

EAGLE Project

**coal Energy Application for Gas, Liquid and Electricity
Status of the Project**

—FutureGen Workshop 2008—

February 25, 2008

EPDC/  POWER

Wakamatsu Research Institute

EAGLE Step1 (2002-'06)



Project Objectives

- Final Target of the EAGLE Step1 is to toward IGFC, which is combined with Fuel Cell, GT, and ST. It's called triple combined cycle.
- Coal must be converted into an ash-free combustible gas with gasification and clean-up to produce a gaseous fuel equivalent to LNG.

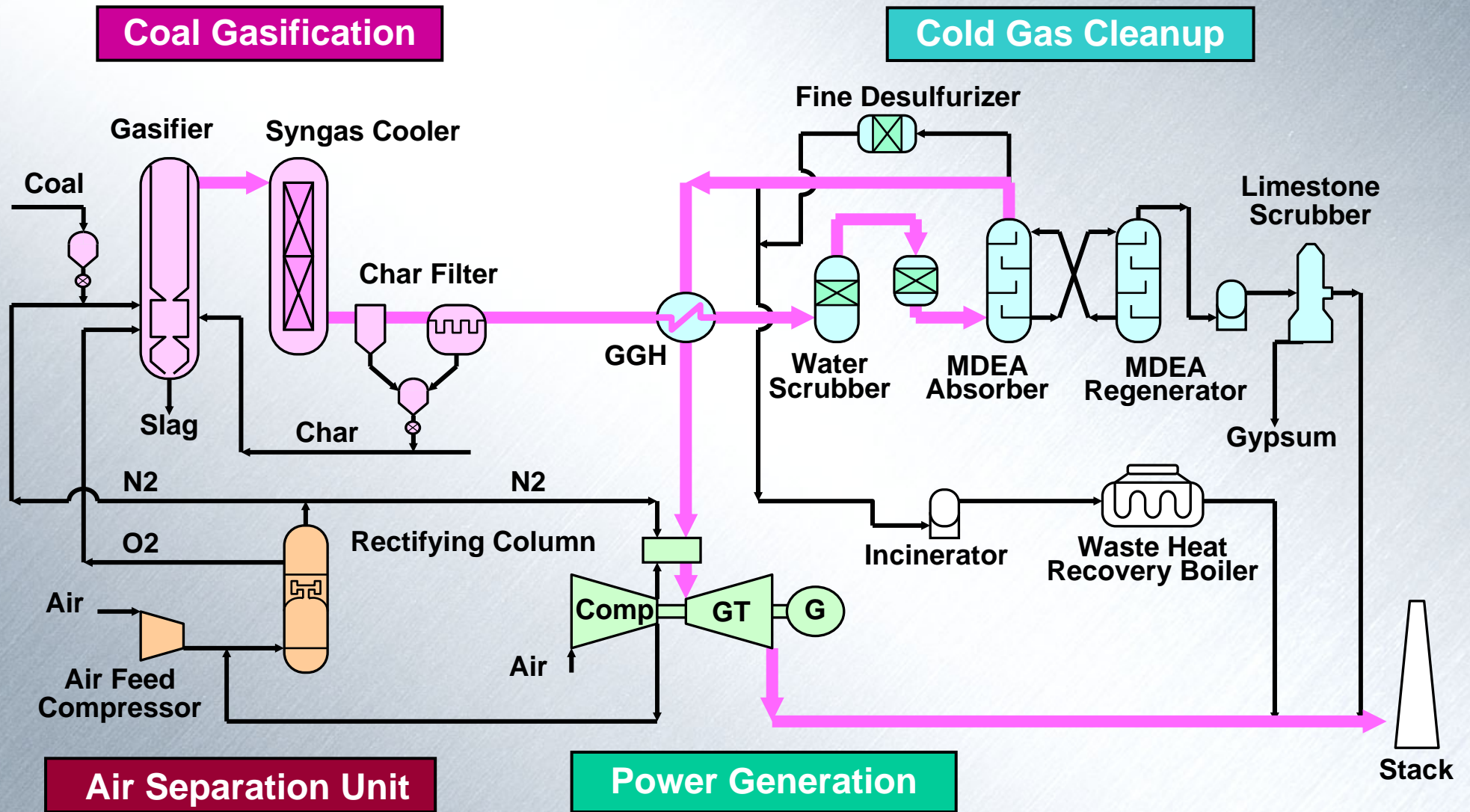
For the above, we set the following as a final target.

1. Development of Oxygen-blown entrained-flow gasifier
2. Establishment of Gas clean-up technology for fuel cells

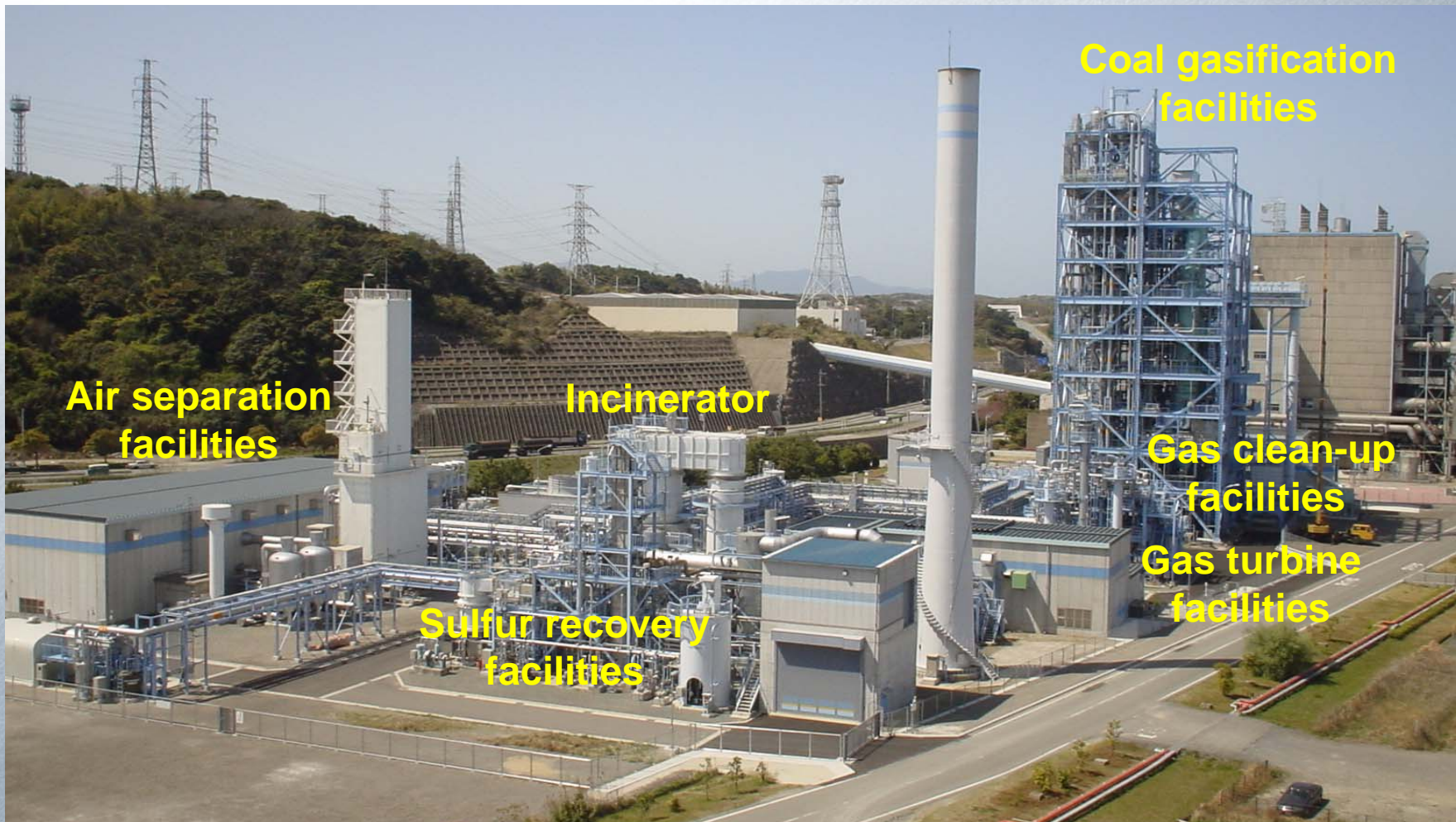
Project Support

- METI & NEDO

EAGLE pilot plant system flow



Site View



Specifications of EAGLE Pilot Plant



Coal Gasifier

Coal Feed Rate
Gasification Pressure

Oxygen-blown Two-stage Entrained-flow

150 tons per day
2.5 MPa

Cleanup System

Syngas Flow
Sulfur Compounds

Sulfur Recovery Unit

Cold Cleanup Using Methyldiethanol Amine

14,800 m³N/h (MDEA Absorber Outlet)
< 50 ppm (MDEA Absorber Outlet)
< 1 ppm (Fine Desulfurizer Outlet)
Limestone Wet Scrubbing

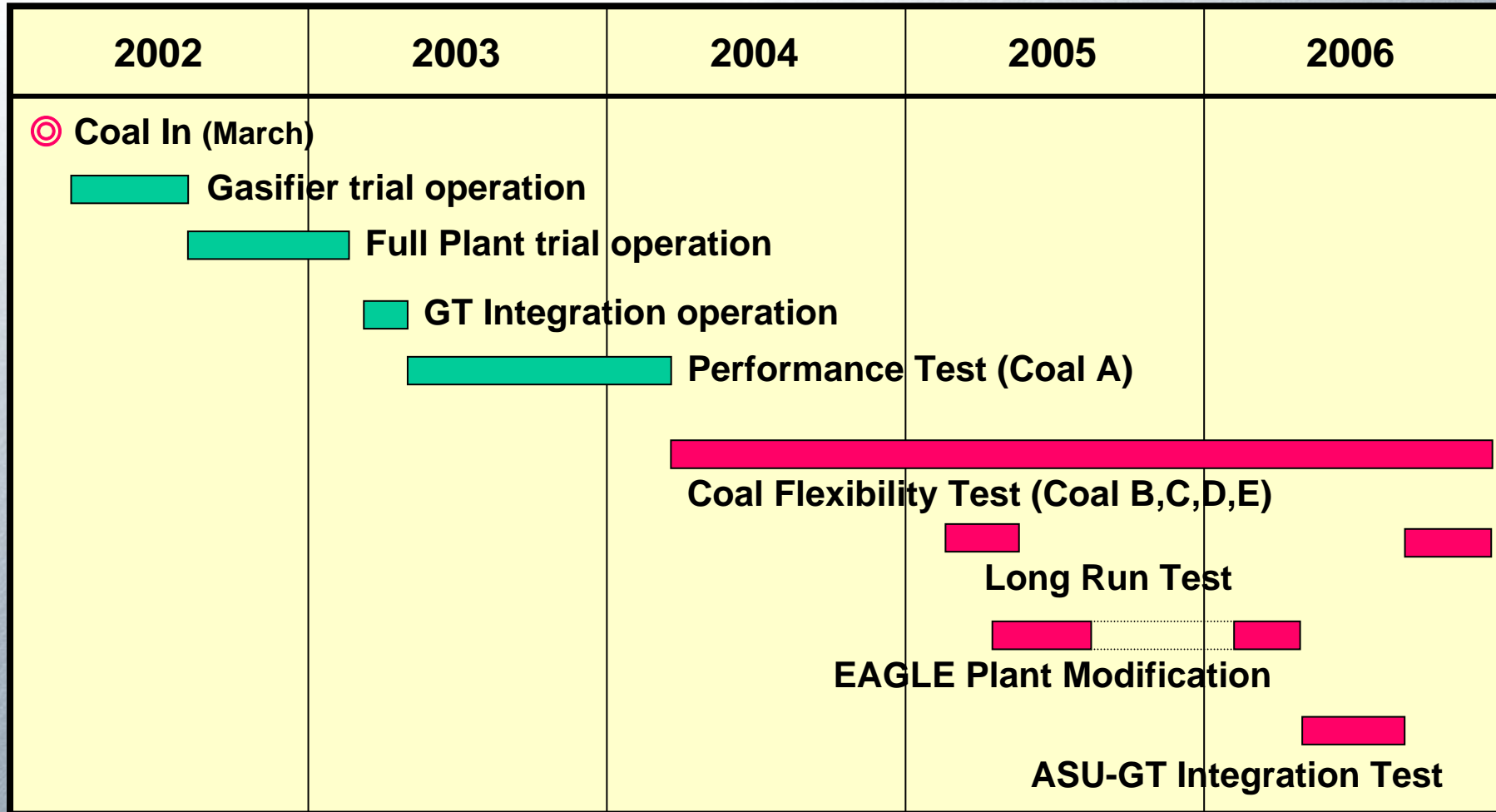
Air Separation Unit

Air Feed Rate
Feed Air Pressure
Oxygen Production
Oxygen Purity

Pressurized Cryogenic Separation

27,500 m³N/h
1.09 MPa
4,600 m³N/h
95.0 vol%

Major Test Items during EAGLE Step1



Project Targets and result



Item		Targets	result
Carbon Conversion Efficiency		$\geq 98 \%$	$\geq 99 \%$
Cold Gas Efficiency		$\geq 78 \%$	82%
Calorific Value (HHV)		10,000 kJ/m ³ N	$\geq 10,100$ kJ/m ³ N
Continuous Operation Time		1,000 hrs	1015 hrs
Kinds of Coal		5	5
in Clean Syngas	Sulfide Compounds	≤ 1 ppm	<1 ppm
	Halogenated Compounds	≤ 1 ppm	<1 ppm
	Ammonia	≤ 1 ppm	<1 ppm
	Particulate Matter	≤ 1 mg/m ³ N	<1 mg/m ³ N

Total Operation Time : **5,600 hrs (as of Jan, 2008)**
Total Coal Consumption: **30,200 ton**

Results of EAGLE Step1



- **Obtained the know-how for Operation and Maintenance of total plant system.**
- **Confirmed the reliability through 1,015 hours long-run operation.**
- **Recognized the gasification property with 5 kinds of coal, having different characteristics.**
- **Obtained the data for large-scale demonstration plant as a next phase.**

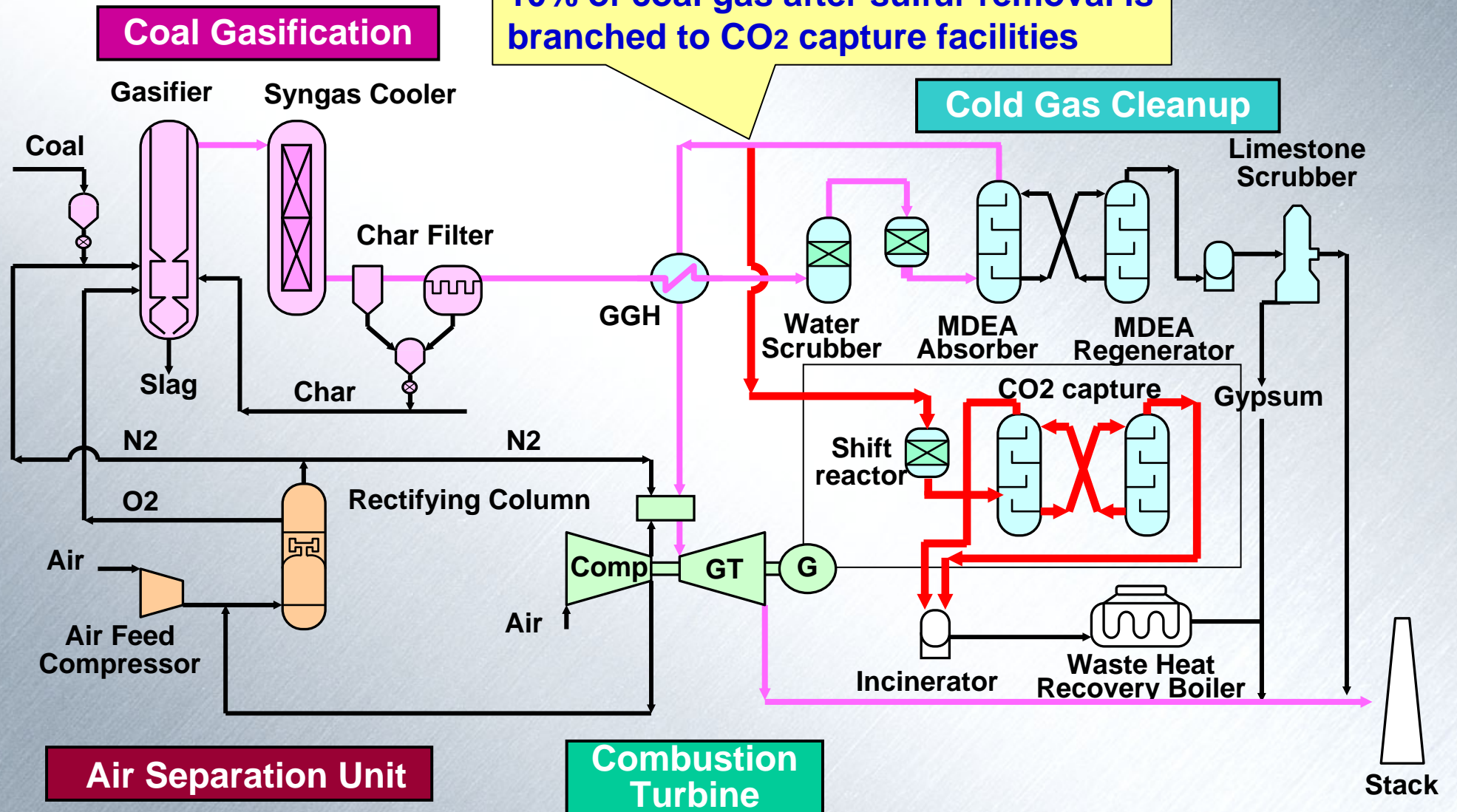
EAGLE Step2(2007-'09)



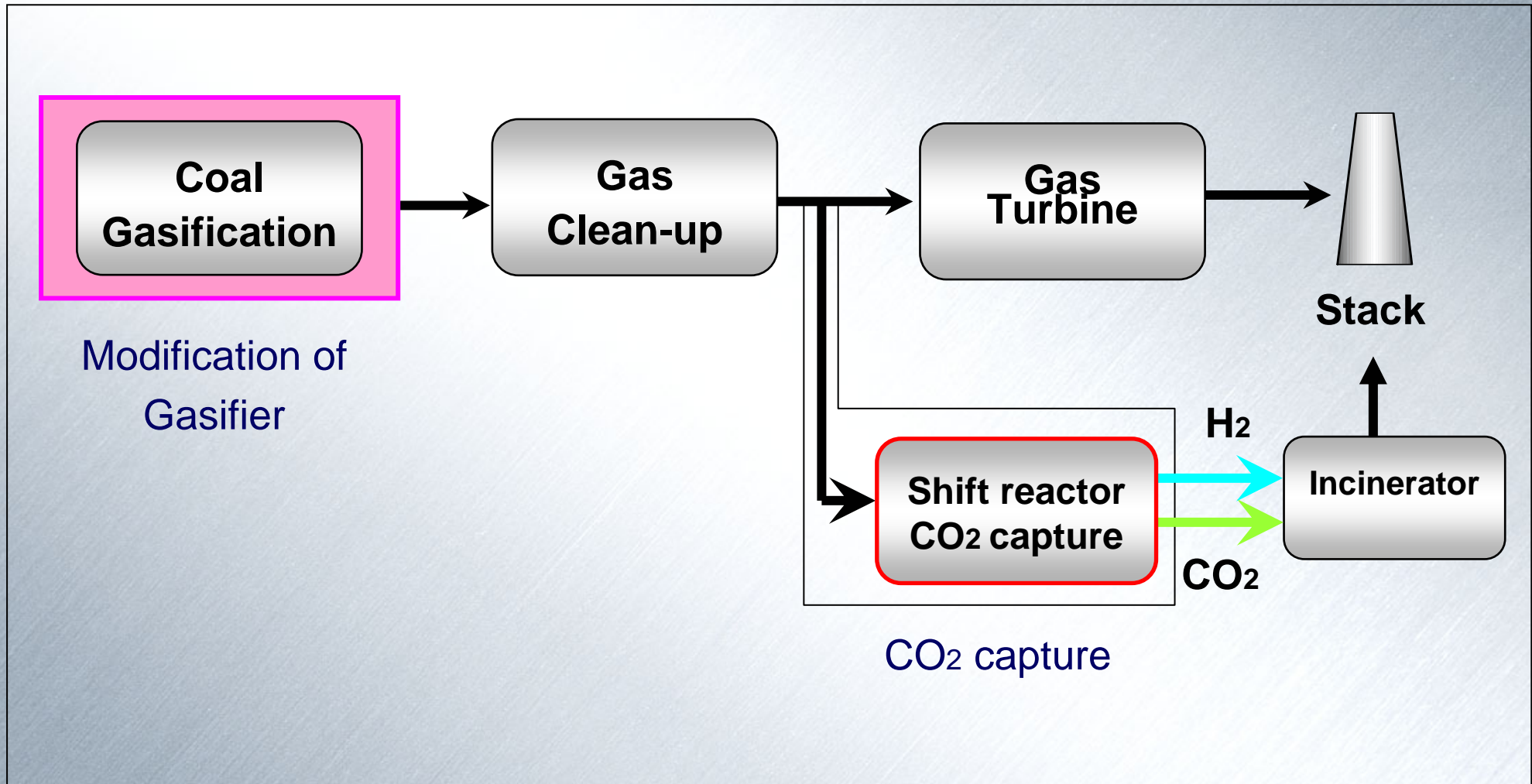
- ✓ **EAGLE step1 was completed in success.**
- ✓ **EAGLE step2 was started to improve the plant reliability and further reduce CO₂.**
- ✓ **EAGLE step2 has three major objectives.**
 - 1. CO₂ capture from coal gas**
 - 2. Expansion of adaptable coal type**
 - 3. Survey on behavior of trace elements**

CO2 capture from coal gas

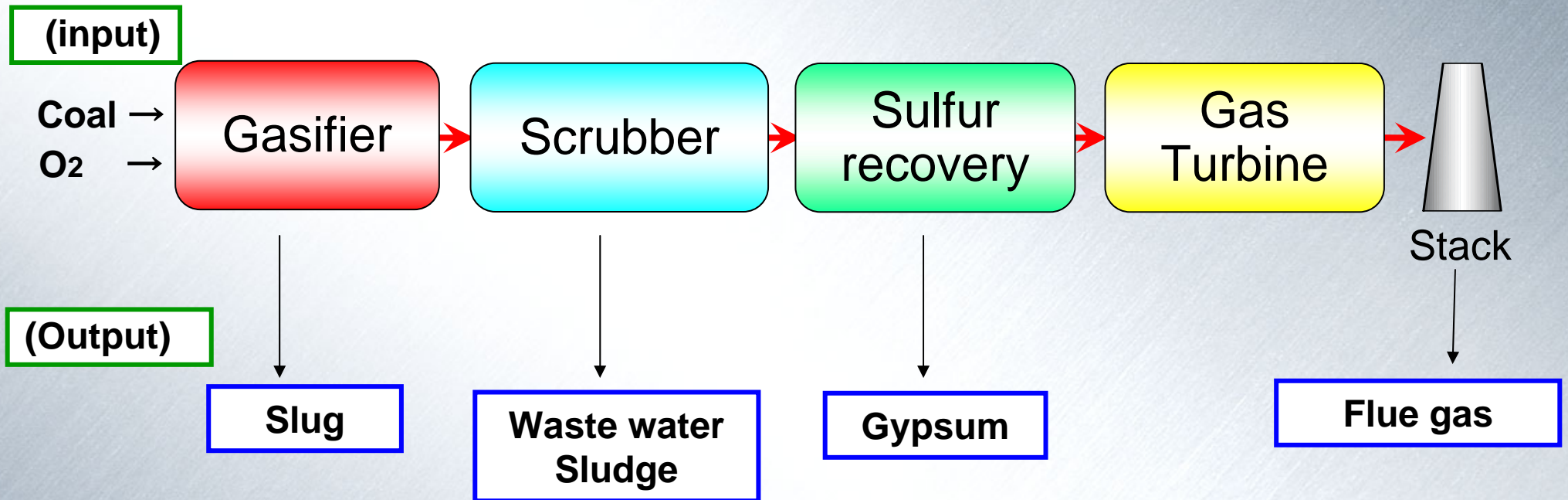
10% of coal gas after sulfur removal is branched to CO2 capture facilities



Remodeling and Installation in Step2



Survey of trace elements behavior



【Survey on trace elements behavior】

- Trace elements (such as Hg, Se, As, Cl,) from IGCC is uncertain.
- Survey for the reliability of plant and environmental assessment.
- Development of sampling technique for coal gas (ie. high temp. and press.).

Potentiality of coal gasification technology

