WEST COAST REGIONAL CARBON SEQUESTRATION PARTNERSHIP
westcarb.org

Sequestration Opportunities

Regulatory and Legal Challenges

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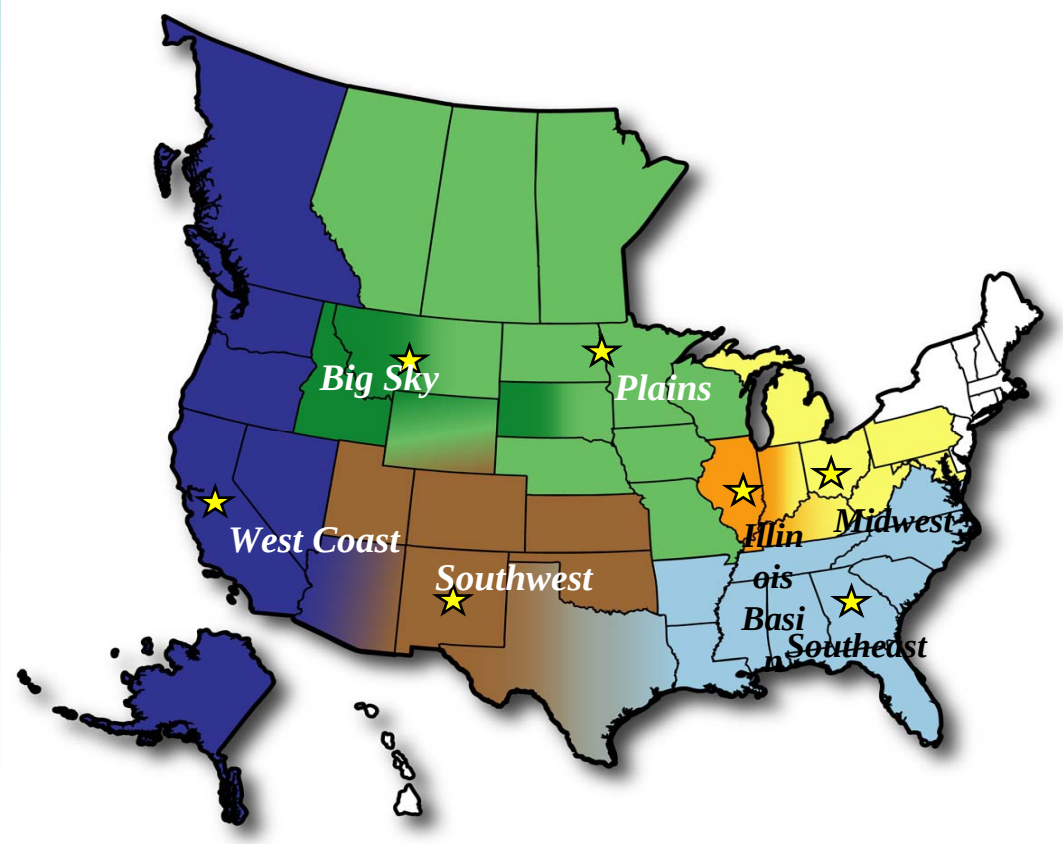
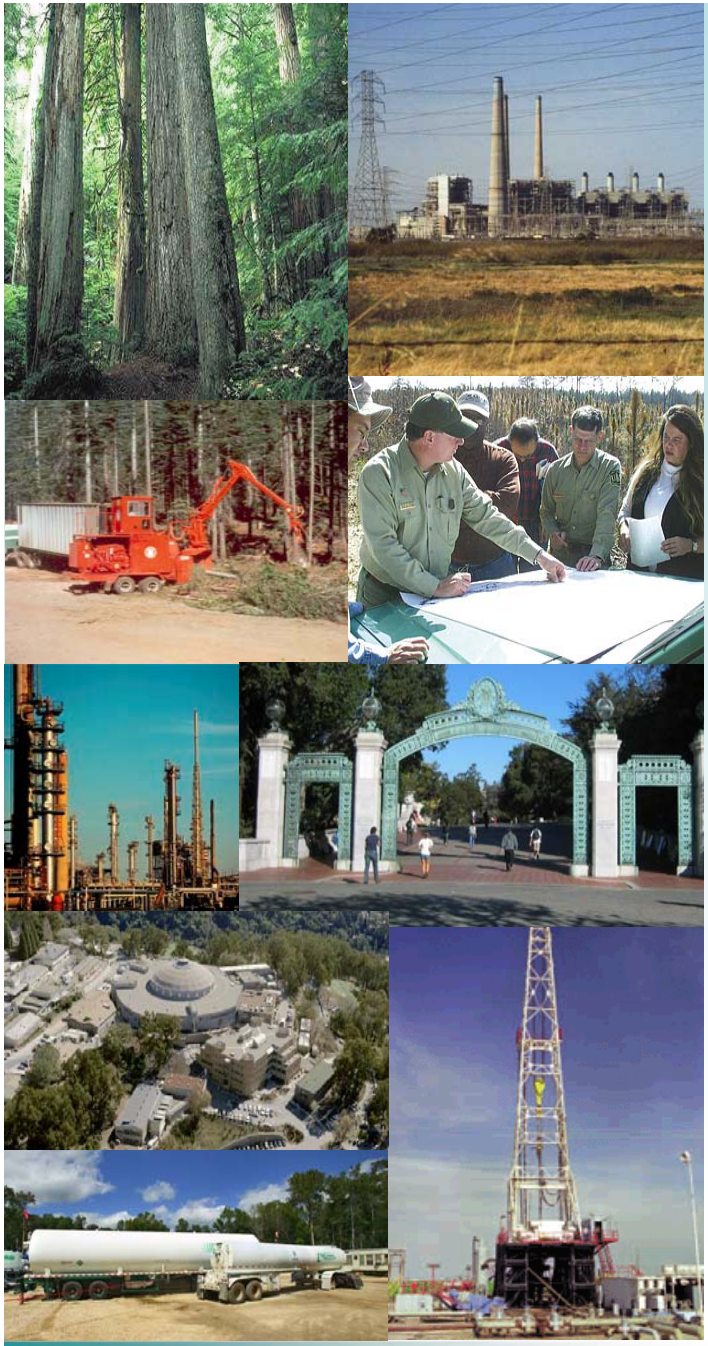
WESTCARB: West Coast Regional Carbon Sequestration Partnership

- Opportunities for terrestrial and geologic CO_2 storage are being evaluated
- Phase I (complete): focus on regional assessments
- Phase II (underway): focus on pilot studies
- Phase III (coming): pre-commercial geologic field test

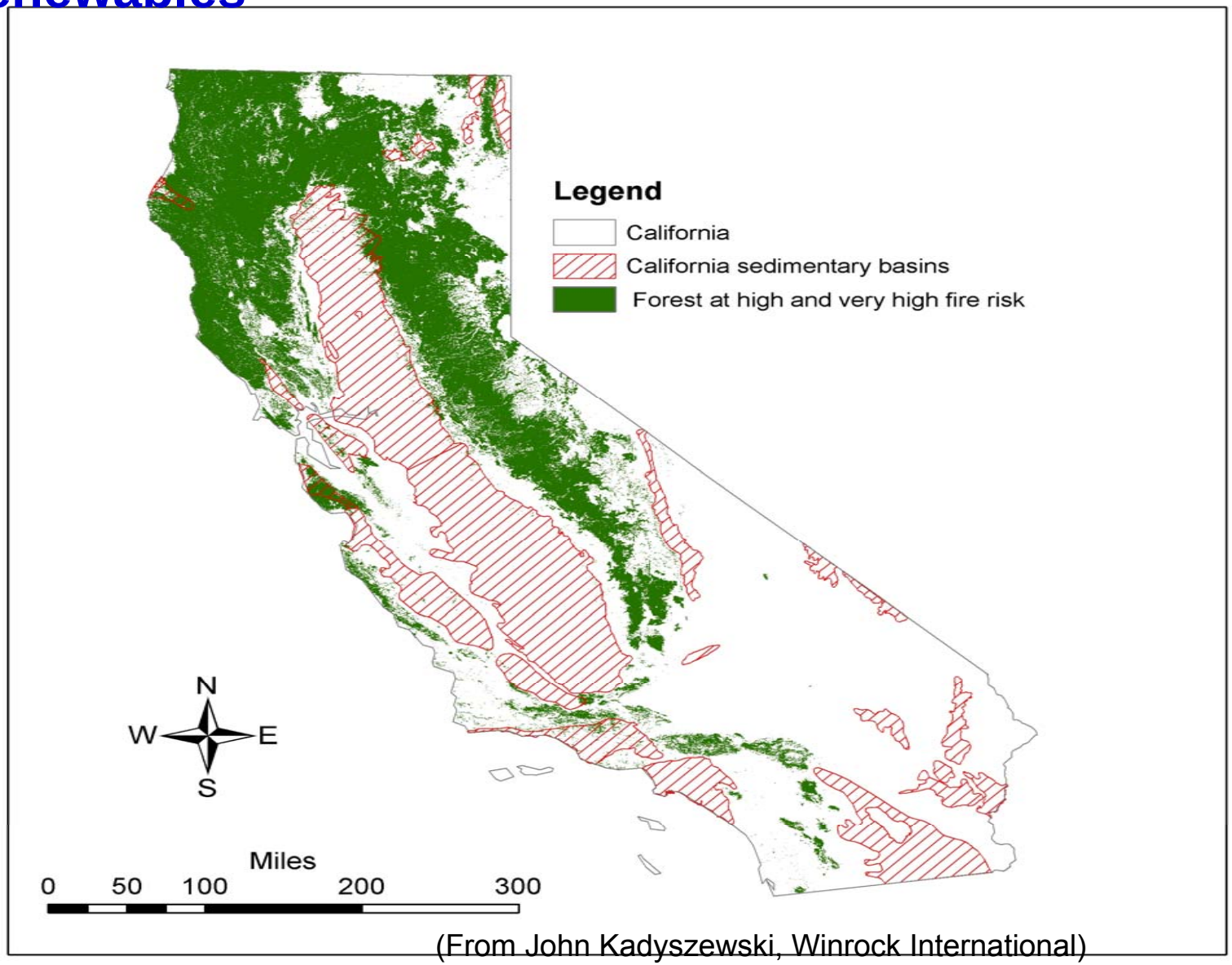




WESTCARB Features Strong and Diverse Set of Partners; Robust Cost Share

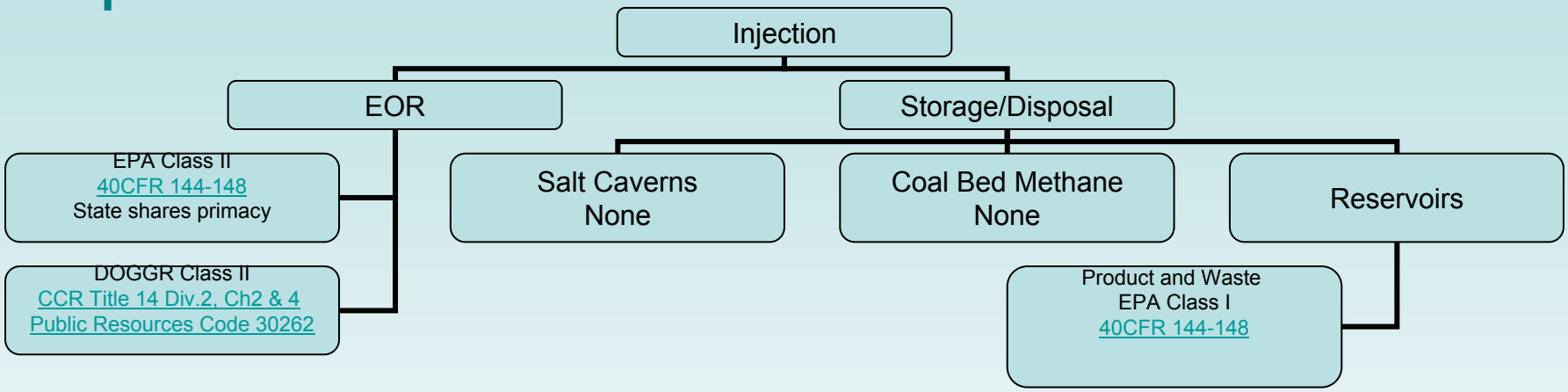
- More than 70 organizations comprising:
  - Resource management and environmental protection agencies
  - National laboratories and research institutions
  - Conservation nonprofits
  - Climate project standards organizations
  - Energy and pipeline companies
  - Colleges and universities
  - Trade associations and policy coordinating bodies
  - Consultants
- CEC/partner cost share >$11.7 million

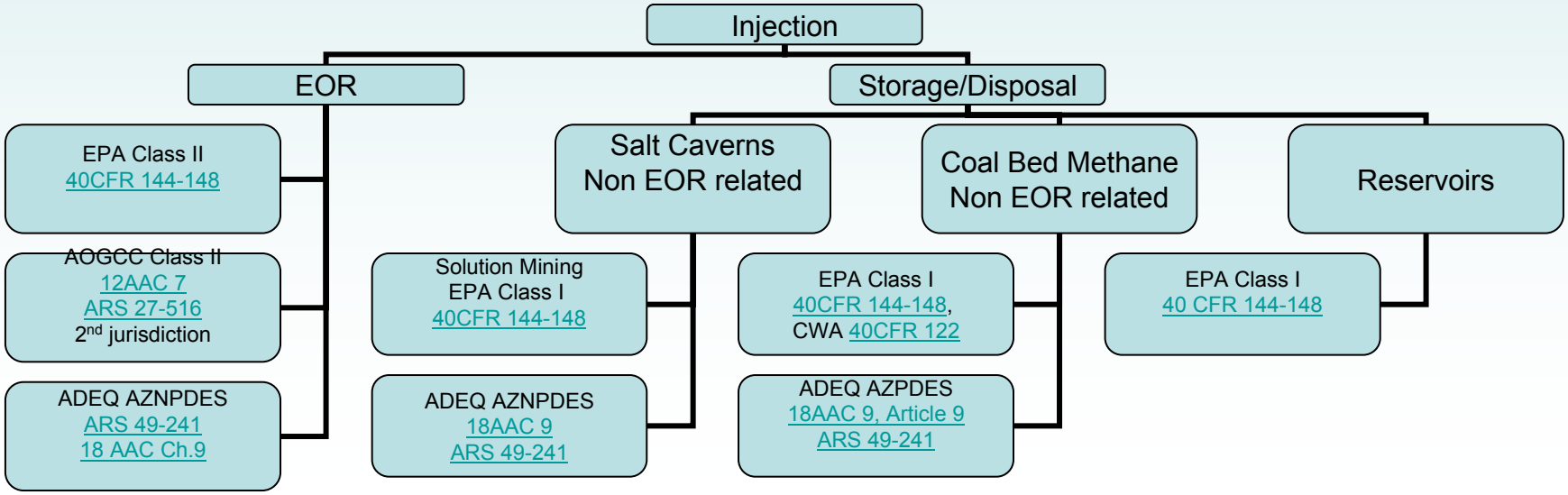
Unique West Coast Opportunities for Linking CCS and Renewables



(From John Kadyszewski, Winrock International)

Current Regulatory Framework in WESTCARB Region Was Reviewed





Outstanding Issues

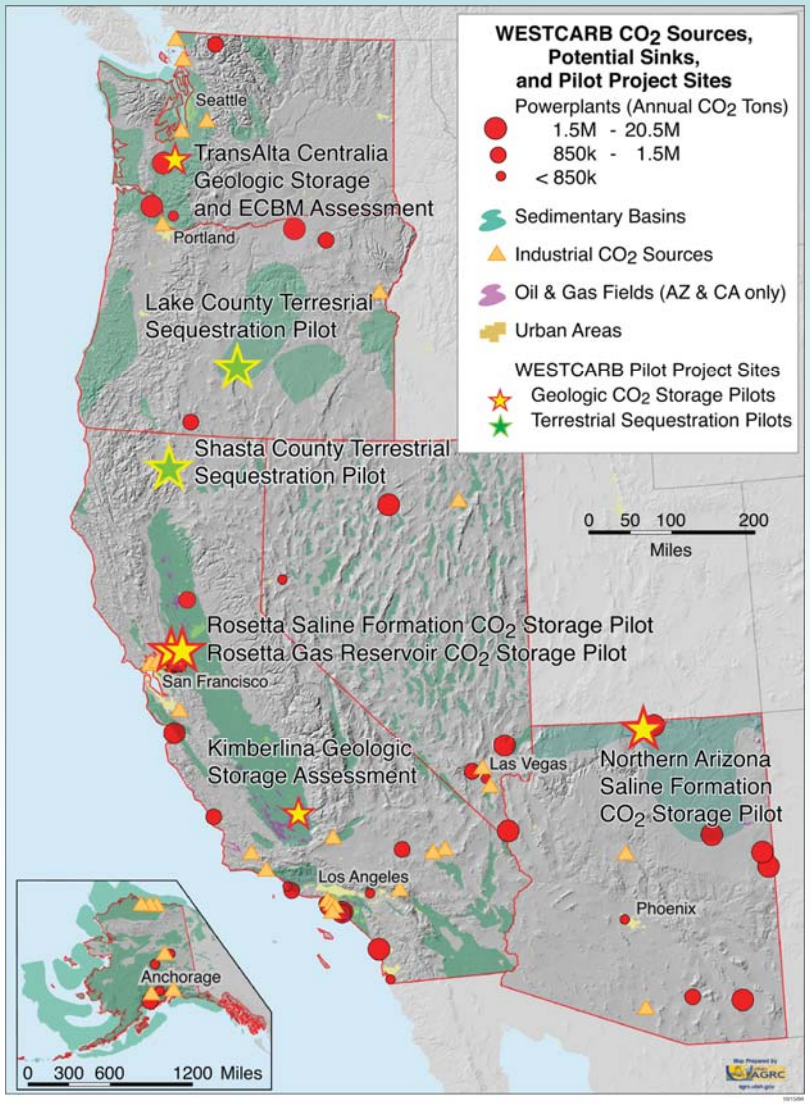
- Is CO_2 injection disposal or storage,or does it matter?
- Is CO_2 a product or a waste, or does it matter?
- Is CO_2 injected as a liquid or a gas, or does it matter?
- Is CO_2 injection into a depleted oil/gas reservoir with no EOR/EGR a Class II injection?

STATE	REGULATING AGENCY	WELL/PERMIT TYPE if Not EOR related	REGULATIONS CITED
Alaska	EPA OGCC share Class II primacy w/EPA	Class V	40CFR144-148 20AAC25; 31 AK O&G Consrv. Act Ch31.05
Arizona	EPA no primacy w/state OGCC	Class I	40CFR144-148 12AAC7; ARS 27-516
California	EPA DOGGR share Class II primacy w/ EPA	Class I	40CFR144-148 14CCR Div2, Ch2, 4; Public Resources Code 30262
Nevada	DEP DOM BLM joint interagency cooperation	Don't know, Class I prohibited	NAC445A.810 to 445A.925 NAC Ch522; NRS 455A.470 43CFR Ch2 Part3160
Oregon	DEQ DOGAMI	Class V, <100ft well only Interagency cooperation	44 OAR 340-044-0005 and Appendix A OAR Ch.632 Div. 10; ORS 520
Washington	DOE	Class V	40CFR144-148; WAC173-218

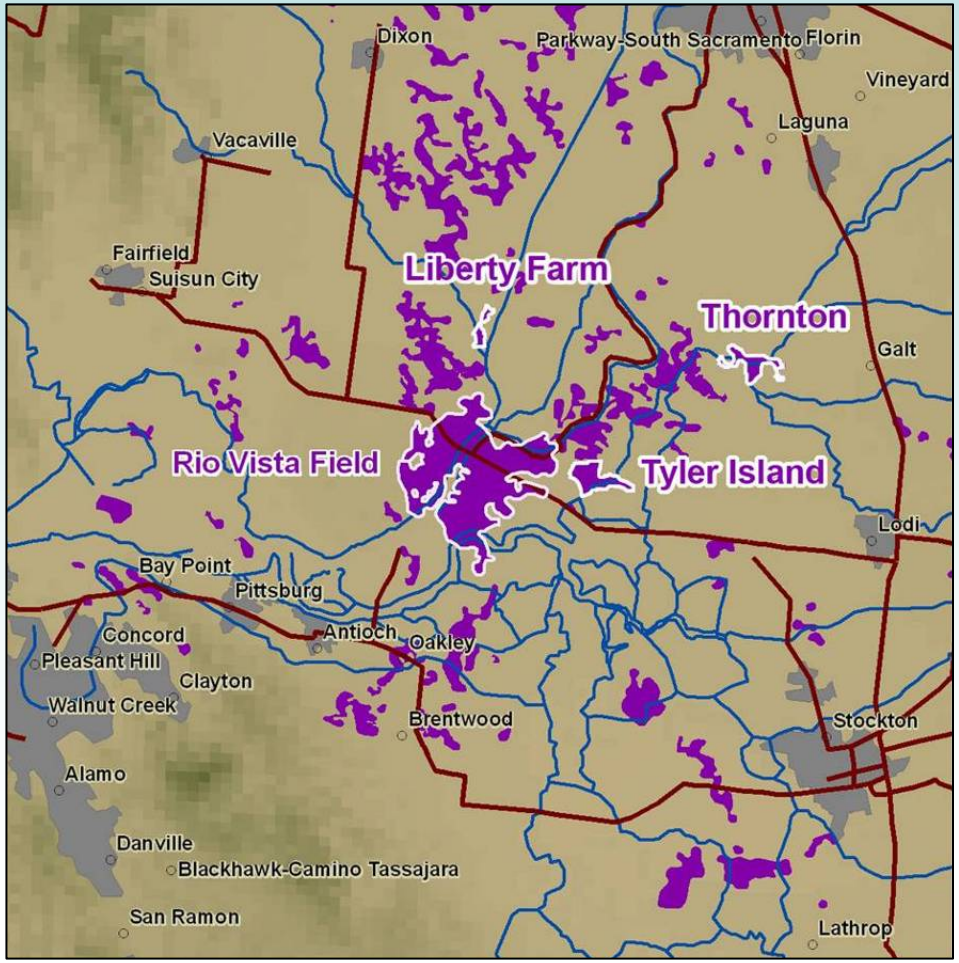
From Jean Young, Terralog, 2005

Pilots Planned in Arizona, California, Oregon, and Washington

- Pilots are representative of best sequestration options, unique technologies and approaches, in region
- Pilots involve site-specific focus for
  - Testing technologies
  - Assessing capacity
  - Defining costs
  - Assessing leakage risks
  - Gauging public acceptance
  - Testing regulatory requirements
  - Validating monitoring methods



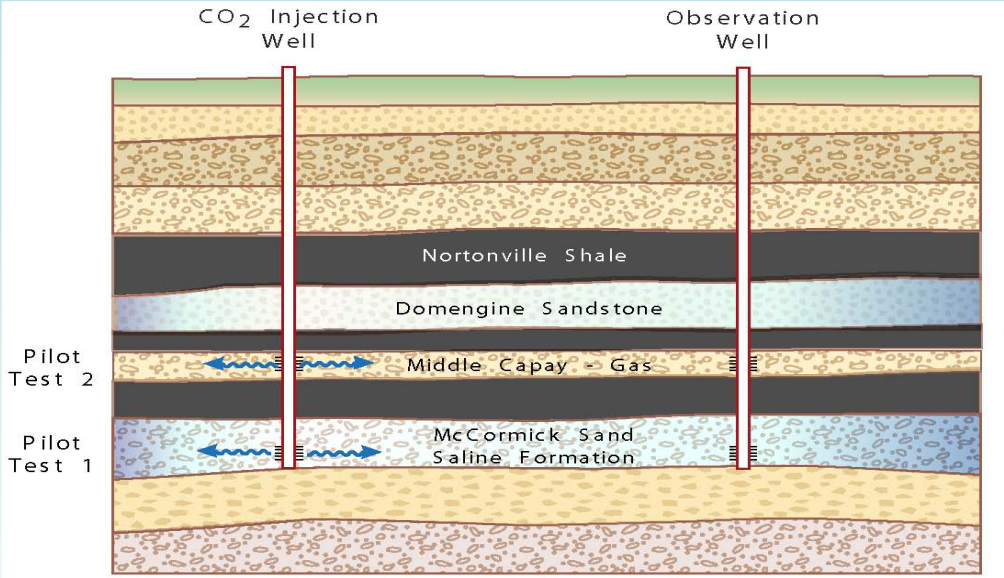
Rosetta Resources CO_2 Storage Pilot

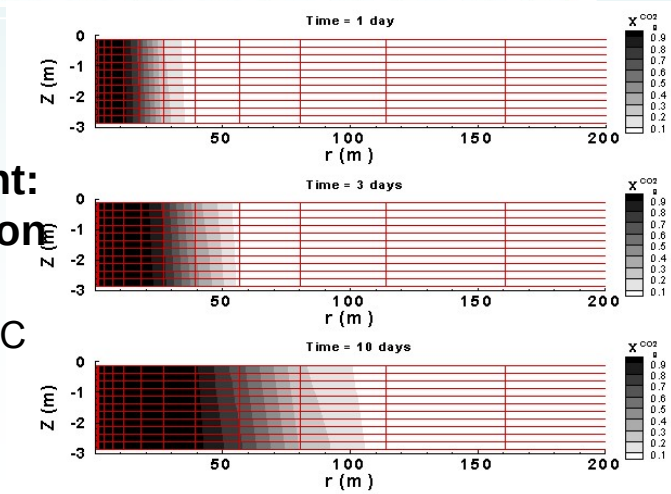


- Lead industrial partner: Rosetta Resources
- Validate sequestration potential of California Central Valley sediments
- Test CO_2 Storage Enhanced Gas Recovery
- Inject about 2000 tons at about 3400ft depth
- Focus on monitoring

Pilot Involves One Injection and One Observation Well

- Assess seal integrity, spatial extent of CO_2, storage capacity, injectivity
- Study mixing and CH_4 displacement in gas reservoir
- Measurements include downhole P and T, fluid sampling, wireline logging, vertical seismic profiling and crosswell seismic, and shallow groundwater and surface CO_2 sensors





Above: schematic cross-section; right: computer simulation of CO_2 in gas reservoir (R Trautz, C Oldenburg, LBNL)

Permitting the Thornton CO_2 Injection Well

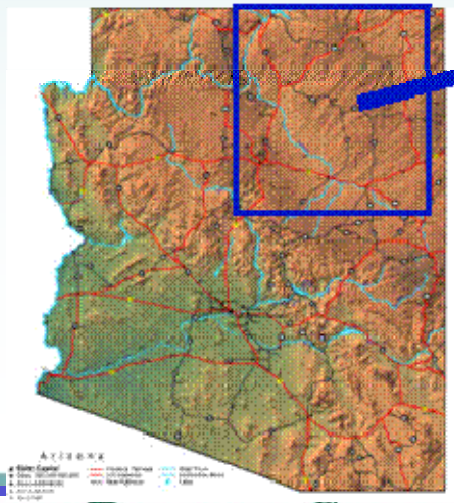
- California Department of Oil, Gas, and Geothermal Resources (DOGGR) will issue permit to drill since well might produce gas
- For injection of 2000 tons into the depleted gas reservoir, DOGGR may not require a permit – since considered an "injectivity test"
- US EPA Region 9 has authority to permit CO_2 injection into the saline formation since the injection point is below the original gas/water contact in the field
  - Injection of 2000 tons requires a Class V injection permit

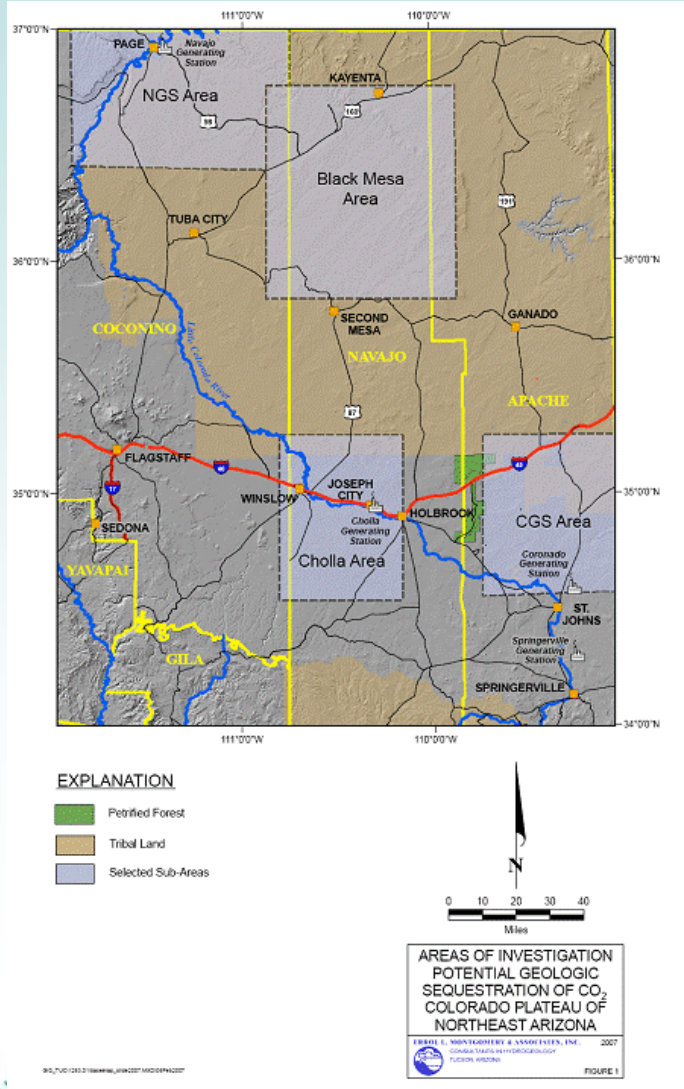
Thornton Legal Issues

- Rosetta Resources will own the wells
- Rosetta has a lease on the mineral rights, but lease does not cover CO_2 injection, so separate agreement needed with mineral rights owner
- Rosetta has legal right to enter property to drill for gas/oil, but not to inject CO_2, so separate access agreement required
- We are asking Rosetta to accept long term liability

Northern Arizona Saline Formation CO_2 Storage Pilot

- Lead industrial partner: Salt River Project
- Establish sequestration potential of Colorado Plateau
- Regional studies form basis for selection of pilot location





Northern Arizona Permitting

- US EPA Region 9 will have permitting authority for injection well
- Class V injection permit will be sought for injection of about 2000 tons into a saline formation
- Arizona Department of Environmental Quality (ADEQ) in early stages of evaluating CO_2 injection

WESTCARB Results Inform Current California Policy Decisions

- AB 1925 requires Energy Commission to prepare a report to Legislature on "recommendations for how the state can develop parameters to accelerate the adoption of cost-effective geologic sequestration strategies for the long-term management of industrial carbon dioxide"
- AB 705 would establish regulations for CCS, utilizing AB 1925 report as part of basis – tabled
- AB 114 would provide for greater research into capture technologies
- AB 32
  - Requires statewide GHG emissions be reduced to 1990 levels by 2020 (target specified in Executive Order S-3-05
  - Authorizes market-based compliance mechanisms
- Senate Bill 1368: Specifies GHG performance for power sources included in long-term baseload procurement contracts issued by California electric "load-serving entities" (IOU, municipal, other)

Kansas State Legislature

- **House Bill 2419, Signed by Governor March 28, 2007**
  - "Carbon Dioxide Reduction Act"
    - Requires Kansas Corporation Commission (KCC) to establish CO_2 injection rules and regulations by July 1, 2008
    - Exempts CCS property and any electric generation unit utilizing CCS from all property taxes for 5 years following completion of construction or installation of the property
    - Allows for accelerated depreciation of CCS equipment

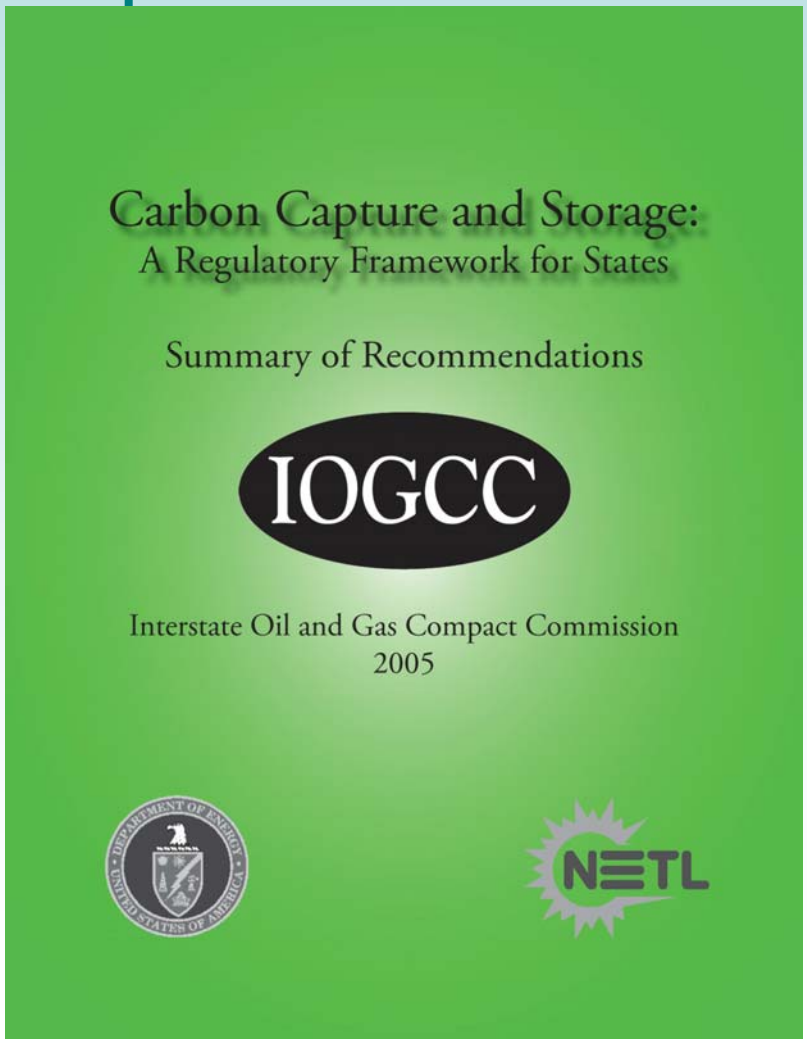
Montana State Legislature

- **Senate Bill 828 (Olson), Introduced March 19, 2007**
  - Would require the Energy & Telecommunications Interim Committee to appoint a subcommittee to conduct a carbon sequestration study that would:
    - review existing federal/state regulations, inventory Montana's CO_2 sources
    - Examine geologic and terrestrial sequestration methods/technologies
    - Perform a cost/benefit analysis
  - Report due to Legislature by September 15, 2008
- **Senate Bill 218 (Lind *et al*.), Introduced January 9, 2007**
  - Would authorize the Board of Environmental Review to adopt rules establishing a CO_2 sequestration program and permit system, to be administered by the Dept. of Environmental Quality (DEQ)
  - Excludes EOR/EGR wells, but allows for their conversion to use for sequestration; requires the Board to coordinate with the Board of Oil and Gas Conservation

New Mexico State Legislature

- **Senate Bill 994 (Cisneros), Signed by Governor Apr. 3, 2007**
  - "Advanced Energy Tax Credit": ≤6% (up to $60M/facility) of eligible expenses for development and construction of qualified generating facilities
  - Would allow public utilities to recover costs for development and construction of qualified generating facilities and costs incurred in reducing "harmful air emissions"
  - Qualified generating facilities include:
    - New or re-powered coal-based electric generating facilities that capture and sequester (including for use in EOR/EGR) or control CO_2
      - CO_2 emissions must be ≤1,100 lb./MWh (same limit was recently set by California regulators)
- **House Bill 430 (Salazar), Introduced 2007**
  - "Advanced Energy Product Manufacturers Tax Credit": ≤5% of qualified expenditures for IGCC facilities components and associated carbon sequestration equipment

Interstate Oil and Gas Compact Commission



- Notable recommendations
  - "Involve all stakeholders, including the public, in the rule-making process at the earliest possible time."
  - "Require clarity and transparency in all statute and regulation development."
  - **Capture:** do not define CO_2 as a pollutant
  - **Transportation:** utilize regulatory structures from existing federal and state rules/regulations regarding CO_2 pipeline construction, operation, maintenance, emergency responses and reporting

Interstate Oil and Gas Compact Commission Recommendations (contin.)

- **Injection**
  - Utilize existing regulatory (e.g., natural gas, UIC) frameworks as a successful analogue for CCS; modify appropriately
  - Should EPA regulate CCS under its UIC program, EPA should either create a Class II subclass for CCS or a new classification
- **Post-Injection Storage**
  - Consider legislation to address pore-space ownership
  - Allow for removal of CO_2 for commercial purposes in the regulatory framework
  - Develop solutions to protect against orphaned sites, or utilize model of state administration of federally guaranteed, industry-funded abandonment programs
  - Establish technical standards for well abandonment, site closure, and long-term monitoring

Interstate Oil and Gas Compact Commission Model CCS Regulations - *in draft*

- Regulations are being drafted by the IOGCC Task Force on Carbon Capture & Geologic Storage
  - Includes state oil and gas regulators, attorneys, and representatives from industry and the Regional Carbon Sequestration Partnerships
  - Same group that drafted the 2005 report
- Written for states to use as the model for their own regulations
- Uses existing natural gas and UIC regulations as a starting point
- State oil and gas regulatory agencies are recommended as the permitting agencies
- Expected release of final version: IOGCC Annual Meeting, Fall 2007

Interstate Oil and Gas Compact Commission Model CCS Regulations - *in draft*

- Key elements:
  - CO_2 Storage Project (sub/surface facilities and subsurface reservoir) Permit requirements, *e.g.,*
    - Regional geology and reservoir- and seal-specific information
    - Area of review
    - MMV, USDW, and human health & environmental safety plans
    - Well casing, cementing, and closure program
    - Bonding
  - Public Hearings, including addressing ownership issues
  - CO_2 Storage Project Well Permits and Operational Standards
  - Reporting Requirements
  - CO_2 Storage Project Closure
  - Guidance on Post-Closure Period