Pre-combustion CO_2 Capture @ National Carbon Capture Center (NCCC)

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History

1996-2009	TRIG™ development
2009-2014	NCCC established
2014-2019	Awarded new 5-yr contract to continue NCCC operation

Kemper 582 MW IGCC

Benefits of NCCC

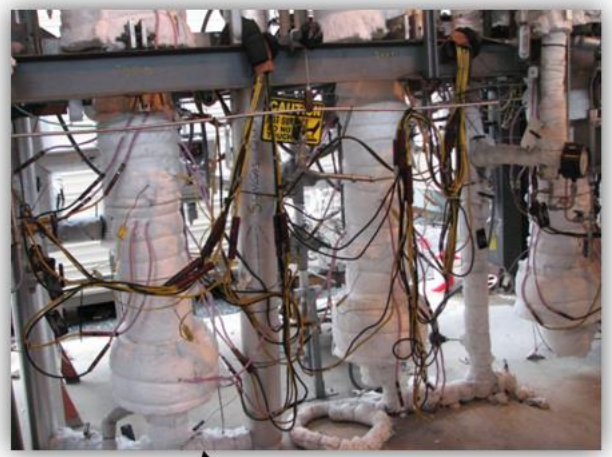
- Serve as centralized R&D facility
  - Reduce redundancy
  - Carry out multiple testing simultaneously
- Make available realistic syngas/flue gas for performance verification
  - Flexible in capacity & process conditions
  - Effective performance comparison between technologies tested
- Leverage existing infrastructure and on-site expertise in power plant, process engineering and integration, design, and O&M areas
- Provide independent data acquisition and analysis for developers as needed

→ **Accelerating CO_2 capture technology commercialization**

Accomplishment 2009-2014

- Facility Expansion
  - Capacity and flexibility
- Technologies Testing Incorporation
  - Accumulated testing hours
  - Technologies tested
- Technology Progression
  - Scale up
  - Component to integrated system
  - Bench & Pilot Systems

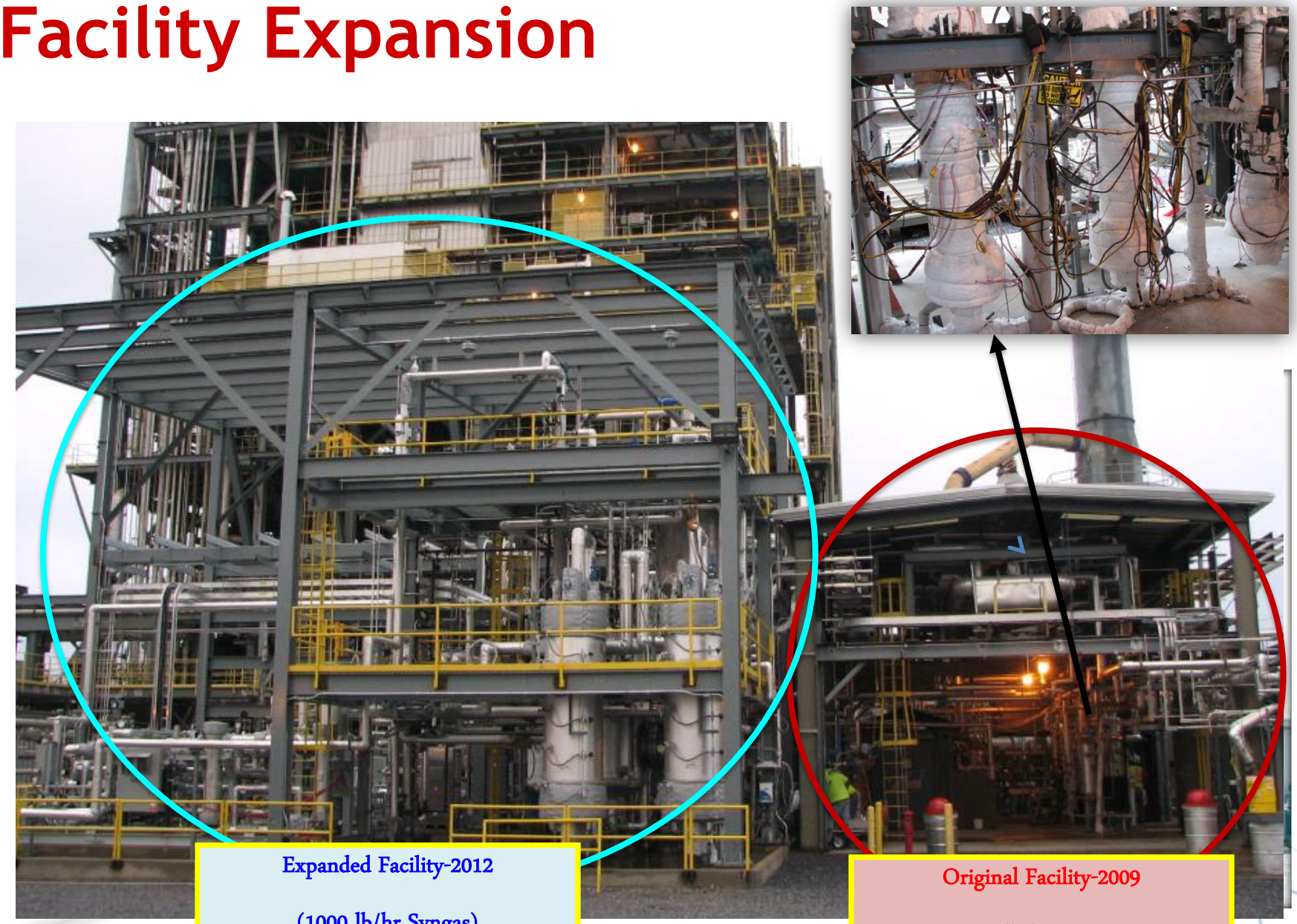
Facility Expansion



Original Facility-2009

(100 lb/hr Syngas)

Facility Expansion



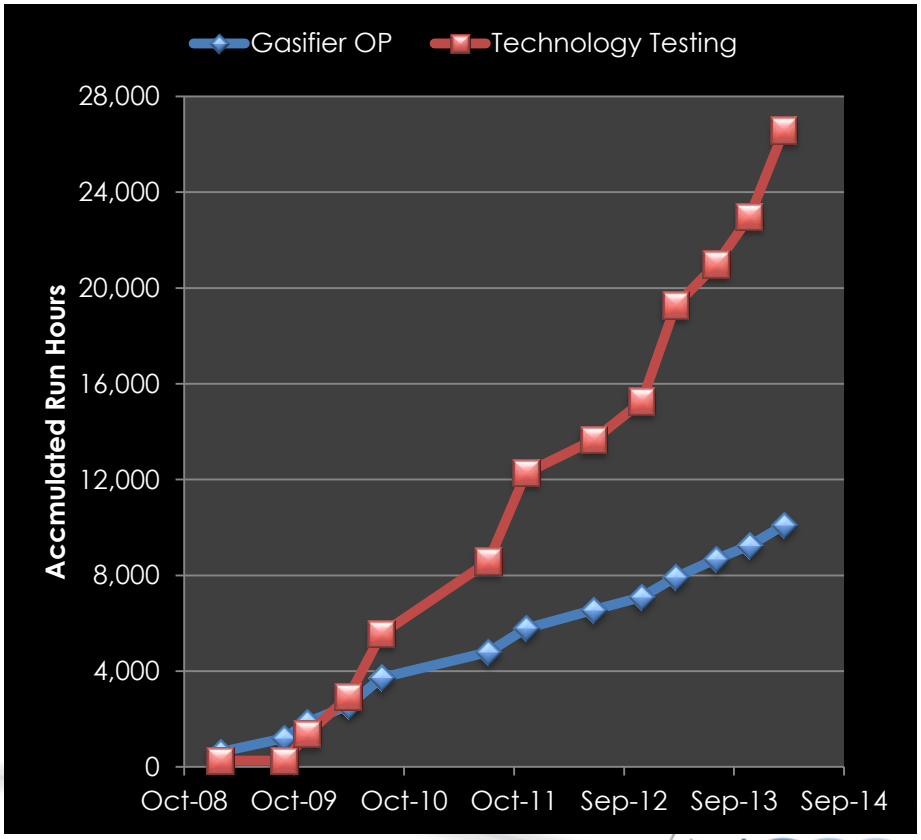
Technologies Testing

Technologies Tested

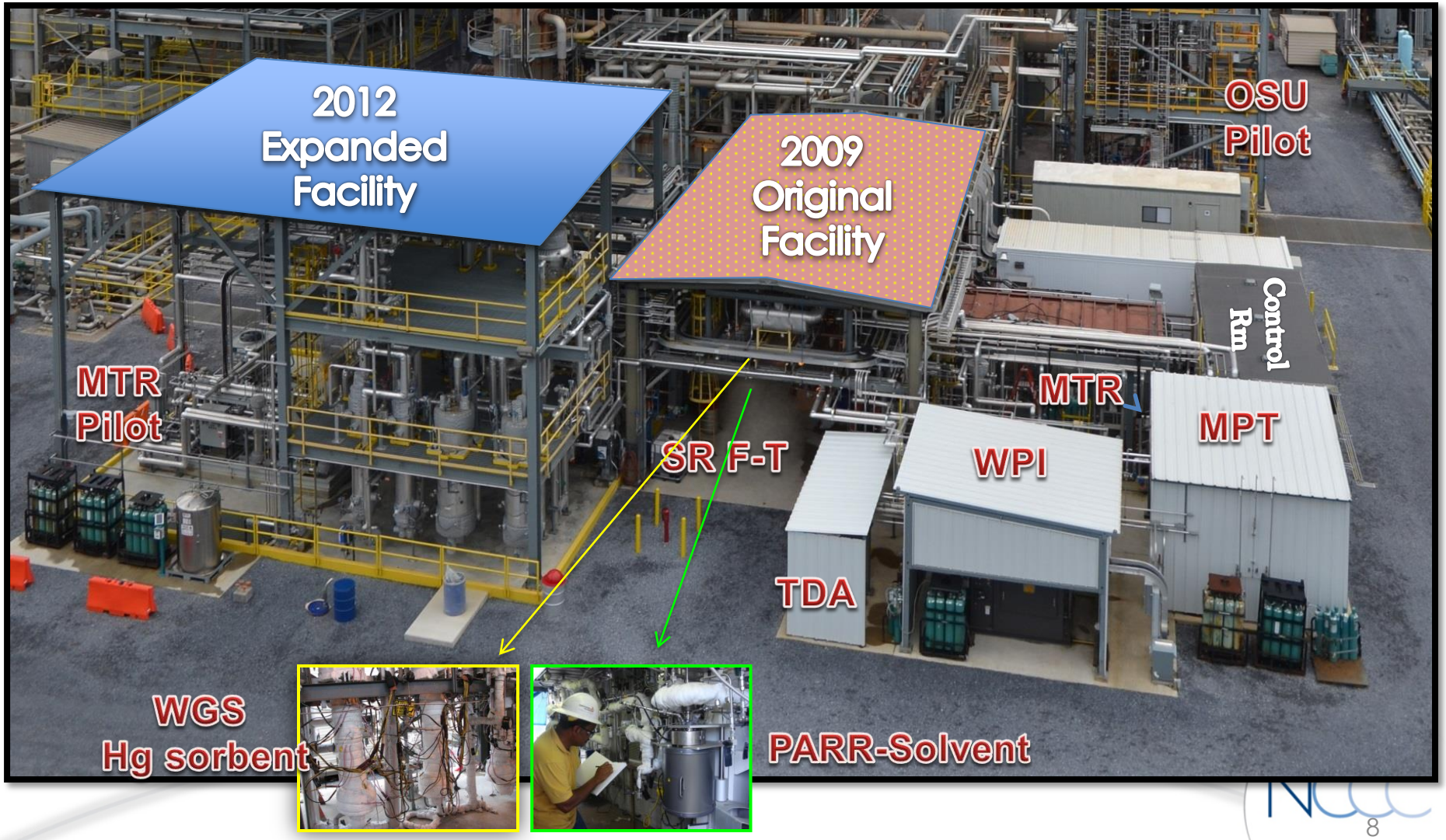
	Solvent (3)	Sorbents Catalyst (9)	Membrane (4)	Chemical Looping (1)
Bench (Component)	NETL UPitt UA	WGS COS SR F-T JM Hg TDA AP*	H_2/CO_2 WPI MTR MPT Eltron	
Pilot (System)	SRI Int*.		MTR CO_2	OSU SCL

*test Oct 2014

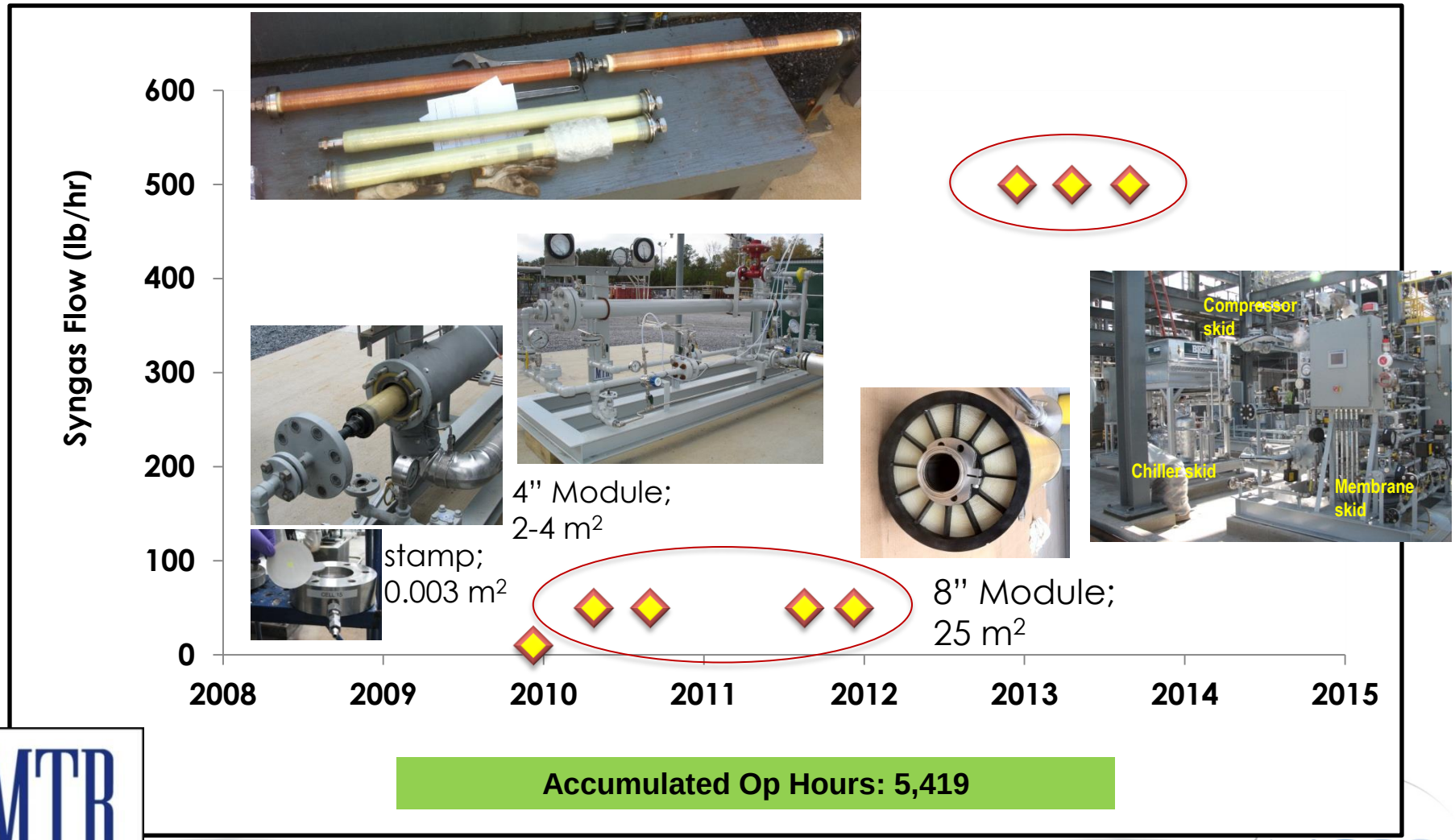
Accumulated Hours



Technologies Testing layout



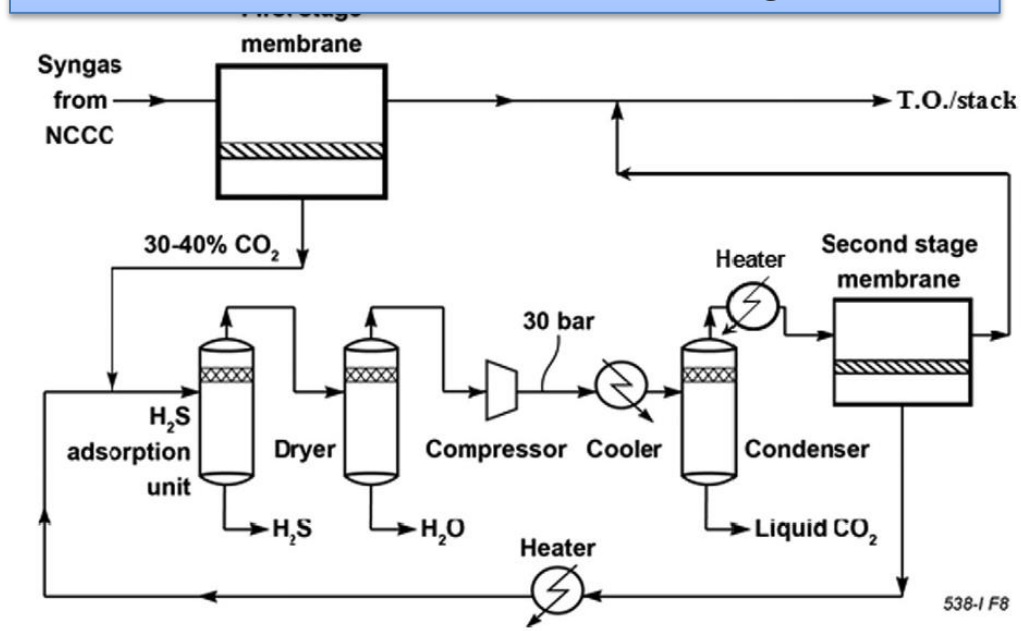
Progression-Scale Up (e.g. MTR CO_2 Membrane)

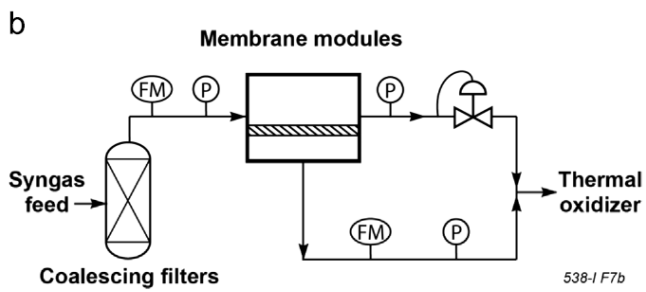


Accumulated Op Hours: 5,419

Progression-Component to System

Integrated CO_2 Membrane System
70% CO_2 Capture w/Liq CO_2 production
@ >96% purity & 420 psig





Component Testing- CO_2 Membrane
CO_2 permeability and selectivity

Bench Scale Systems

H_2 and CO_2 Membranes

MPT

WPI

Eltron Research & Development

MTR

Sorbents and Catalysts

TDA Research

NETL

Johnson Matthey

Vendor A

HALDOR TOPSOE CATALYSING YOUR BUSINESS

CLARIANT

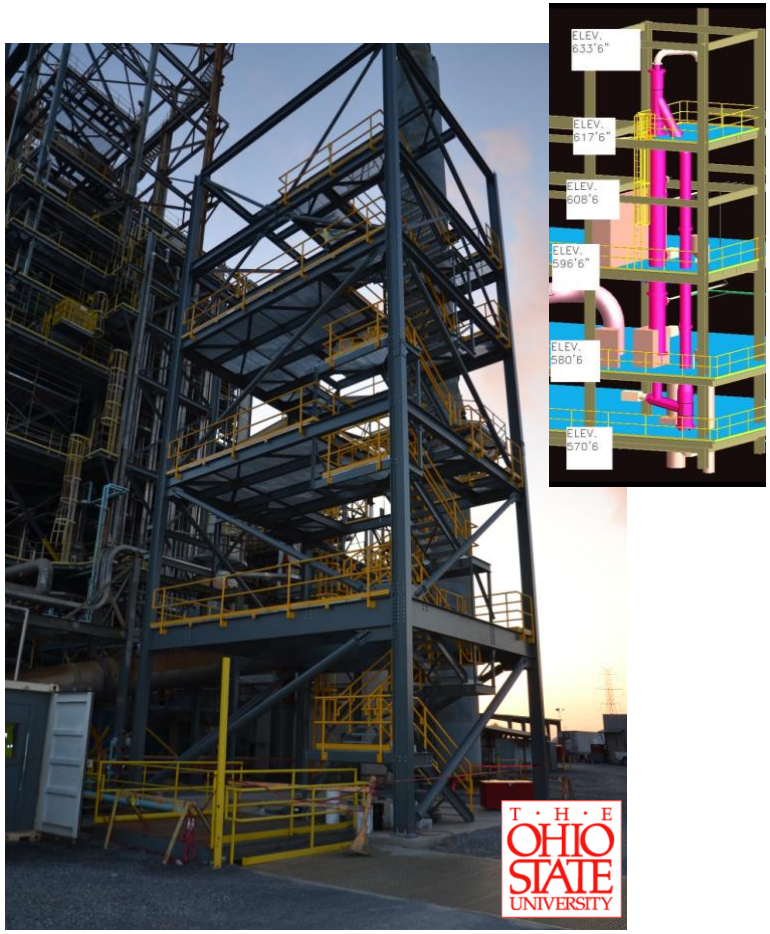
Solvents

NETL

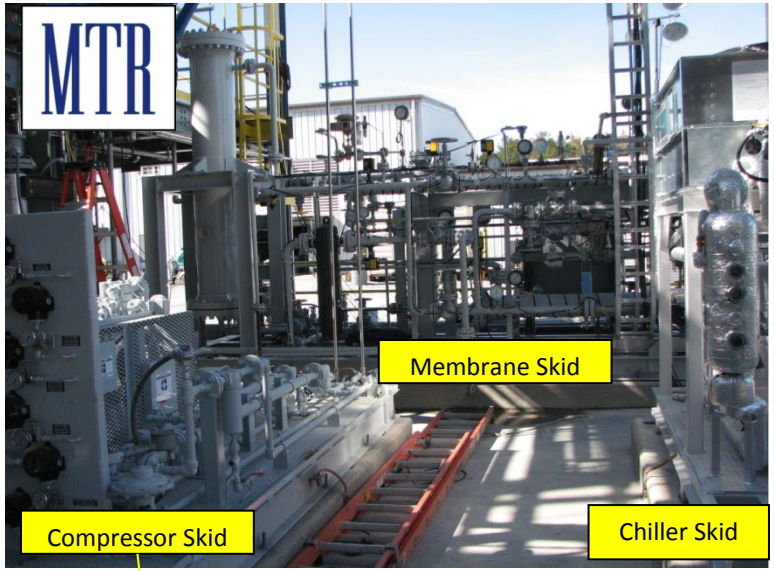
THE UNIVERSITY OF ALABAMA

University of Pittsburgh

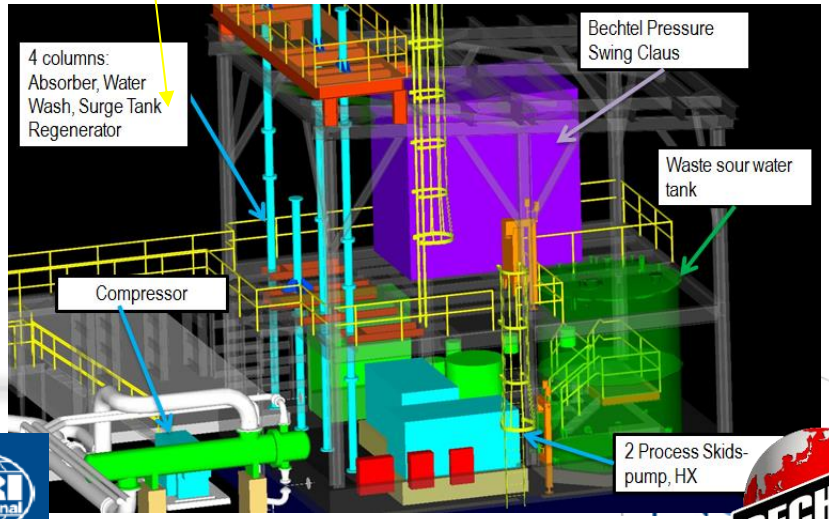
Pilot Scale Systems



OSU Syngas Chemical Looping- 880 lb/hr Syngas



MTR CO2 Membrane- 500 lb/hr Syngas Scale



SRI International

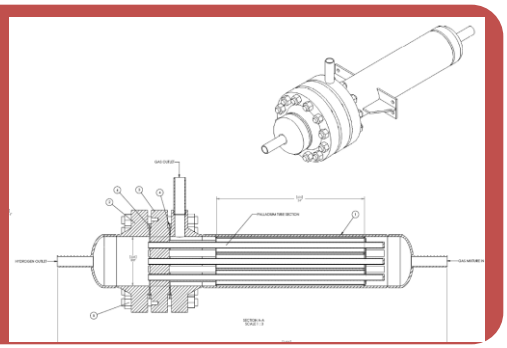
SRI/Bechtel AC-ABC/BPSC- 500 lb/hr Syngas

BECHTEL

New Projects-Technology Scale-up

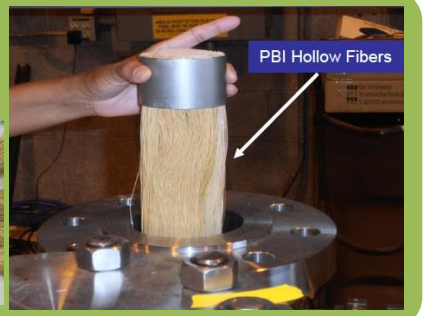
WPI Pd H_2 Membrane

- Single tube
- → 7 tubes→ 20-30 tubes



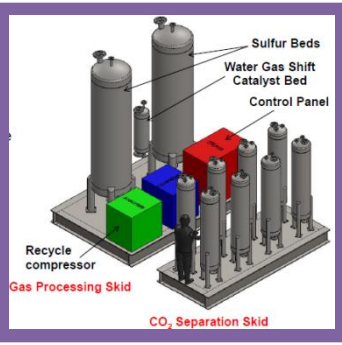
SRI Int. HF Polymeric H_2 Membrane

- Lab → Field 50 KW

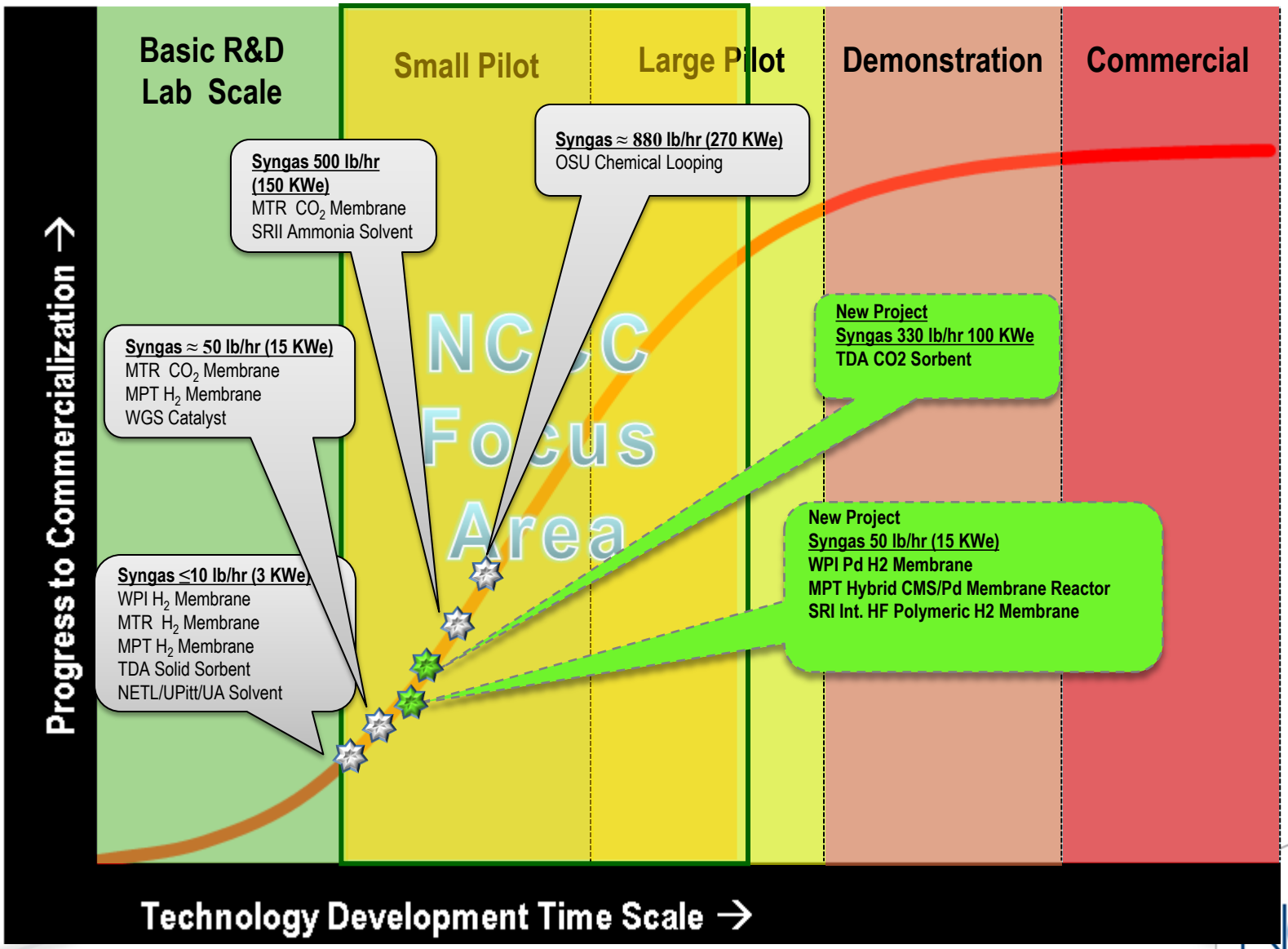


TDACO$_2$ sorbents

- 5 KW → 100 KW



Summary: NCCC Focus



Acknowledgements

- DOE/NETL Sponsorship
  - Mike Mosser, Project Manager, NETL
- EPRI
- Industrial Sponsors
  - Utility: AEP, Duke, Luminant, NRG,
  - Coal : Arch Coal, Cloud Peak Energy
- Technology Developers' Participation
  - Air Products, Eltron, Johnson Matthey, MPT, MTR, NETL, OSU, Southern Research, SRI Int., Stanford, TDA, UA, UPitt, WPI