



# Maturing 2nd Generation Technologies

## University of Texas Concentrated Piperazine Solvent Process

DOE/FE/NETL has sponsored highly successful second-generation technologies that will dramatically reduce CO<sub>2</sub> capture costs. The University of Texas' Concentrated Piperazine Solvent Process is one of those technologies.



Pilot absorber/stripper system with high temperature flash skid

## BACKGROUND

### CHALLENGE:

- 1st generation MEA-based capture processes have numerous deficiencies resulting in cost and performance challenges
- Low MEA absorption rate, working capacity, and thermal stability along with high degradation rate and boiling point result in high capital and operating costs

### UNIVERSITY OF TEXAS' SOLUTION:

- Intrinsic properties of piperazine (enhanced absorption kinetics, minimal degradation, etc.) result in lower costs
- High-temperature, flash stripping enhances working capacity and produces high-pressure CO<sub>2</sub>

## SIGNIFICANT RESULTS

### Techno-economic analyses indicate:

- ✓ **Reduced Capital Costs**  
Smaller reactors required due to fast absorption; flash stripping reduces compression needs
- ✓ **Reduced Operating Costs**  
Lower degradation reduces solvent make-up



## Lab/Bench-Scale Development

2010 - 2017

- Testing at up to 100 kW scale showed advantages of piperazine (PZ) compared to MEA: increased adsorption rate (2x) and working capacity (1.8x) with 4x reduction in volatility and minimal degradation
- Preliminary TEA shows 21% reduction in overall cost of capture
- Managed aerosol formation and other emissions; nitrosamines formed are substantially decomposed during high-temperature stripping



## Small Pilot-Scale Testing

Initiated 2017

- Testing conducted at 0.5 MWe scale at the National Carbon Capture Center
- Nearly 2000 hours of parametric and long-duration testing completed
- Validated robustness of the PZ solvent and significant improvements in energy performance with the high-temperature advanced flash stripper process configuration
- Data generated will support scale-up to large pilot



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