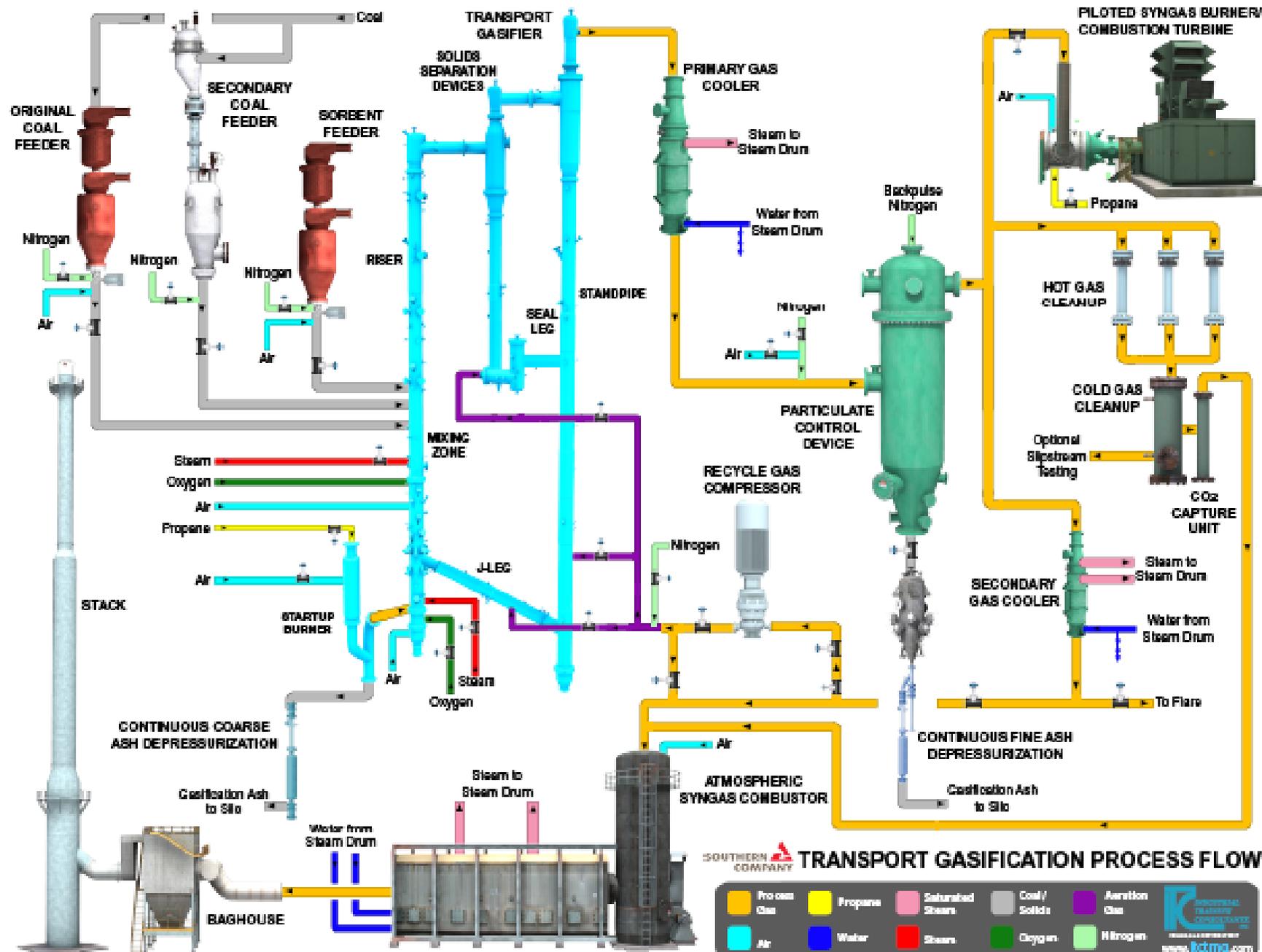


DOE's National Carbon Capture Center

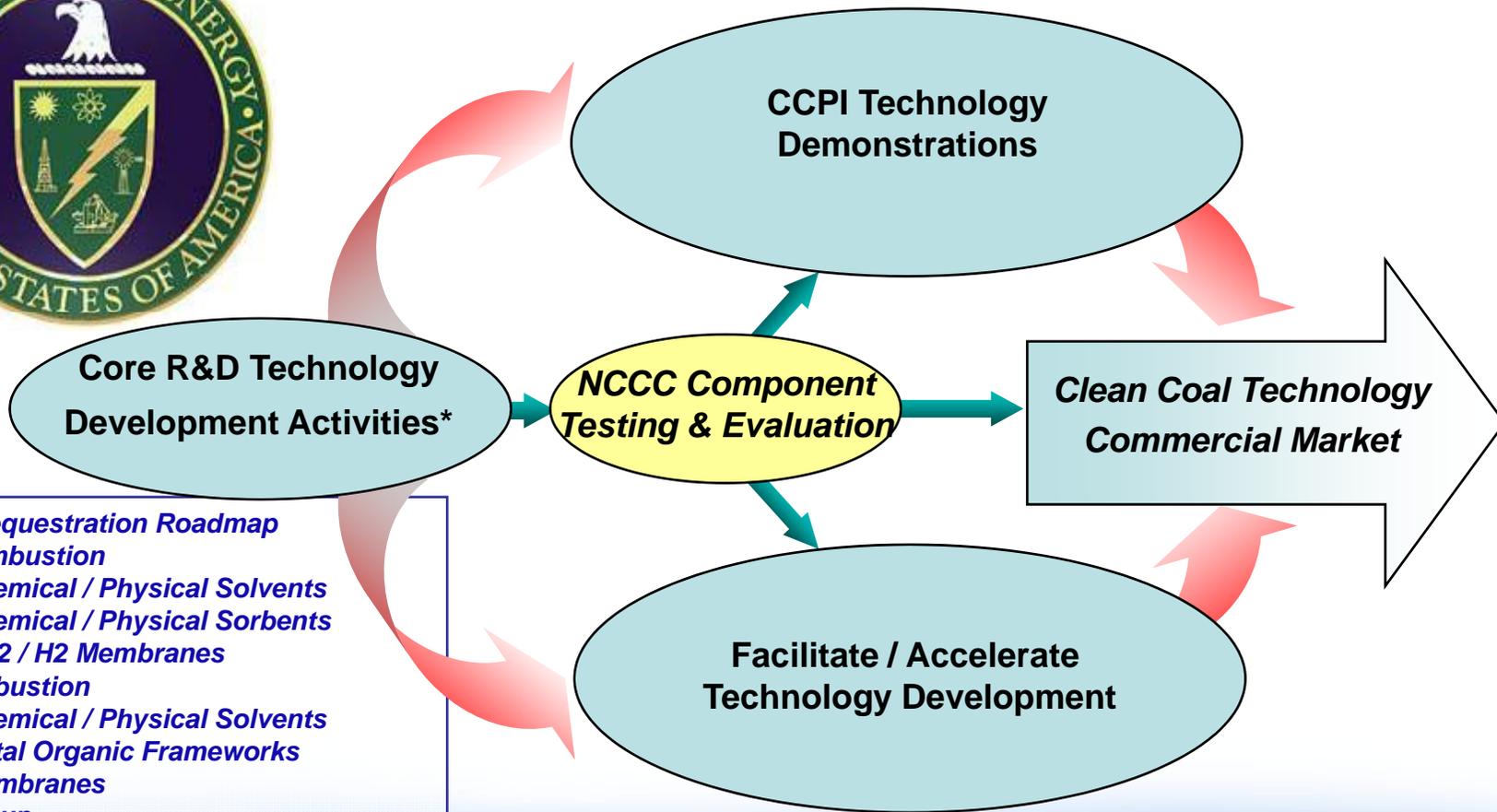


**Frank Morton
Presented to UK/US Collaboration
May 24, 2010**

PSDF Process Flow Diagram



NCCC links DOE's Coal Power R&D Program to the Commercial Market



- * Carbon Sequestration Roadmap
 - Post-Combustion
 - Chemical / Physical Solvents
 - Chemical / Physical Sorbents
 - CO₂ / H₂ Membranes
 - Pre-Combustion
 - Chemical / Physical Solvents
 - Metal Organic Frameworks
 - Membranes
- * Gas Clean-up
 - Mercury Sorbents
- * Advanced Generation
 - Fuel Cells
 - Biomass Gasification

U.S. Department of Energy National Carbon Capture Center

at the Power Systems Development Facility

PARTICIPANTS:

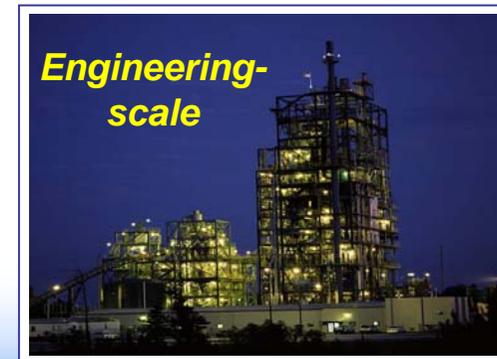
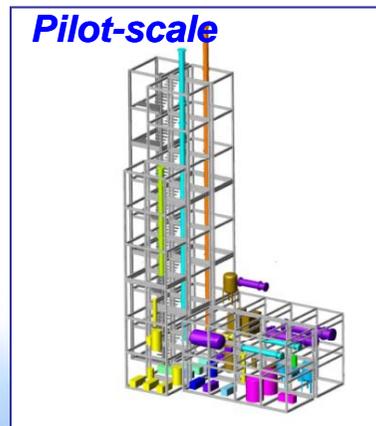


Managed by Southern Company Services, Inc.

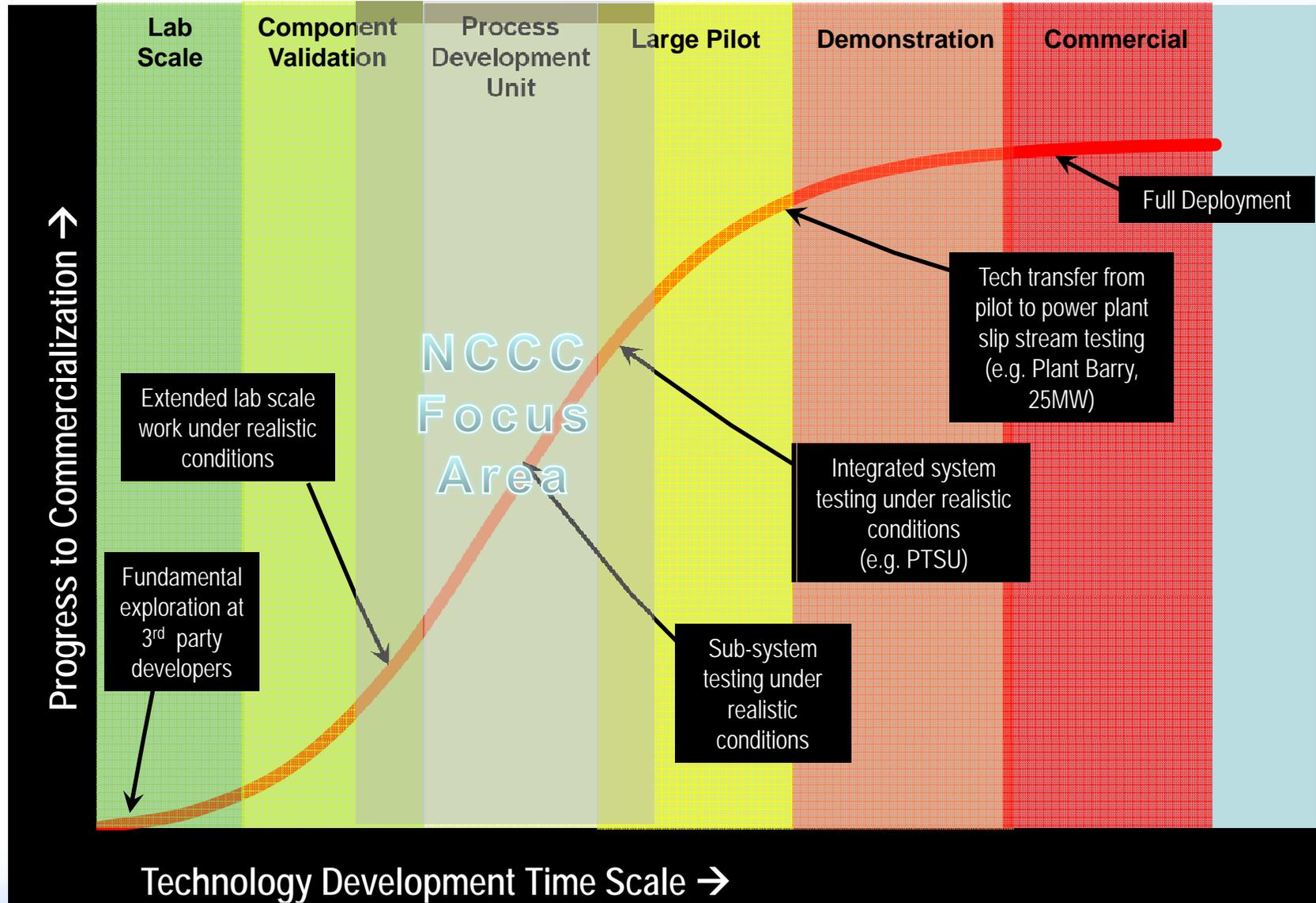


Goals of NCCC Development Program

- Offer a unique flexible testing facility where processes can be tested on coal derived gas at various scales
- Serve as a technology development facilitator by providing facilities for the scale-up from bench-top to engineering-scale
- Solicit and incorporate activities and projects from a wide variety of participants and partners. Find “Best-in-class” Technology.
- Deliver innovation through a cross-cutting, collaborative project portfolio that provides an accelerated pathway to cost-effective CO₂ capture technology for coal fueled power production



Technology S-Curve



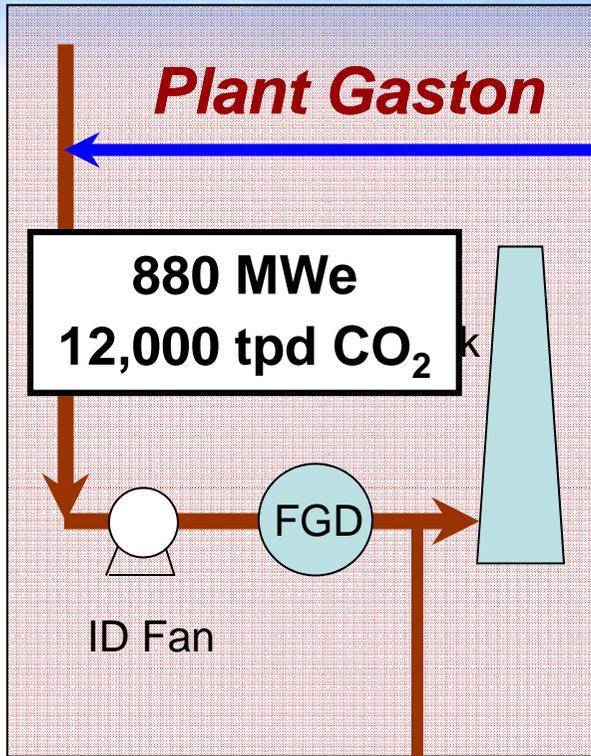
Confidential and Proprietary

Carbon Capture Technology Development at the NCCC

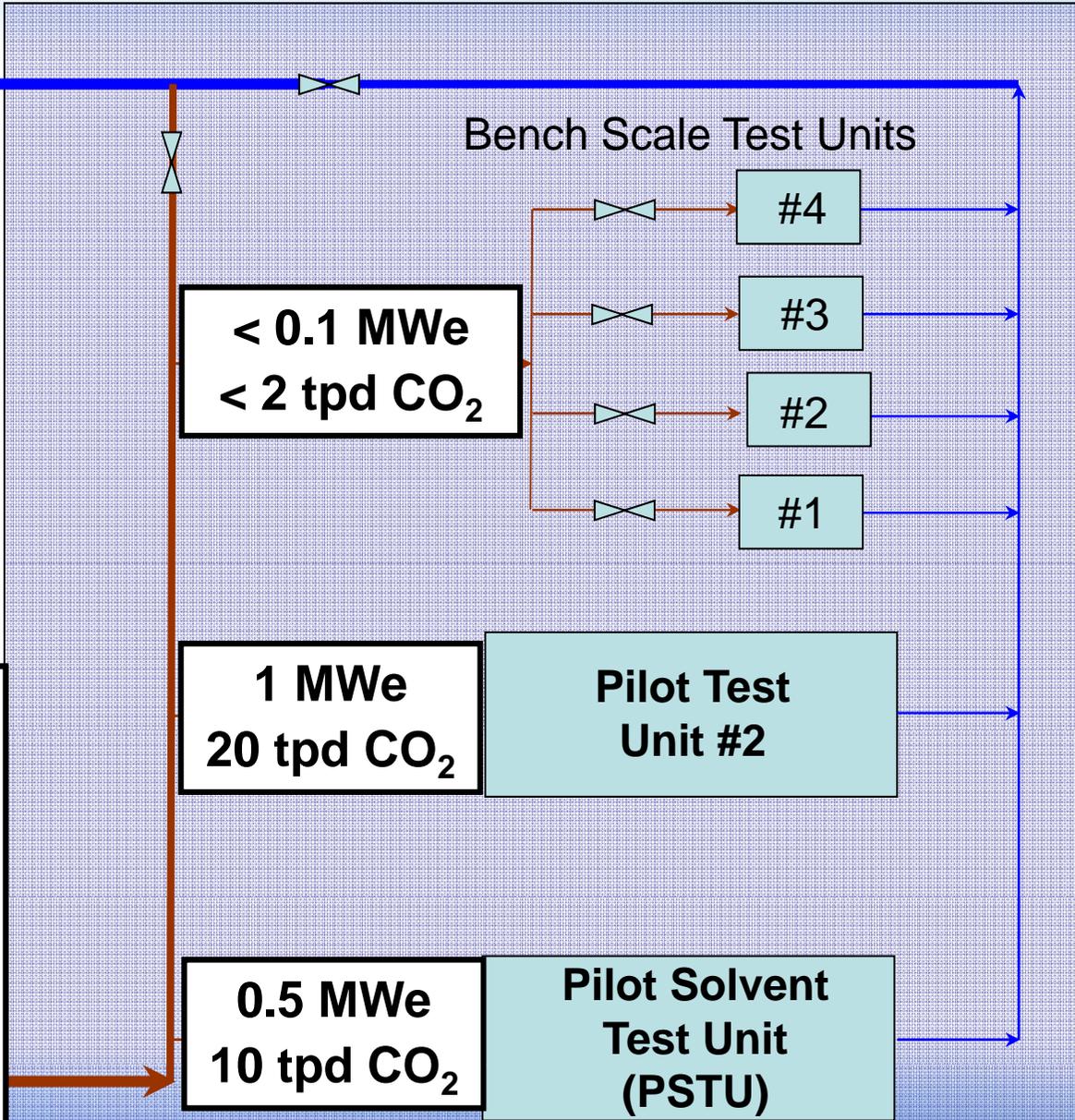
1. Post-combustion (Pulv. Coal)

2. Pre-combustion (IGCC)

Post-Combustion Carbon Capture Center (PC4)



P = 1" WC	T = 140 F
CO₂ 11.1% (by vol)	
O₂ 6.6%	
N₂ 68.8%	
H₂O 13.4%	
SO₂ 25 ppmv	
H₂SO₄ 3 ppmv	
HCl 1 ppmv	



Alabama Power Plant E.C. Gaston



Confidential and Proprietary



PC4 Site During Site Preparation



Confidential and Proprietary

COMPANY



Confidential & Proprietary

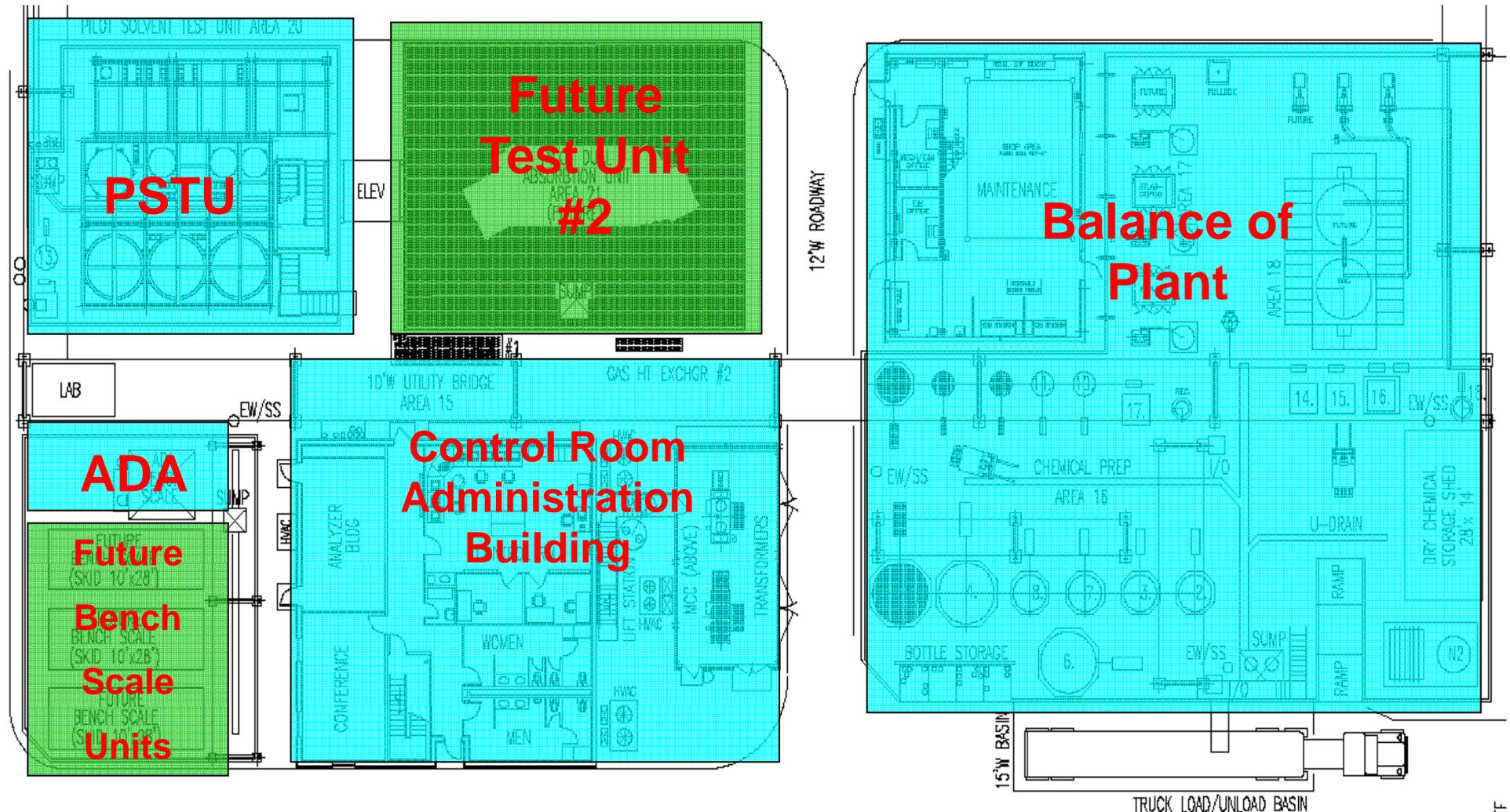




Confidential & Proprietary



Post-Combustion Site Arrangement



Flexible Test Units

Key Schedule Milestones

	Start	Complete
Caissons for Site	Nov 2009	Mar 2010
Gaston 5 Outage Connections (Steam & Flue Gas)	Feb 2010	Mar 2010
Utility Bridge Installation	Mar 2010	Jul 2010
Control Room/Admin Bldg	Apr 2010	Aug 2010
*PSTU Installation	Apr 2010	Jul 2010

* The goal is to have the PSTU Operational in the 4th Quarter of 2010

Confidential and
Proprietary

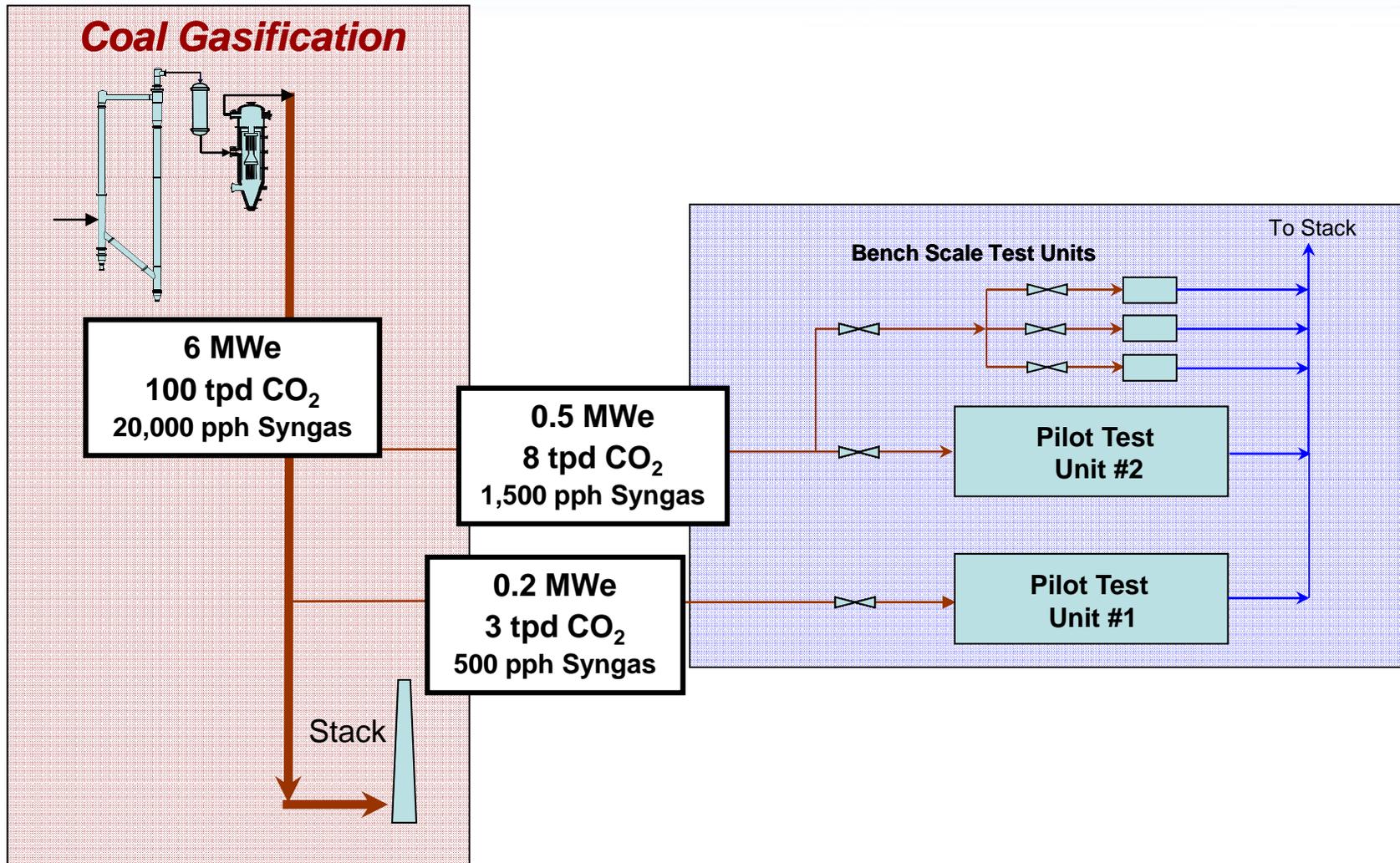


Carbon Capture Technology Development at the NCCC

1. Post-combustion (Pulv. Coal)

2. Pre-combustion (IGCC)

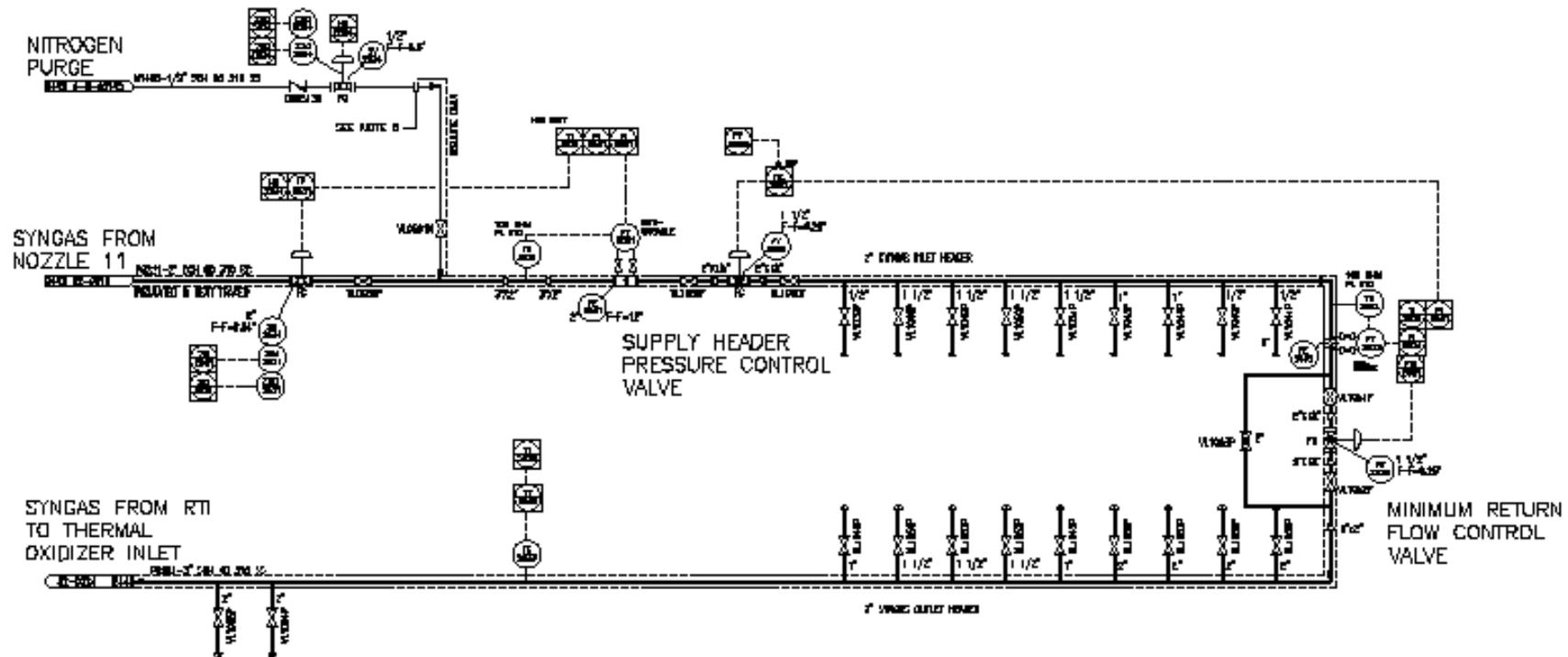
Pre-Combustion Capture Slip-Streams



Average Syngas Composition

		Air Blown Raw Syngas	Shifted Air Blown Raw Syngas	O2 Blown Raw Syngas	Shifted O2 Blown Raw Syngas
H ₂ O	Vol %	7.7	2.6	20.0	10.4
CO	Vol %	13.1	2.6	12.0	2.4
H ₂	Vol %	7.1	17.6	14.0	23.6
CO ₂	Vol %	7.4	17.9	14.0	23.6
CH ₄	Vol %	1.4	1.4	2.7	1.4
C ₂ H ₆	Vol %	0	0	0.3	0
N ₂	Vol %	63.4	57.9	37.0	38.6
H ₂ S	ppm	150	150	500	500
COS	ppm	15	15	50	50
CS ₂	ppm	2	2	5	5
NH ₃	ppm	1800	1800	3000	3000
HCN	ppm	50	50	50	50
Cl	ppm	59	59	59	59
Fl	ppm	18	18	18	18
As	ppb	0.3	0.3	0.3	0.3
Cd	ppb	1.3	1.3	1.3	1.3
Pb	ppb	0	0	0	0
Te	ppb	0	0	0	0
Tin	ppb	0.3	0.3	0.3	0.3
Se	ppb	18.9	18.9	18.9	18.9
Zn	ppb	10	10	10	10
Hg	ppb	6	6	6	6

Increased Capacity at Slipstream Test Facility



Infrastructure Upgrades:

- Medium pressure nitrogen
- Low pressure nitrogen
- Superheated steam
- Vent header to flare to accommodate off-line testing of hot gas cleanup systems
- Cooling water supply and return
- Potable water
- Utility water
- Instrument air
- Power source
- DCS I/O capability

Syngas Header Pipe Bridge



Confidential and Proprietary



Syngas Cleanup Pilot-scale Testing



Advanced cleanup technologies:

- COS Hydrolysis & Direct H₂S Oxidation
- Ammonia and Hydrocarbon Cracking
- CO₂ Removal

Pilot scale testing by 3rd party developers:

- Fuel Cells
- Heavy Metal Removal
- Gas Analyzers

