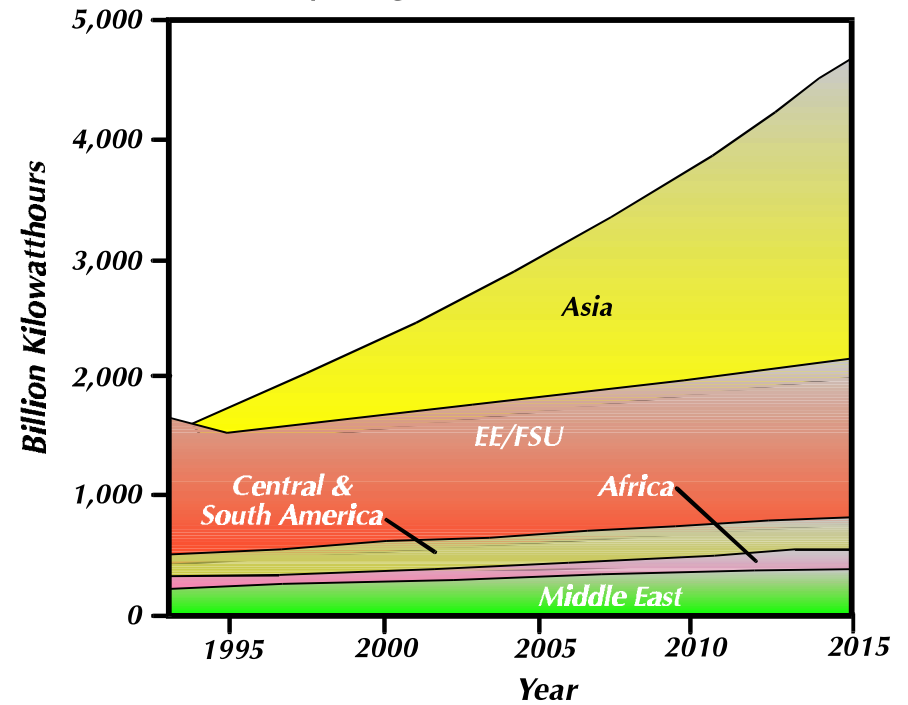
- ***U.S. repowering***
- ***Global demand***
- ***Co-production***
- ***Opportunity fuels***
- ***Environmental drivers***
- ***Advanced systems***

# Global Demand

**World Electricity Consumption  
1970 - 2015**



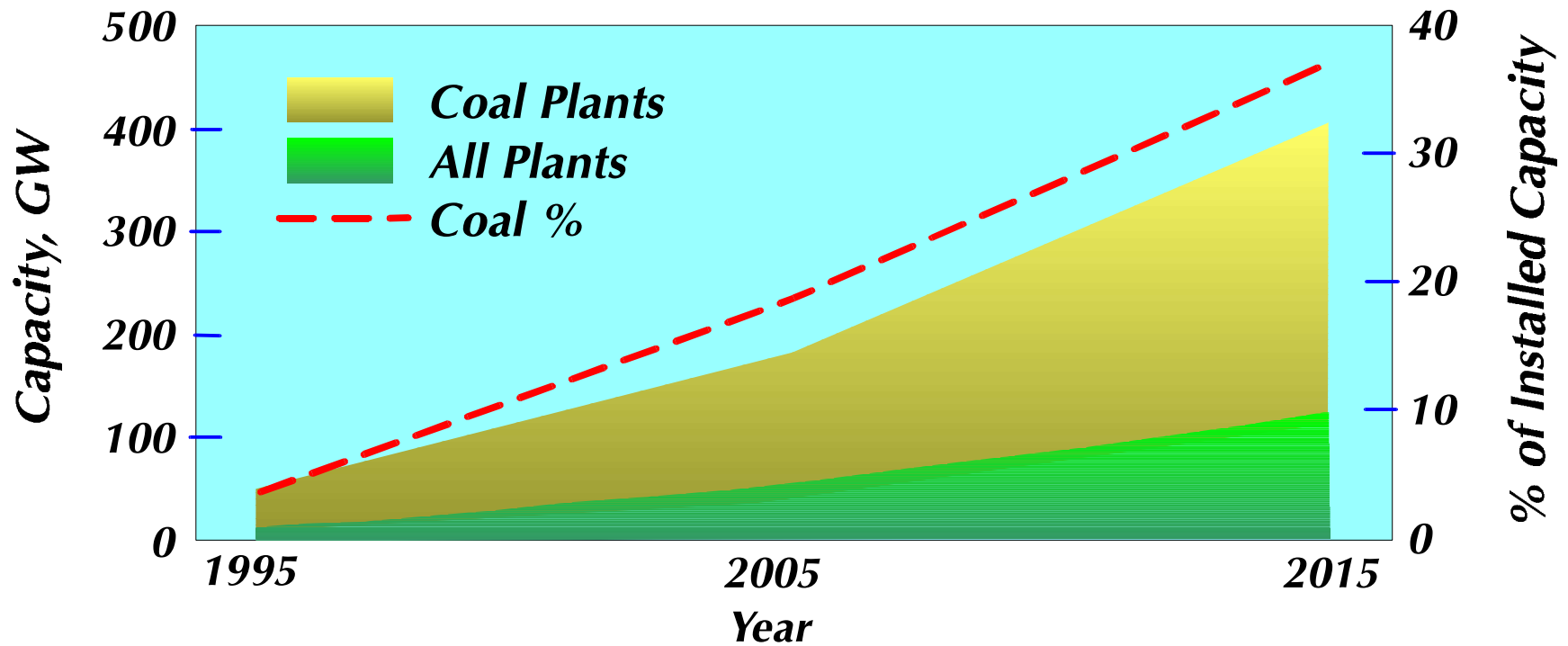
**Non-OECD Electricity Consumption  
By Region, 1993 - 2015**



Source: History: Energy Information Administration (EIA) International Energy Annual 1993, DOE/EIA-0219(93) (Washington, D.C., May 1995). Projections: EIA, World Energy Projection System (1996).

# *U.S. Repowering*

## *Plants Over 40 Years Old*

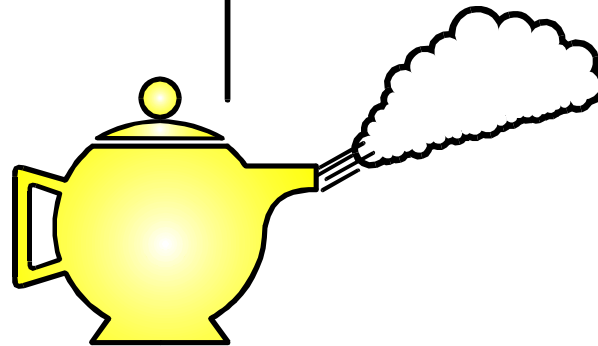


# ***Co-Production***

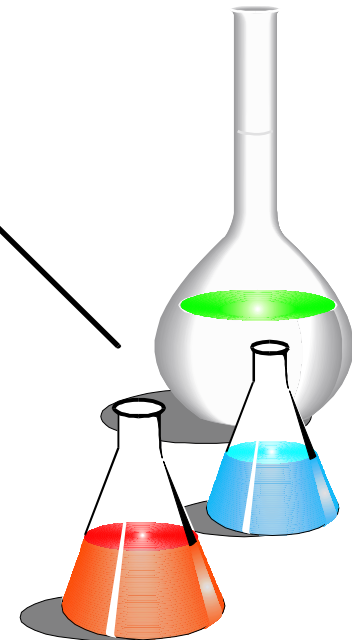
**COAL**



***Electricity***



***Steam***

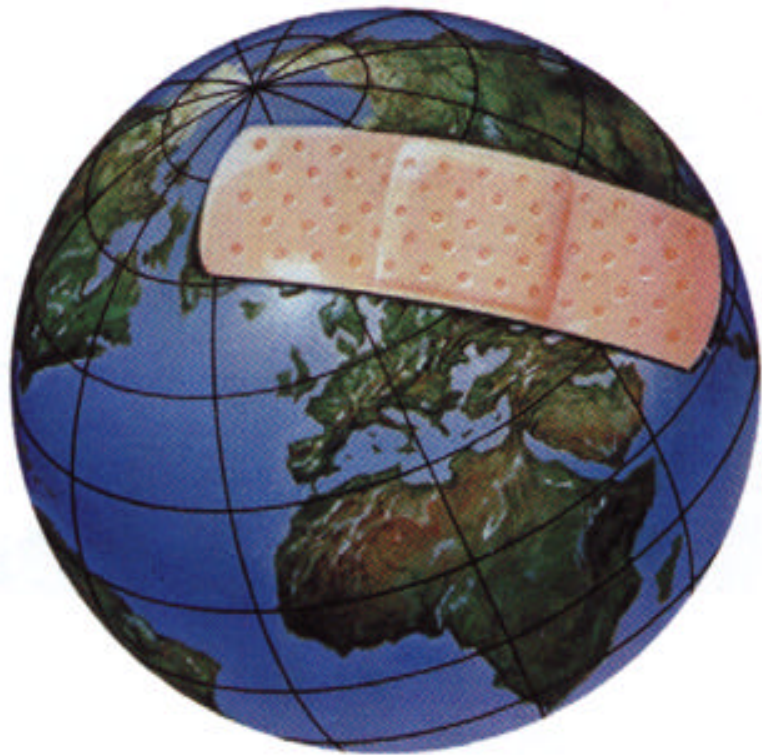


***Chemicals***



## *Opportunity Fuels*

- Plastic
- Biomass
- Sewage
- RDF
- Petcoke
- Waste Fuel

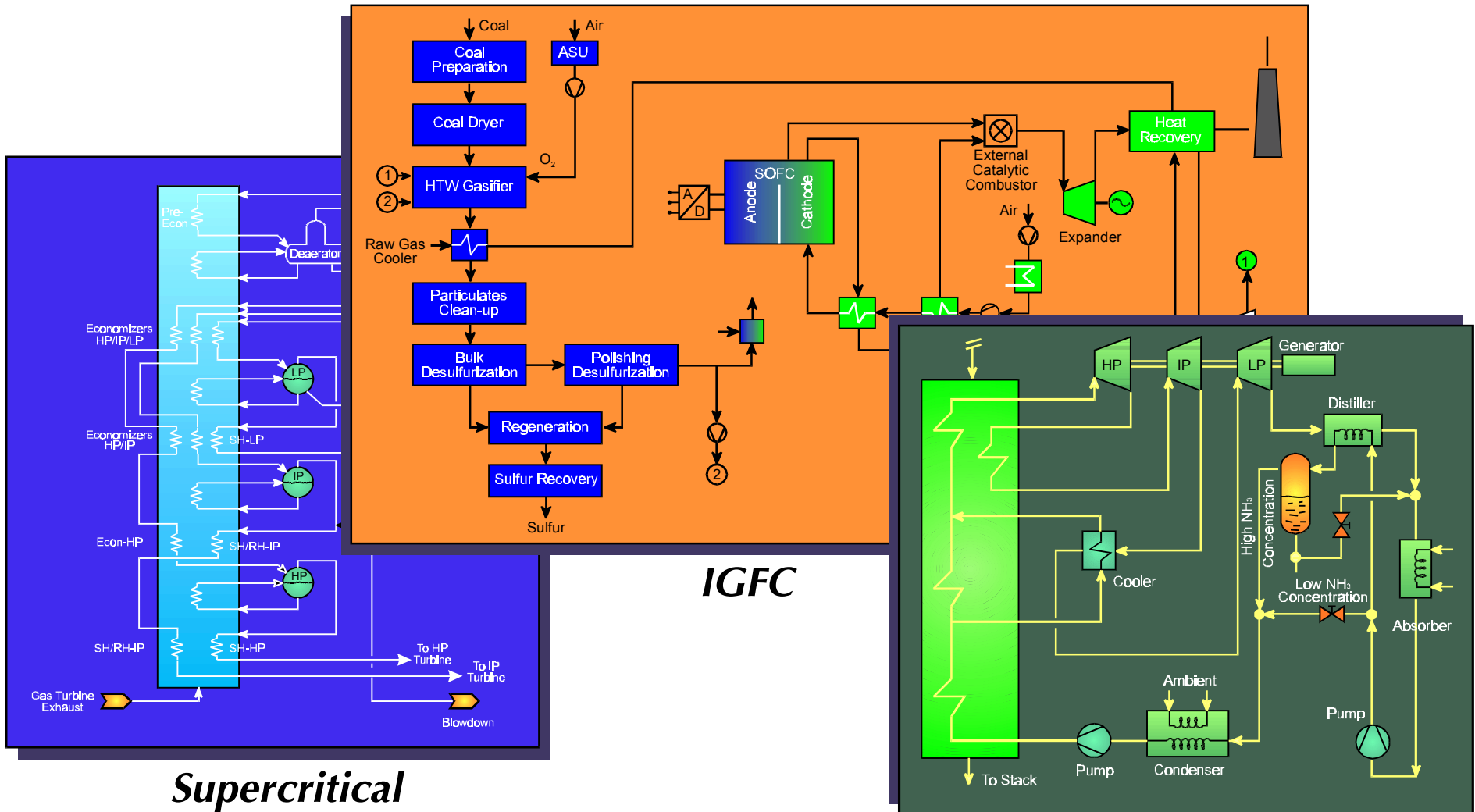


## ***Environmental Drivers***

- **SO<sub>2</sub>**
- **NO<sub>x</sub>**
- **CO<sub>2</sub>**
- **Particulates**
- **HAPs**



# Advanced Systems



**Supercritical**

**IGFC**

**Kalina and Other Advanced Cycles**