

Geologic CO₂ Sequestration Potential of 42 California Power Plant Sites



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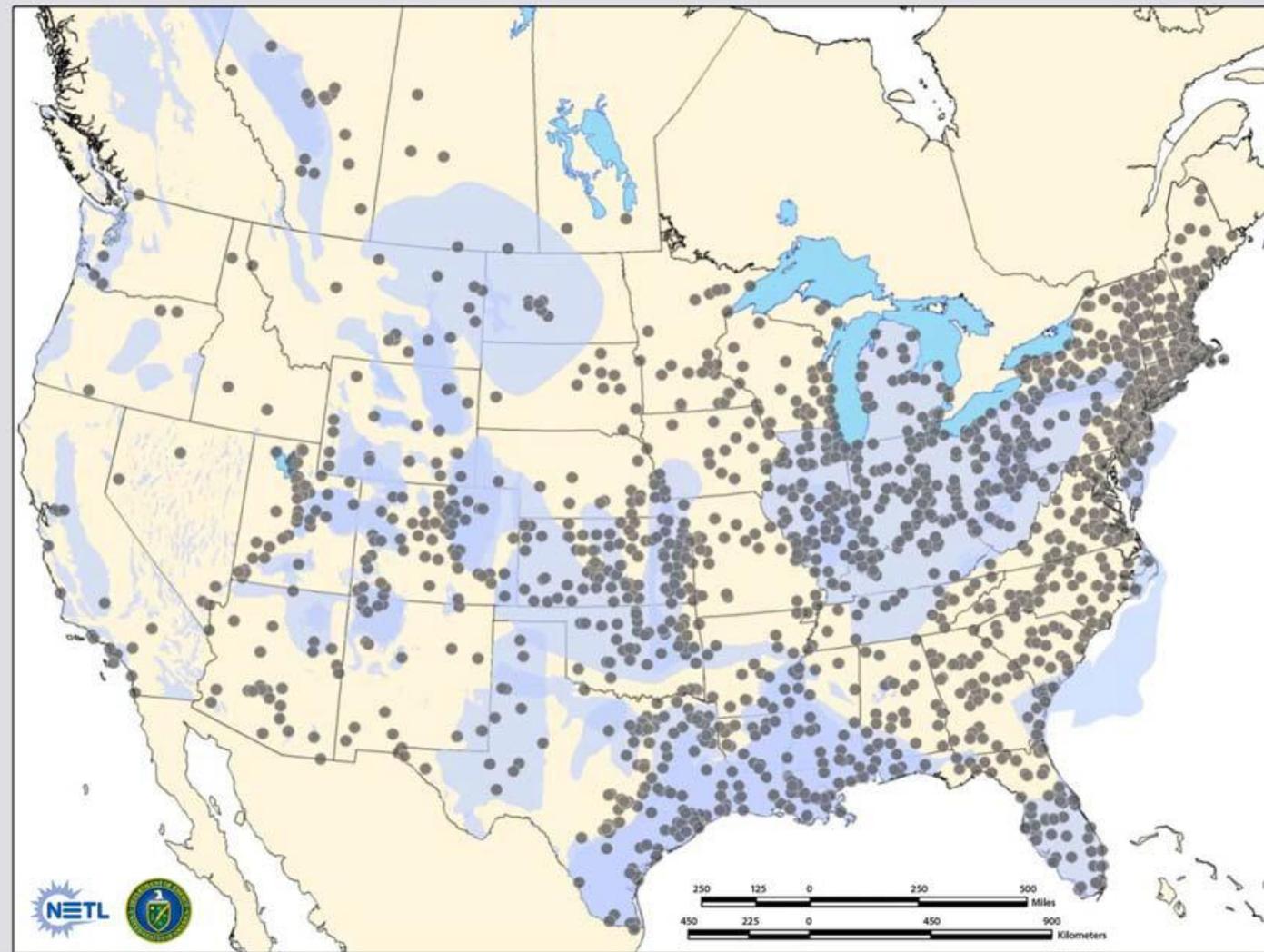


Outline

- Background
 - Previous Work
- This study
 - Four Goals
 - Five Geologic Parameters Considered
 - Preliminary Results
 - Future Work

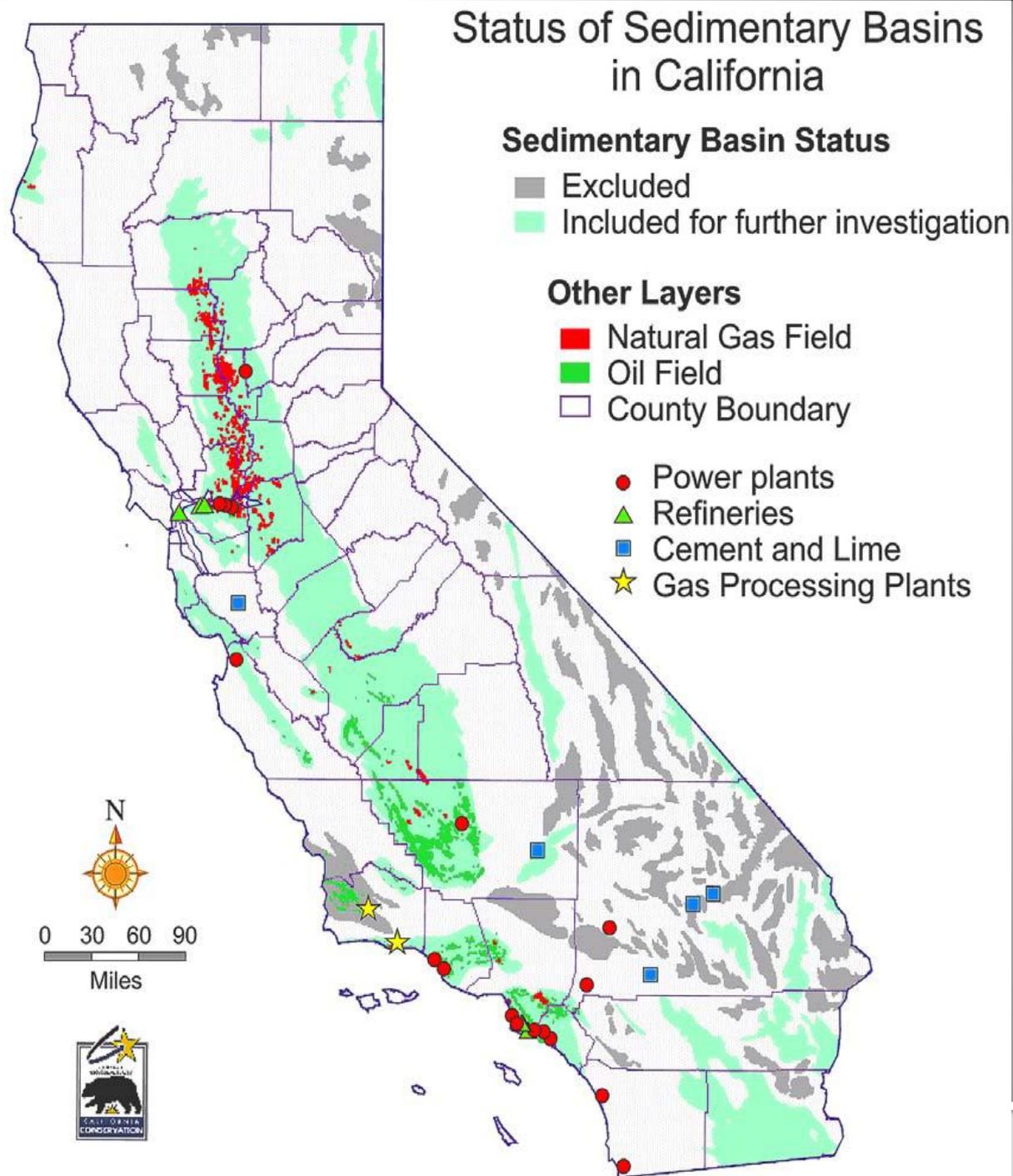
National Source-Sink Matching

NETL

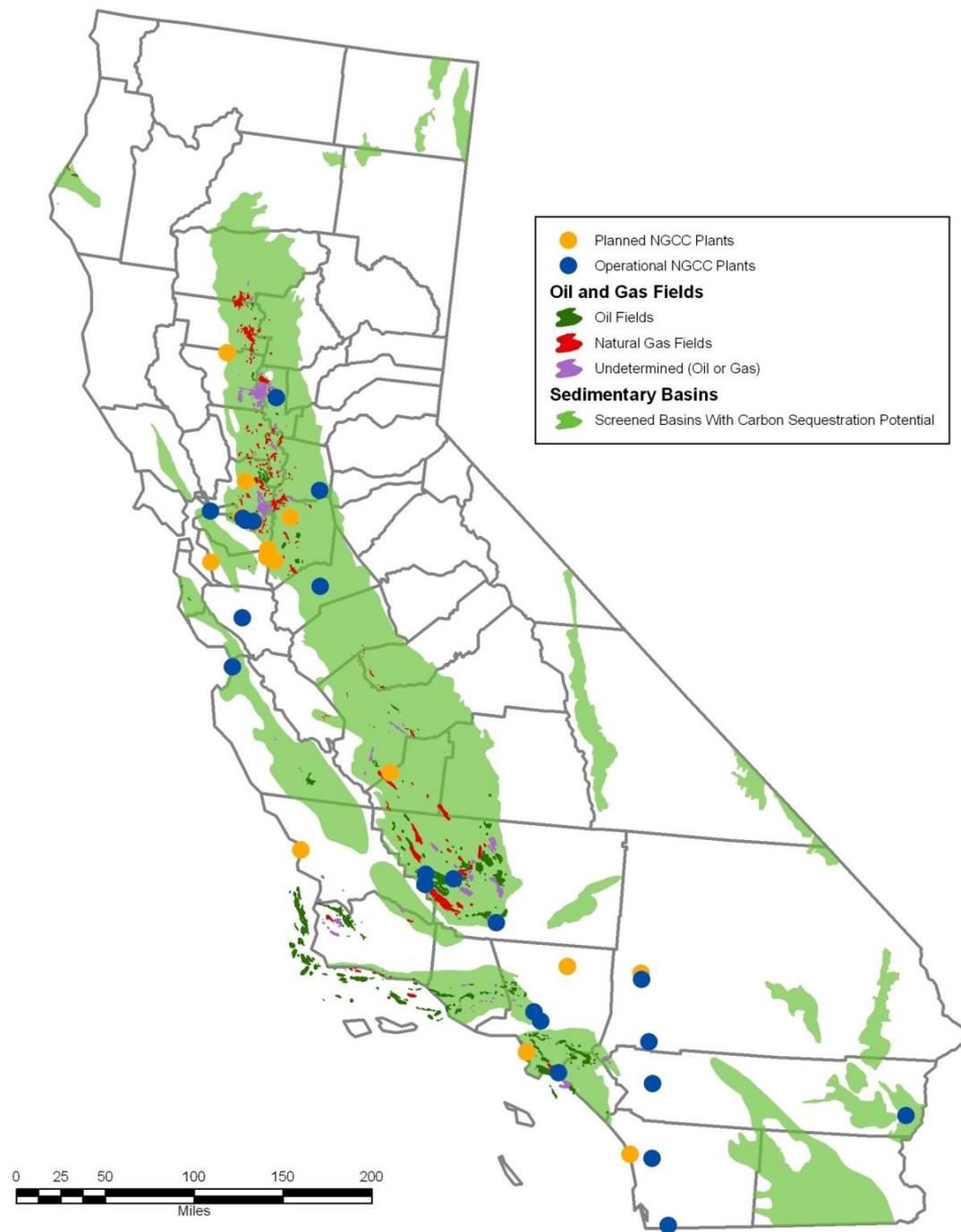


California Source-Sink Matching

California
Geologic Survey
(CGS)



This Study: 42 Individual Power Plant Sites

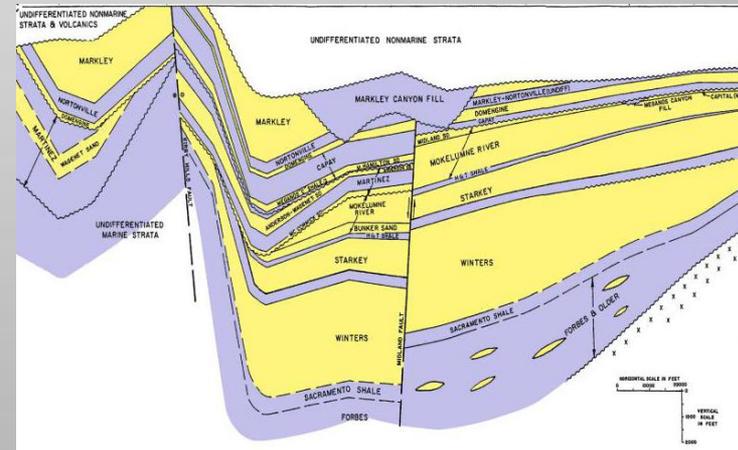


Geology is One Component of the California NGCC – CCS Study

- Above ground: engineering study
- Stone & Webster



- Below ground: geologic characterization
- LLNL



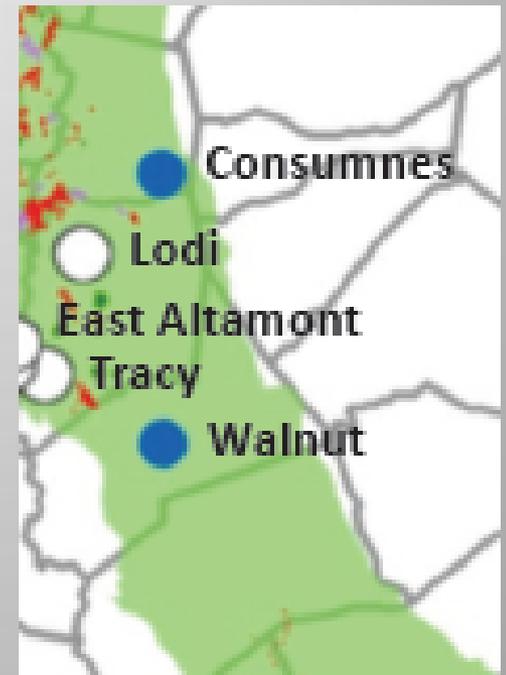
4 Goals of this Study

1. **Review geology** of NGCC sites
2. **Combine results** with the engineering study
3. **Select** a promising site for geologic carbon sequestration
4. **Construct 3D geologic model** of the site

Where is California's best NGCC source – sink match?

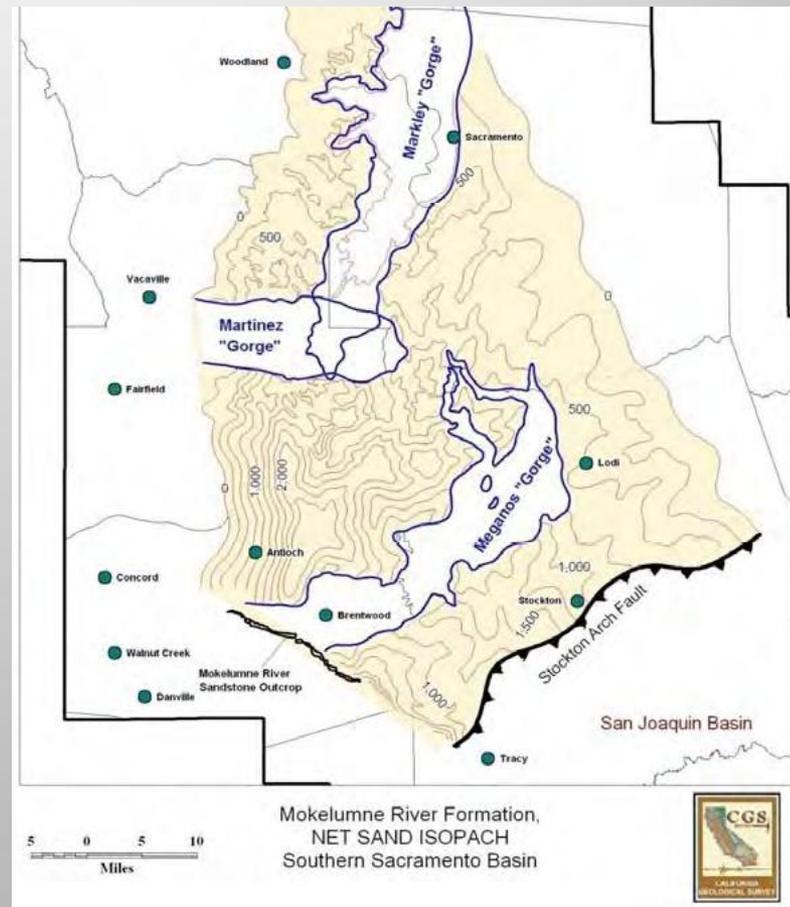
Five Geologic Parameters Considered

1. Distance to nearest potential CO₂ sink
2. Proximity to oil or gas fields
3. Subsurface geology
4. Surface expression of nearby faults
5. Groundwater



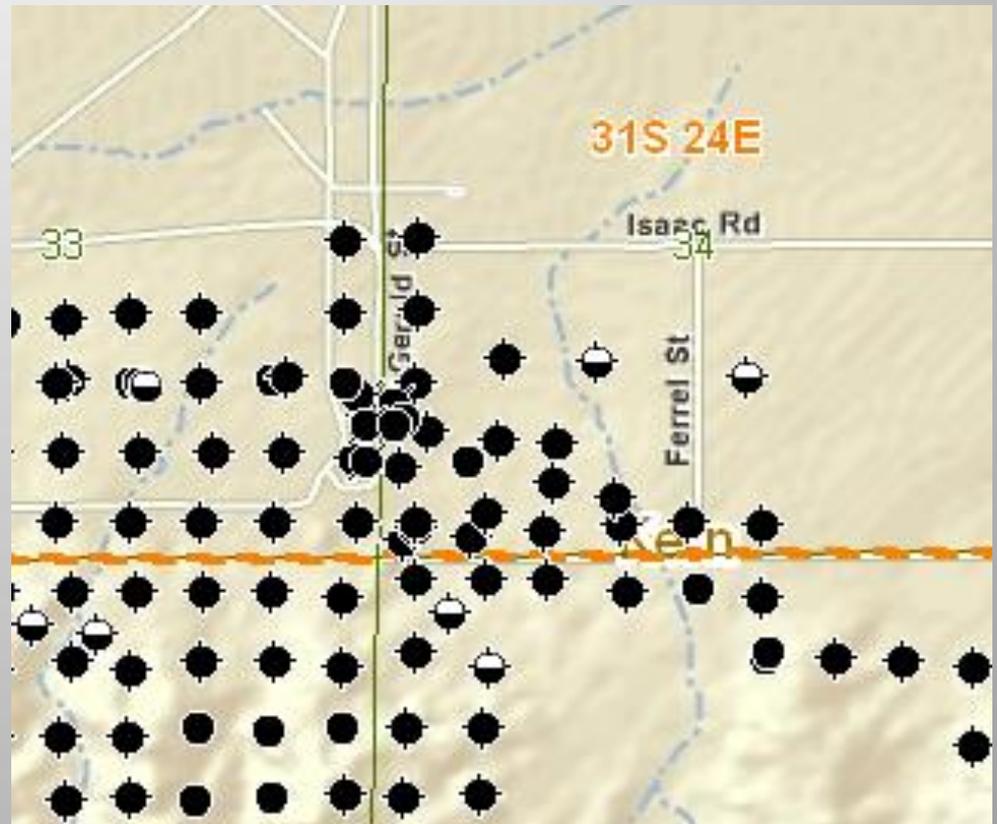
Geologic Parameters Considered: Distance to Nearest Potential CO₂ Sink

- CGS
- California Division of Oil and Gas and Geothermal Resources (DOGGR)



Geologic Parameters Considered: Proximity to Oil or Gas Fields

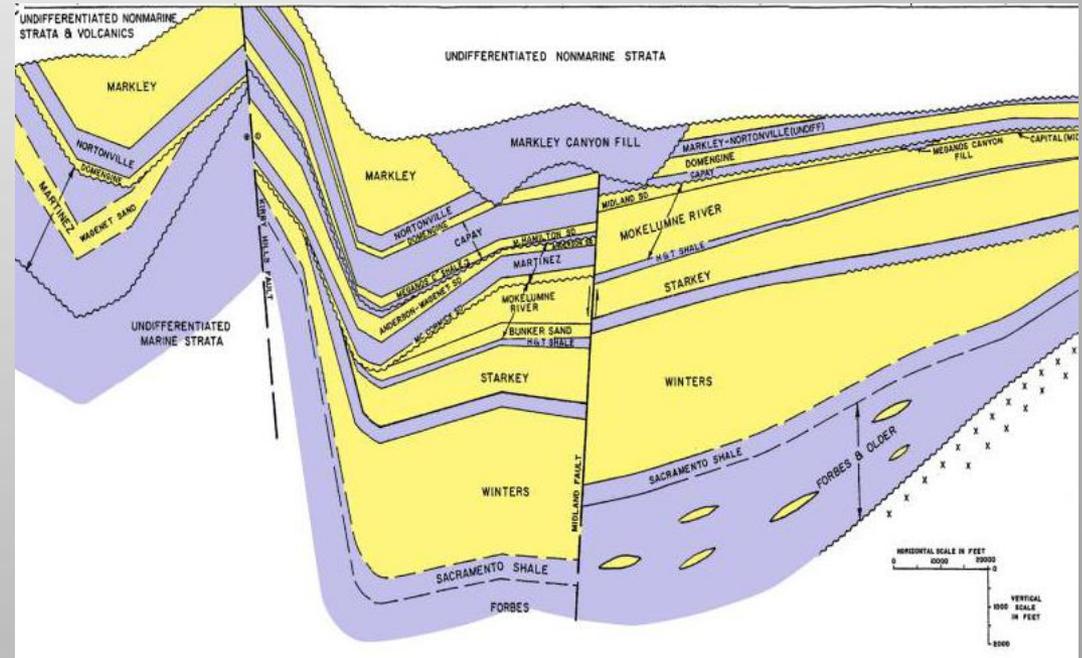
- DOGGR
- CGS



Geologic Parameters Considered: Subsurface Geology

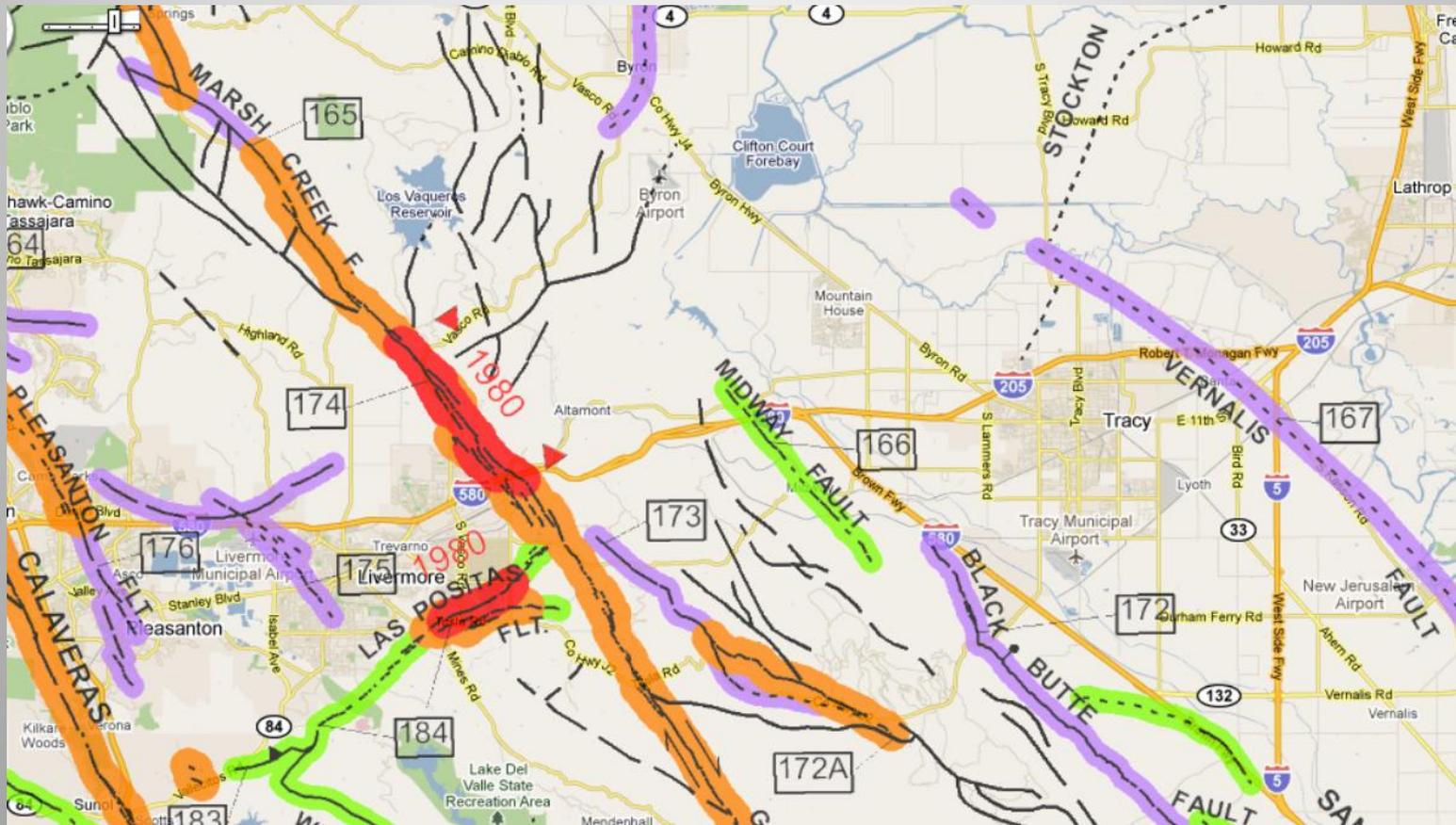
Units suitable for injection
Caprocks/seals

- In oil/gas regions:
 - DOGGR, CGS
- Otherwise:
 - Academic papers
 - Field guides
 - USGS



Geologic Parameters Considered: Surface Expression of Nearby Faults

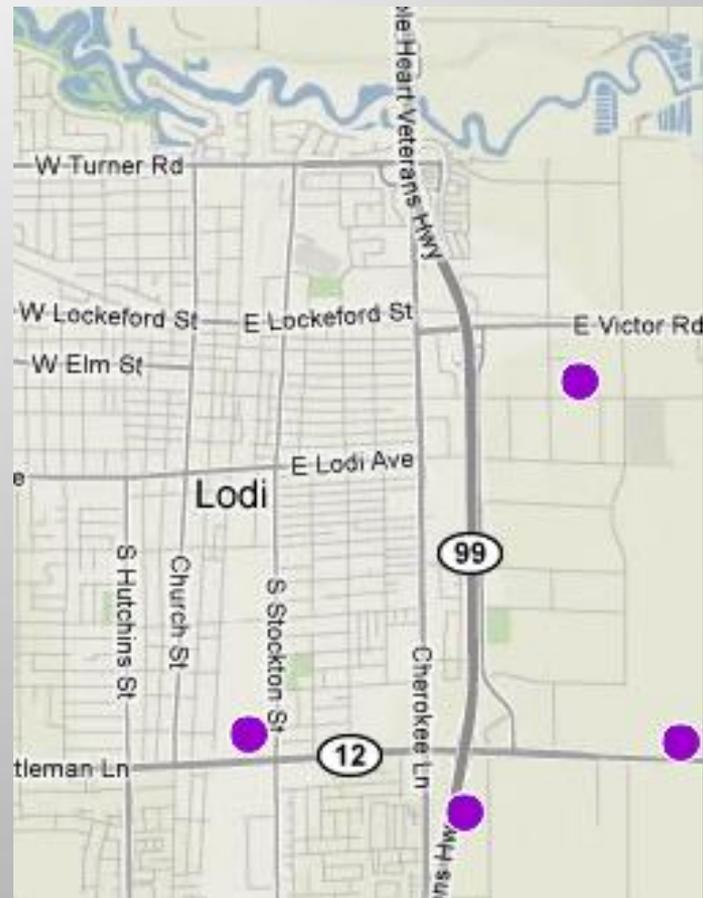
CGS: 2010 Fault Activity Map of CA



Geologic Parameters Considered: Groundwater

Depth to saline aquifers (>10,000 ppm TDS)

- Recent CGS Study
- California Department of Water Resources
- California Energy Commission siting documents



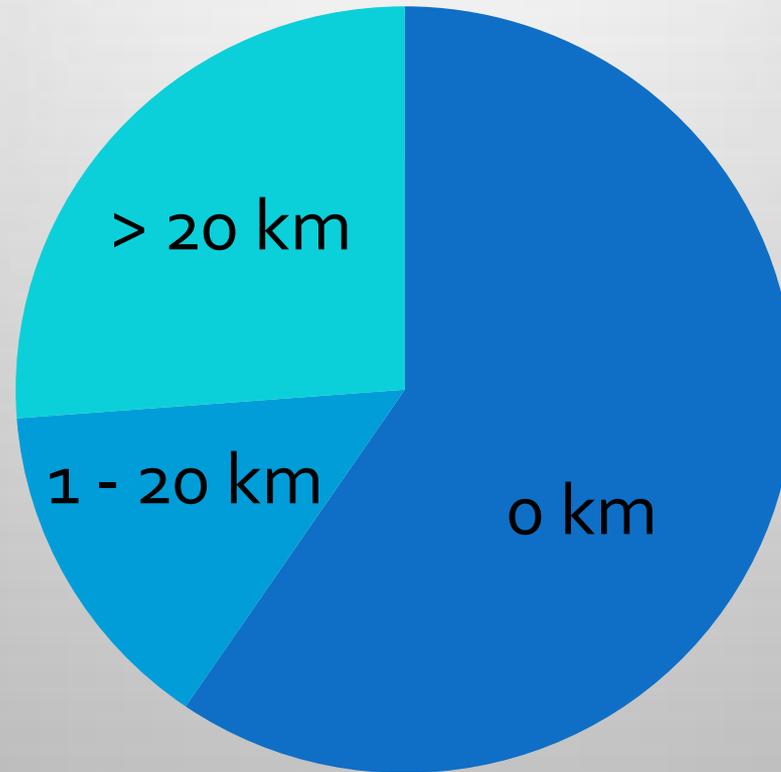
Geologic Parameters Summarized into 42 Profiles: One Example

Magnolia Power Plant Project Profile of Geologic CO₂ Sequestration Potential	
Nearest Potential CO₂ Sink ^{i, ii}	8 km; located near the edge of the Ventura Basin, which is one of California's larger marine basins with potential sequestration opportunities.
Proximity to Oil or Gas Fields ⁱⁱⁱ	Approximately 20 km to the Pacoima Oil Field.
Subsurface Geology ⁱ	<p>Depth to geologic units suitable for injection (desired is >800 m): Not applicable</p> <p>Description of geologic unit: Depth to crystalline basement rocks is less than 800 m, according to a depth-to-basement map created by the California Geologic Survey (CGS). The site is located approximately 8 km east of thick sandstone deposits within the Sespe through Pico formations, according to CGS.</p> <p>Description of caprock: Not applicable</p>
Surface Expression of Nearby Faults ^{iv}	<p>Distance to nearest surface expression of a fault: 1 km</p> <p>Description of nearby fault(s): The site is 1 km from the Holocene-age Verdugo Fault and 4 km from another unnamed Holocene-age fault. The nearest Historic-age fault is the San Fernando Fault, located 10 km north.</p>
Subsurface Water ^v	<p>Depth to base of fresh water aquifer: Fresh water could extend to the top of crystalline basement, given that the Saugus Formation is the main water-bearing unit in the vicinity, and it could reach depths of 800 m in this area.</p> <p>Depth to saline aquifer (>10,000 ppm TDS): Not readily available</p>



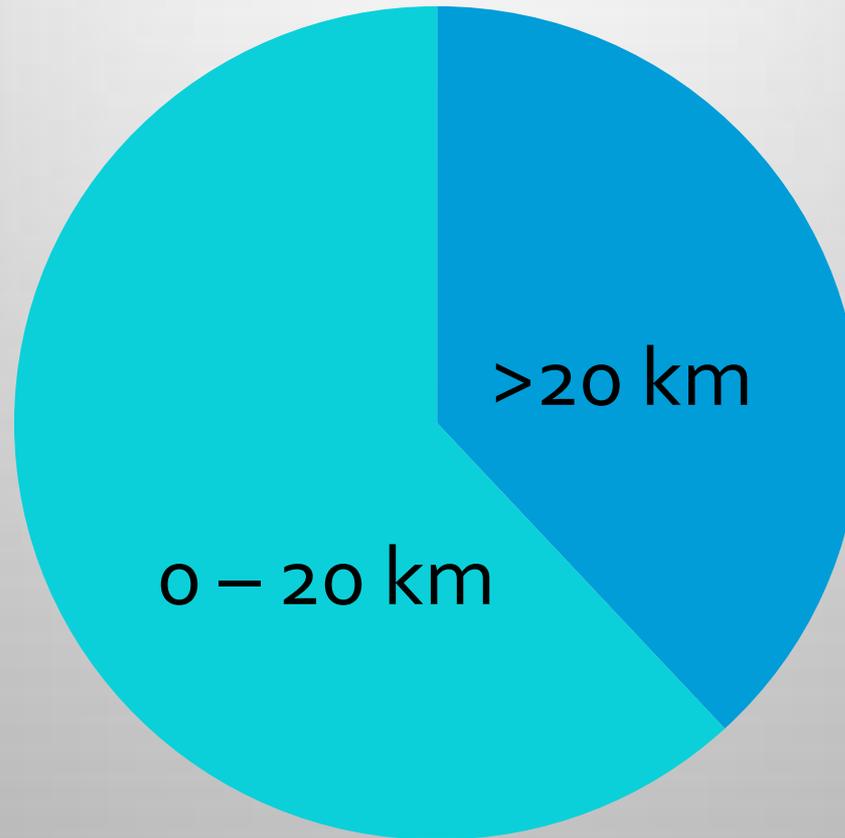
Geologic CO₂ Sequestration Potential of 42 California Power Plant Sites, Katherine B. L. Myers and J. L. Wagoner, June 2011, LLNL-TR-489273

Preliminary Results: Distance to Nearest Potential CO₂ Sink



Most sites co-located with a potentially suitable sink

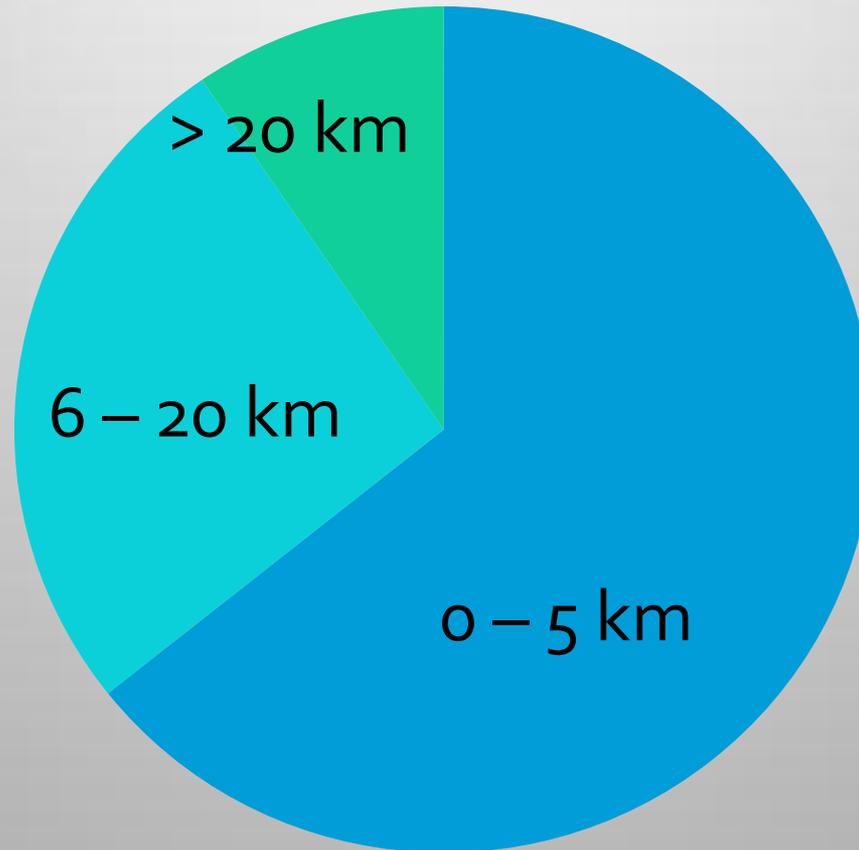
Preliminary Results: Proximity to Oil or Gas Fields



Most sites located within 20 km of an oil or gas field

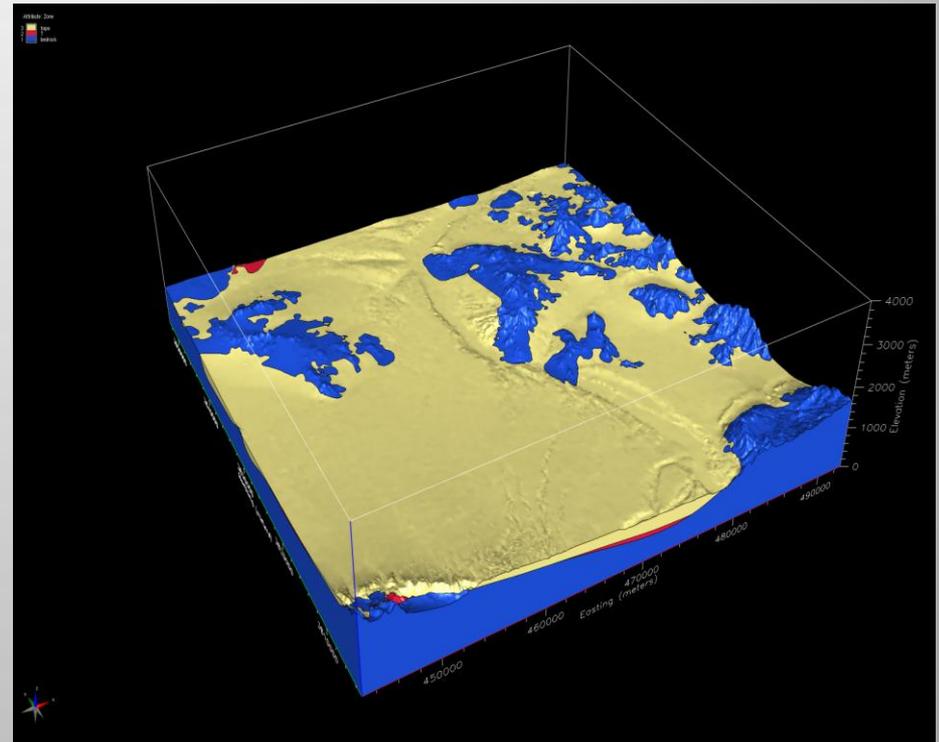
Preliminary Results: Surface Expression of Nearby Faults

Distance to Nearest **Surface Expression** of a Fault



Future Work

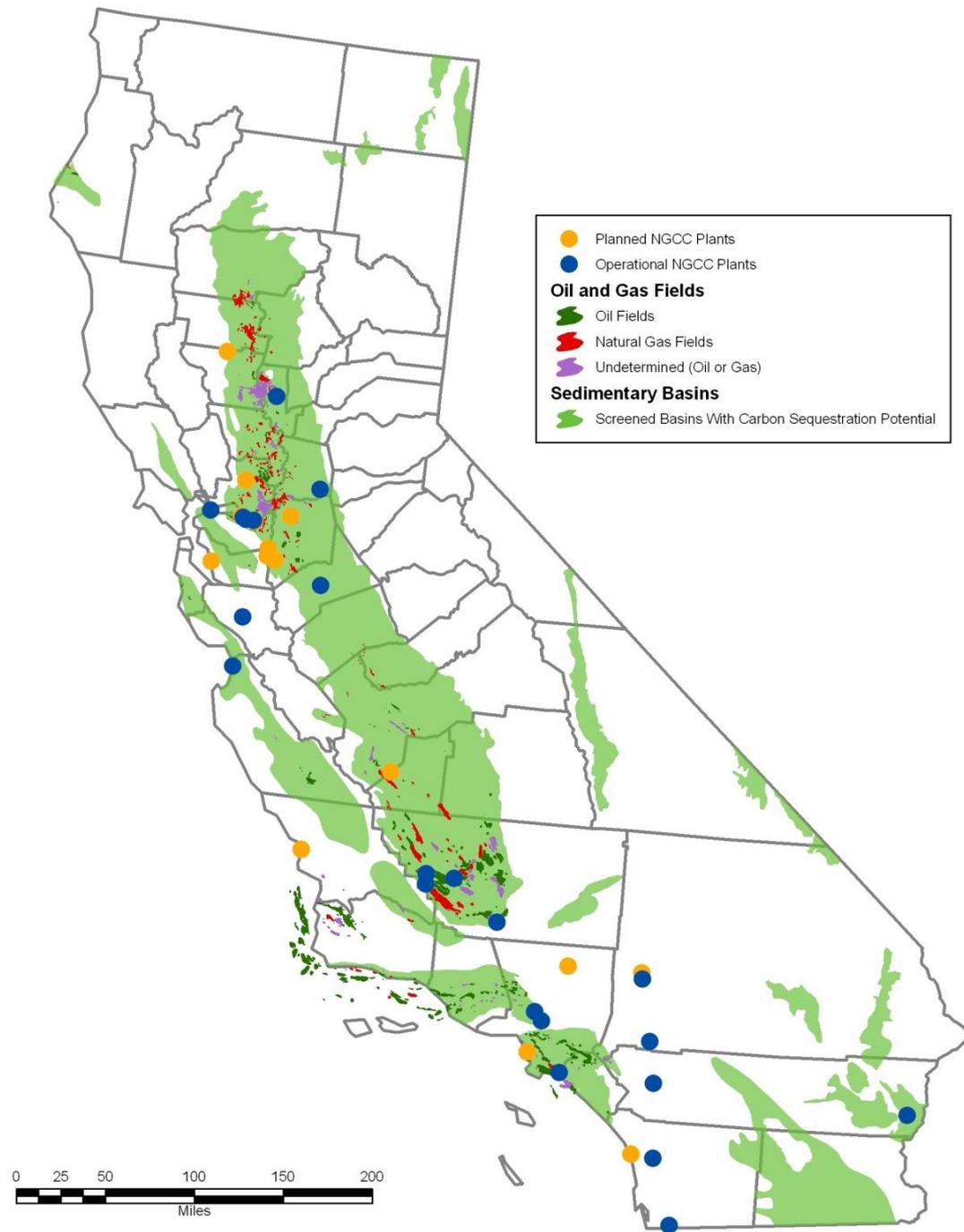
- **Combine results** with the engineering study
- **Select promising site** for geologic carbon sequestration
- **Model 3D geology** to further characterize the site (50 km x 50 km)



Conclusions

- Most California NGCC sites are located:
 - Above a potentially suitable sink
 - Within 20 km of an oil or gas field
 - Within 5 km of the surface expression of a fault
- Geologic storage of CO₂ appears practicable for many California NGCC sites.

Thank you

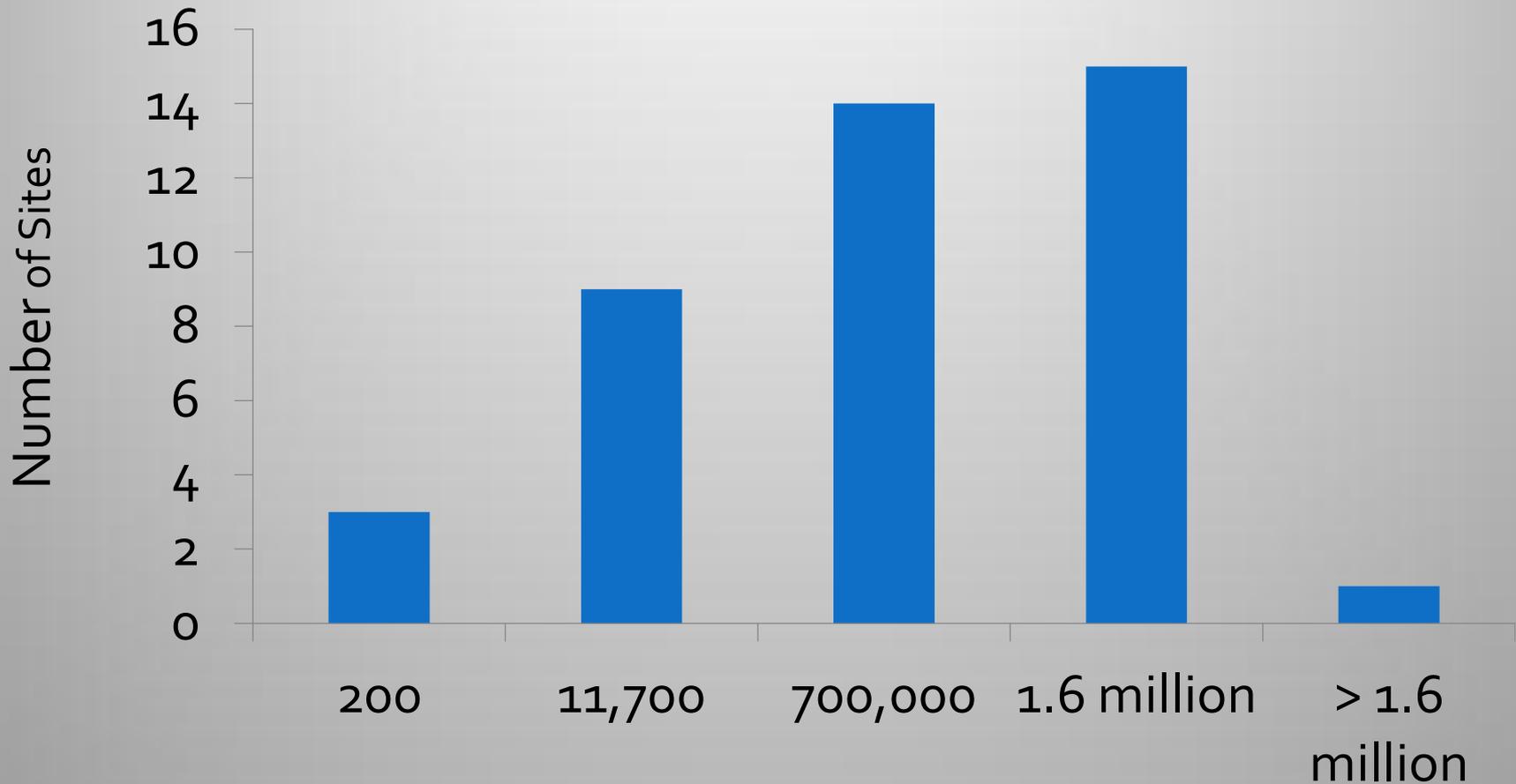


Extra figures

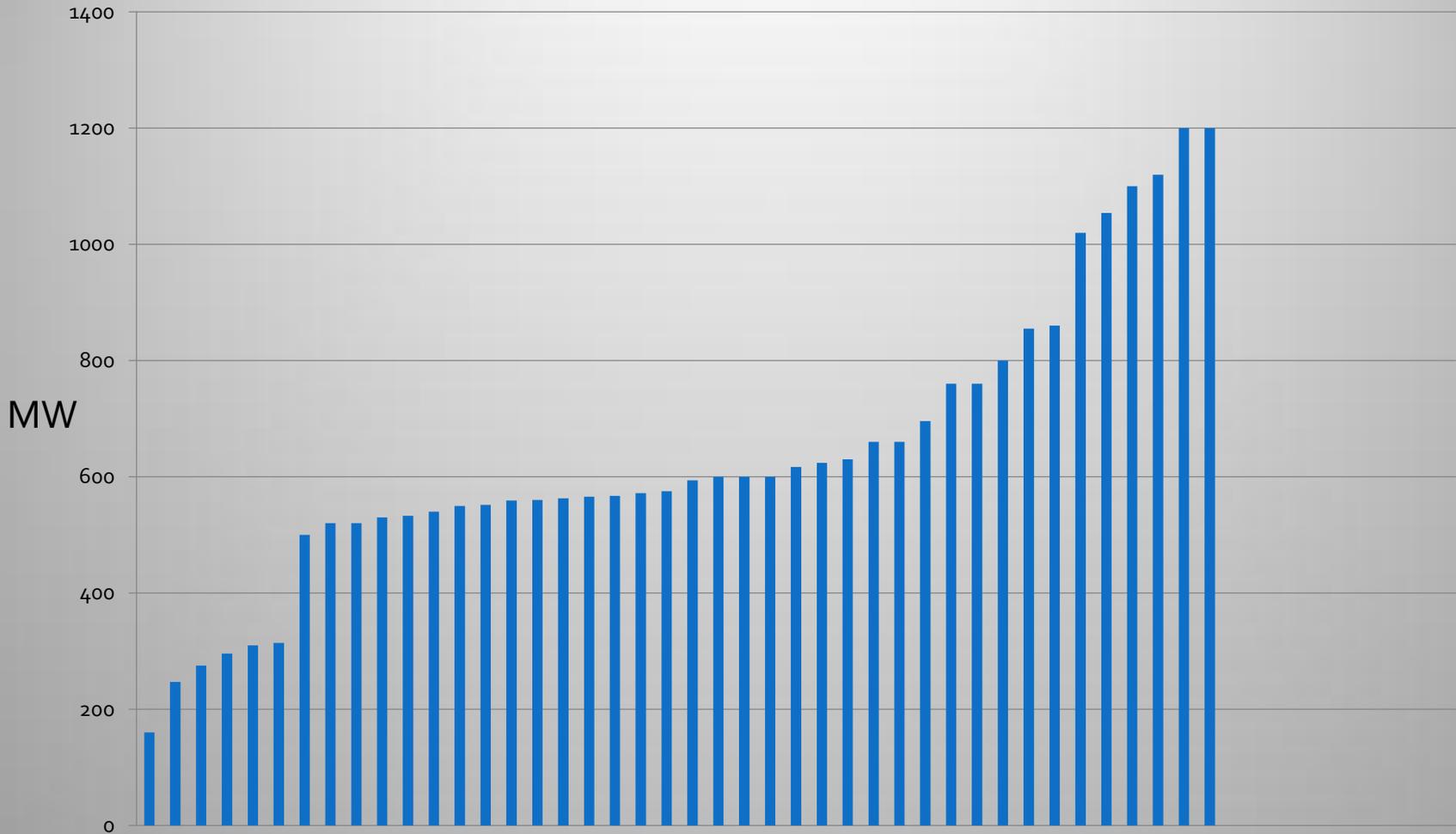
Sources of Geologic Data

- California Division of Oil and Gas and Geothermal Resources (DOGGR)
- California Geological Survey (CGS)
- United States Geological Survey (USGS)
- WESTCARB publications
- Published research
- California Energy Commission siting documents
- California Department of Water Resources

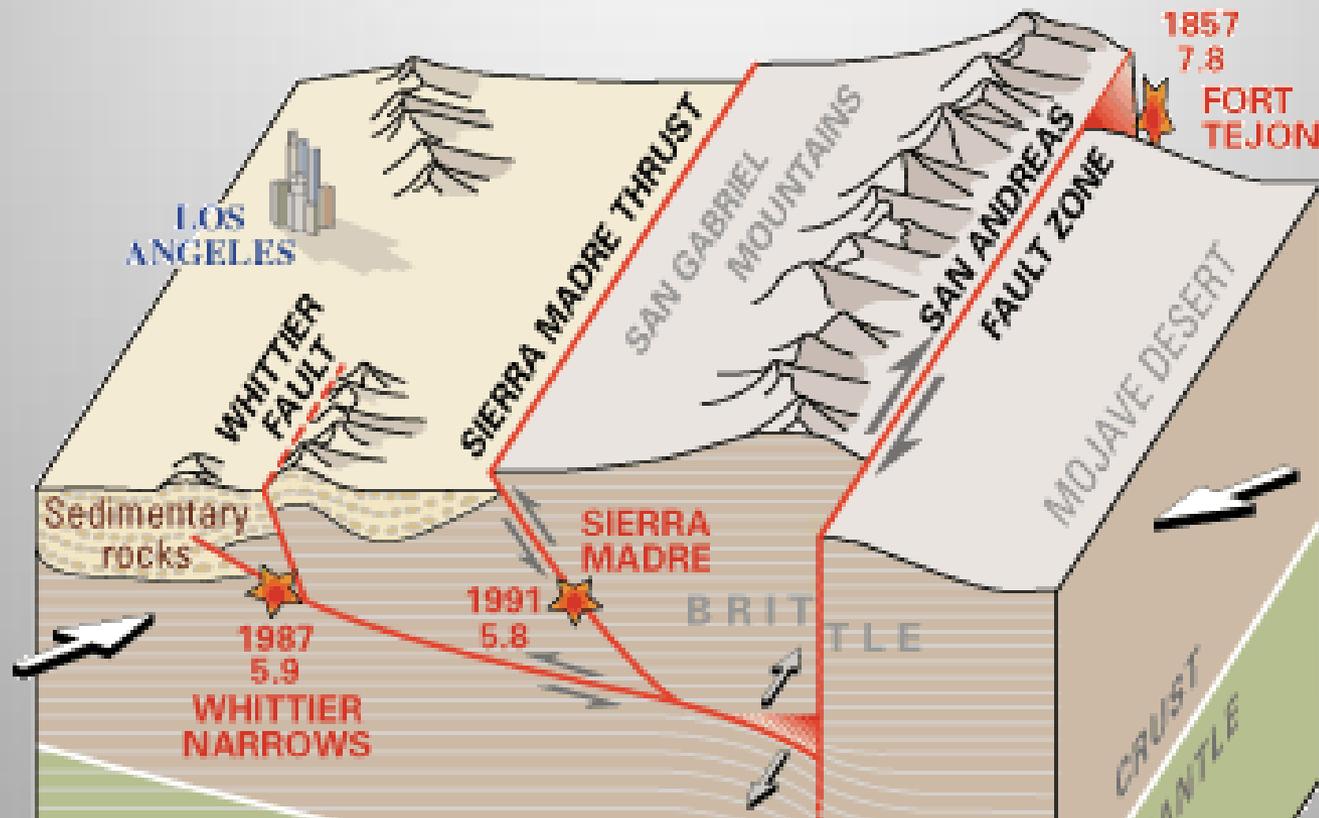
Preliminary Results: Fault Age (Timing of Most Recent Displacement)



Power Generating Capacity (megawatts)



Distance Between an Injection Site and a Fault Can Change with Depth



From http://www.education.com/reference/article/Ref_Earthquake_Related/

Names of 42 plant sites

