

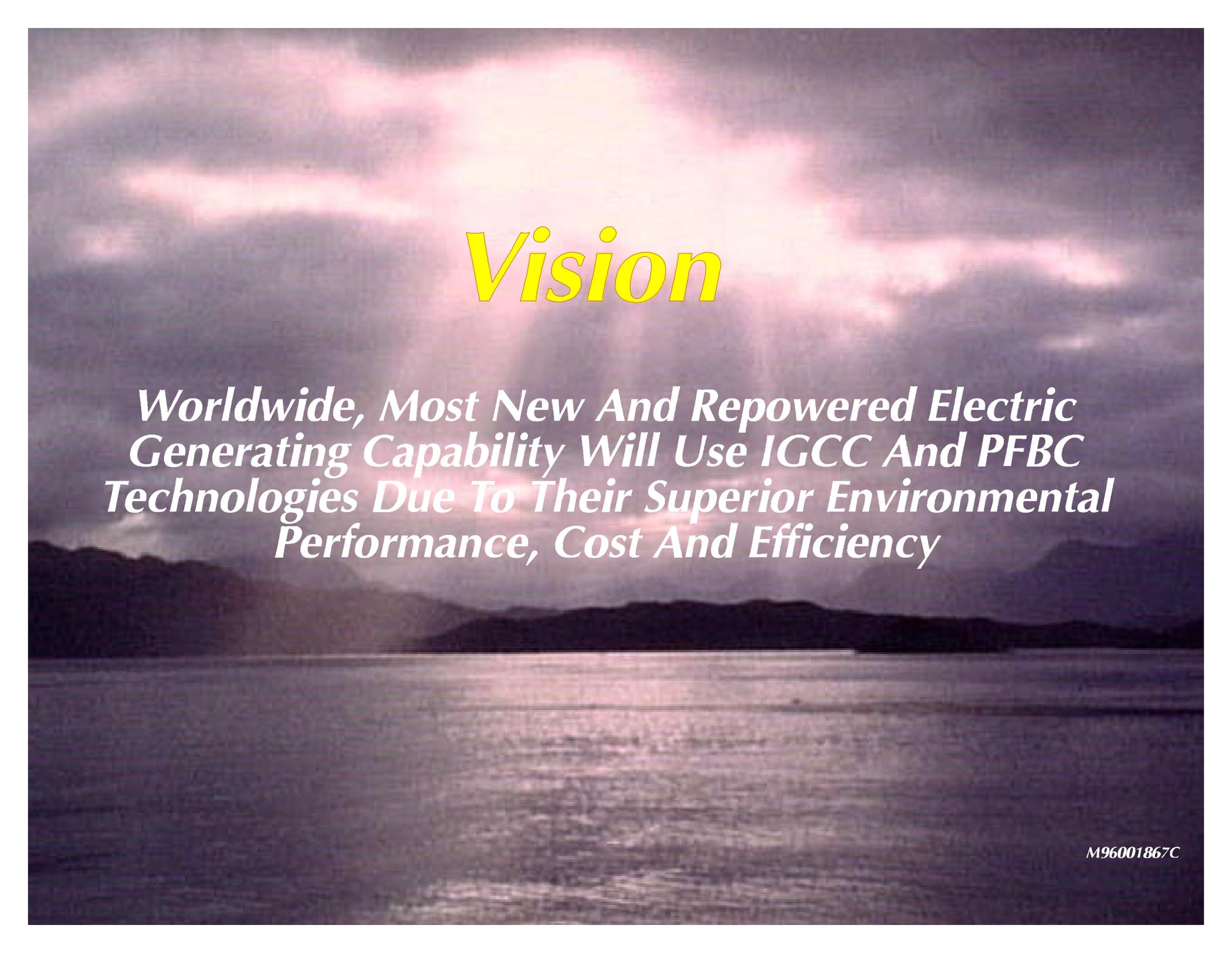
Advanced Coal-Fired **Power Systems '96**

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"

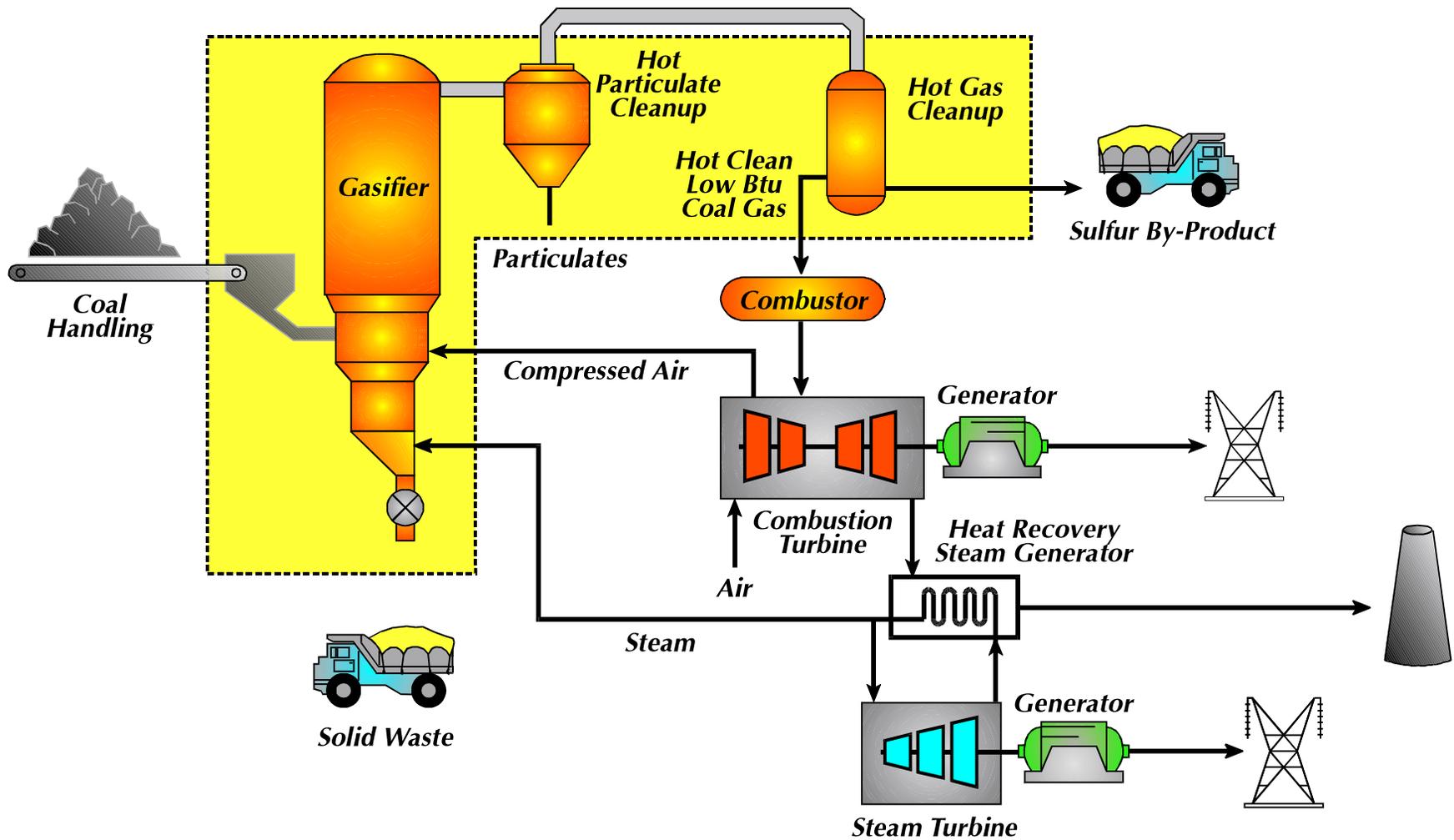


IGCC

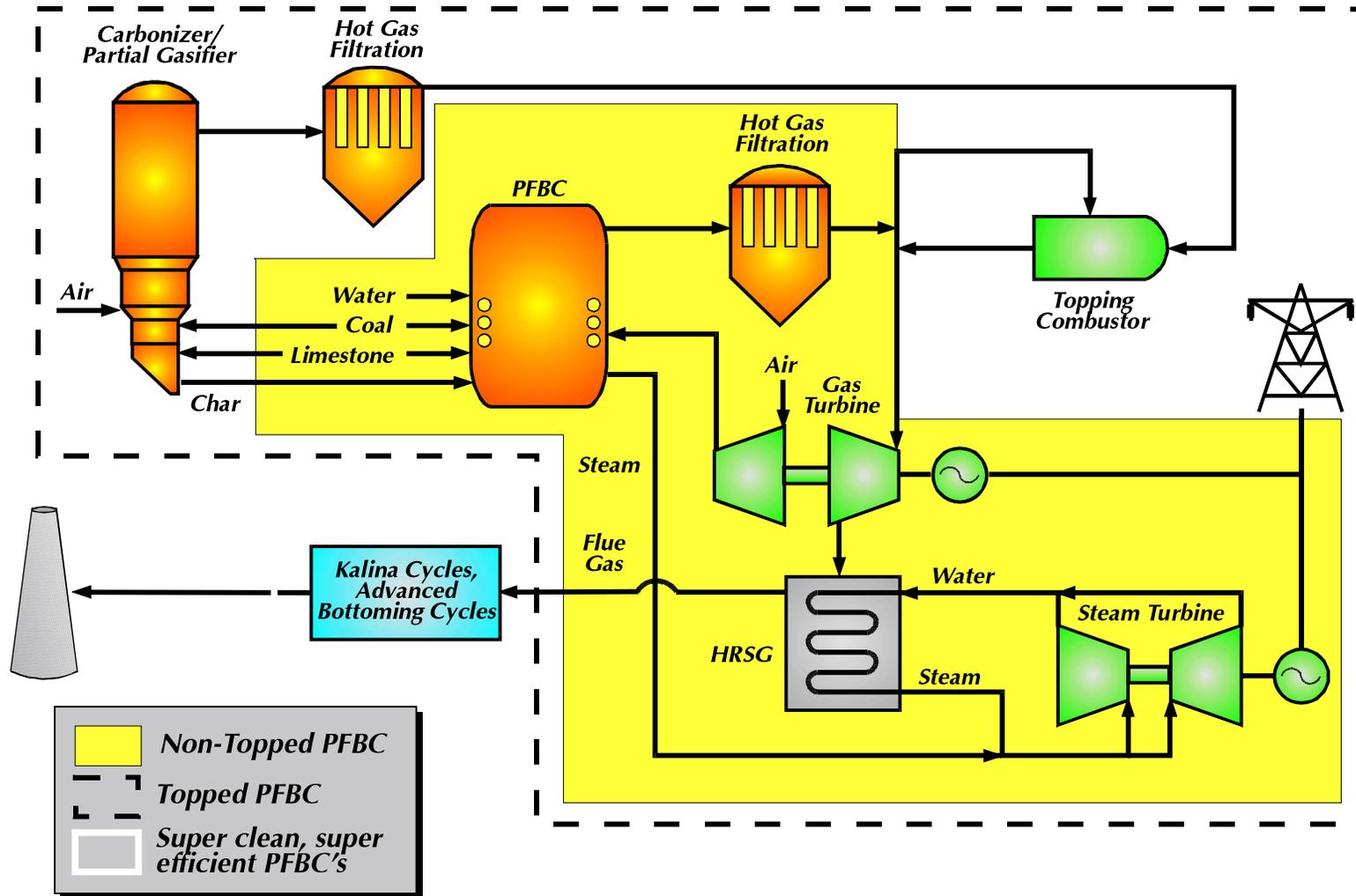


PFBC

Integration Gasification Combined Cycle (IGCC)



Pressurized Fluidized Bed Combustion (PFBC)

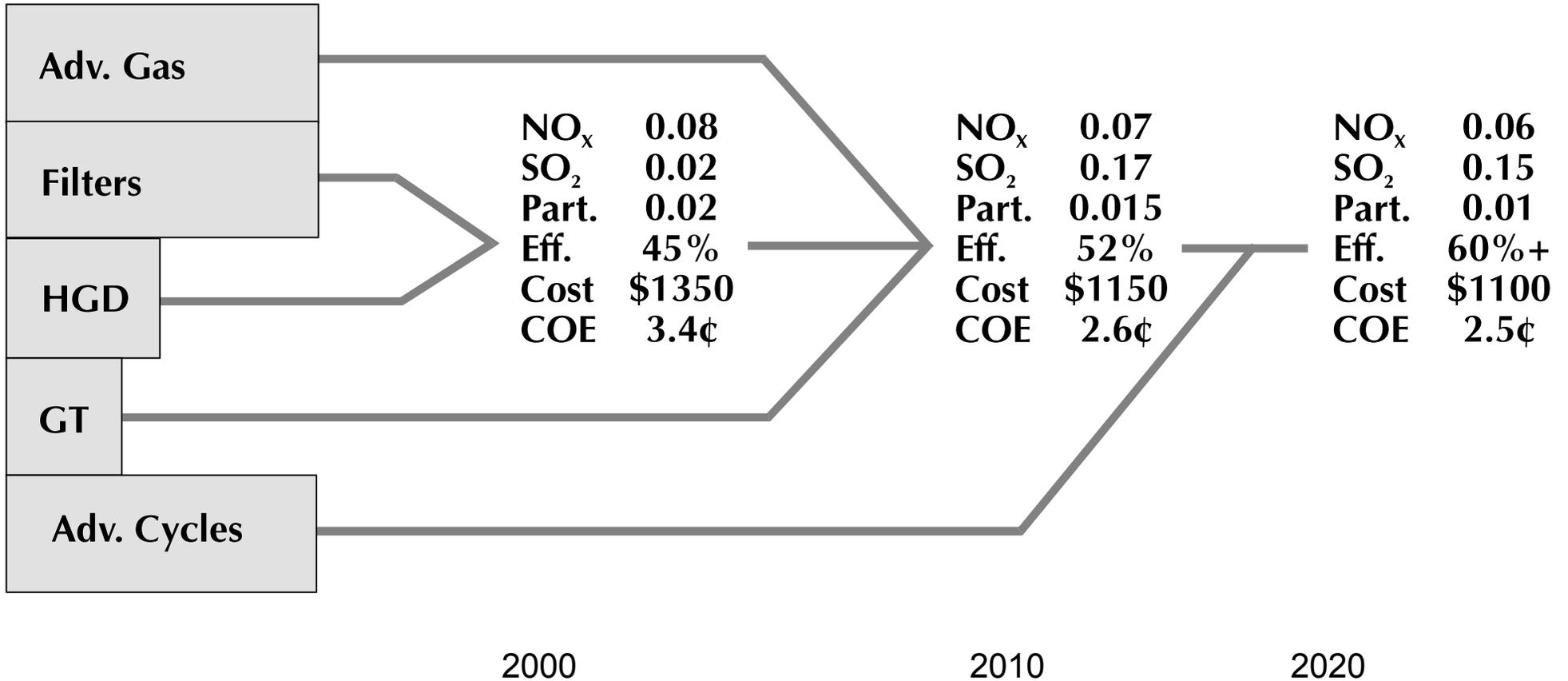


Goals

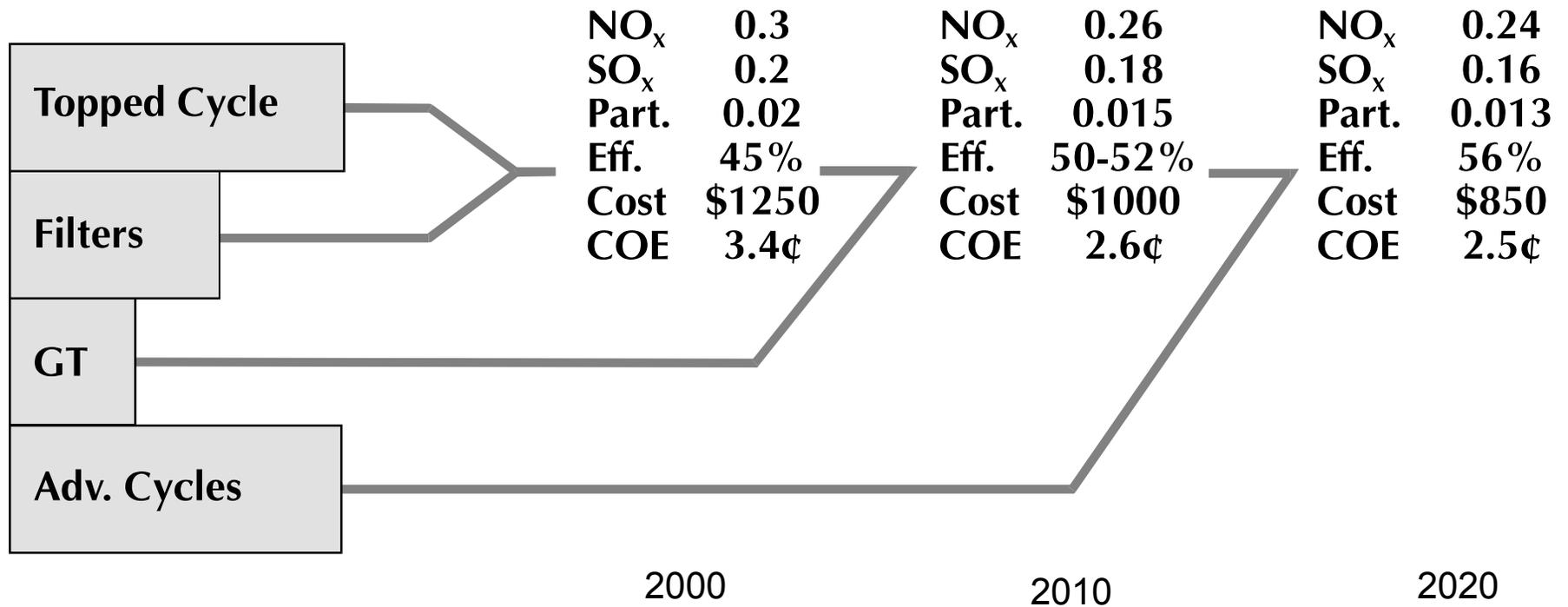
- ***Coal Based Power Systems***
 - ***Environmental Performance***
 - ***Efficiency***
 - ***Cost***



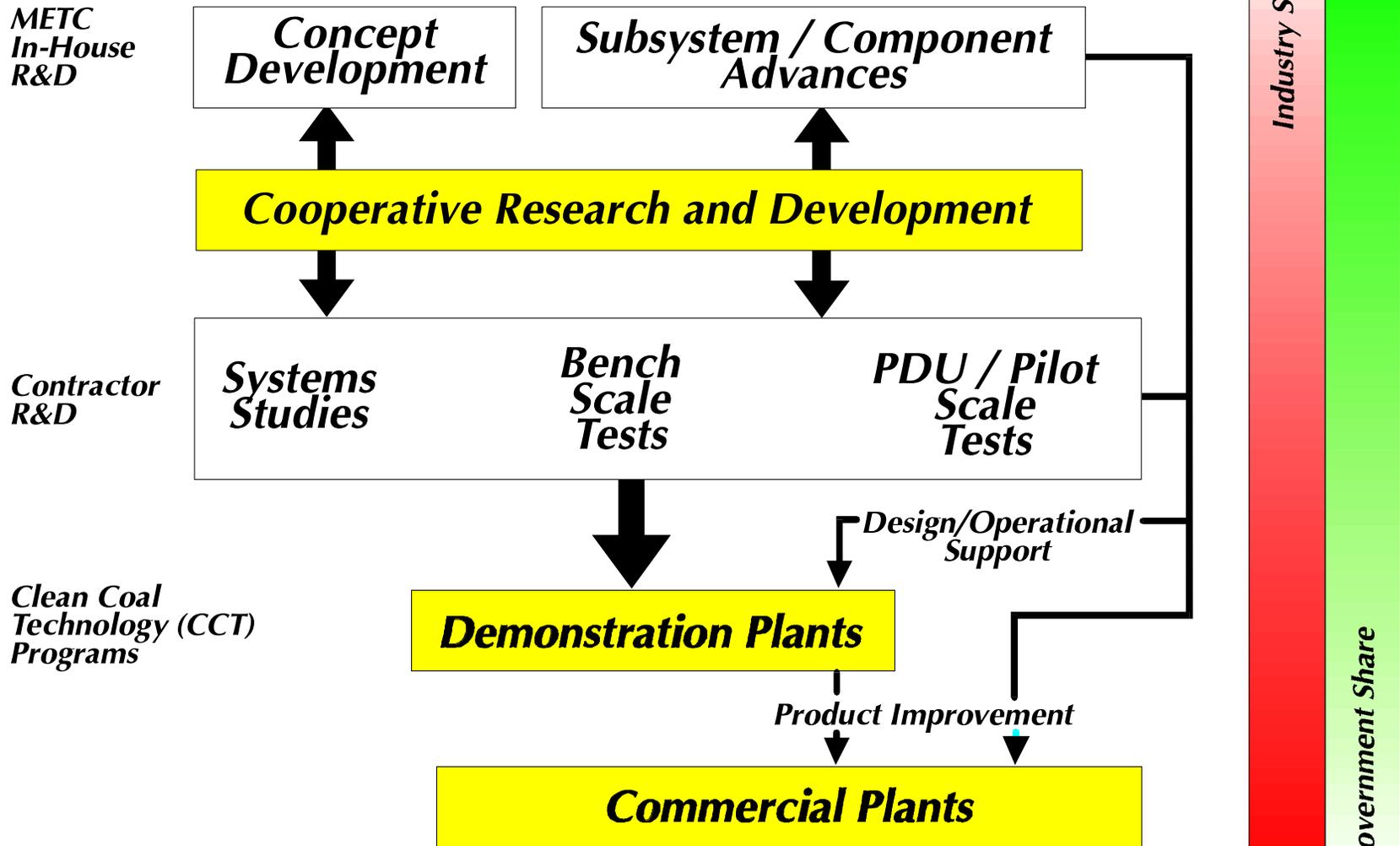
IGCC Goals



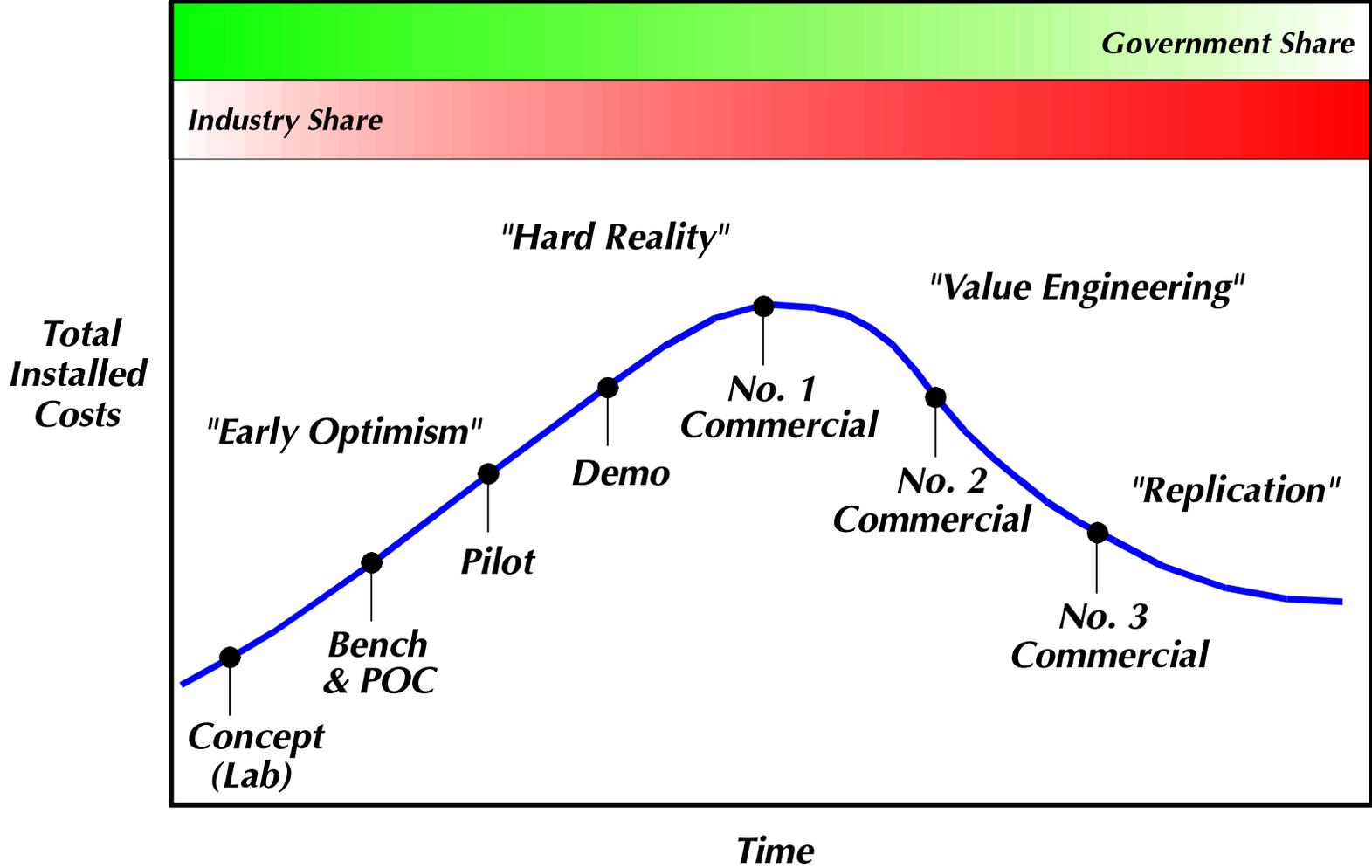
PFBC Goals



Product Development Cycle



Product Development Cycle



Technical Status

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

Key R&D Activities

Sorbents

***ICCI
GEESI
METC
RTI***

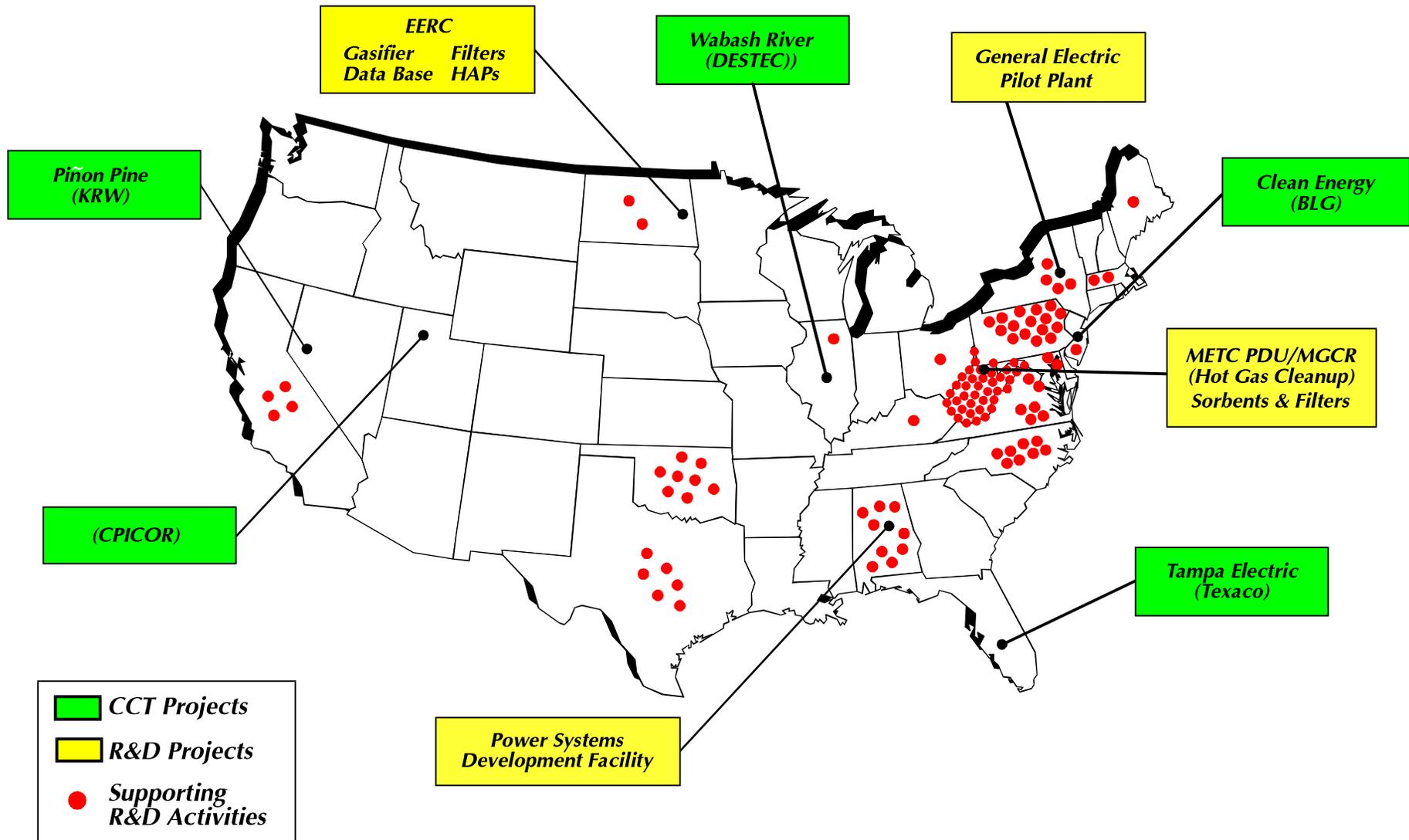
Filters

***EERC
MGCR
KARHULA
METC***

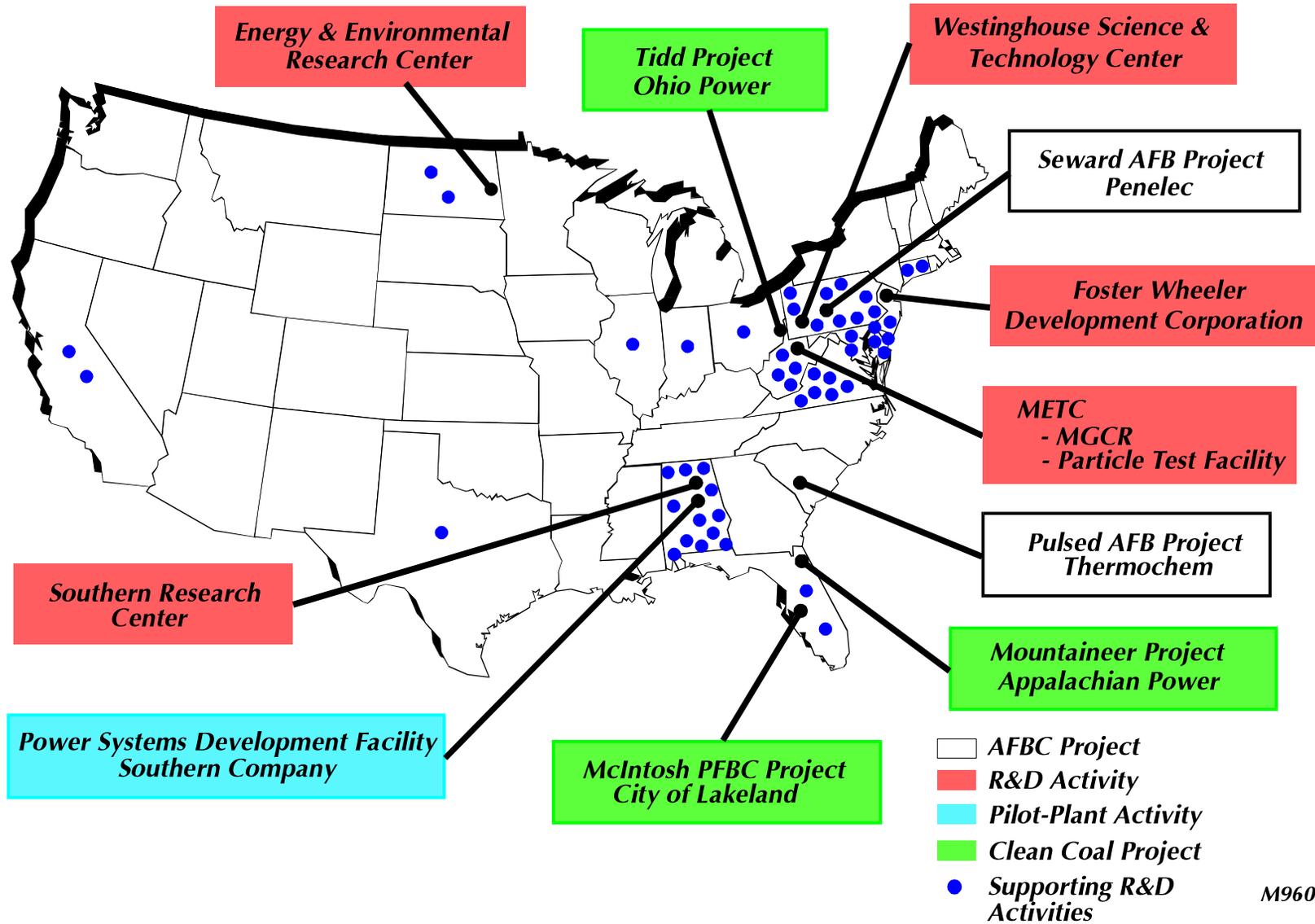
Air Toxics

***LGTI
AMES***

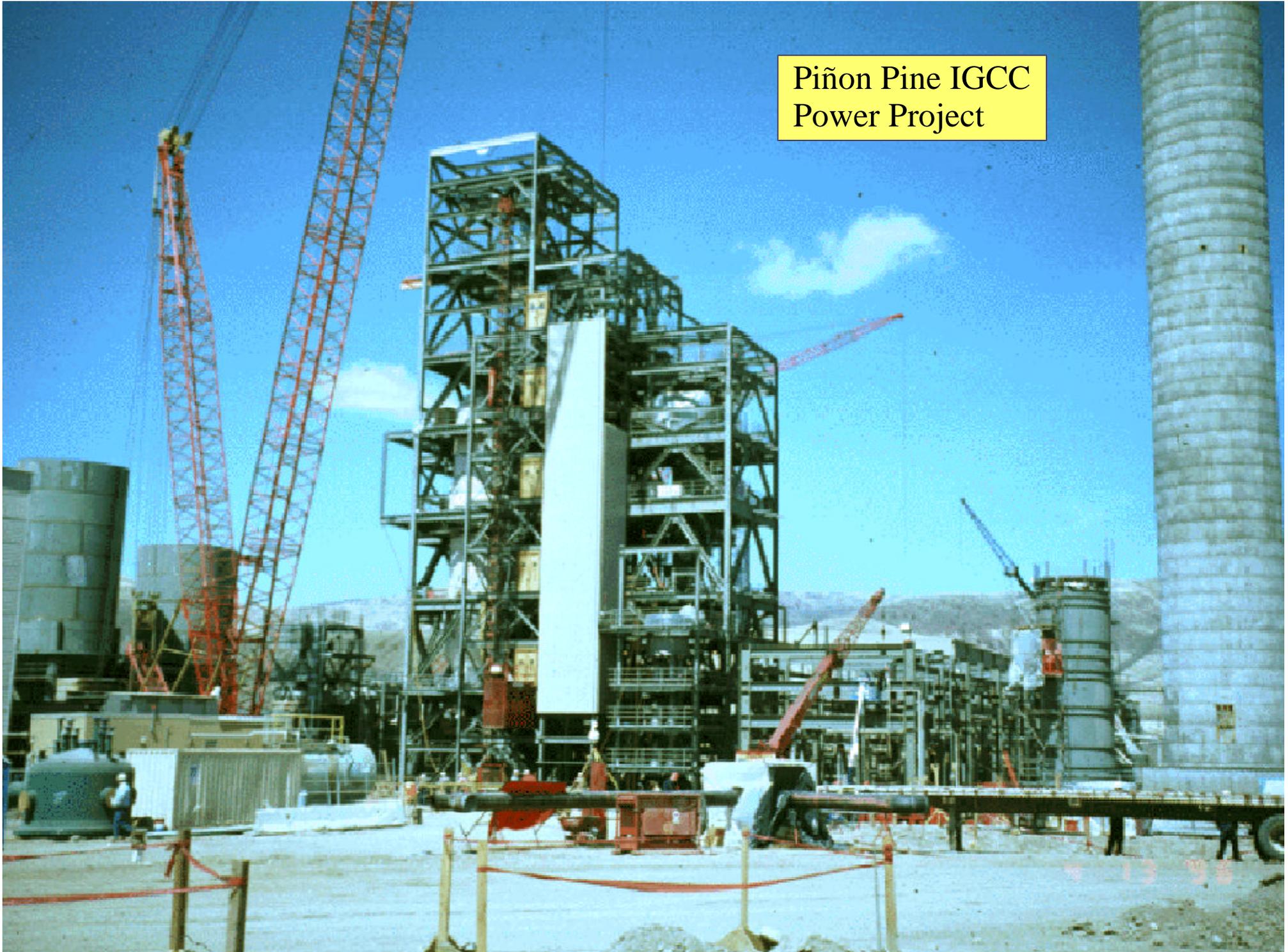
IGCC Projects, Major R&D, Support



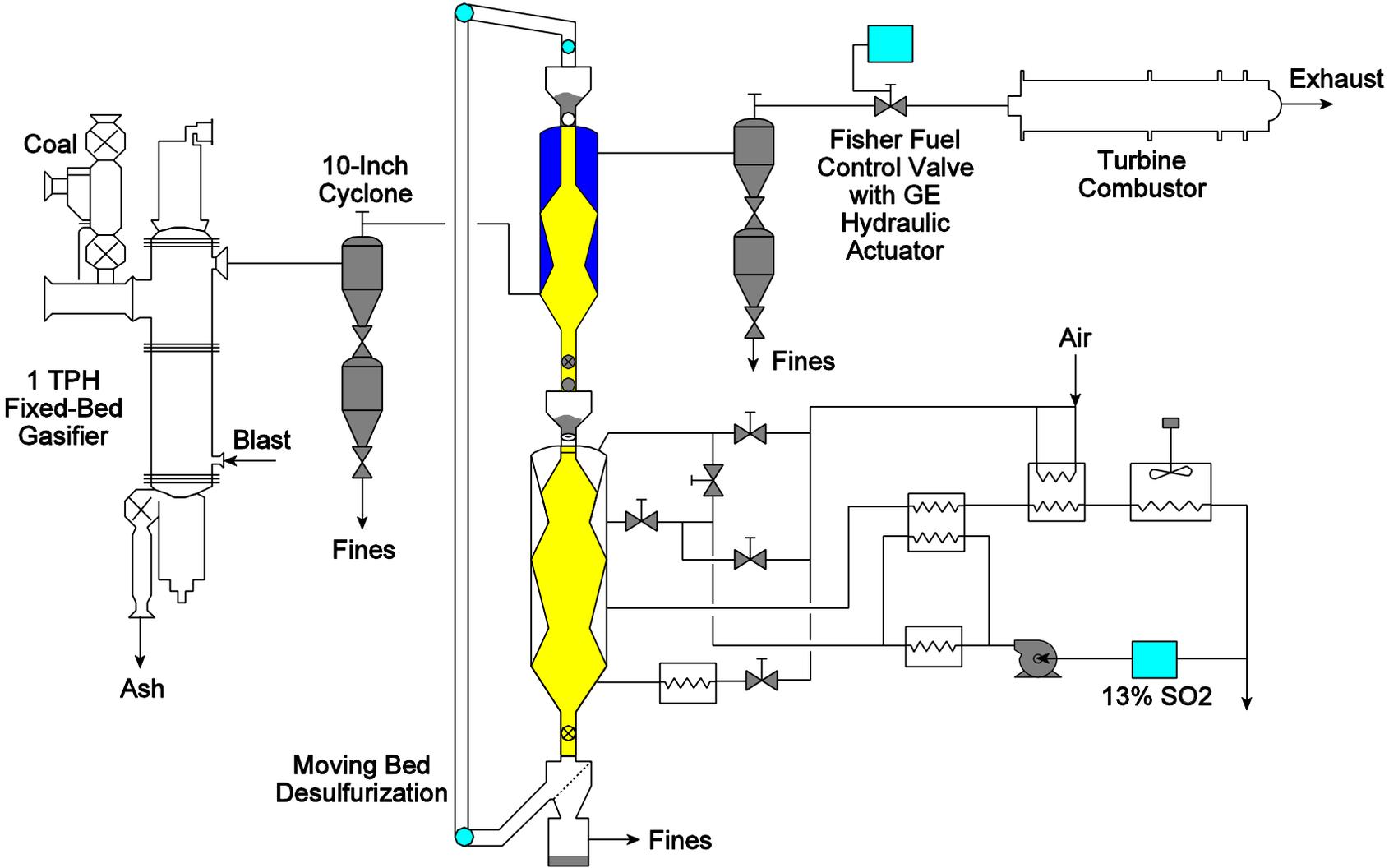
PFBC Projects, Major R&D, Support



Piñon Pine IGCC
Power Project

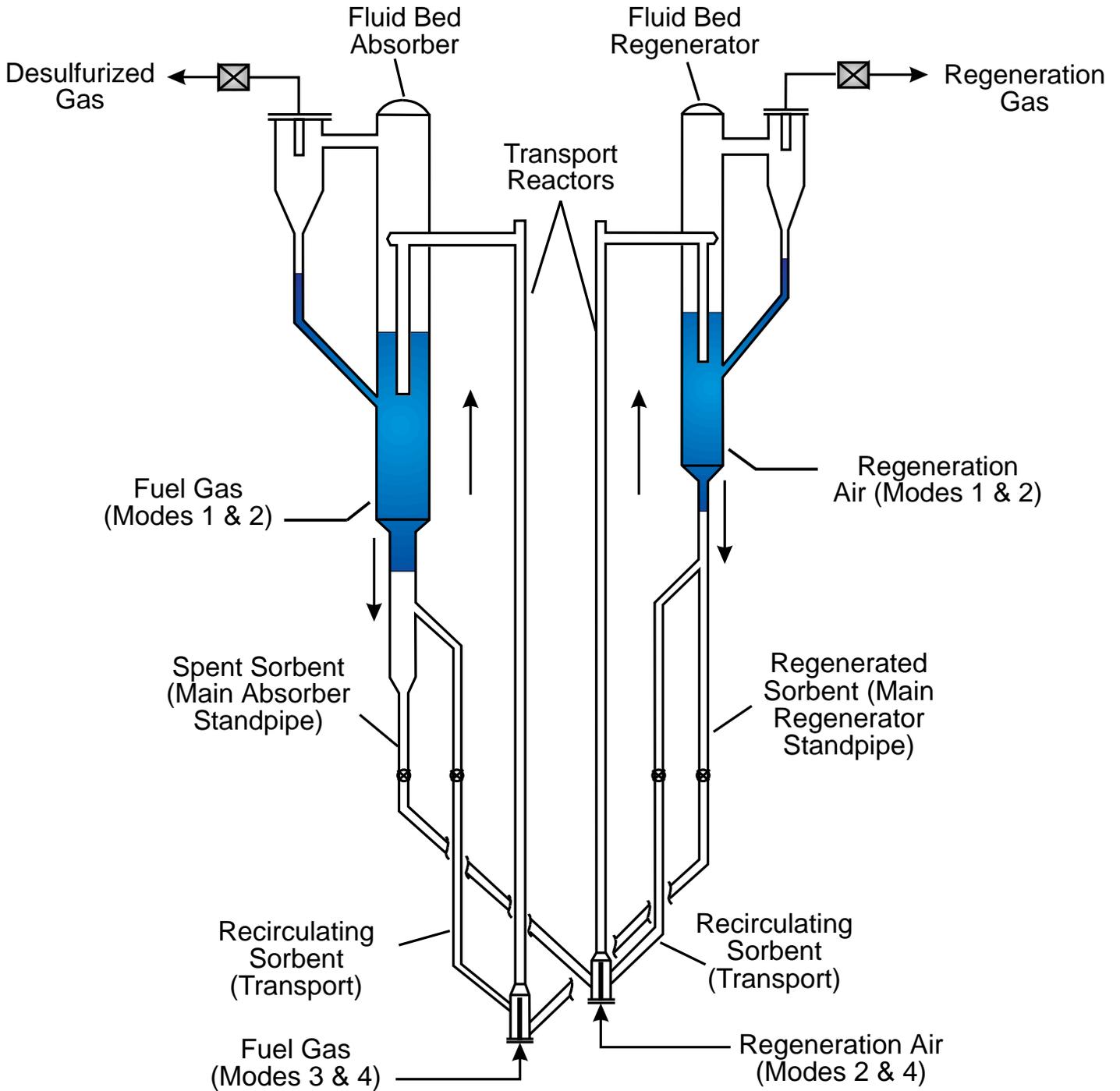


GEESI Moving Bed Desulfurizer



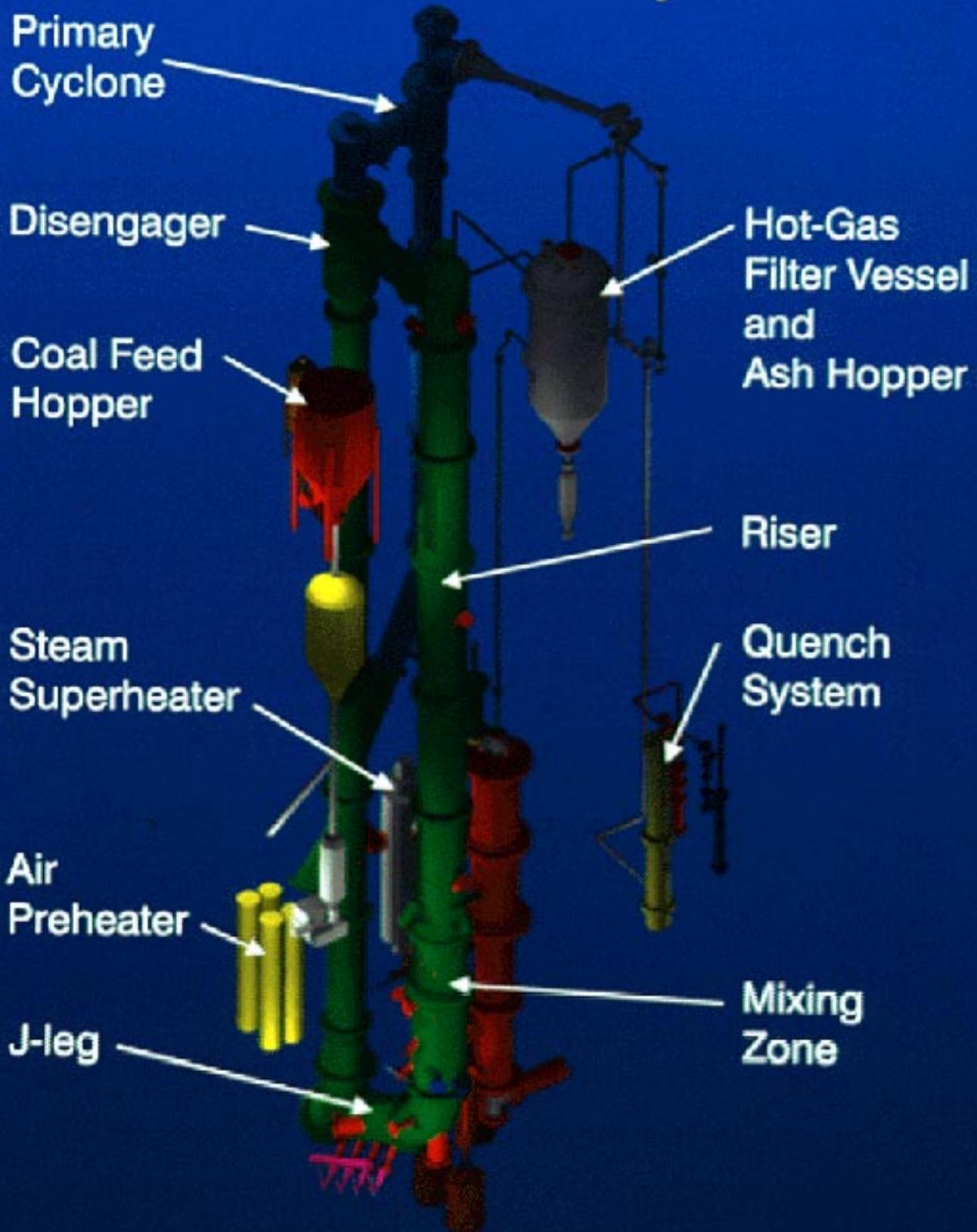
Samples of Fresh,
Sulfided, and
Regenerated Sorbents

PDU Reactor Schematic



METC
Desulfurization PDU

Transport Reactor with Hot-Gas Filter System

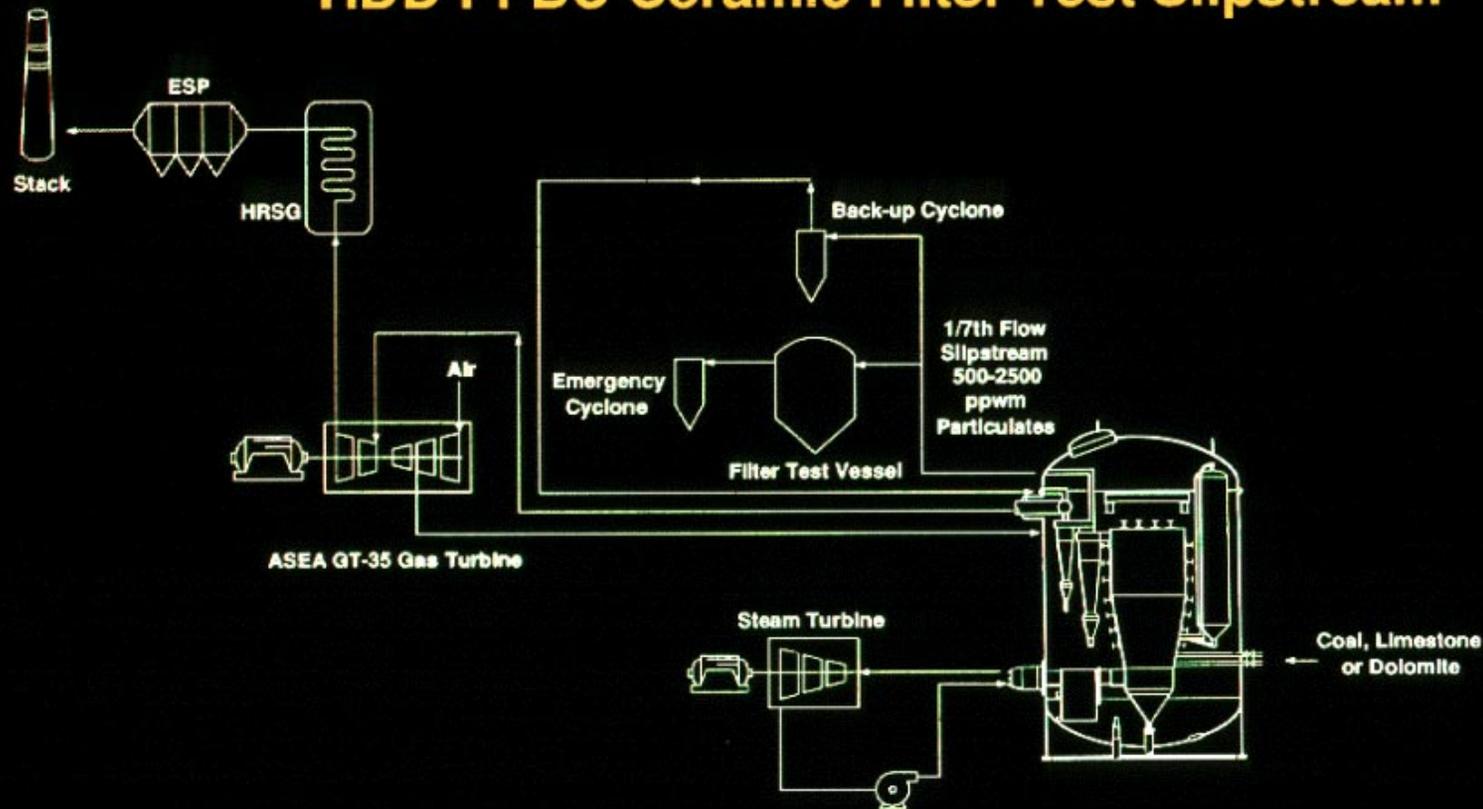


**METC
Desulfurization PDU**

**Ceramic Barrier
Filter Designs**

Westinghouse Cold
Flow Filter Module

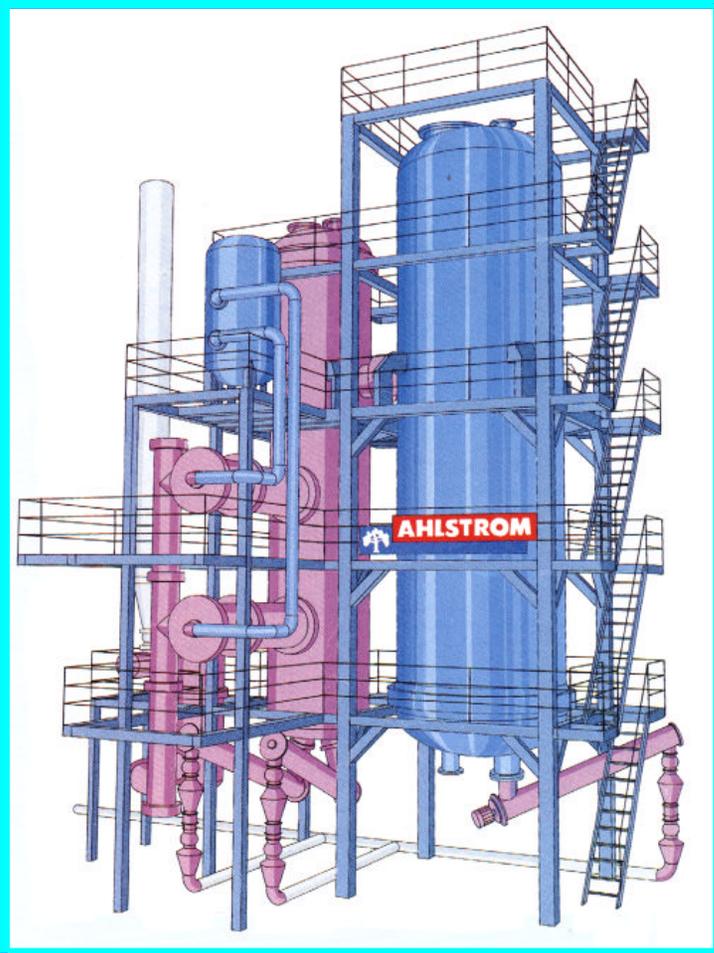
TIDD PFBC Ceramic Filter Test Slipstream



- 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



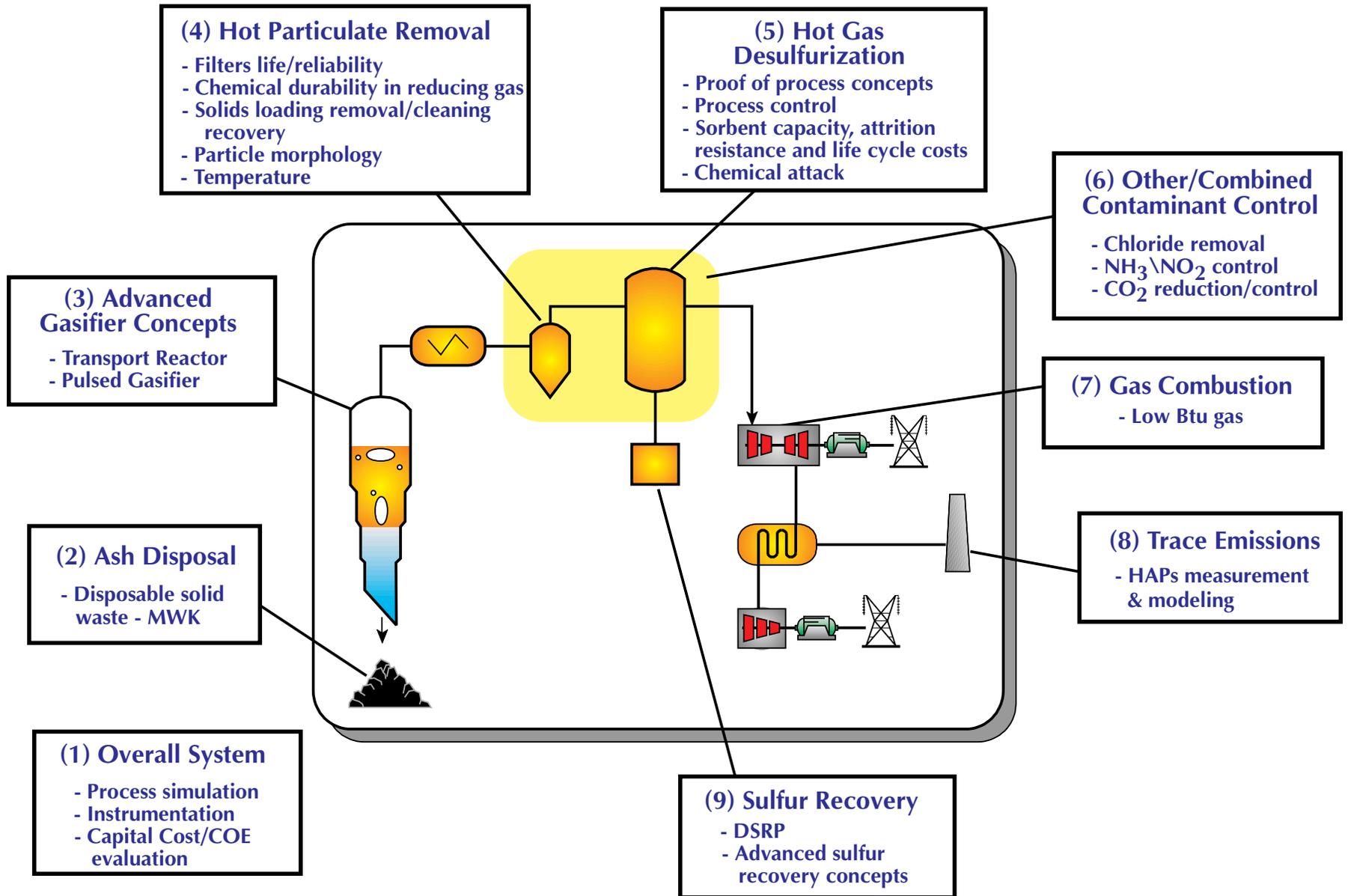
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Barrier Issues

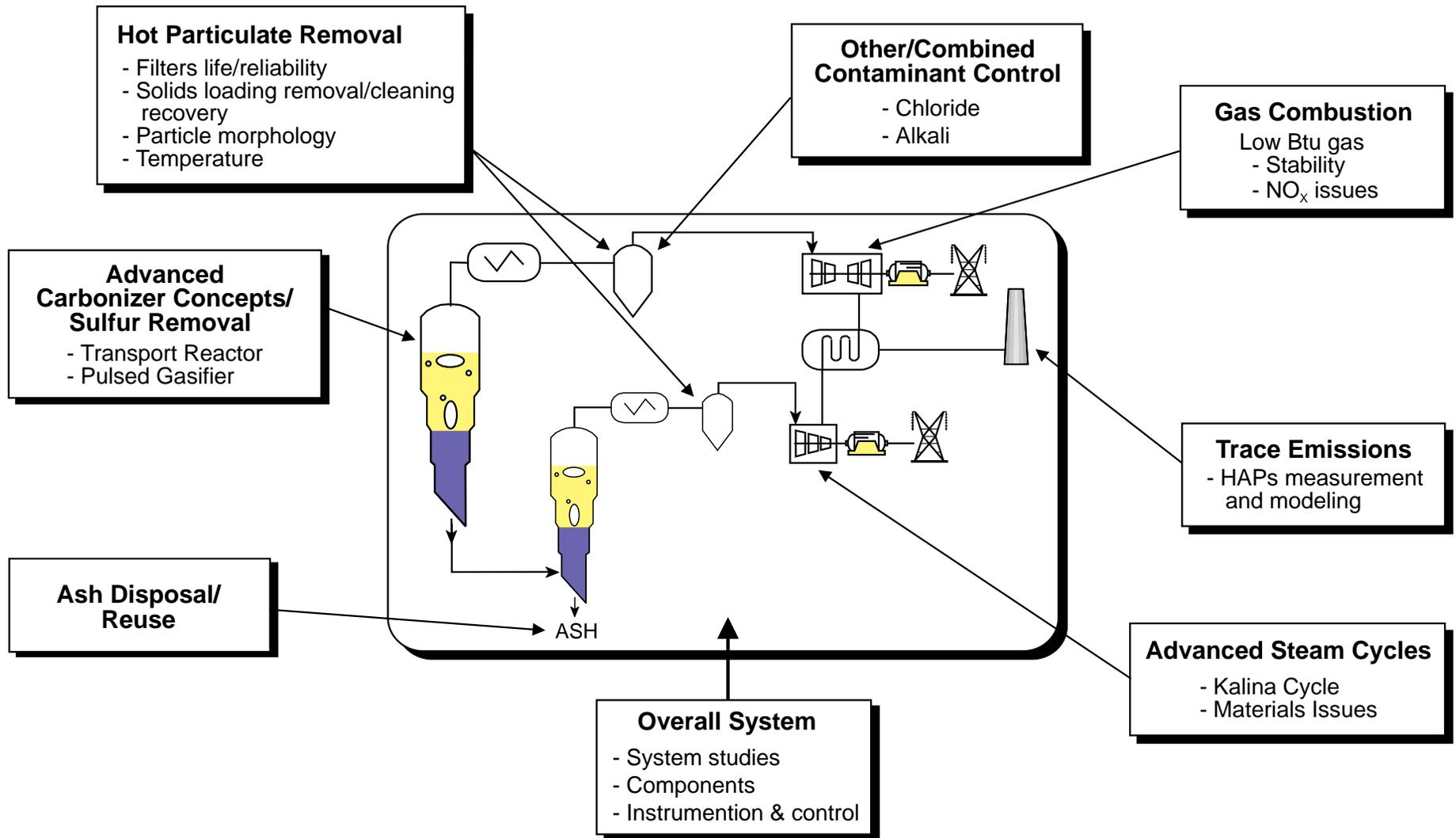
- ***Technical***
 - ***Filters***
 - ***CO₂***
 - ***S and other gases***
 - ***Materials***

- ***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*

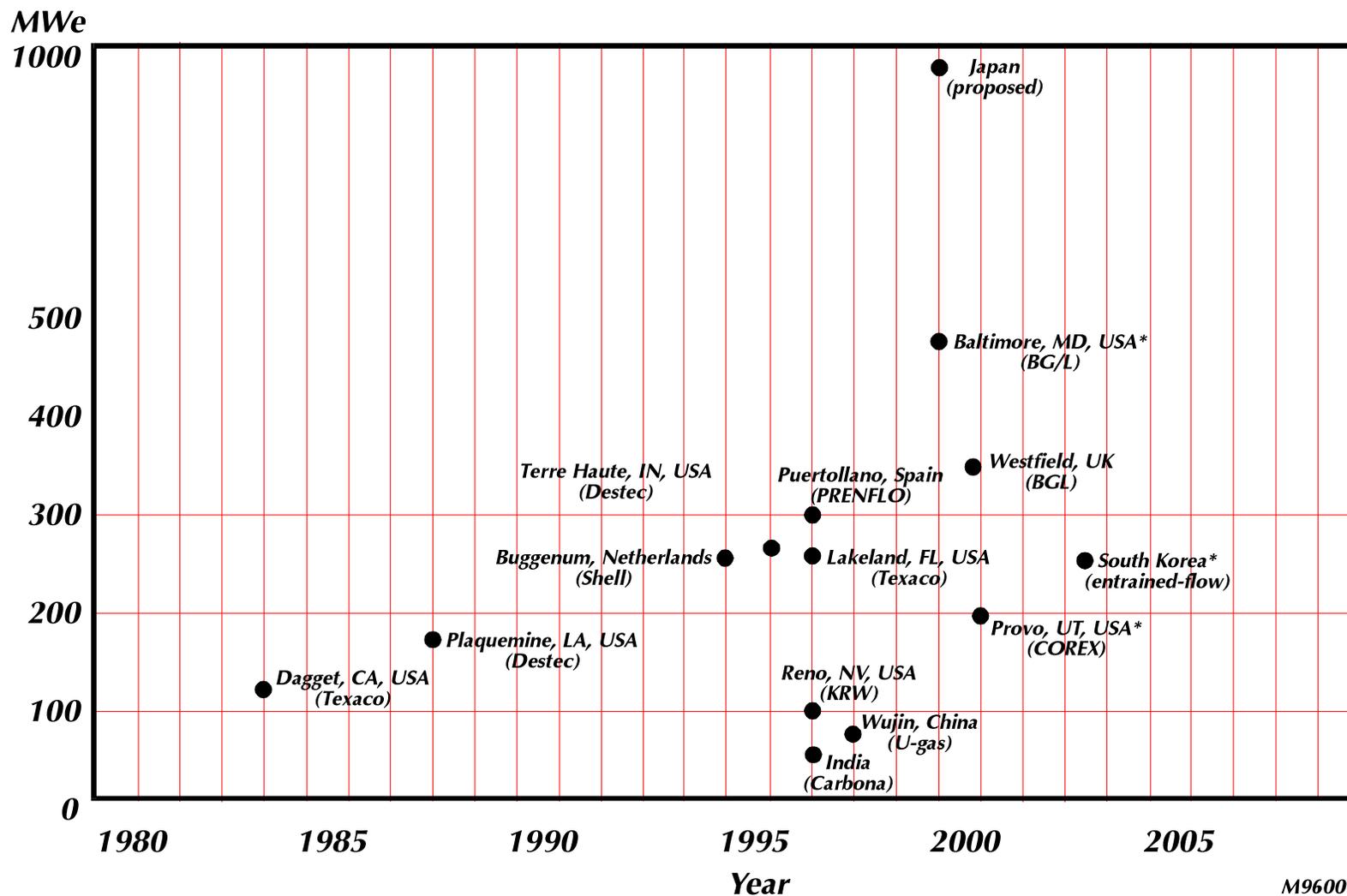
**Wabash River Coal Gasification
Repowering Project**

Power Systems Development
Facility at Wilsonville, AL

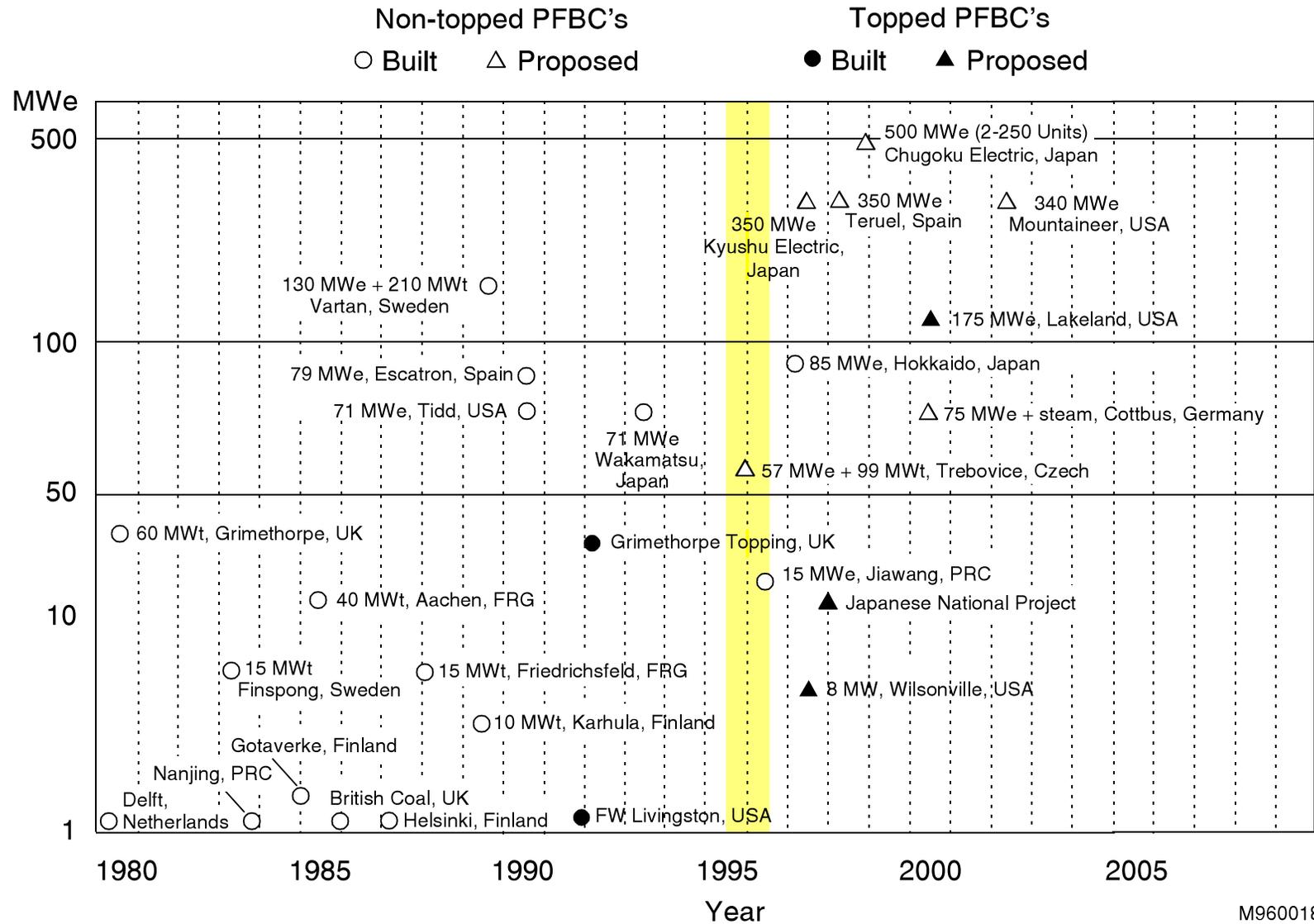
Tampa Electric Integrated
Gasification Combined
Cycle Project

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

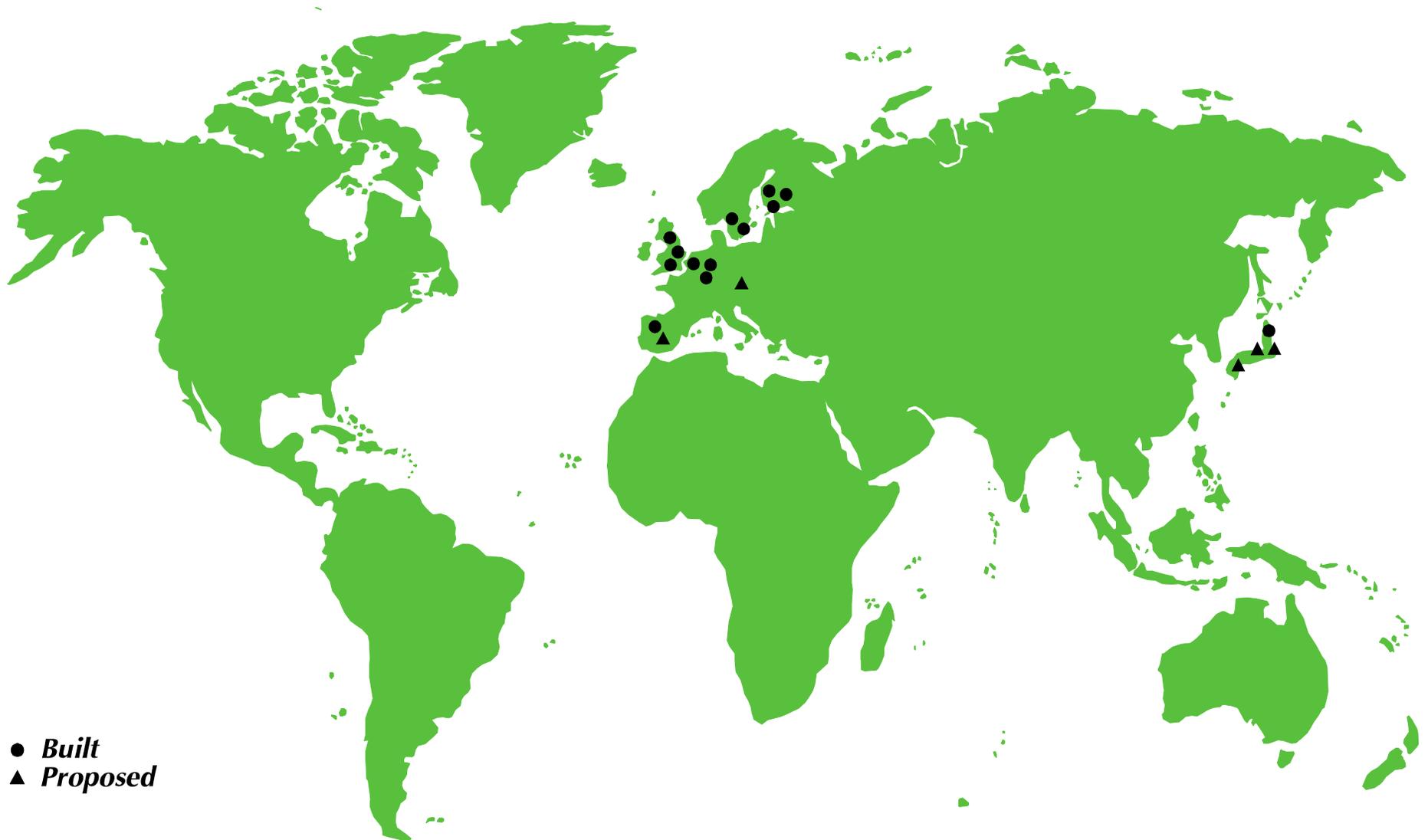
List of IGCC Projects in the World



List of PFBC Projects in the World



PFBC Plants and Projects



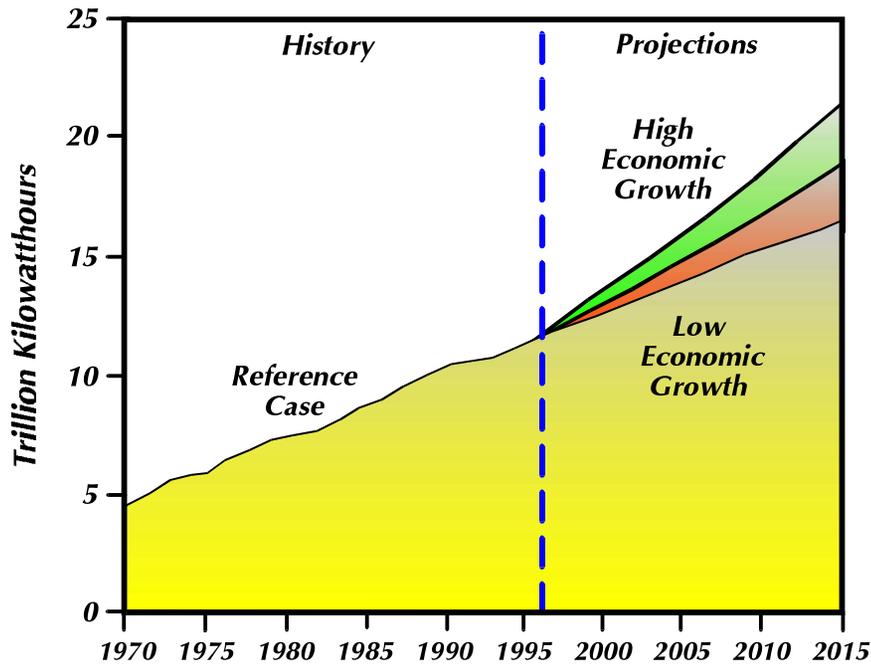
● ***Built***
▲ ***Proposed***

Marketplace Opportunities

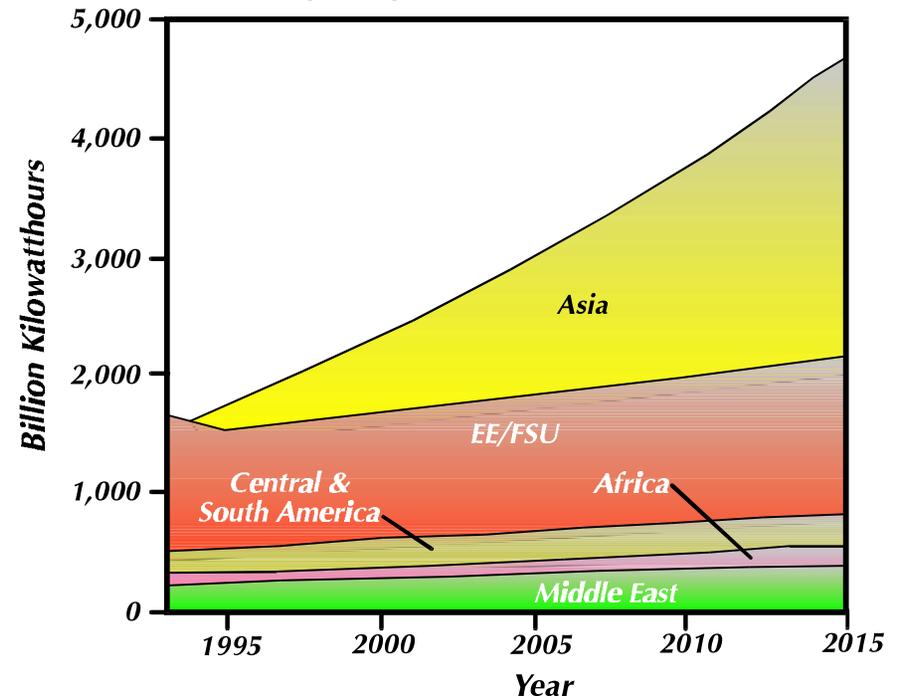
- ***U.S. repowering***
- ***Global demand***
- ***Co-production***
- ***Opportunity fuels***
- ***Environmental drivers***
- ***Advanced systems***

Global Demand

**World Electricity Consumption
1970 - 2015**



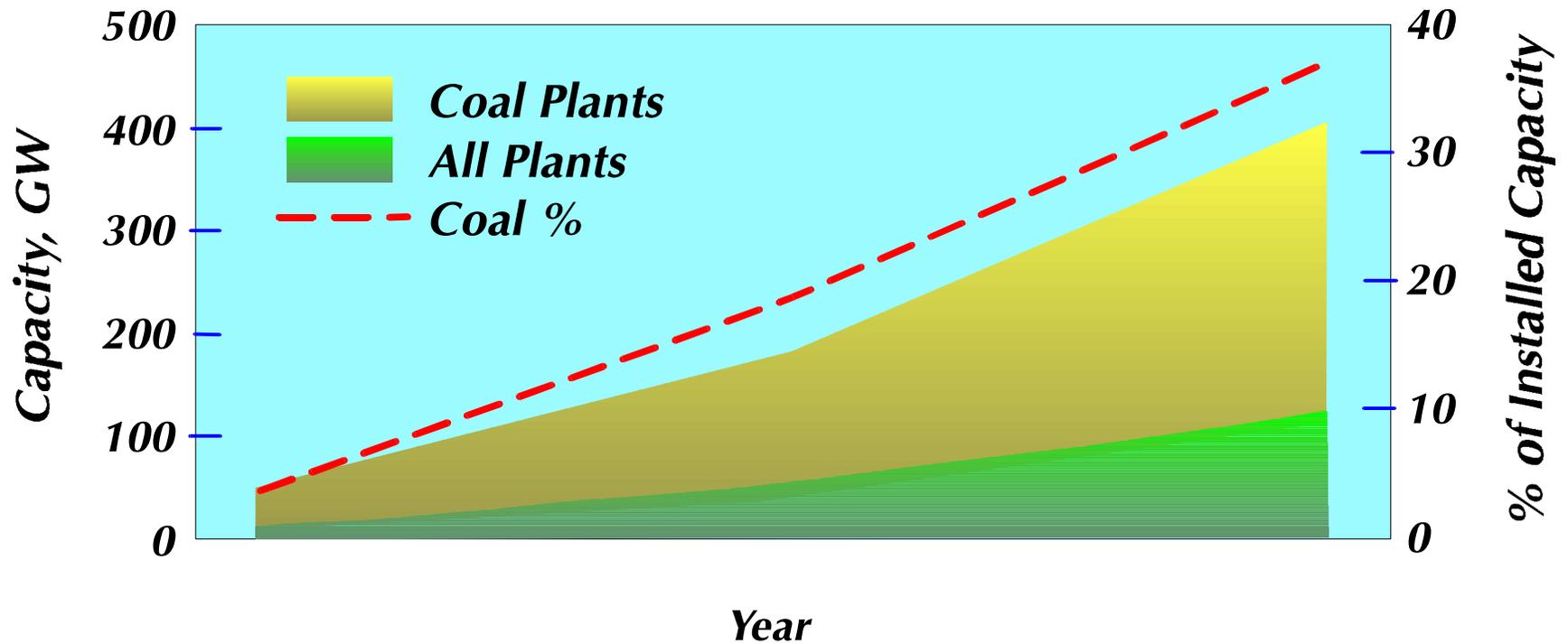
**Non-OECD Electricity Consumption
By Region, 1993 - 2015**



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

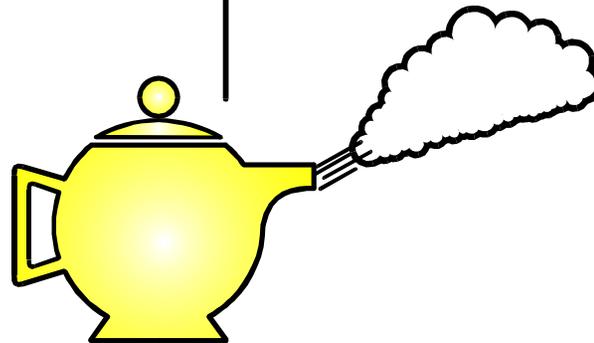


Co-Production

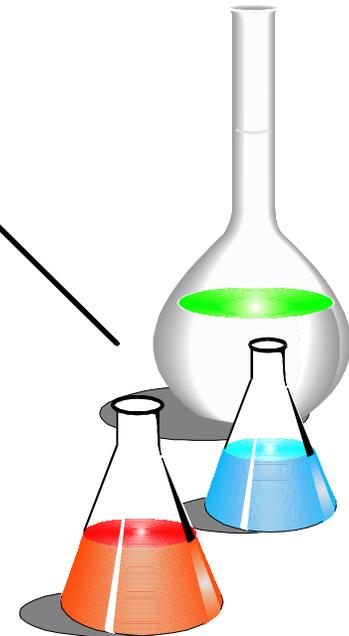
COAL



Electricity



Steam

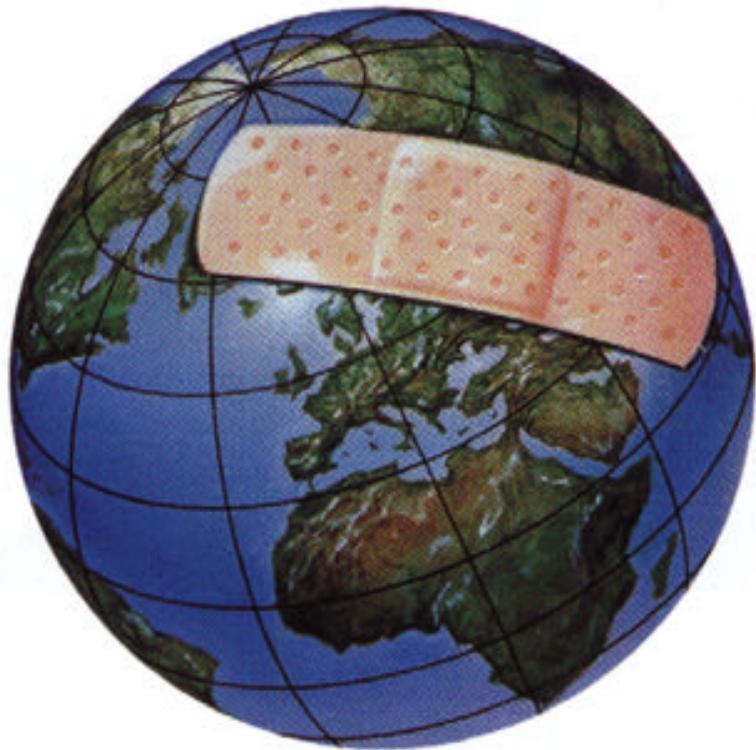


Chemicals



Opportunity Fuels

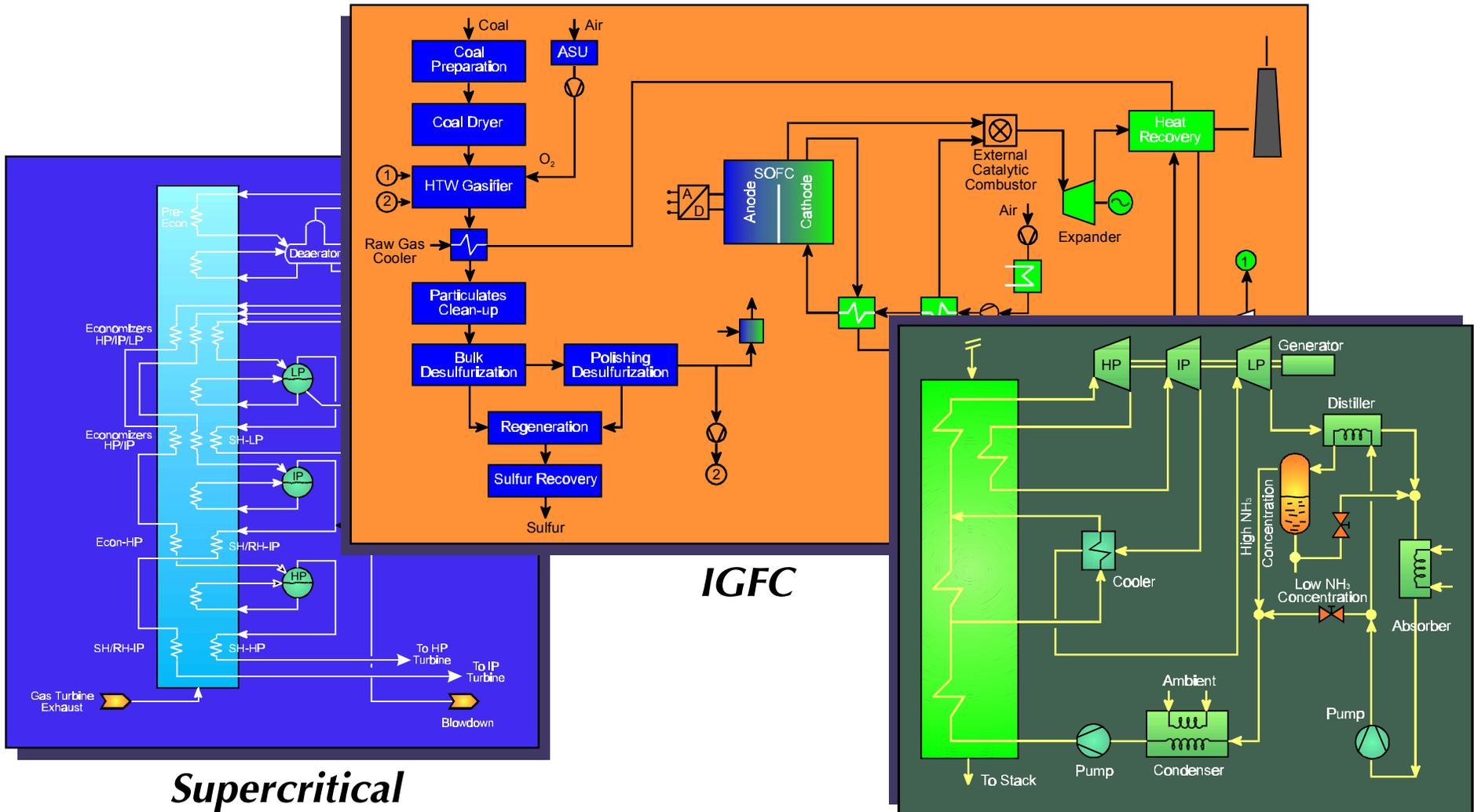
- Plastic
- Biomass
- Sewage
- RDF
- Petcoke
- Waste Fuel



Environmental Drivers

- SO_2
- NO_x
- CO_2
- Particulates
- HAPs

Advanced Systems



Supercritical

IGFC

Kalina and Other Advanced Cycles