Economics of CO_2 Capture and Sequestration (CCS)

Work Group Meeting on AB1925

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Sacramento, CA

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Overall Chapter Outline

- Overview and Strategy
- Capture Economics
- Transport and Storage Economics
- California Economics
- External Risks

Disclaimer: The data in this presentation are very preliminary and will be updated/revised for the final report.

Mitigation Costs Overview

- For a coal-fired power plant, cost is \$30/tonne CO_2 avoided (ref: MIT Coal Study, see mit.edu/coal). This cost assumes:
  - New plant optimized for capture compared to a new plant without capture
  - 2005\$
  - Today's technology (i.e., no technological breakthroughs required)
  - n^{th} plant
  - Regulatory issues resolved without imposing significant new burdens
  - Operations at scale
- For a gas-fired power plant, cost is 50-100% greater (ref: IPCC Special Report), i.e., \$45-60/tonne CO_2 avoided

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Mitigation Costs Today in CA

- Additional considerations
  - First-of-a-kind
  - Significant inflation in last 2 years in power plant costs
  - CA conditions (permitting, labor costs, etc.)
  - Retrofits
- Bottom line – cost of CCS today in CA could be double the costs on the previous slide

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CO_2 Sources in California

	# of Facilities	Capacity	2004 CO_2 Emissions (Mt/yr)
Gas Power	221	39,000 MW	58
Oil Power	3	32 MW	0
Coal Power	8	440 MW	3
Cement	11	15 Mt/yr	12*
Ethanol	4	68×10^6 gal/yr	0.4*
Gas Processing	31	1×10^9 CFD	?
Refineries	15	2×10^6 bbl/d	18*
Total	**293**	**-**	**~90**

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Four Critical Issues for Economics

- Proximity of Sources to Sinks
- Economies of Scale
- Boundary Issues - Regional vs. In-state
- Existing vs. New Sources

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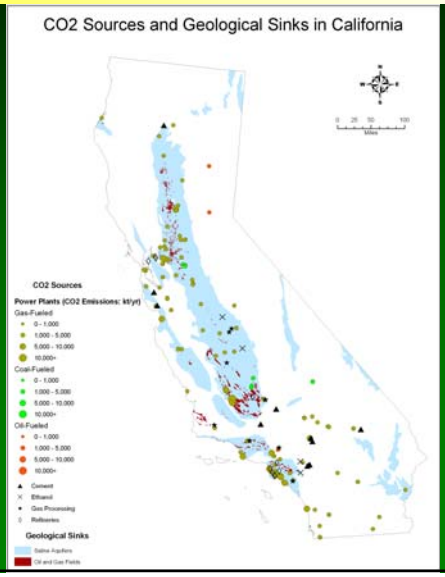
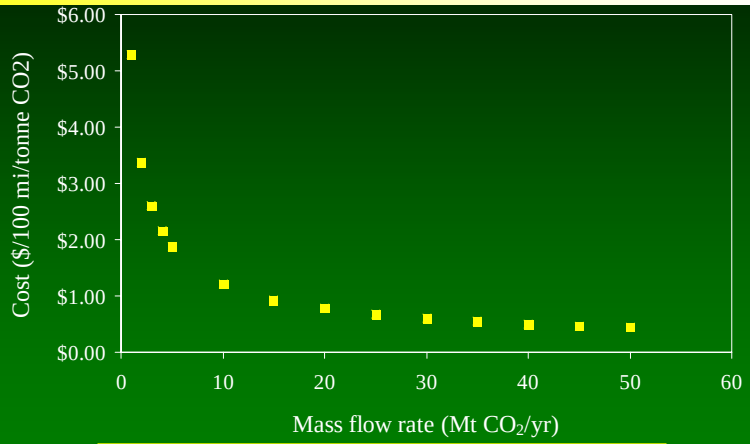
Proximity of Sources to Sinks



Economies of Scale Example
Cost of CO_2 Pipeline Transport



Economies of scale reached at 10 Mt CO_2/yr
(1500 MW_e of coal-fired power)

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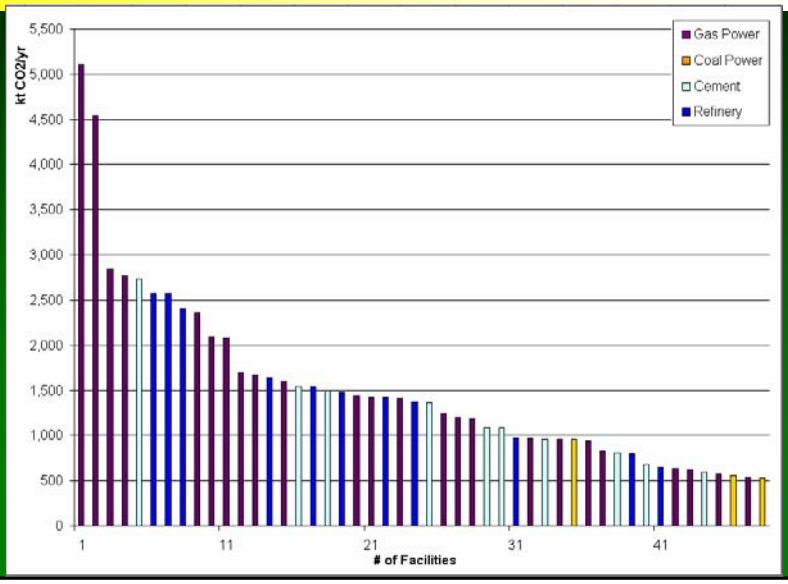
CA Facilities Emitting over 500 kt CO_2/yr



Boundary Issues

- With the possible exception of a few, relatively small industrial facilities, coal-fired power plants are most cost-effective target for CCS
- CA essentially lacks these targets, but they exist in neighboring states who export electricity to CA
- Issue – Apply CCS strictly in-state vs. a regional approach
- Analogous situation - Norway

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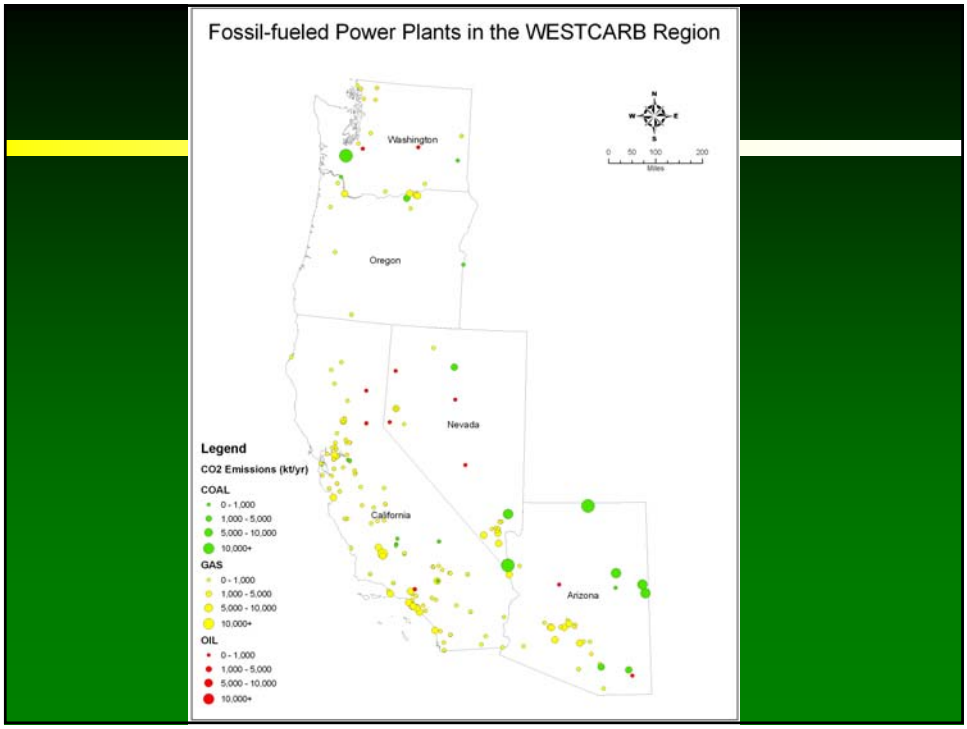

Existing vs. New Sources

- In general, applying CCS to a new source has advantages over retrofits
  - Lower costs
    - » Optimized designs
    - » Higher efficiencies
    - » Fewer constraints
  - Siting flexibility
  - Adding capacity vs. subtracting capacity

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External Risks

- Financing

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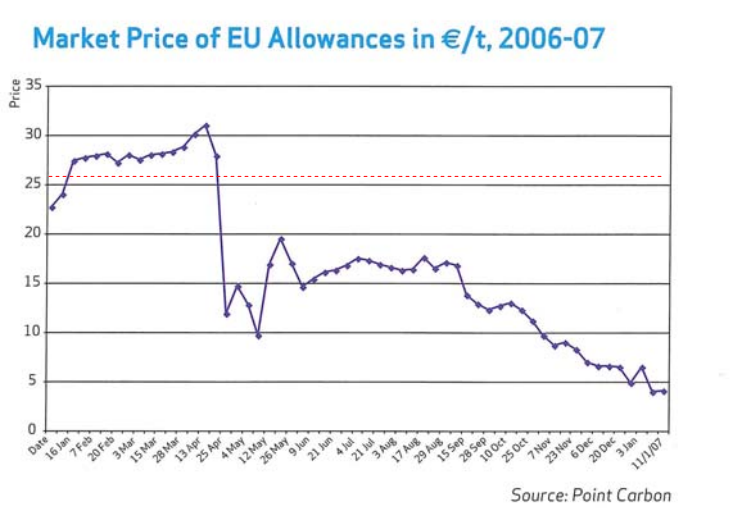
Carbon Prices – EU Trading System



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External Risks

- Financing
- Regulatory
- Public Acceptance
- Liability

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