

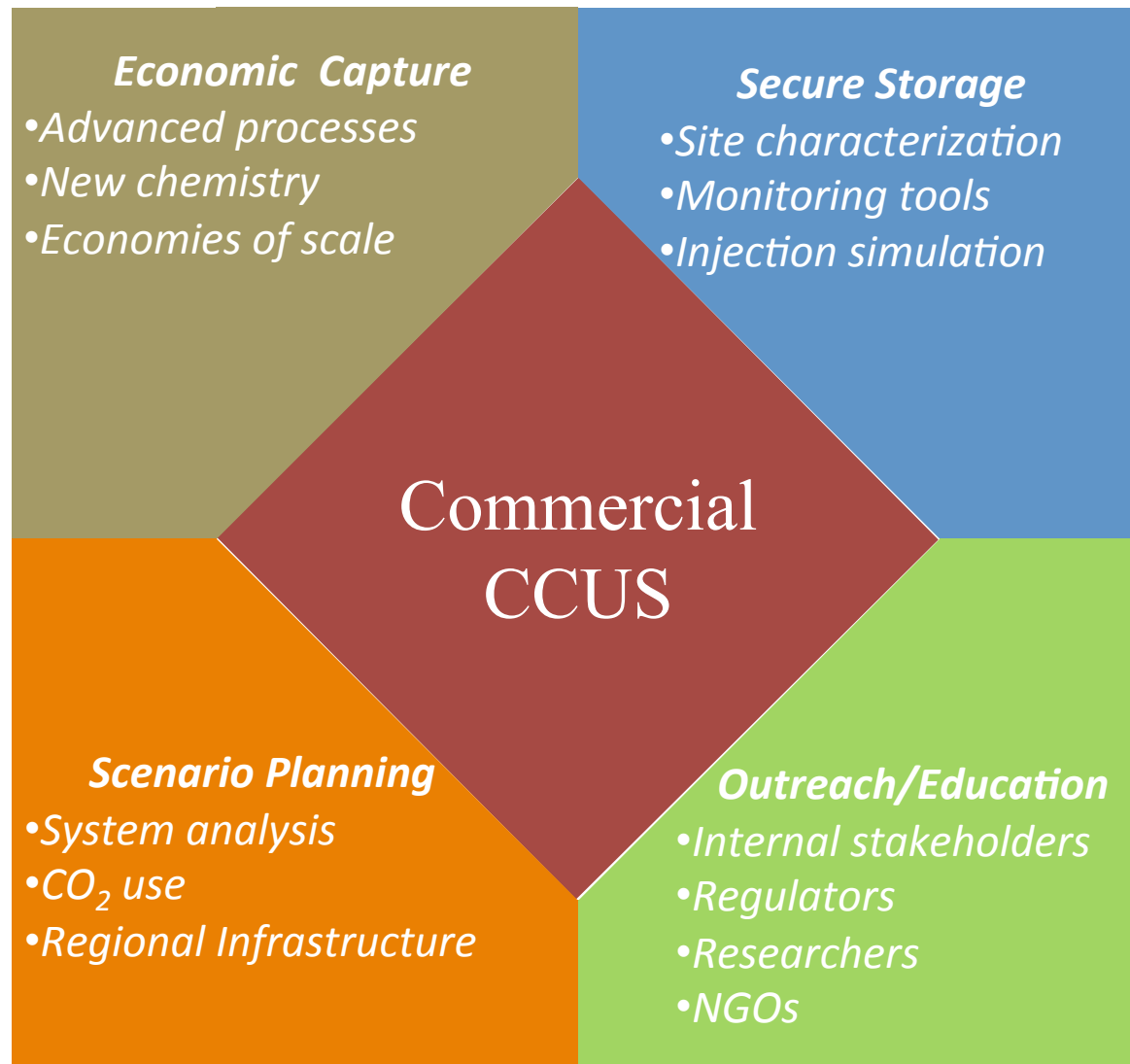
Southern Company/MHI Ltd. 500 TPD CCS Demonstration

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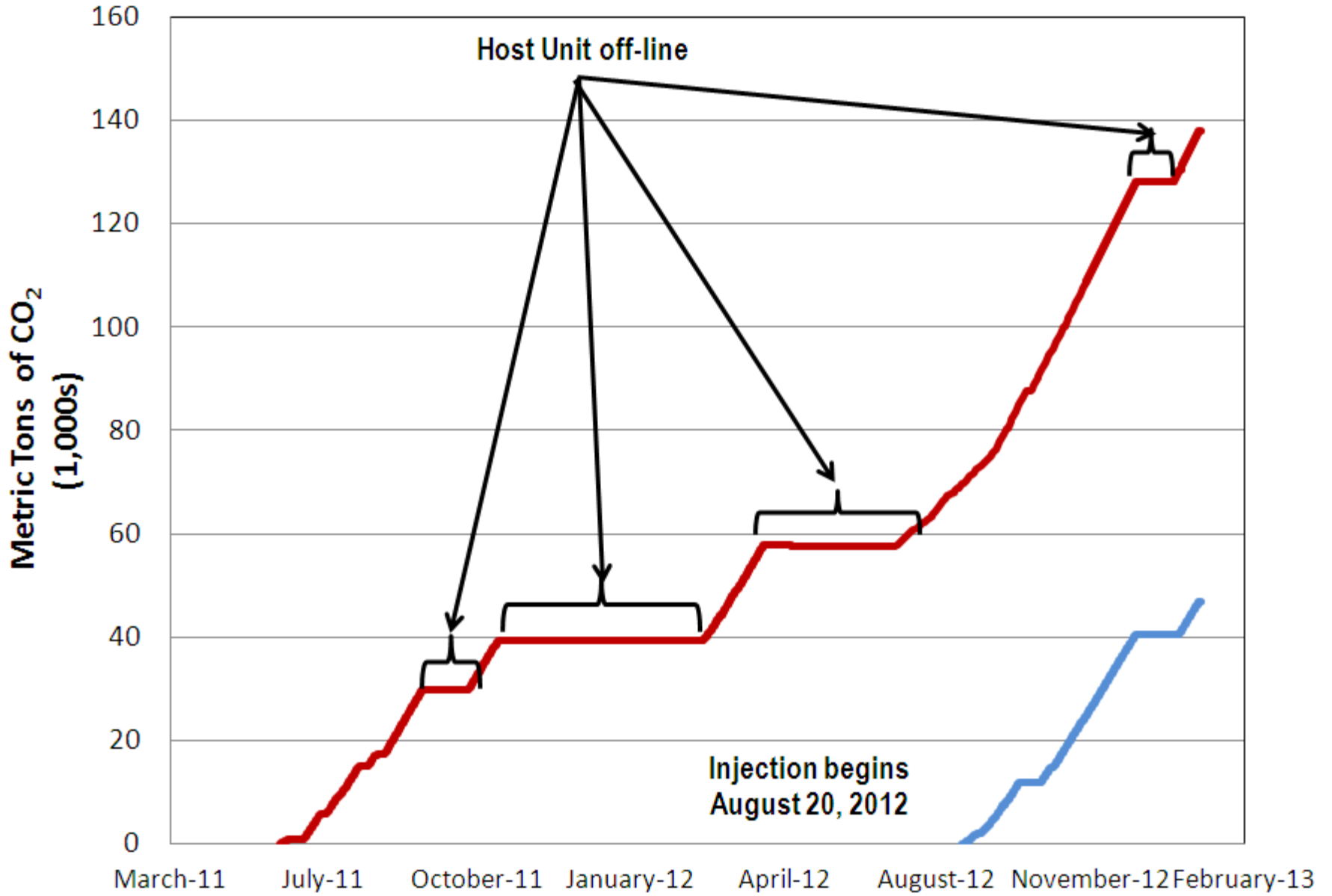
The Commercialization Puzzle



500-TPD Demonstration



CO₂ Captured and Injected



Online Amine Analyzer

- Proprietary on-line analyzer to monitor the **process conditions** and amine emissions
 - consists of an auto sampling unit and a high resolution analyzer with computational control unit
- Improvement of **operability and controllability**
 - provides the operational status to allow immediate response to optimize operational parameters



Fig. Online Amine Analyzer

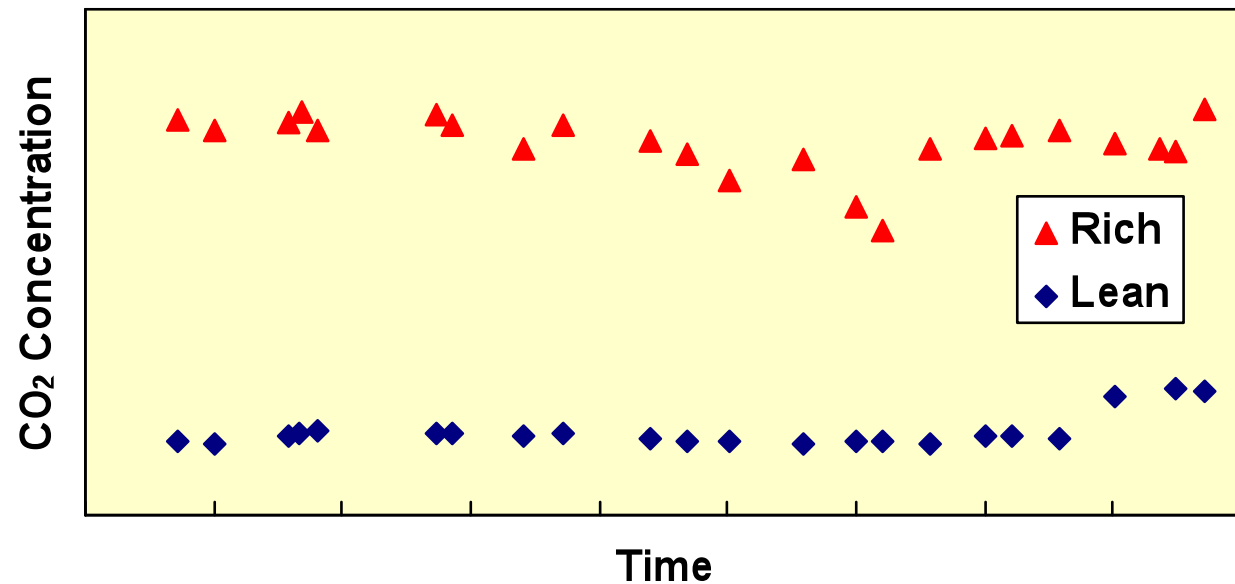
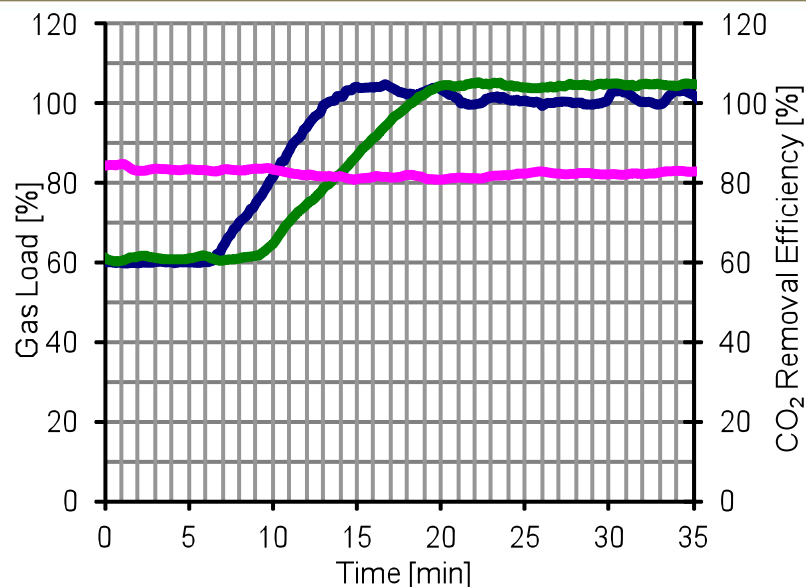


Fig. Periodic Results of CO₂ concentration trends in KS-1™ solvent

Actual load following data in 2 modes



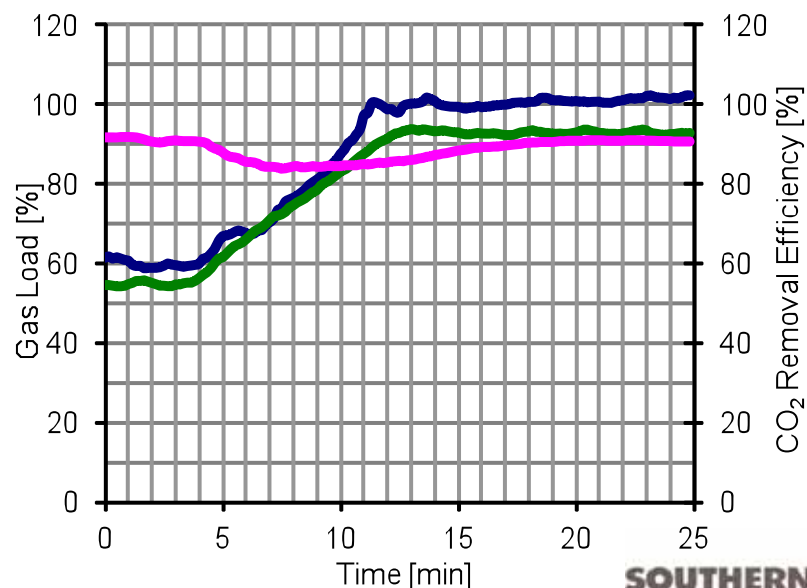
CO₂ Production Scheme

- Demand dictated by additional CO₂ product requirement
- Ramp of ~5%/minute
- Very stable removal rate

- Capture Rate
- CO₂ Flow
- Flue Gas flow

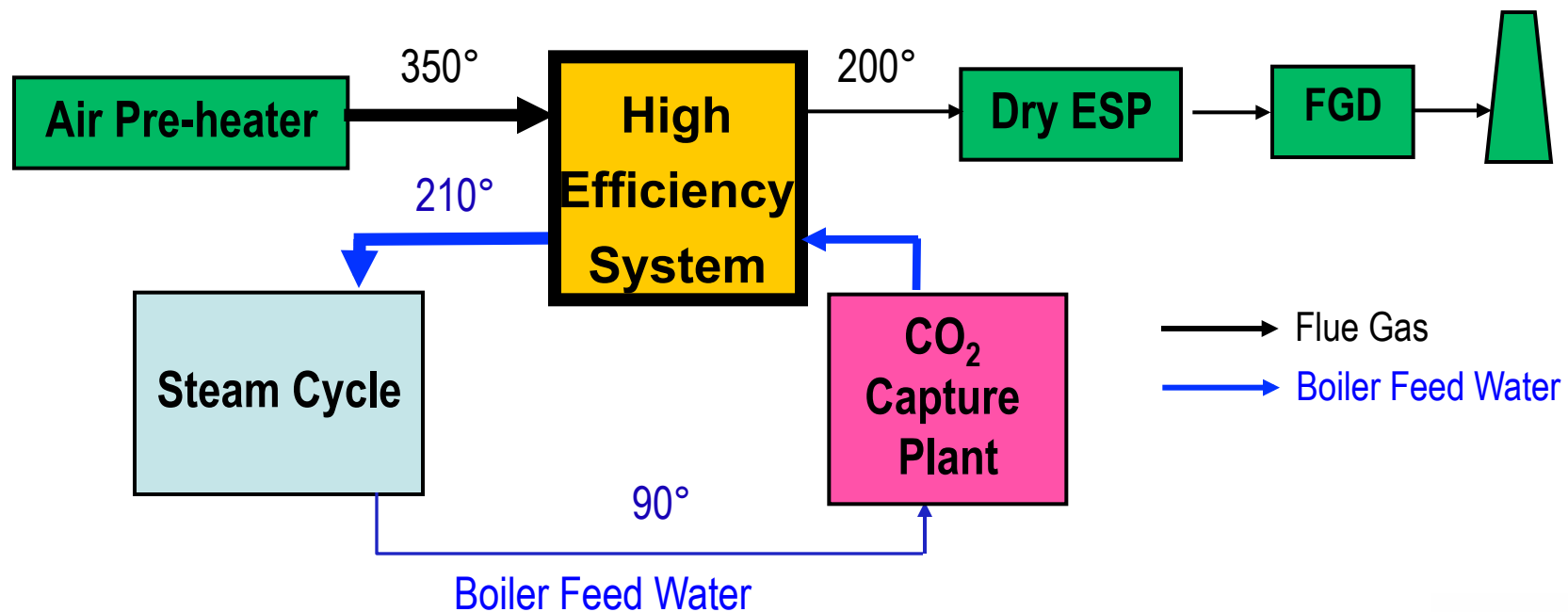
CO₂ compliance scheme

- Demand dictated by additional boiler load (leads to more flue gas flow)
- Ramp of ~5%/minute
- Small dip in removal (5%), but recovery to 90% within 10 minutes



Process Flow & Technology Benefits

- Improve efficiencies of host steam cycle and CO₂ recovery plant
- Reduce water consumption in FGD by lowering flue gas inlet temperature
- Improve ESP performance
- Remove SO₃ and heavy metals (mercury and selenium) in ESP



Summary

- The 500 tpd demonstration plant successfully started up and achieved full load in June 2011 with ~150k tonnes captured
- **Plant performance is very stable** at full load condition with CO₂ capture rate of 500 tpd at 90% CO₂ removal and lower steam consumption than the conventional process
- Operation by Southern Company staff has been very successful
- **Collaboration** between Southern Company and MHI has lead to significant **process improvements** and **enhanced operability**

Southern Company

Leading the Industry in CCS

