NATIONAL ENERGY TECHNOLOGY LABORATORY

FutureGen 2.0 Overview

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July 12, 2012

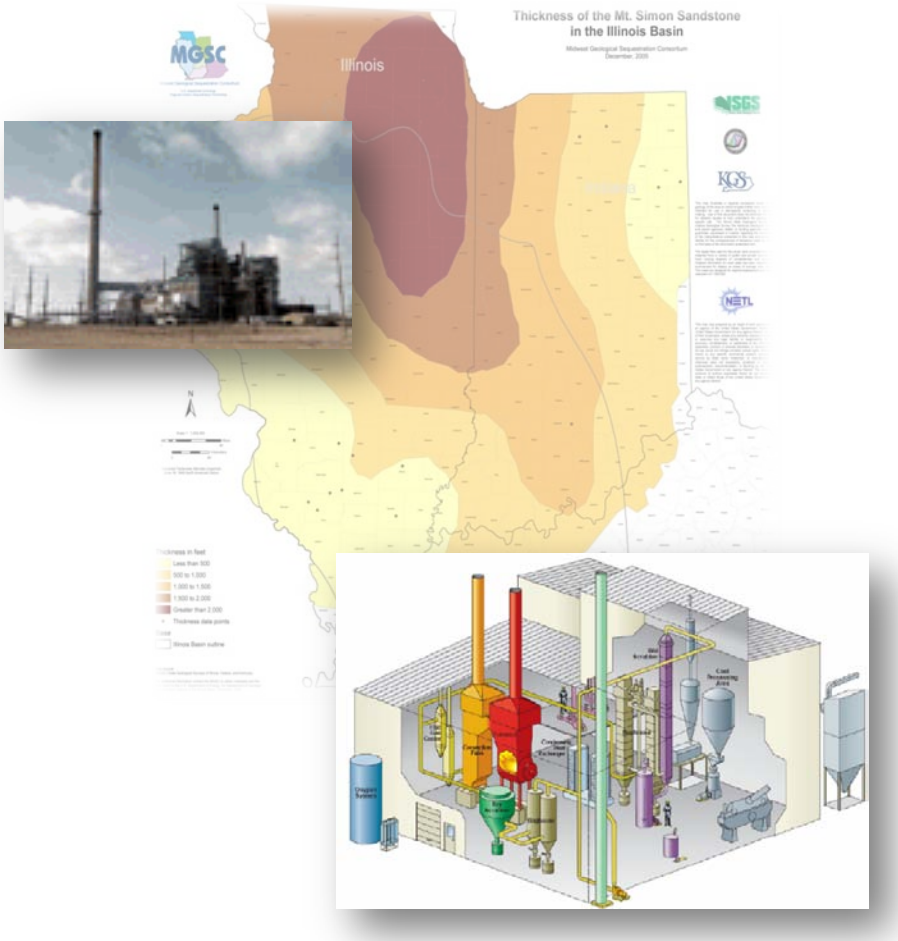
Office of Fossil Energy

U.S. DEPARTMENT OF ENERGY

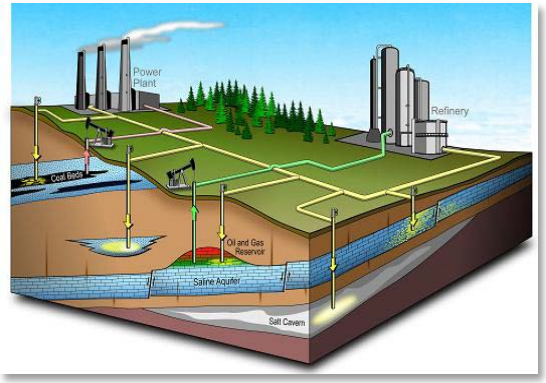
FutureGen 2.0

Large-Scale Oxy-Combustion Integrated with CCS

- **Repower Unit 4 of Ameren's Meredosia, Illinois power station with coal-fueled oxy-combustion**
- **Utilize existing 200 MWe steam turbine & Meredosia plant infrastructure**
- **Pipeline CO_2 ~30 miles to sequestration site in NE Morgan County, Illinois & sequester CO_2 in Mt. Simon saline sandstone formation**



FutureGen 2.0



- **On Sept. 27, 2010, the U.S. Department of Energy awarded:**
  - **$590 million to Ameren Energy Resources, Babcock & Wilcox, and American Air Liquide to demonstrate Oxy-Combustion technology at utility-scale; and**
  - **$459 million to the FutureGen Alliance to transport & geologically sequester the CO_2, and to build a visitor center and research & training facilities**

- **The FutureGen 2.0 project will incorporate:**
  - **CO_2 Capture: Repower an existing Ameren power plant unit in Meredosia, Illinois with oxy-combustion and CO_2 compression & purification;**
  - **CO_2 Transport: Build a CO_2 pipeline to a CO_2 storage facility in Morgan County, Illinois (preferred site); and**
  - **CO_2 Storage: Develop a deep saline geologic storage facility to sequester CO_2 from the power plant in the Mt. Simon sandstone formation**

FutureGen 2.0 Project Participants

Power Generation & CO_2 Capture

CO_2 Transport & Storage

FutureGen Alliance

International Non-Profit Consortia

Alpha Natural Resources

AngloAmerican

CATERPILLAR®
(Intention Accounced)

CONSOL ENERGY

JOY

Exelon.
(Intention Accounced)

Peabody

LG&E KU
PPL companies

RioTinto

xstrata

FutureGen 2.0

FutureGen 2.0 Oxy-Combustion Project

Meredosia Plant

- Meredosia, Illinois;

  Owned by Ameren

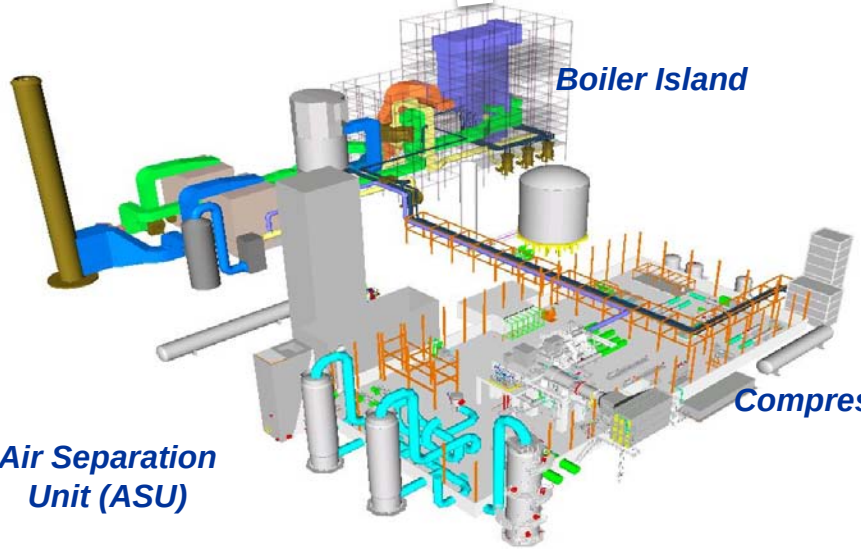
  Energy Resources
- 3 coal-fired units

  (Units 1 & 2 retired)
- Unit 4, oil-fired boiler built in 1975;
  ~200 MWe nameplate,
  ~170 MWe net rating,
  2400 psig 1000 / 1000°F steam cycle

FutureGen 2.0: Meredosia Power Station

Meredosia Plant

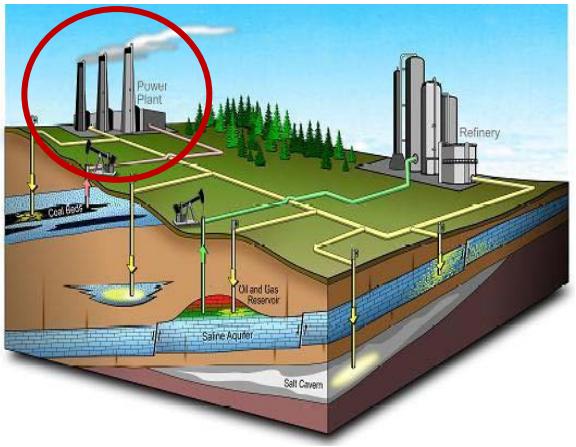
- Unit 4, oil-fired; turbine & generator have low operating hours
- Repower Unit 4 steam turbine with purpose-built pulverized coal Oxy-boiler
- Infrastructure exists to accommodate repowering Unit 4 with coal
- Illinois coal, PRB or Illinois/PRB coal blends
- Barge & truck unloading facilities
- (Rail access nearby)
- 3500 tpd CO_2 to pipeline & storage project



FutureGen 2.0: Oxy-Combustion Repowering

A large-scale integrated test to repower Ameren's existing Meredosia Unit 4 with oxy-combustion & carbon capture technology

- ✓ A purpose-built oxy-combustion system
- ✓ Confirmation that oxy-combustion is a viable repowering/new build technology for coal-fueled power plants, incorporating a testing program that will utilize Illinois bituminous coals & other coals
- ✓ Basis for industry acceptance: lowers equipment, operational, reliability & financial risks for future commercial deployments to meet U.S. & world energy needs

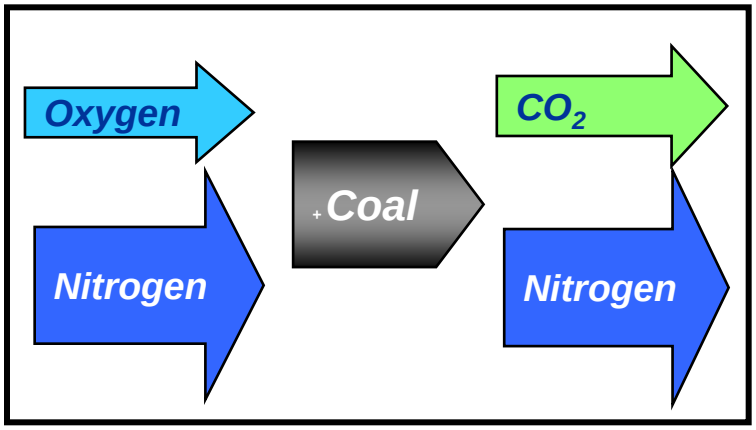


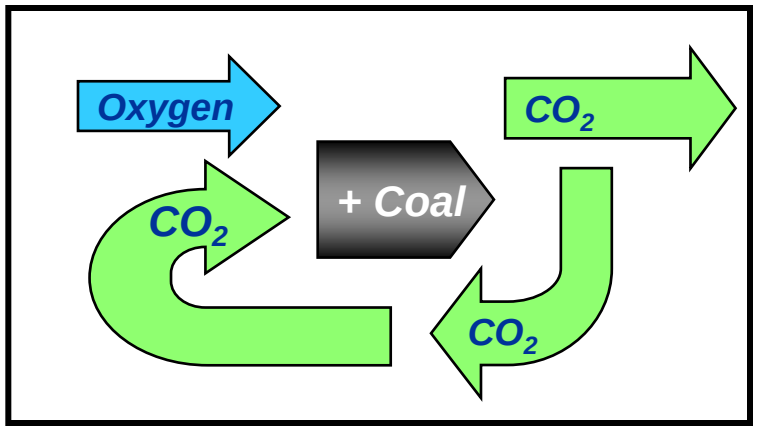
Benefits of the Meredosia Host Site

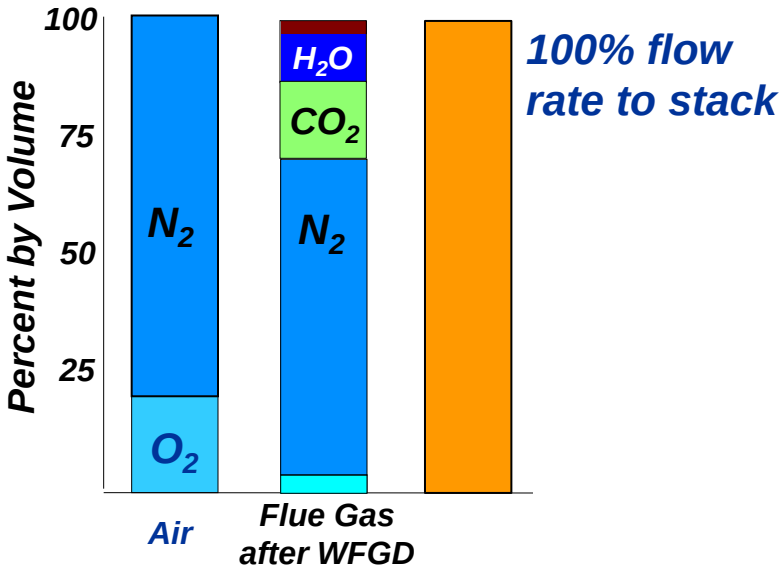
- ✓ Existing site infrastructure conserves capital cost
- ✓ It is the "right size" unit
  - Demonstrates retrofit/repowering potential for existing coal units
  - Large enough test of the technology to support commercial deployment (e.g., 500-800 MWe, supercritical) without another, intermediate, scale-up step
  - Small enough to conserve capital expense for a large-scale integrated test

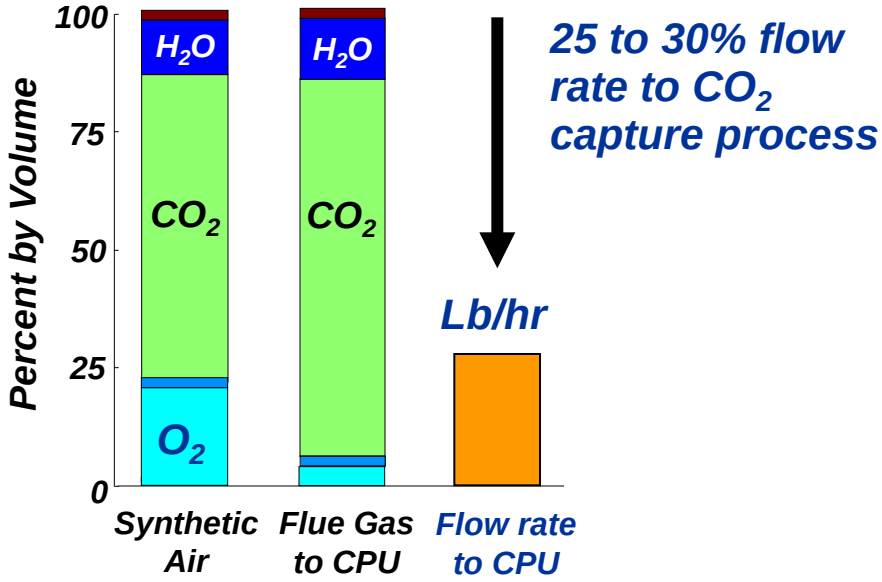
Meredosia Power Plant

Oxy-Coal Combustion Principles



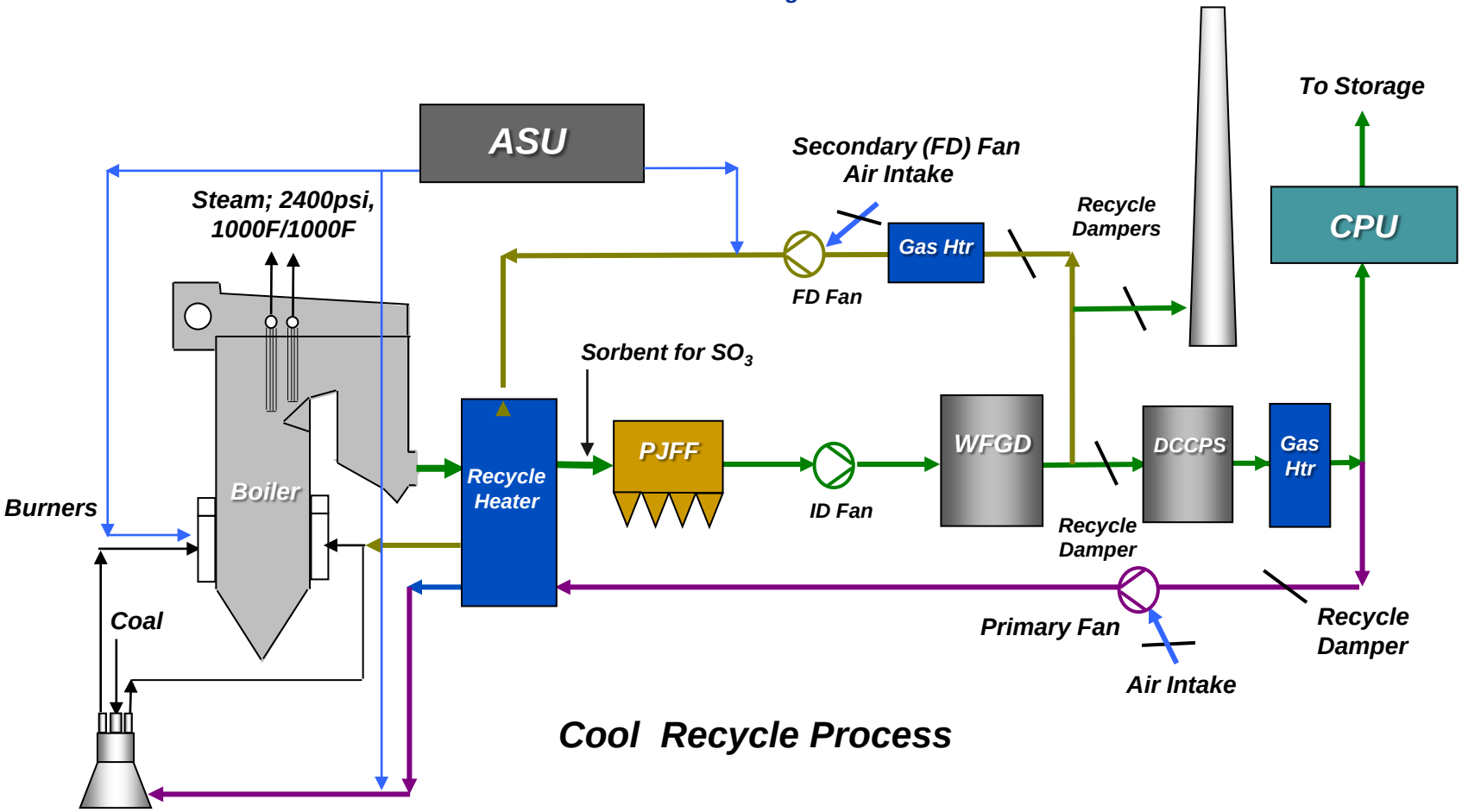




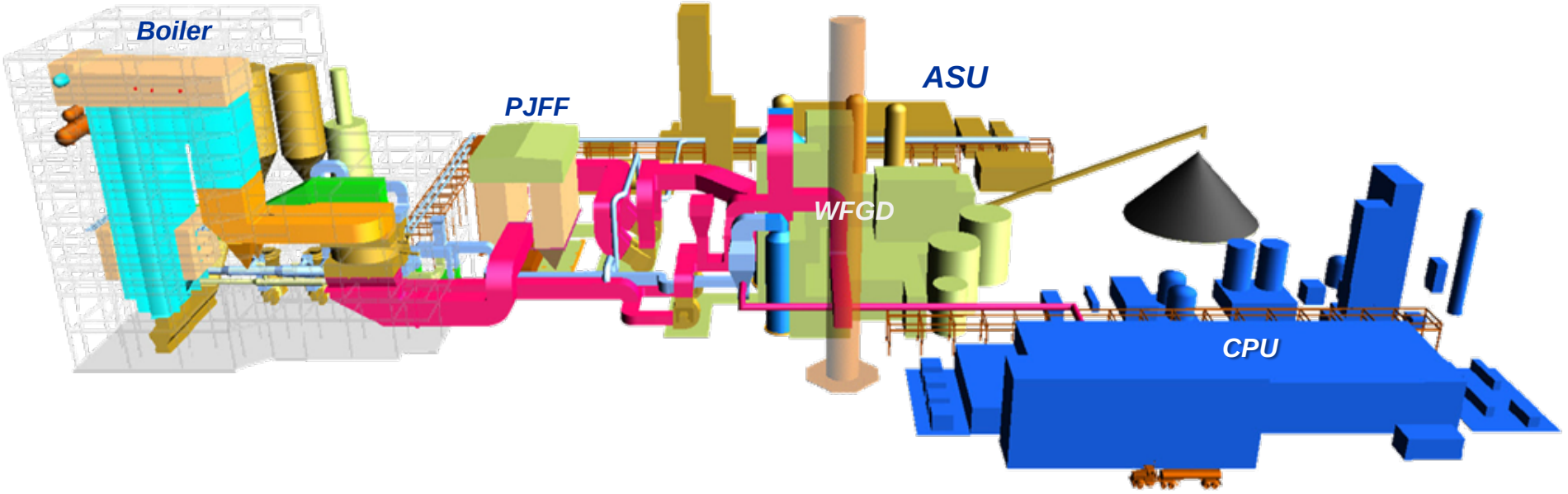


FutureGen 2.0
Oxycombustion Carbon Capture Plant

Power Block Configuration

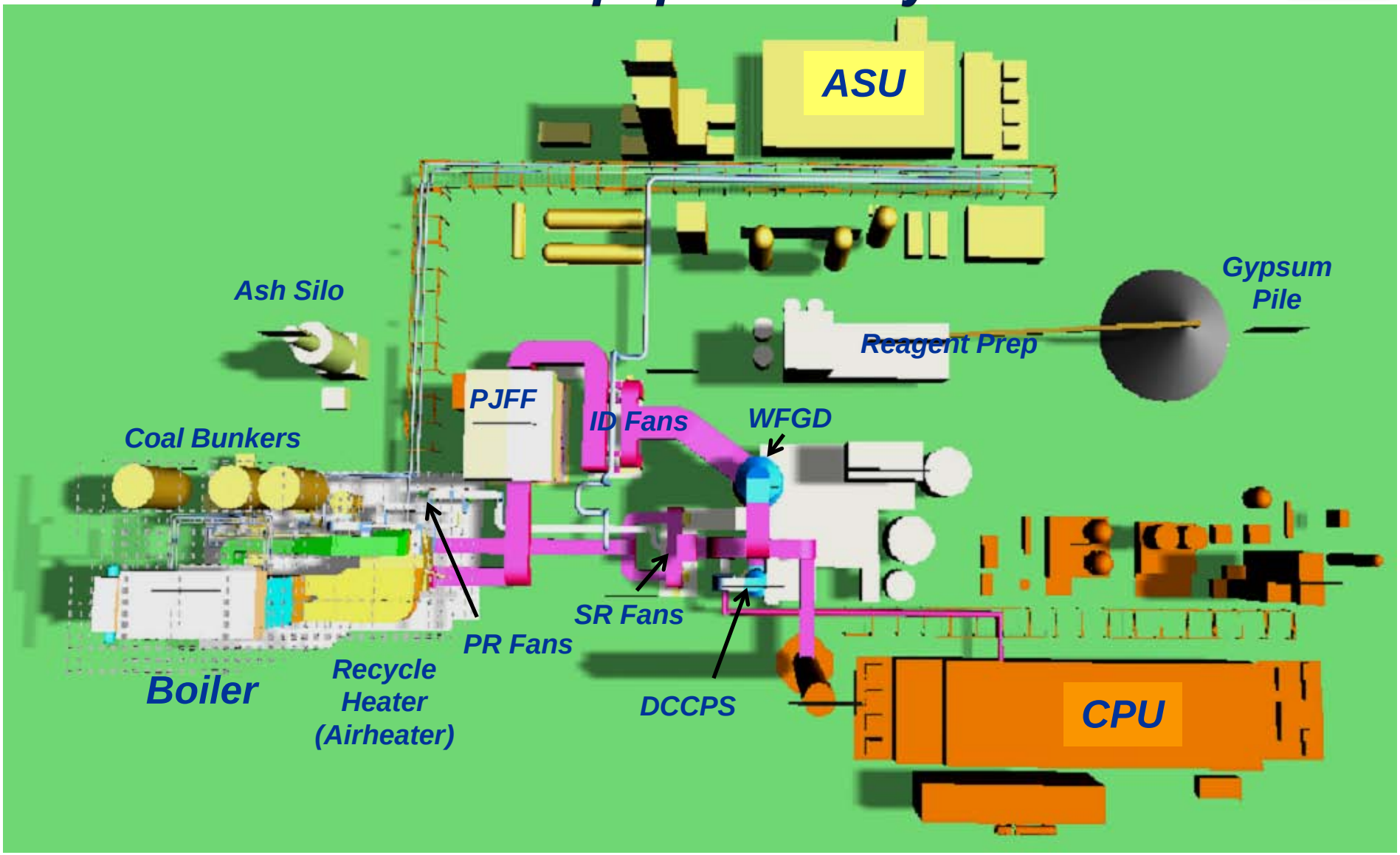


FutureGen 2.0 Oxy-Coal Capture Plant



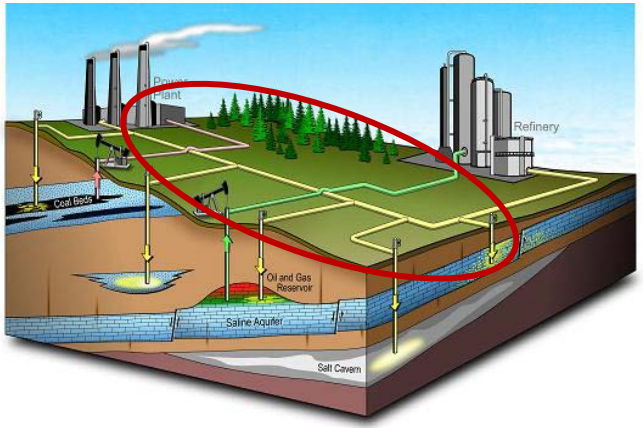
Not the optimal equipment arrangement for a new plant, but the best possible in this case due to site space limitations. Will be a common occurrence with existing plant retrofits & repowerings.

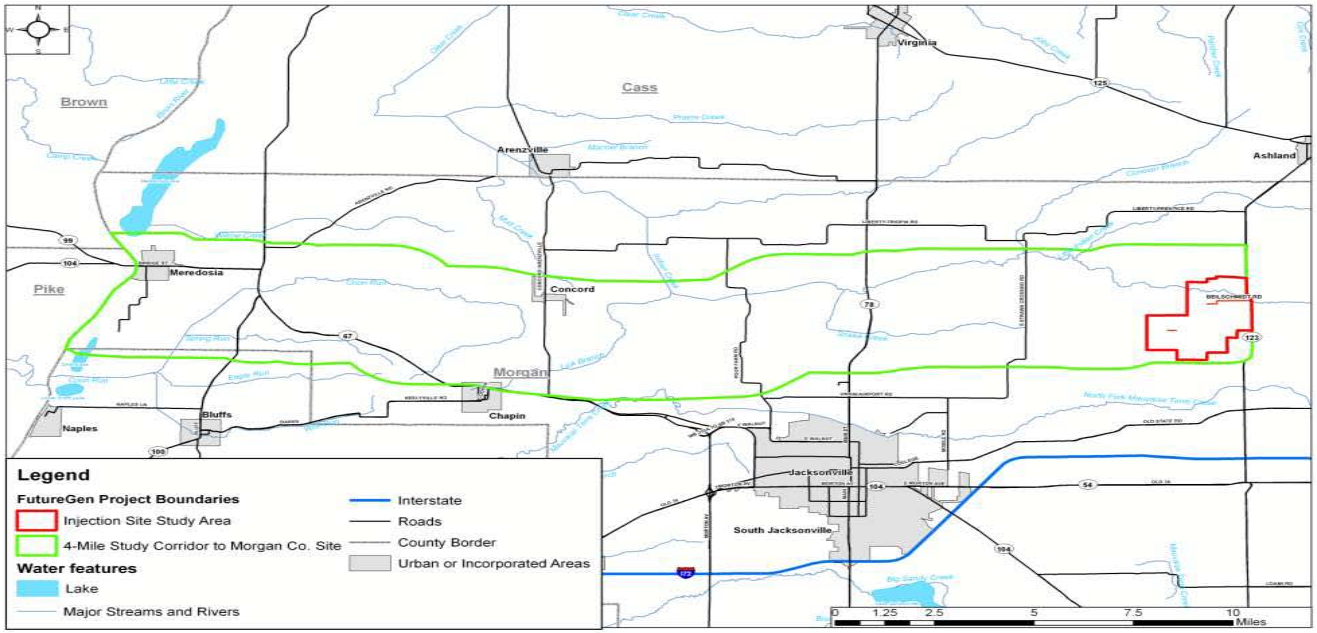
Plant Equipment Layout



FutureGen 2.0: CO_2 Transmission Pipeline

- **Pipeline to transport CO_2 from Meredosia to preferred CO_2 storage site in northeastern Morgan County, Illinois**
  - ~30 miles of pipeline from Meredosia to Morgan County site
  - 12-inch diameter pipeline; 2000 psi operating pressure
  - 4-mile wide corridor to be studied as part of EIS

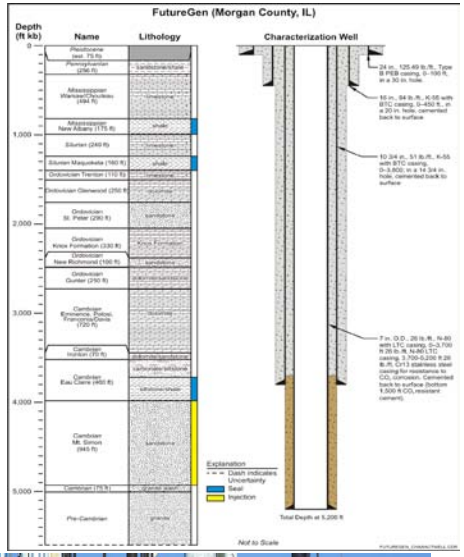


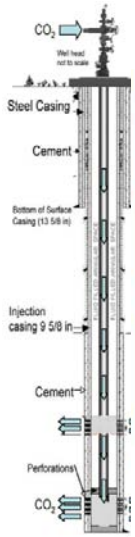


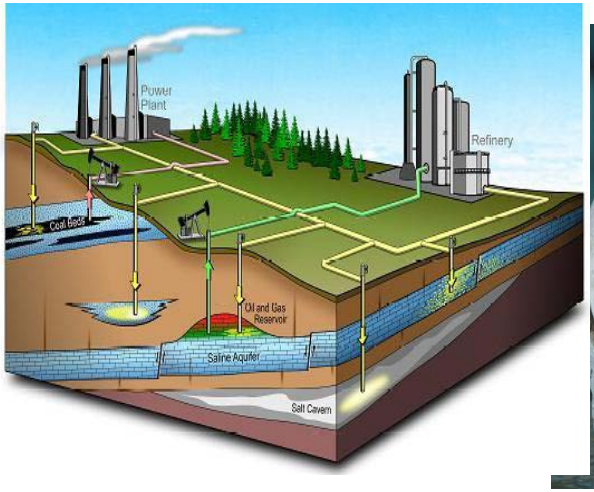
FutureGen 2.0: Geological CO_2 Storage

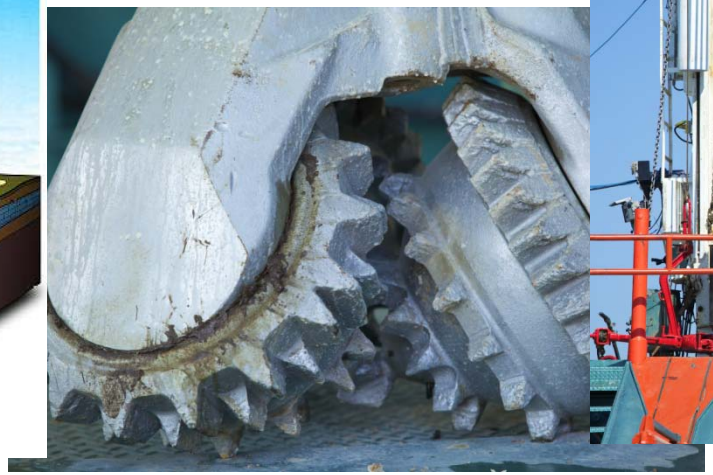
- **Design, build & operate geologic storage repository capable of safely & permanently sequestering anthropogenic CO_2**
  - Site characterization for large volumes to be stored
    … Modeling, seismic surveys, drilling of characterization wells, injection well design
  - Visitor, education & research facilities
  - Strong community interest, at preferred site & two alternate sites
  - Characterization well completed to depth of 4826’ on December 4, 2011
  - Core sample analyses & reservoir characterization studies under way

1. The FGA will not cost share in the visitor, education and training facilities.

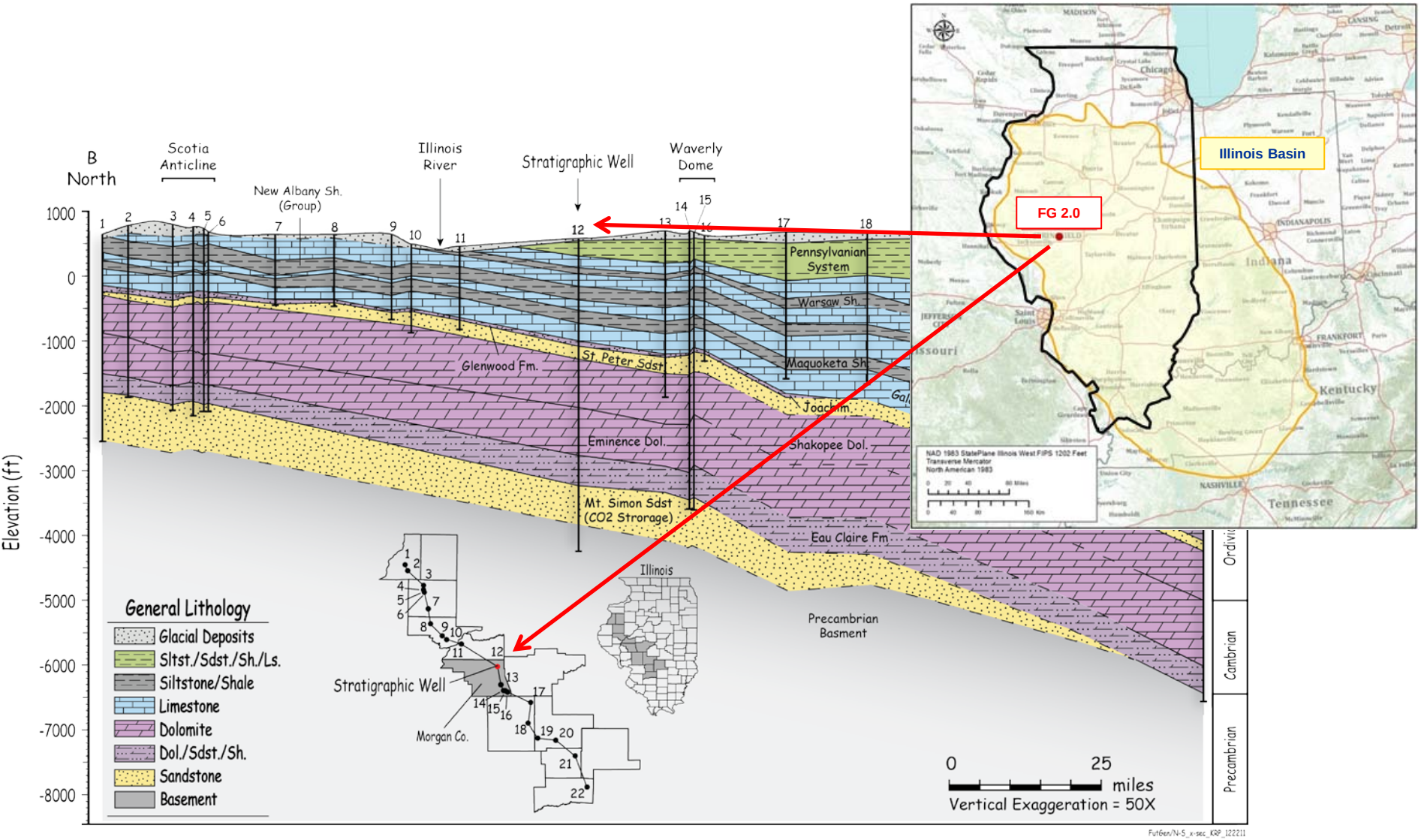




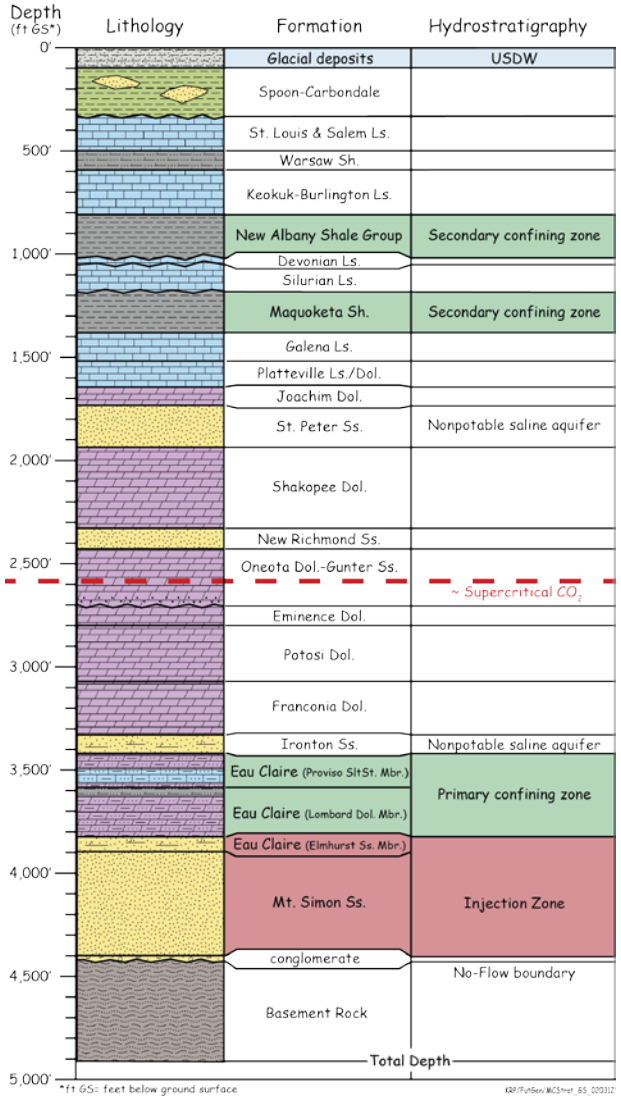




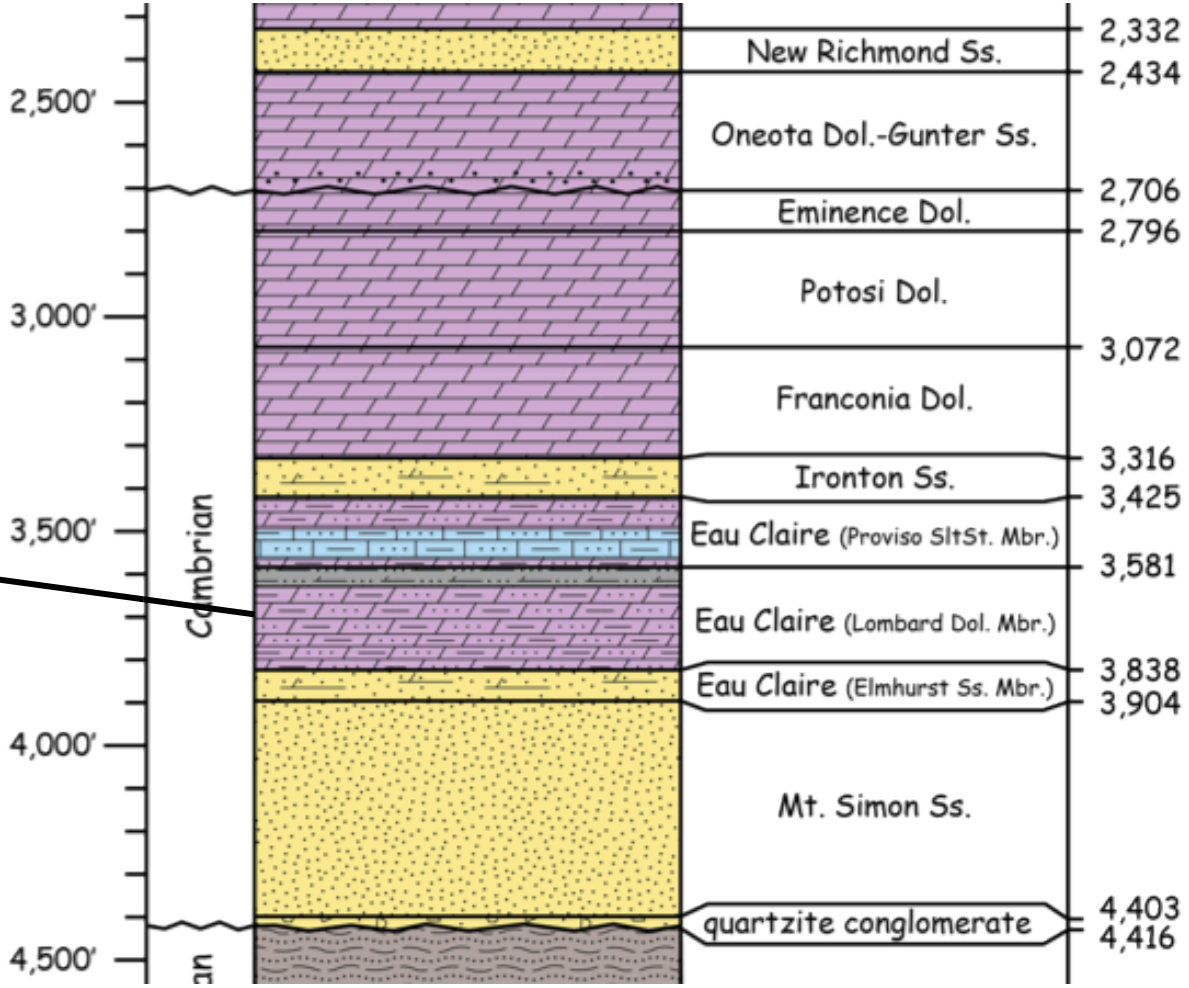
Illinois Basin and Regional Geology



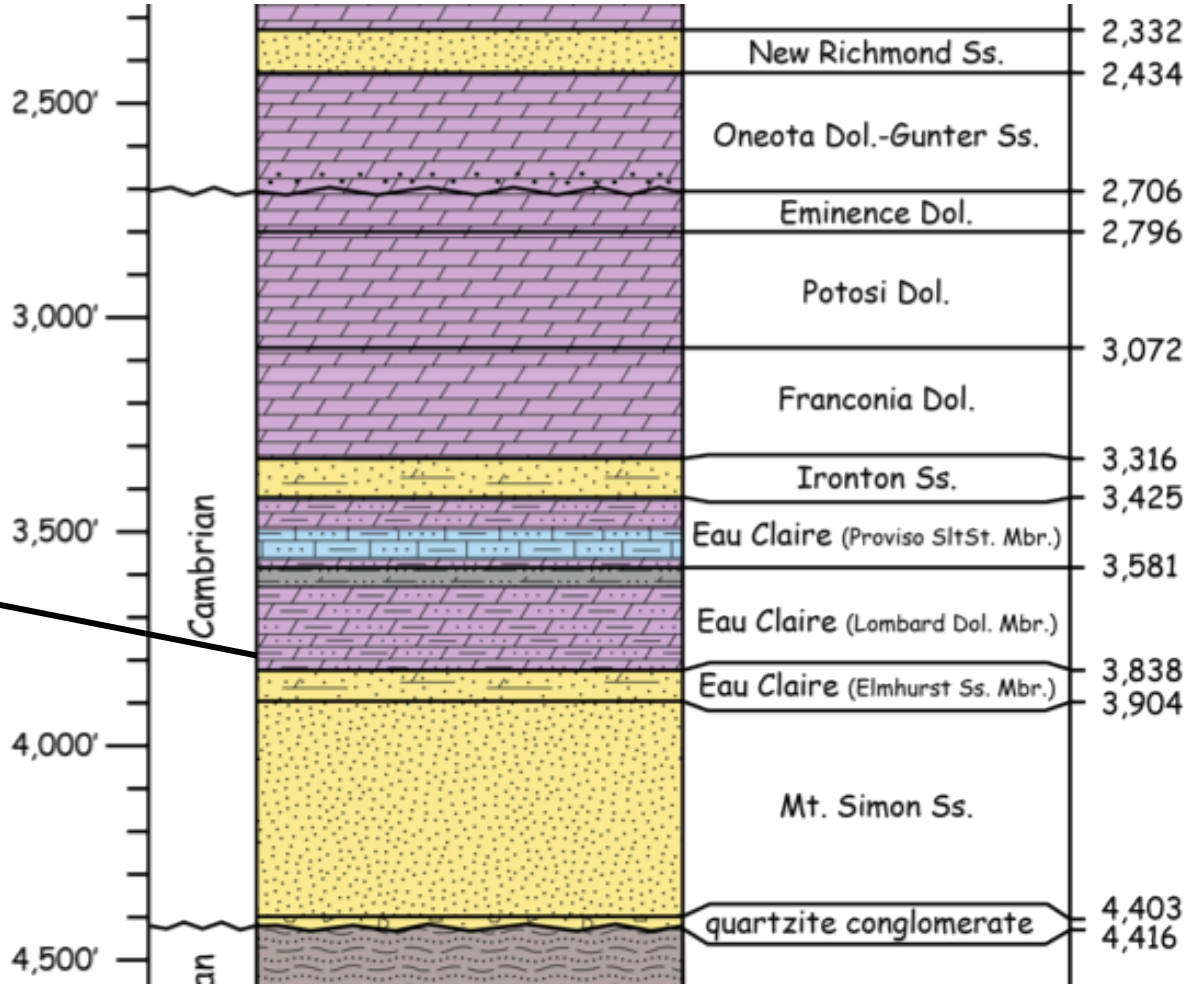
Stratigraphy – Morgan County Well



Caprock Seal ~1,130m BGS

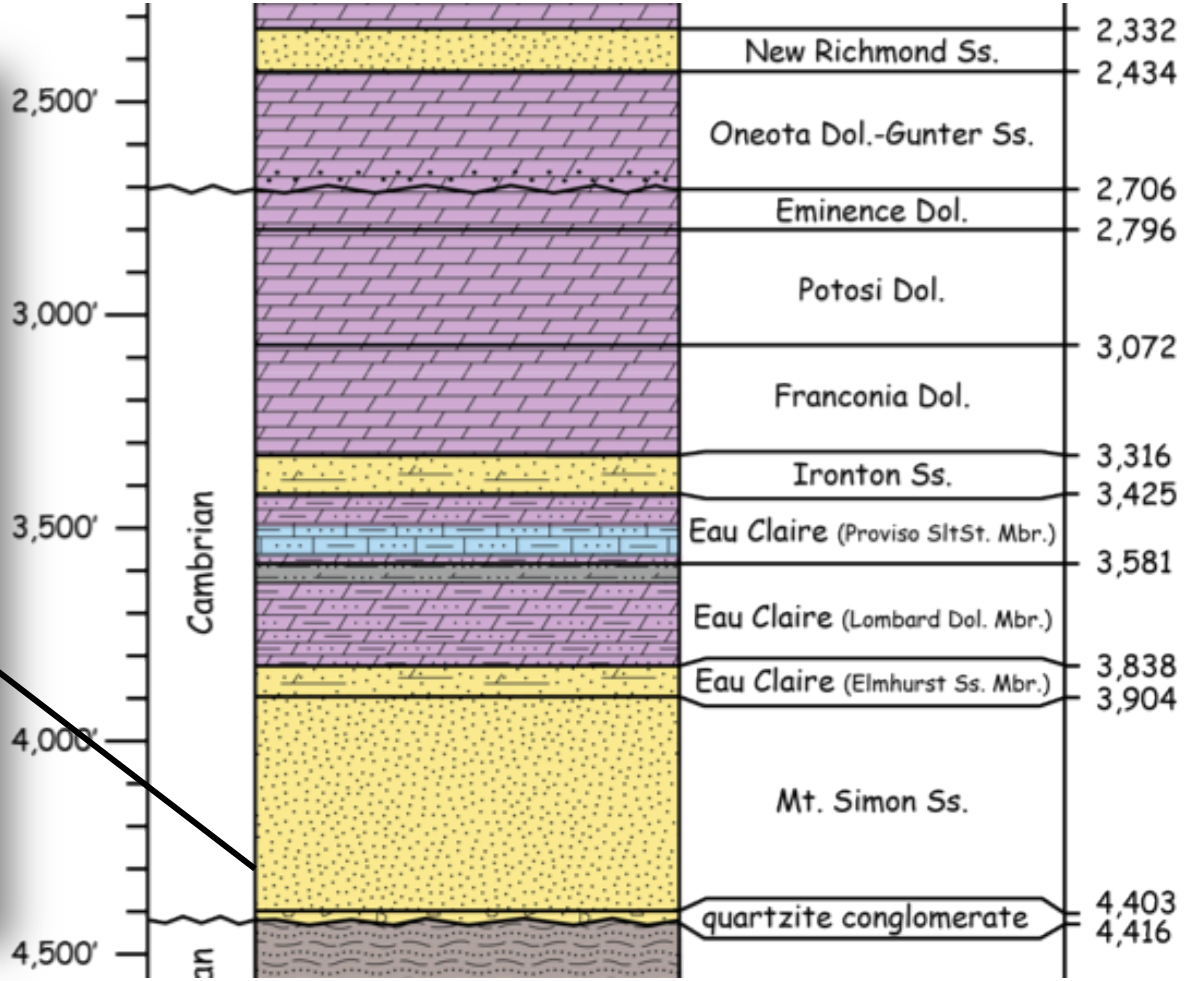


Caprock Seal ~1,160m BGS



Sandstone Formation ~1,300m BGS

4284 ft



For Additional Information

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