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CAPTURING  
THE POWER  
OF NATURE



# Iowa Stored Energy Park (ISEP) Update

[www.isepa.com](http://www.isepa.com)

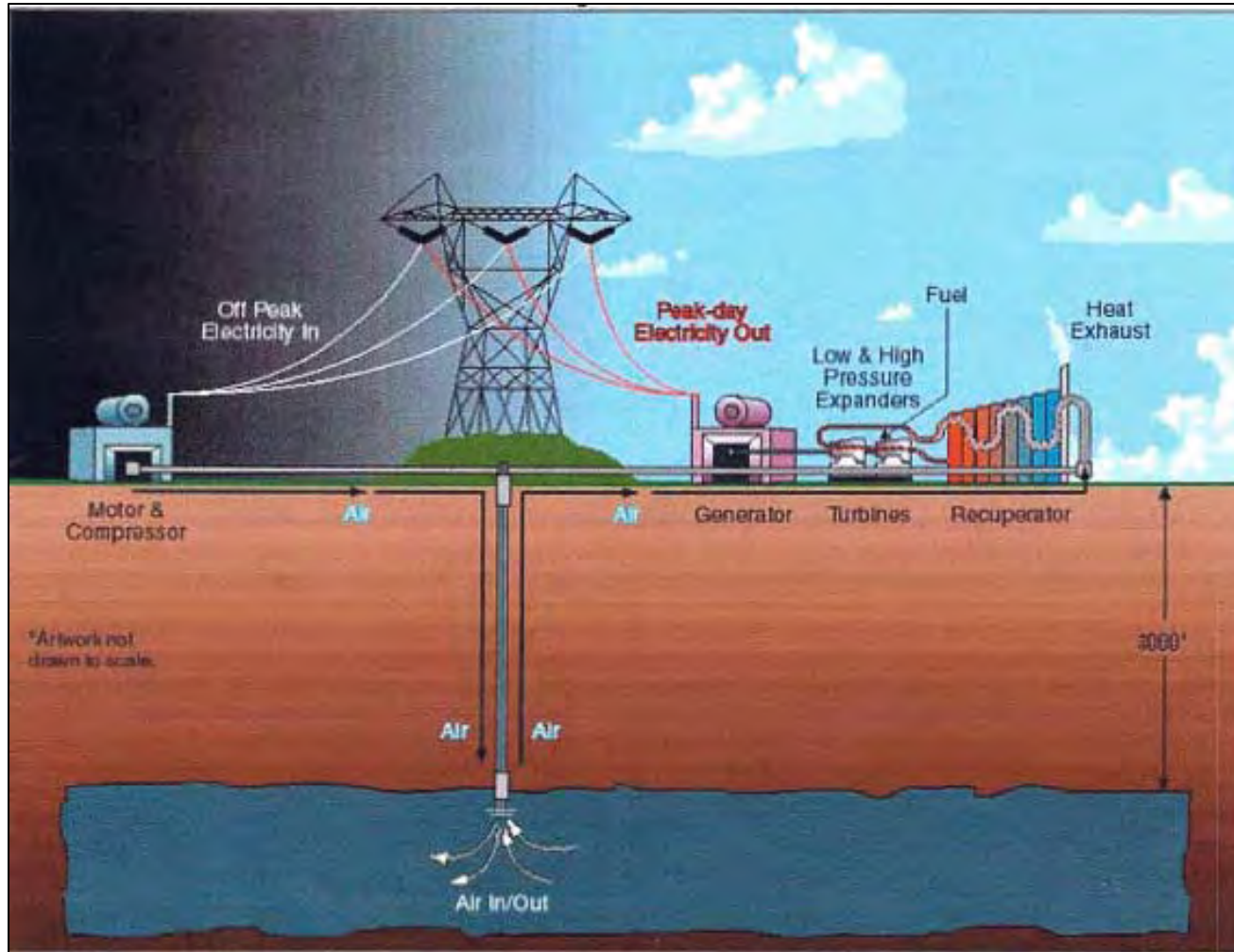
January 31, 2011

# About ISEP

- Proposed 270 Megawatt (MW) compressed air energy storage (CAES) project, 2015 in-service.
- Capital cost: ~\$400 million
- Site: Dallas Center, Iowa
- Unique: Fully-dispatchable electric load
  - Compress (220 MW): up to 12 to 16 hours, weeknights and weekends.
  - Generate (270 MW): up to 12 to 16 hours per day on weekdays.
- In daily operation, generation will look like an intermediate-duty, combined-cycle unit.
  - But heat rate only ~4400 Btu/kWh\*

\*Excluding energy content of compressed air input to generator.

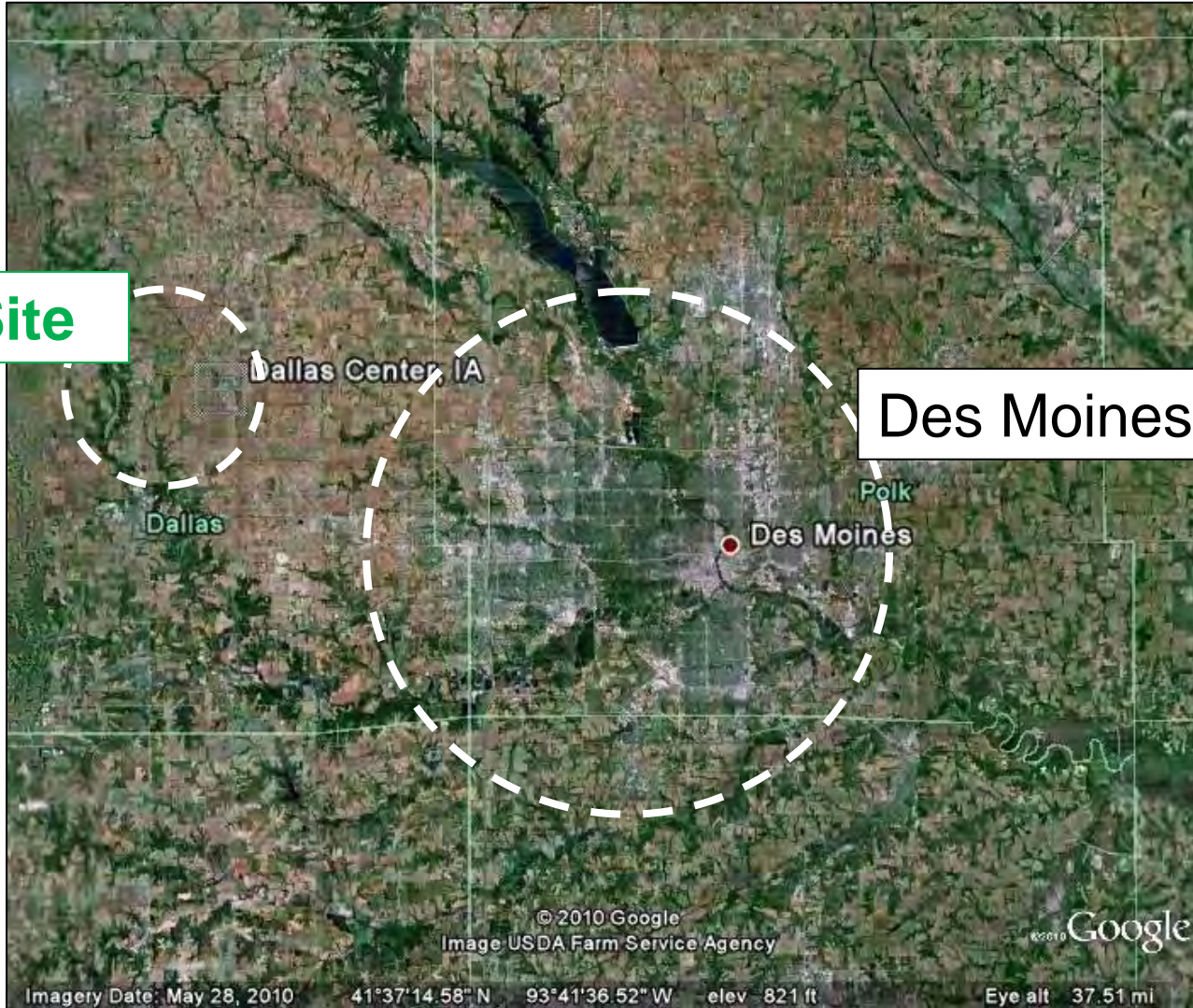
# CAES Conceptual Layout



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# Project Site

ISEP Site



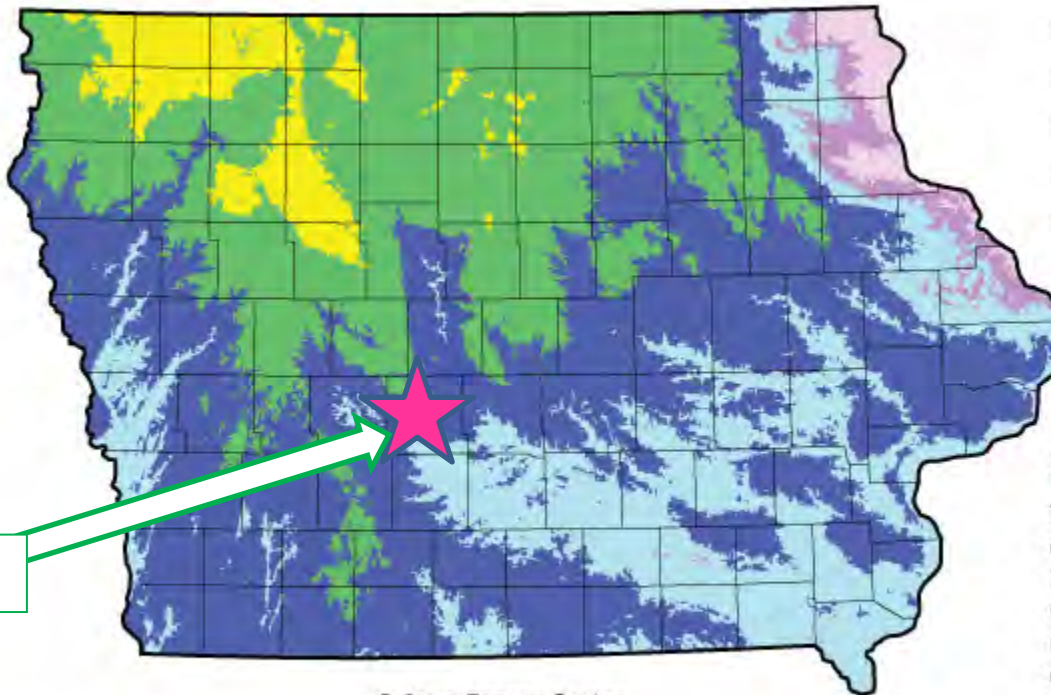
Des Moines

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# Wind Energy Country

## Estimated Average Annual Wind Speeds

Typical average wind speeds on well exposed sites at 50m above ground



MPH		m/s
> 19.0	Red	> 8.5
17.9 - 19.0	Orange	8.0 - 8.5
16.8 - 17.9	Yellow	7.5 - 8.0
15.7 - 16.8	Green	7.0 - 7.5
14.5 - 15.7	Dark Blue	6.5 - 7.0
13.4 - 14.5	Light Blue	6.0 - 6.5
12.3 - 13.4	Purple	5.5 - 6.0
< 12.3	Pink	< 5.5

### Iowa Energy Center

This map was generated from data collected by the Iowa Wind Energy Institute under Iowa Energy Center Grant No. 93-04-02. The map was created using a model developed by Brower & Company, Andover, MA.

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ISEP Site

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## Wind projects in Iowa



### ■ NextEra Energy

Cerro Gordo, Franklin, Hancock, Osceola, Story and Winnebago

### ■ Existing MidAmerican projects

Adair, Buena Vista, Carroll, Cass, Crawford, Floyd, Sac, Hamilton, Pocahontas, Polk (at the fairgrounds), Pottawattamie and Wright

### ■ New MidAmerican projects

Adair, Adams, Calhoun, Cass and Marshall

Sources: MidAmerican Energy and NextEra Energy

THE REGISTER

Iowa Stored Energy Park (ISEP) Site

Map source: The Des Moines Register, 12/19/10. (ISEP site added.)

# Geology: Tapping the Mt. Simon Sandstone

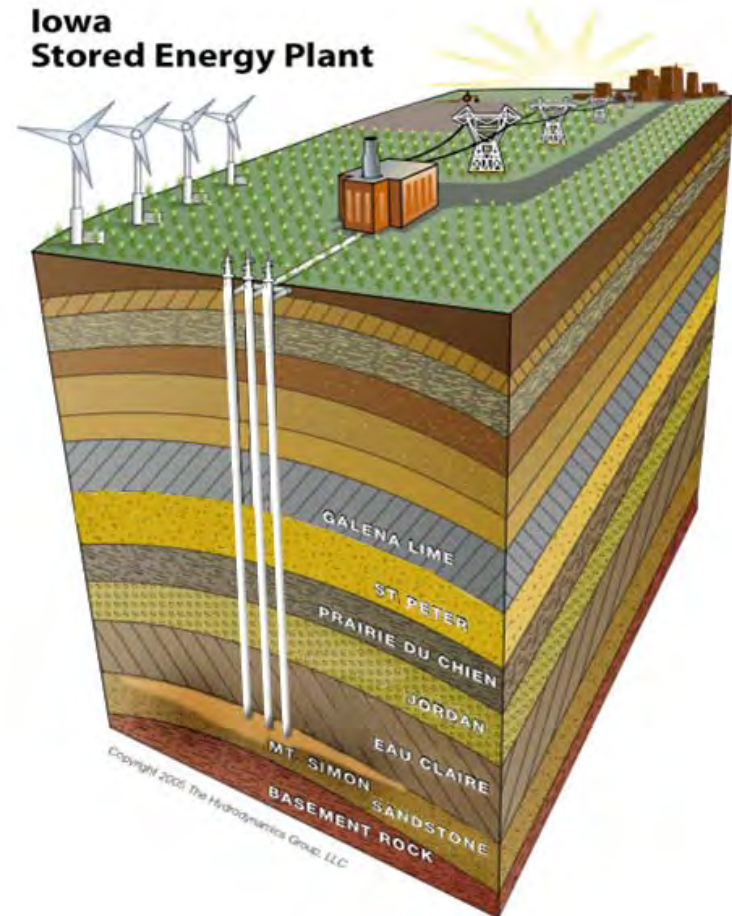
## Completed Work Activities

- Dallas Center Site Selected
- Geophysical Surveying
- Drilled Three Test Wells
- Draft Economic Analysis

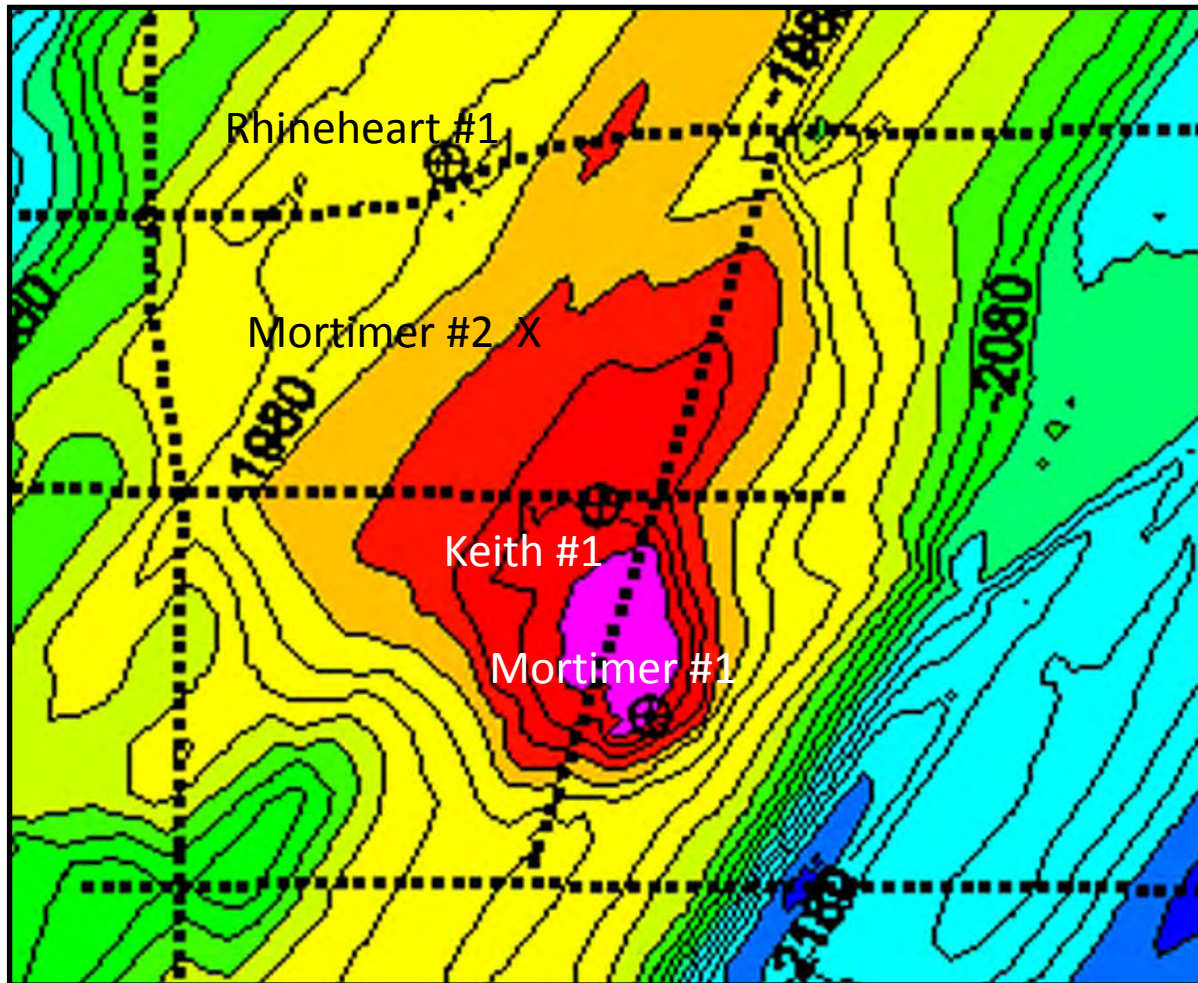
## Current Work Activities

- Coring Third Test Well
- Complete Laboratory Core Analysis
- Perform CAES Reservoir Simulation Analysis
- Perform Geology Peer Review

**GO/NO-GO DECISION  
FOR AIR INJECTION TESTING  
Spring/Summer 2011**



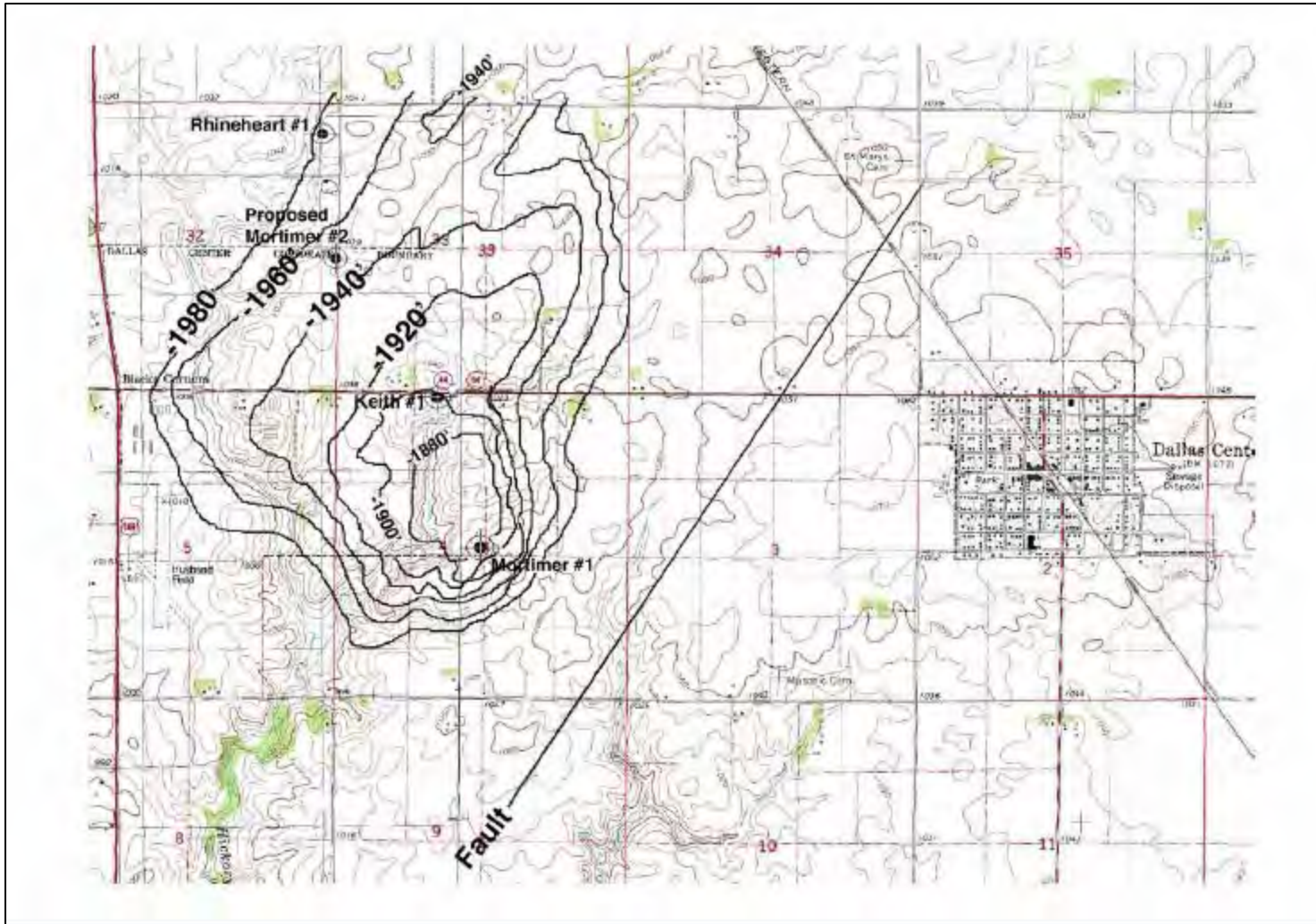
# A Unique Underground Structure



- Not a cavern.
- Porous sandstone structure
  - ~ 1 square mile x 100 feet thick.
- 3000 feet underground.
- Originally discovered by Northern Natural Gas in the 1960s as a potential natural gas storage site.
- Northern stores natural gas in a similar structure 10 miles away.

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# Site Map



# Benefits

- Off-peak to on-peak price arbitrage
- Optionality to hedge future generation costs
  - Increases in natural gas prices
  - Increased cycling wear and tear on conventional generation
  - Retirement of older, intermediate coal capacity
- Ancillary Services
  - Regulation service
    - Ramp-up and ramp-down, in both compression and generation modes
  - Quick-start reserves
  - Reactive power
    - In both compression and generation modes

# Benefits (continued)

- A new market for wind energy generated off-peak.
  - Time-shift it to on-peak.
  - Enable wind producer to “unbundle” on-peak and off-peak wind production, and price/market them separately.
    - Sell both based on on-peak prices.
    - Reduce/eliminate off-peak price “drag” on overall average value.
  - Addresses “baseload bottoming” time periods
- Enable more wind to be installed.
  - Helps with RES/RPS compliance.
  - Reduces CO<sub>2</sub> footprint.

**A Time Machine**



# Benefits (continued)

- Possible contributor to RES/RPS compliance itself.
  - Storage enables more renewables.
- Transmission benefits
- System load factor benefits
  - Valley filling in compression mode
- Jobs for Iowa
  - Construction
  - Operation and Maintenance

# Schedule

- Geology
  - Test well results and recommendations: **March 2011**
  - Peer review 2<sup>nd</sup> opinion: **April 2011**
  - Air injection testing: **Fall 2011 – Fall 2012**
- Engineering & Permitting **2012 – 2013**
- Notice to Proceed **2013**
- Commercial Operations **2015**



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# In Summary

- Innovative
- Green
- Cost-Effective

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## *Questions?*

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