Cranfield CO_2 Geothermal Field Demonstration

Project Officer: Sean Porse
Total Project Funding FY14: $750k
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Principal Investigator:
Barry Freifeld
LBNL
EGS Demonstration

Relevance/Impact of Research

Project Objective

- Perform a field demonstration of geothermal energy production using CO_2 to mine heat
- Acquire data sufficient to evaluate predictive simulations and enhance future modeling capability
- Evaluate the data for implications to future research in CO_2 geothermal
- Monitor induced seismicity with a IS Protocol in place for responding to any observed events

Mandatory- may utilize multiple slides

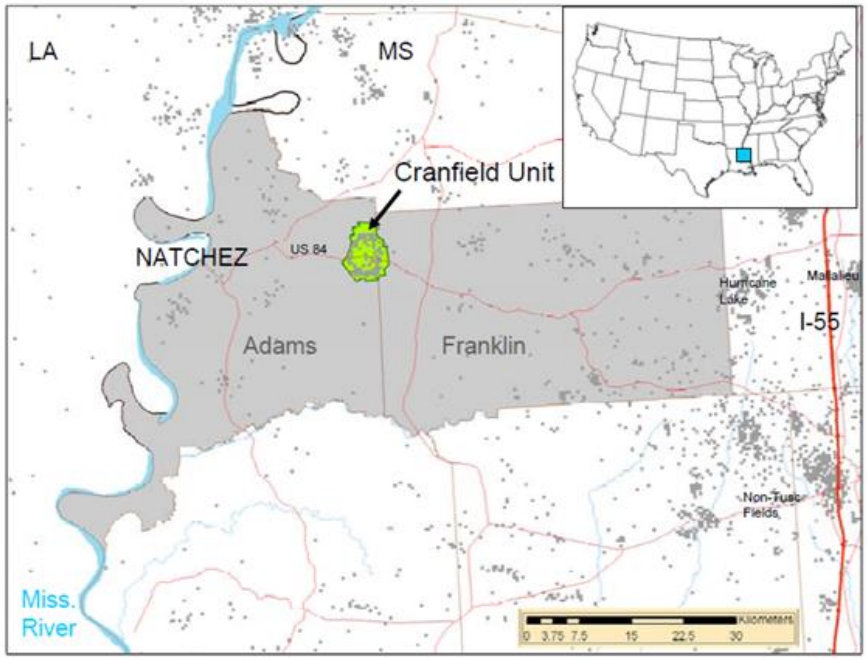
Scientific/Technical Approach

- Instrument wells with fiber-optic DTS and pressure temperature sensors to monitor thermophysical parameters.
- Set up a two-well doublet with an injector and producer in a sufficiently warm reservoir to create a CO_2 thermosiphon
- Initiate the thermosiphon and monitor thermophysical parameters and geochemistry

- Success! World's first CO_2 geothermal thermosiphon operated using a reservoir at 3 km depth.

Mandatory- may utilize multiple slides

Cranfield, Mississippi Geothermal Demonstration – Producing Clean Renewable Energy Using Supercritical CO_2



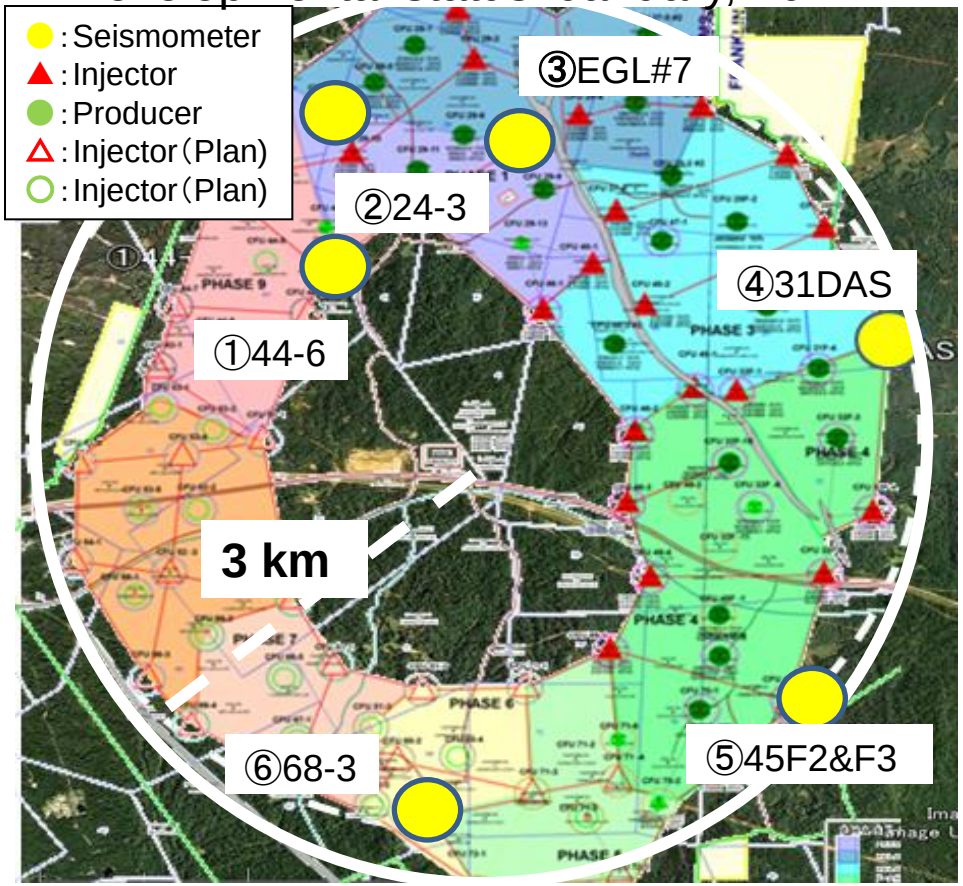
- At Denbury Resource's Cranfield Field in Adams County, Mississippi, the first ever demonstration of using supercritical CO_2 for extracting geothermal energy is commencing in January 2015.
- This technology can potentially produce clean renewable energy, while at the same time sequestering carbon dioxide and enhancing oil production.

Developed an Induced Seismicity Plan and operated a network of both real-time surface geophones and RITE (Japan) operated a recorded array at six locations

RITE Microseismic monitoring array at the Cranfield site, MS

Microseismic monitoring station

Developmental status January, 2012



Provided by Denbury, July 2012

<u>Sensor (Velocity: NS, EW, and UD)</u>

Frequency range 0.012-100 Hz
Velocity range ±2m / s
Sensitivity 200V / (m/s)

<u>Data logger</u>

A / D converter 24 bit
Dynamic range 130 dB

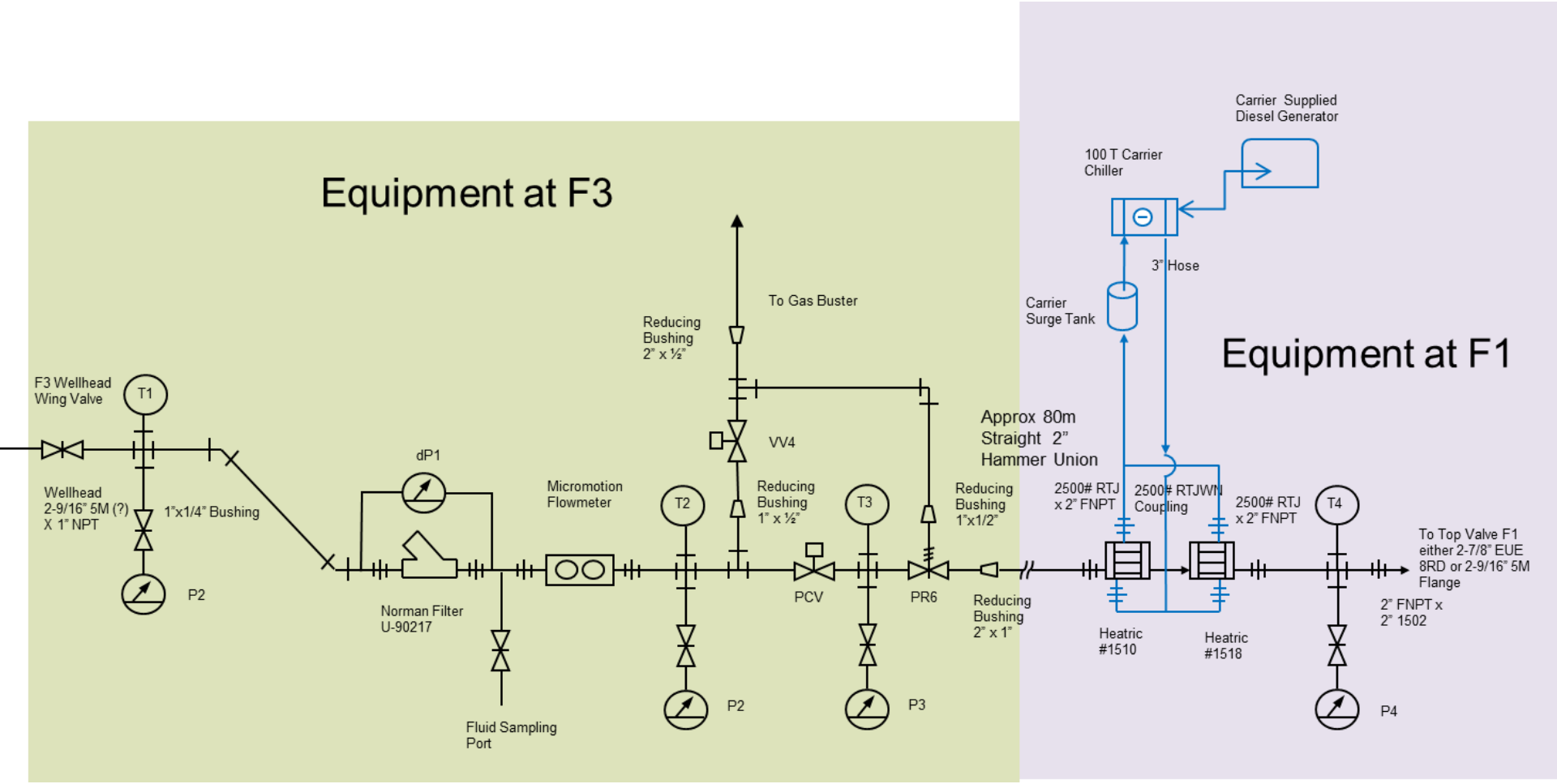
Commercial-scale injection

- •CO2 injection since 2007 （EOR)
- •4 Mt has been injected <u>(1Mt/yr)</u>

<u>Low Seismicity, Large Injection Volume</u>

Instrument F2 well with fiber-optic DTS sensor and quartz pressure temperature sensors.

Design, procure and fabricate a surface control system for operation and monitoring of the CO_2 thermosiphon test



Monitoring and Control System at F3

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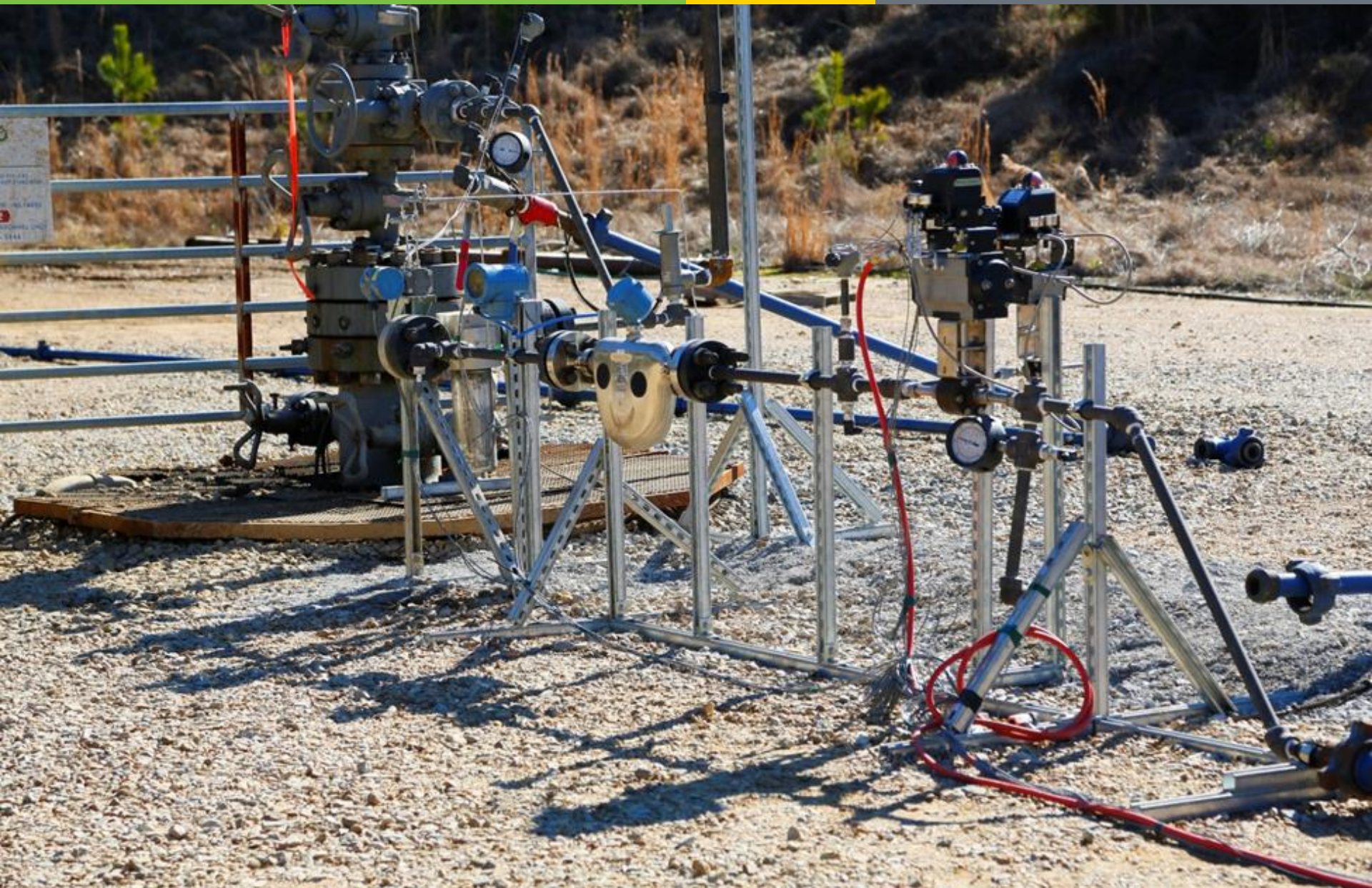

Flow Iron – Producer to Injector

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Heatric Exchangers for Cooling CO_2

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Venting Operations – bring up warm CO_2

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Operations control center and systems monitoring

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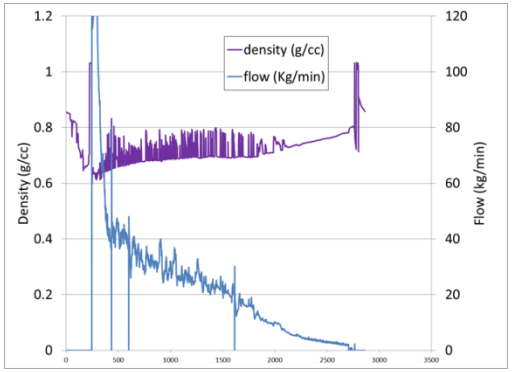
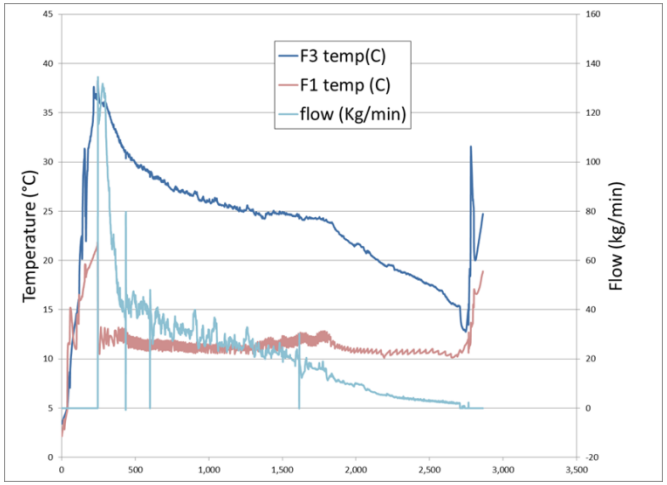
Data Collected

- DTS fiber-optic temperature logs of F2 and F3 well
- Quartz pressure and temperature from the reservoir interval in F2 and F3
- Fluid pressure and temperature at the outlet of the F3 production tubing
- Differential pressure across the 100 μ filter unit
- Emerson Micromotion Coriolis measurement of the fluid mass flux rate and density
- Pressure and temperature at the Coriolis flowmeter exit
- Pressure and temperature downstream of the recirculation pressure control valve
- Pressure and temperature at the outlet of the heat exchangers and inlet to F1
- Set point for vent valve
- Set point for pressure control valve





Future Directions

- Proposal Submitted to DOE for processing and interpretation of data collected. Possible continuation of project effort in FY16.

Summary Slide

- Our project team has successfully operated a CO_2 thermosiphon at the Cranfield Site.
- This is a first of its kind demonstration of the technology at a pre-commercial scale that will allow us to validate our reservoir simulations.
- Future work is required to interpret the voluminous data collected during the field campaign.

Mandatory slide- keep to one slide