



DOE Regional Carbon Sequestration Partnerships Project Review Meeting

Arizona Utilities CO₂ Storage Pilot

Robert Trautz

Sr. Project Manager

Electric Power Research Institute

Pittsburgh, PA

December 13, 2007



Arizona Utilities and Collaborators



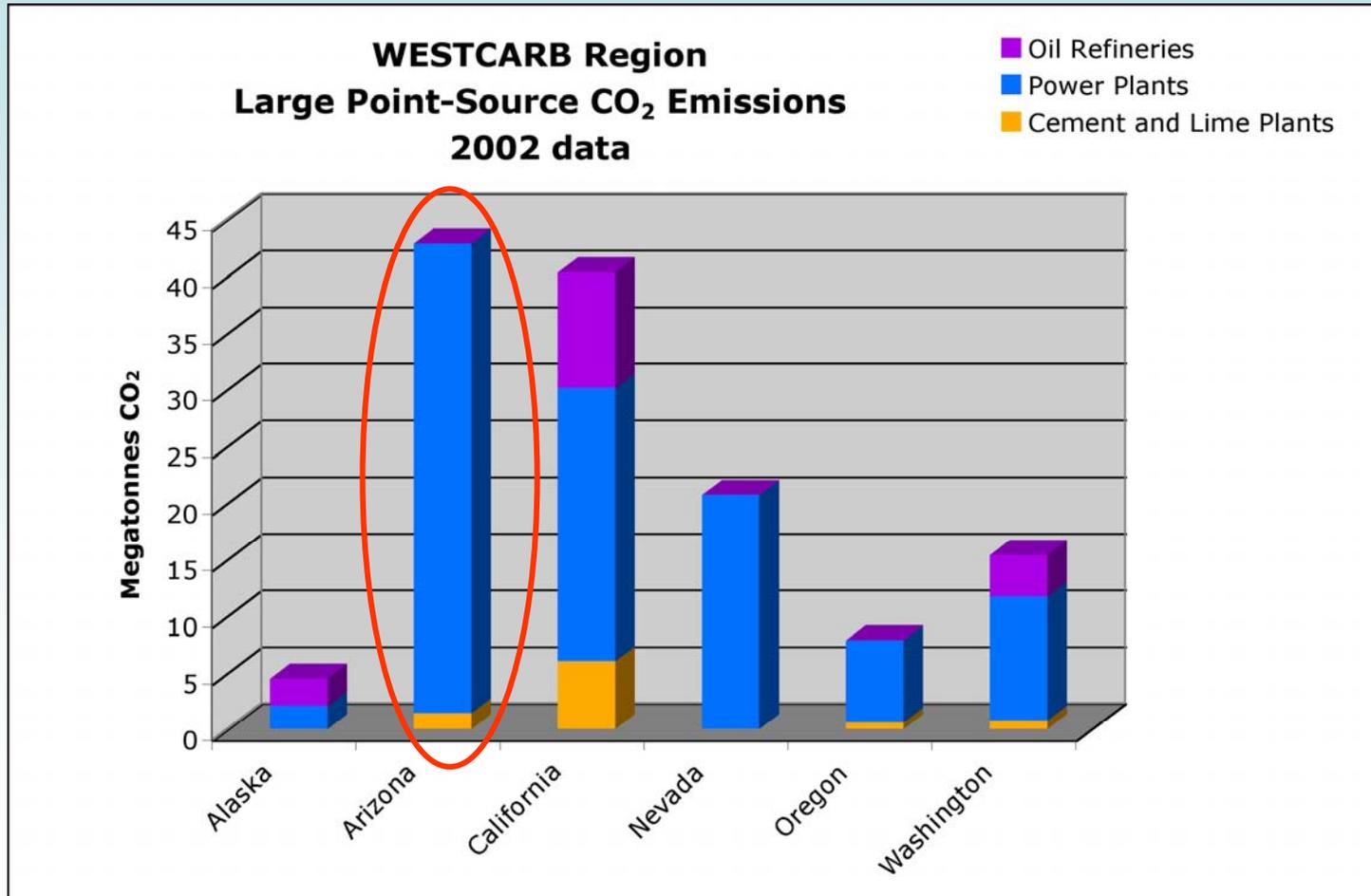
A UniSource Energy Company



- Arizona Public Service Company
- Salt River Project
- Tucson Electric Power
- Electric Power Research Institute
- Lawrence Berkeley National Laboratory
- California Energy Commission
- U.S. Department of Energy

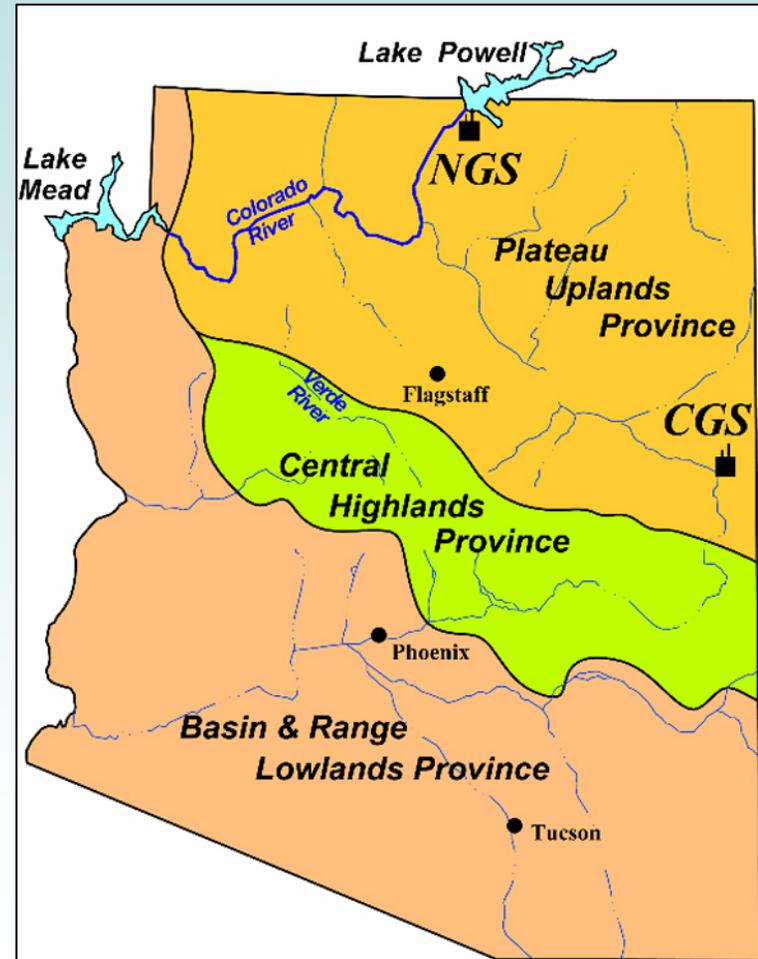


Arizona CO₂ Emissions Are Primarily From Coal-Fired Power Plants



Arizona Geologic Storage Potential

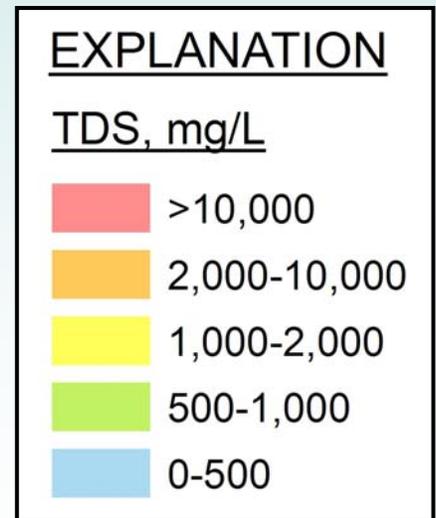
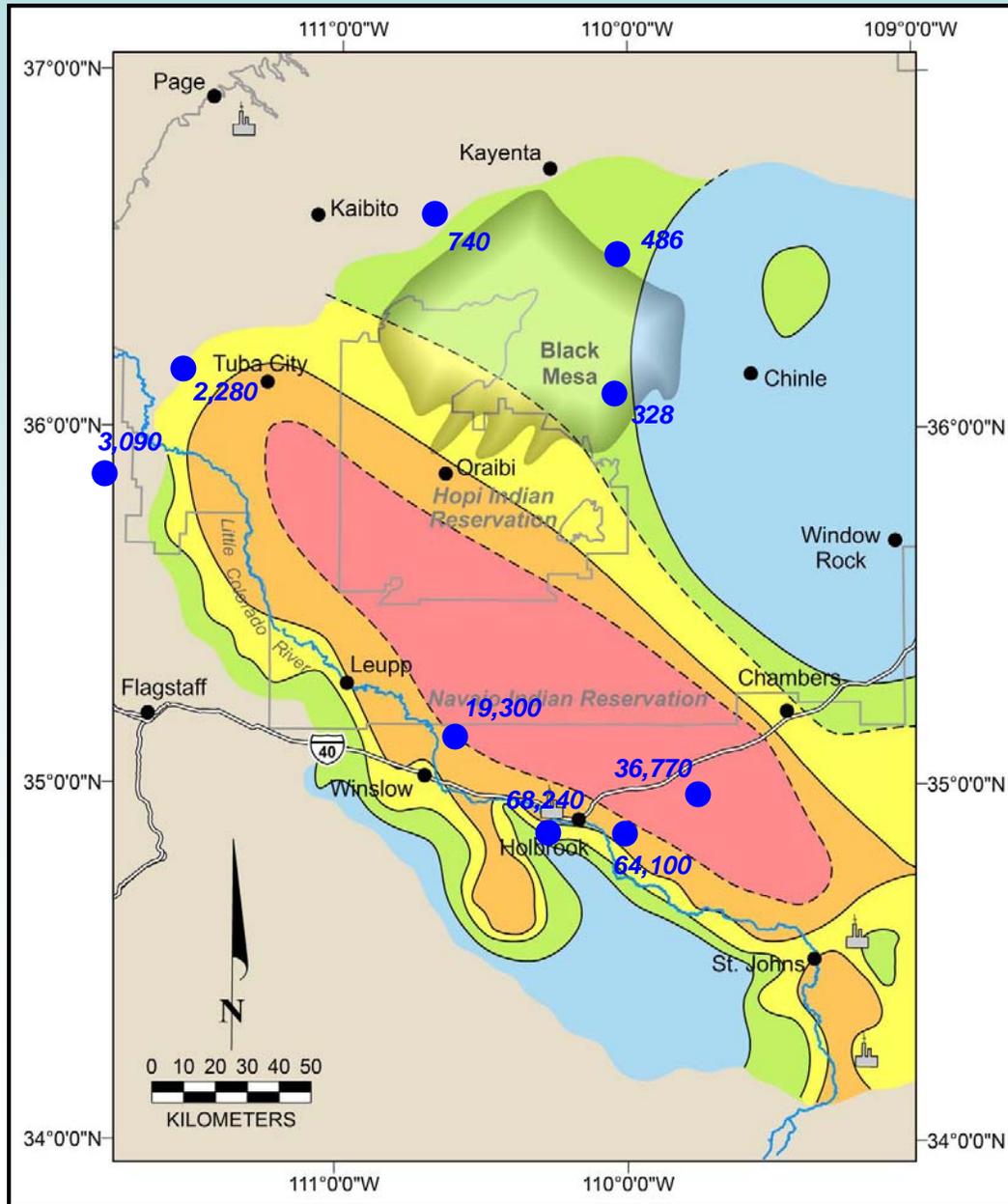
- Potentially significant capacity in Colorado Plateau Province
- Limited capacity in Basin and Range province
- Minor capacity in Central Highlands Province (Mogollon Rim)
- Capacity assessment is in progress



Colorado Plateau Target Formations

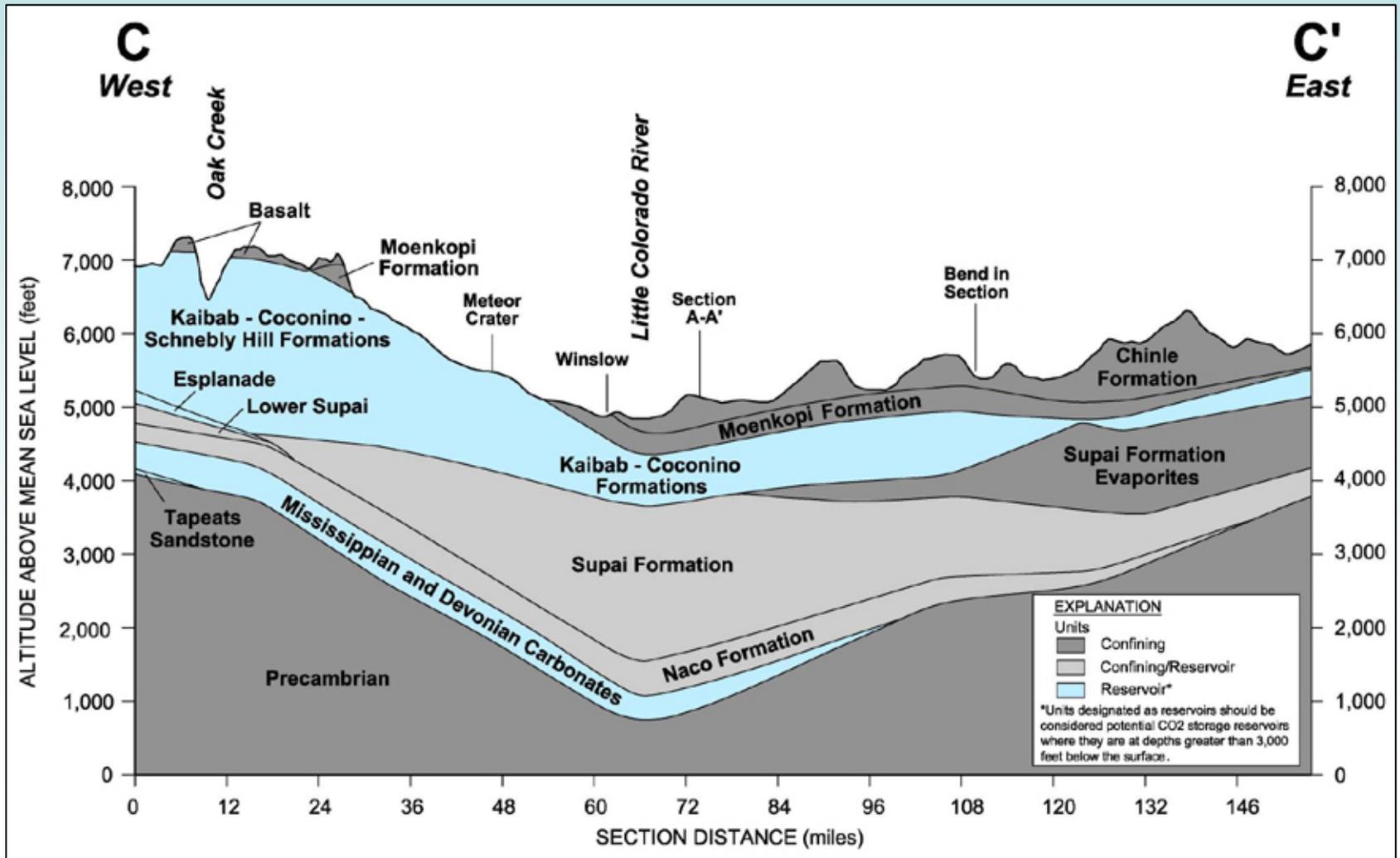
SUB-AREA	POTENTIAL RESERVOIR AND LITHOLOGY	ESTIMATED DEPTH TO TOP OF UNIT (feet bls)	THICKNESS (feet)	FORMATION PRESSURE (w.r.t. CO ₂)	INFERRED POROSITY	EXPECTED WATER QUALITY
Coronado Generating Station	Lower Supai Fm siltstone, mudstone, sandstone, evaporites	~ 2,700 (in area northwest of CGS)	800+	likely sub-critical	2 - 5% Primary	highly saline
Cholla Power Plant	Naco Fm limestone, sandstone, mudstone	3,200 - 4,100	400 - 500	sub-critical to super-critical	10 - 20% Secondary	saline
	Martin Fm dolomite and limestone, siltstone, mudstone	3,600 - 4,600	400	super-critical	10 - 20% Secondary	saline
Navajo Generating Station	Cedar Mesa Sandstone sandstone, siltstone	4,000	300	unknown	15 - 25% Primary	unknown
	Devonian/Mississippian carbonates limestone, dolomite	5,800 - 6,300	800	super-critical	10 - 20% Secondary	unknown
	Tapeats Sandstone medium to coarse sandstone	6,500 - 7,500	300	super-critical	5 - 10% Primary	likely saline
Black Mesa	Cedar Mesa Sandstone sandstone, siltstone	4,500 - 5,500	300	unknown	15 - 25% Primary	unknown
	Devonian/Mississippian carbonates limestone, dolomite	5,500 - 6,500	800	super-critical	10 - 20% Secondary	unknown
	Tapeats Sandstone medium to coarse sandstone	6,300 - 7,300	250	super-critical	5 - 10% Primary	likely saline

Challenge: Find saline groundwater



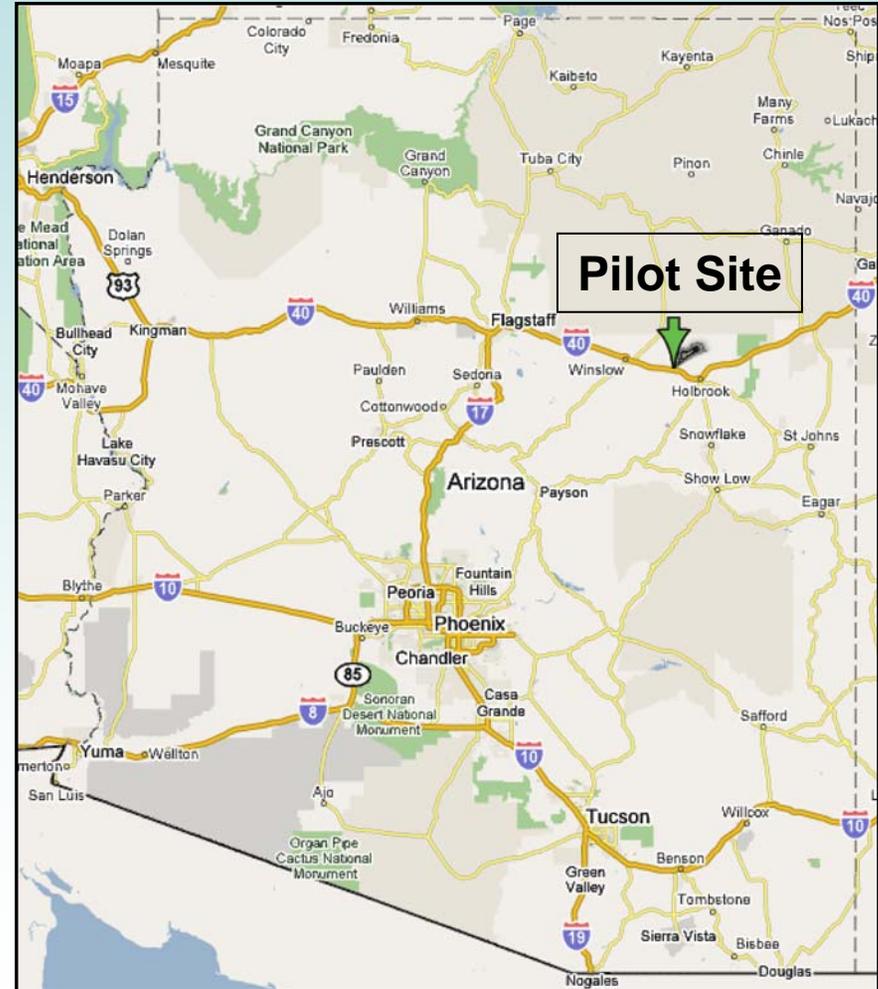
TDS in Coconino/DeChelly Sandstone

Geologic Section in Southern Colorado Plateau



Arizona Pilot-Specific Objectives

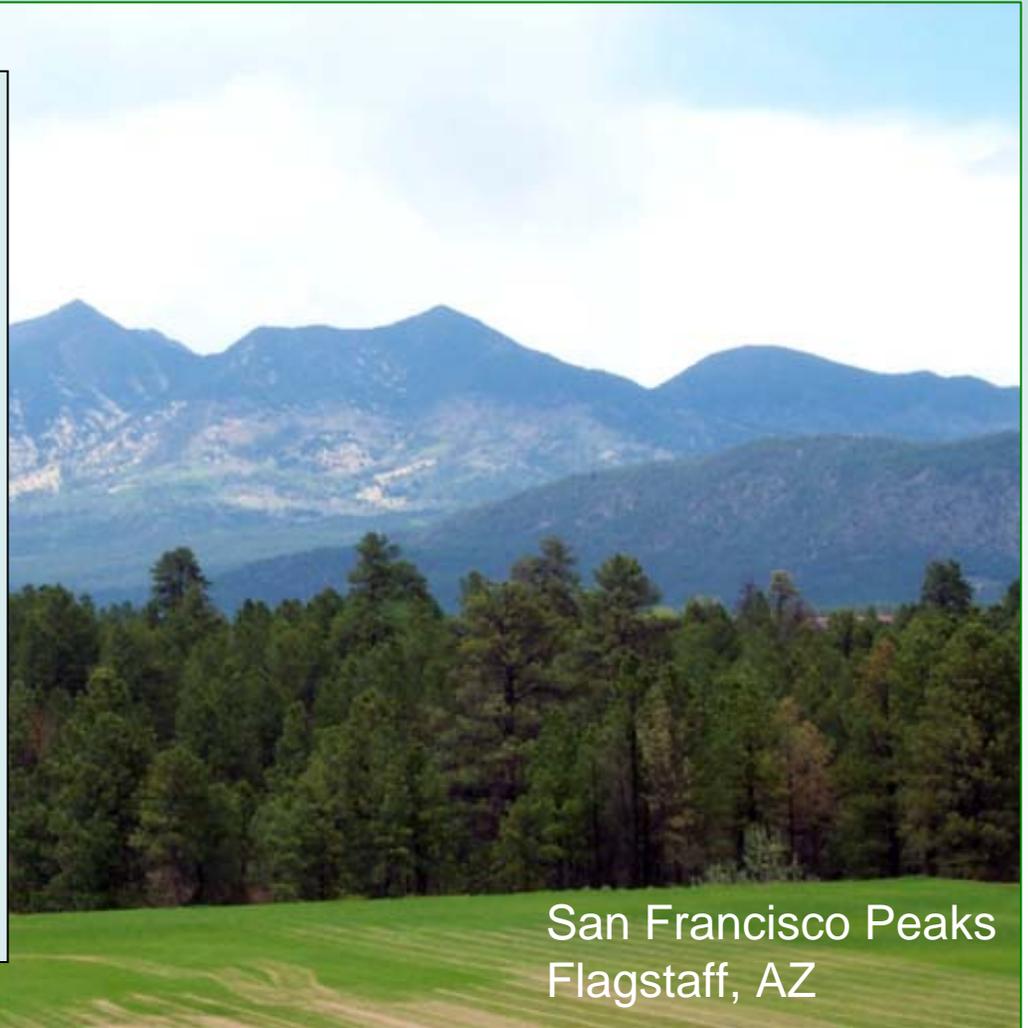
- Evaluate CO₂ sequestration opportunities in the Colorado Plateau Province
- Single deep injection well simulates commercial operation
- “Greenfield” saline formation injection



Arizona

WESTCARB Pilot Test Scientific Objectives

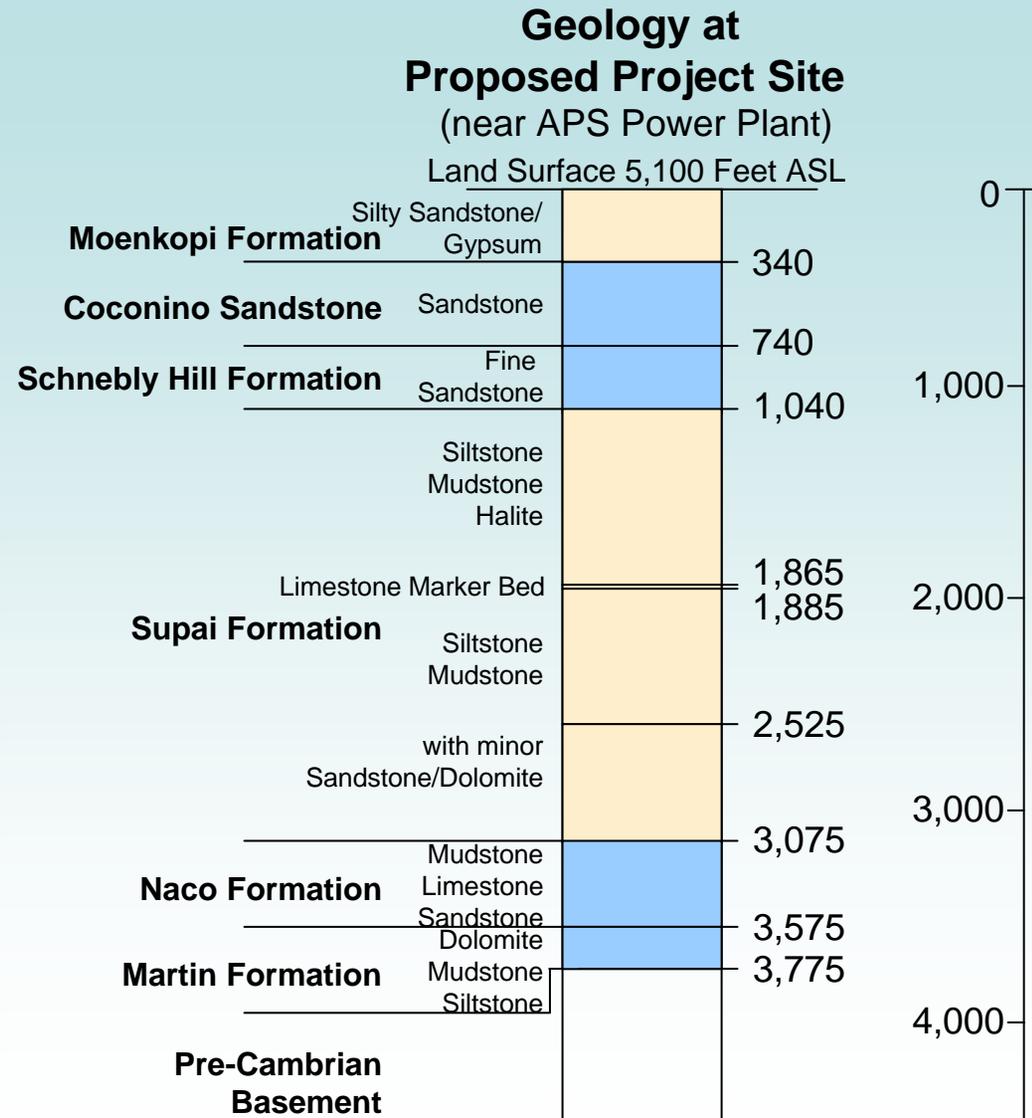
- Develop method for imaging extent of CO₂ in the subsurface
- Assess caprock integrity
- Determine injectivity and storage capacity of the reservoir
- Assess potential environmental impacts
 - Surface leakage
 - Groundwater
- Validate multiphase flow models



San Francisco Peaks
Flagstaff, AZ

Phased Approach

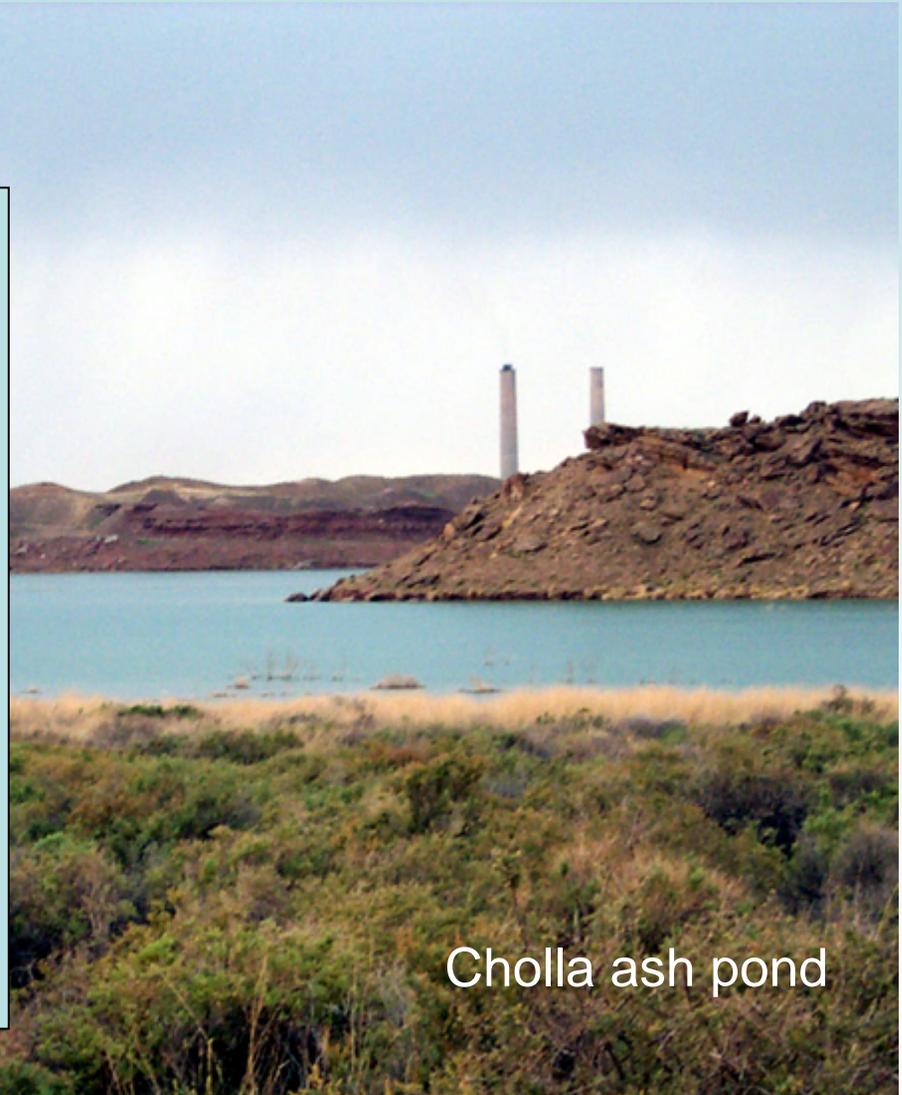
- Phase I: Select site and obtain permits
- Phase II: Drill and test exploratory well
 - Decision point
- Phase III: Injection
 - Inject up to 2000 tons of CO₂
 - Monitor CO₂ movement in the subsurface



Source: Errol L. Montgomery & Associates

What Are We Proposing to Do? (Overview)

- Obtain permits
- Drill a single well about 4000 ft deep near the ash storage pond about a mile northeast of APS's Cholla Power Plant
- Perform injectivity test using saline water
- Truck in commercial-grade CO₂ and inject 2000 tons into the well
- Monitor the CO₂ movement in the subsurface using pre- and post-injection vertical seismic profile (VSP)



Cholla ash pond

What Are We Proposing to Do? (Continued)

- Perform well logs to check for leaks
- Share our results with the community and public officials; compare our results with those from 25 similar tests across the United States and Canada
- Seal the well upon completion of the project
- Conduct outreach to educate and receive input from the public regarding climate change and geologic sequestration



What Will This Accomplish?

- CO₂ can be safely stored in porous geologic formations containing nonpotable saline water
- Develop, calibrate and validate models used by project to predict how CO₂ will move into, and interact with, saline formations typical of northeast Arizona
- Show that MMV tools can measure CO₂ injected underground and detect leaks
- Engage state and federal agencies in the CO₂ permit and certification process



Proposed Research Project Will Comply With Federal and State Requirements

- ✓ National Environmental Policy Act (NEPA)
- ✓ U.S. EPA Underground Injection Control (UIC)
- ✓ Arizona Aquifer Protection Program (APP)
- ✓ Arizona Oil & Gas Commission drilling permit



Historical/Cultural Resources

Arizona Utilities Pilot — Summary

The WESTCARB project has ...

- Selected a site for the AZ pilot test
- Added two new industry partners

is...

- Preparing NEPA and permit applications
- Reaching out to the community through public meetings
- Developing detailed budgets and schedules
- Evaluating qualifications/bids for a site test manager

...and will begin

- ... Drilling and testing in Fiscal Year 2008–2009

WEST
COAST
REGIONAL
CARBON
SEQUESTRATION
PARTNERSHIP
westcarb.org



PUBLIC MEETING

Storing Carbon Dioxide to
Fight Global Warming:
Arizona Utilities CO₂
Storage Pilot Project

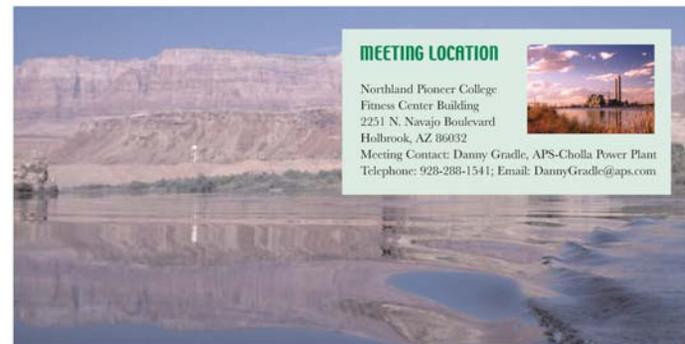
Holbrook, Arizona, August 1, 2007, 6:30–8:00 p.m.

Purpose

This informational meeting is being held to discuss plans for a research project to test “carbon sequestration,” a promising new technology that can keep carbon dioxide (CO₂) away from the atmosphere to curb global warming. Also known as CO₂ storage, carbon sequestration involves injecting CO₂ about ½ mile underground into porous geologic formations suitable for secure long-term storage. In Arizona, well-sealed, deep-lying formations such as limestone, mudstone, and sandstone are excellent candidates for CO₂ storage. The depth and high salinity of the water in these formations rule out the practicality of using it for human consumption or agriculture. The proposed

CO₂ storage test in northeast Arizona will inject a small amount of commercial-grade CO₂ into a dedicated well equipped with sensitive monitoring instrumentation. This will allow researchers to “see” the CO₂ as it is absorbed into the porous rocks. Successful subsurface geologic tests would help confirm the feasibility of ultimately storing CO₂ captured from nearby power plants, which could be required by future regulations.

Everyone is welcome to attend the meeting to learn and ask questions about our proposed project. [Please see our Q & A section on the back of this announcement.]



MEETING LOCATION

Northland Pioneer College
Fitness Center Building
2251 N. Navajo Boulevard
Holbrook, AZ 86032
Meeting Contact: Danny Gradle, APS-Cholla Power Plant
Telephone: 928-288-1541; Email: DannyGradle@aps.com

