AEP CCS Project Update

Mountaineer Plant - New Haven, WV

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A Brief Look at History: 
Our view of the future, way back in March of 2007

**Phase 1**

- **Mountaineer Plant (WV)**
  - MOU (Alstom)
  - Chilled Ammonia
  - CO₂ (Battelle)
- **Project Validation**
  - 20 MWₑ scale
  - (Scale-up of Alstom/EPRI 1.7 MW field pilot at WE Energies)
  - ~100,000 tons CO₂ per year
  - In operation 3Q 2009
  - Approximate total cost $80 – $100M
  - Using Alstom “Chilled Ammonia” Technology
  - Located at the AEP Mountaineer Plant in WV
  - CO₂ for geologic storage

**Phase 2**

- **Northeastern Plant (OK)**
  - MOU (Alstom)
  - Chilled Ammonia
  - CO₂
- **Commercial Scale Retrofit**
  - ~200 MWₑ scale
  - ~1.5MM tons CO₂ per year
  - In operation 2012
  - Approx. capital $250 – $300M (CO₂ capture & compression)
  - Approx. O&M cost $12M per year
  - Energy penalty ~ 35 – 50 MW steam, 25 – 30 MW for CO₂ compression
  - Retrofit NOx Controls and Wet FGD Required: ~$225 – $300M (required for CO₂ capture equipment)
  - Located at AEP’s Northeastern Plant Unit 3 or 4 in Oklahoma
  - CO₂ for Enhanced Oil Recovery (EOR) or geologic storage

Phase 1 will capture and sequester 100,000 metric tons of CO₂/year

Phase 2 will capture and sequester 1.5 Million metric tons CO₂/year
Site Characterization and Feasibility Study

The foundational work for AEP’s CCS program

Seismic Survey
Summer 2003

Drilling and Testing
AEP#1 Well – 2003-05

Site characterization and feasibility assessment conducted by Battelle under previous funding by DOE and others.
CO₂ Injectivity In the Mountaineer Area

CO₂ injection should also be possible in shallower sandstone and carbonate layers in the region.

Rose Run Sandstone (~7800 feet) is a regional candidate zone in Appalachian Basin.

A high permeability zone called the “B zone” within Copper Ridge Dolomite has been identified as a new injection zone in the region.

Mount Simon Sandstone/Basal Sand - the most prominent reservoir in most of the Midwest but not desirable beneath Mountaineer site.
Where We Are Today:  
*Chilled Ammonia CCS Validation Facility*

- **Location:** AEP Mountaineer Plant
  - 1,300 MWe Supercritical PC Unit
  - High Sulfur Eastern Bituminous Coal
  - SCR, ESP, Wet FGD, SO\textsubscript{3} mitigation

- **20 MWe scale**
  - Approximately 1.5% of power plant flue gas
  - (Scale-up of Alstom/EPRI 1.7 MW field pilot at WE Energies)

- **Approximate total cost >$100M**
  - Funding provided by AEP, Alstom, RWE, & EPRI

- **Using Alstom “Chilled Ammonia” CO\textsubscript{2} capture technology**
  - >85% CO\textsubscript{2} capture rate

- ~100,000 tons CO\textsubscript{2} per year stored in deep-saline formations approximately 1.5 miles below the plant surface

- **First CO\textsubscript{2} captured - September 1, 2009**

- **First CO\textsubscript{2} injected underground - October 2, 2009**

- **Project expected to operate for 1 to 5 years**
UIC Permitting - Area of Review

Battelle Simulations of 165,000 tons CO$_2$ per year

STOMPCO$_2$ Simulations Showing CO$_2$ Saturation

Time = 4.000000E+00, yr

Rose Run Sandstone

Copper Ridge “B-zone”
Monitoring System Design

- Passive Seismic/Tiltmeters
- Injection Wells
- Surface CO₂ H&S Gas Meters
- Groundwater/Soil Gas
- Periodic Brine Sampling
- Periodic Wireline Logging
- System CO₂ PVT Monitoring
- Deep Monitoring Wells
- Crosswell Seismic
- Pressure Gauges
- CO₂ Pipeline
- Slipstream Capture
- CO₂ Capture and Separation
Alstom’s Chilled Ammonia Process
Installation Progress at AEP Mountaineer Plant
(20 MWe Equivalent or Approximately 1.5% of Unit Flue Gas)
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To date we have had approximately 35 media tours of the facility from reporters with media outlets around the world.

In addition, we had approximately 40 reporters at the October 29 dedication.
Next Steps for AEP CCS Program

- **AEP received notification from DOE of $334M grant through CCPI III**
  - Announced on Friday, December 4
  - **Scale up of the CO$_2$ capture systems to commercial-scale.**
    - 235-MW slipstream at Mountaineer Plant
    - ~1.5 million tonnes CO$_2$ per year into saline formations
    - Estimated project cost: $668M
    - Alstom’s Chilled Ammonia Process
    - Schlumberger & Battelle to lead sequestration efforts
    - Geologic Experts Advisory Group
      - Battelle, Schlumberger, CONSOL, OSU, WVU, MIT, UT, LLNL, WV Geological Survey, OH Geological Survey, & WV DOE
  - **System to startup in mid-year, 2015**

- **Continuing to evaluate other CO$_2$ capture technologies through US Carbon Research Center**

- **Ongoing assessments of geologic capacity throughout AEP fleet**
  - Regional partnership efforts
  - Privately-contracted geology studies
Thank You