WEST COAST REGIONAL CARBON SEQUESTRATION PARTNERSHIP
westcarb.org

WESTCARB Annual Business Meeting

AB 1925: Accelerating Geologic CO_2 Sequestration in California

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Main Points

- **With little in-state coal use and ambitious GHG reduction goals, California's approach to CCS will be different than that of most other states**
- **Assembly Bill 1925 requires reports to policy makers on key parameters to accelerate CCS adoption**
- **Process to develop policies, regulations and statutes for accelerating CCS adoption will be rely heavily on early demonstration projects, involve multiple agencies, and will need to be regional**

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California's Policy Strategy to Address GHG Emissions Reductions

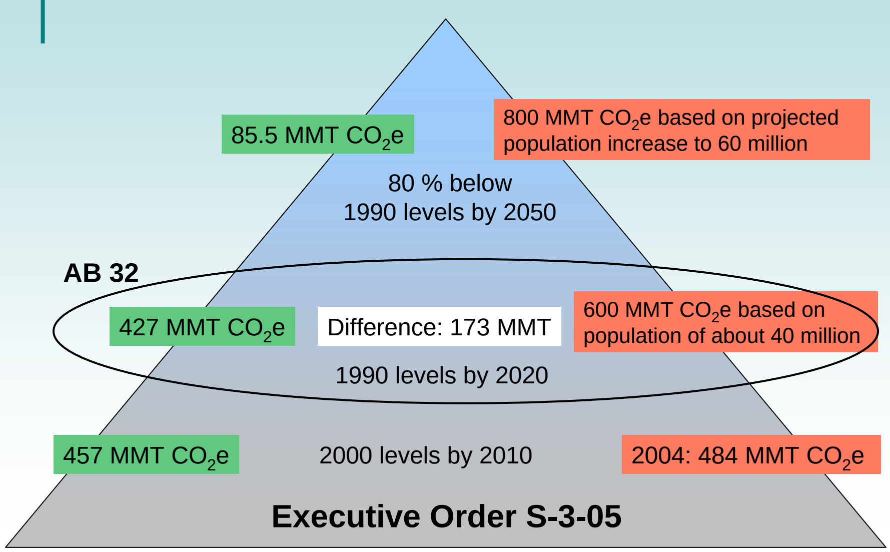
Executive Order S-3-05 established three target reduction levels for GHG emissions in California:

- 2000 levels by 2010
- 1990 levels by 2020
- 80% below 1990 levels by 2050

AB 32 requires the Air Board to adopt regulations to report and verify greenhouse gas emissions and to adopt limits at 1990 levels to be achieved by 2020

SB 1368 sets an emission standard (1100 lbs CO_2/MWh) and prohibits long-term power purchase agreements for baseload power with emissions greater than that standard

California's GHG Reduction Goals



Numbers from CARB, Staff Report: California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit. November 16, 2007

Energy Sources, Sector Energy Use, and Emissions for California

Figure ES-5:
California Energy Sources - 2006

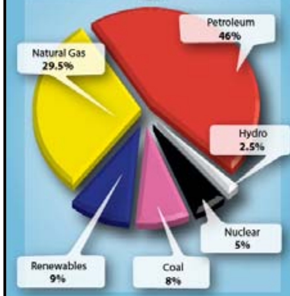


Figure 1-5:
Energy Use by Sector - 2006

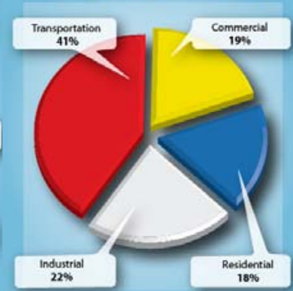
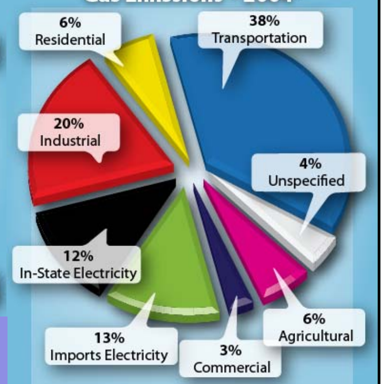


Figure 1-3: California Greenhouse Gas Emissions – 2004*



* Numbers may not add to 100% due to rounding.

Geologic storage is a potential application for 45% of California's emissions

Meeting 2020 and 2050 Goals by Sector Proportion

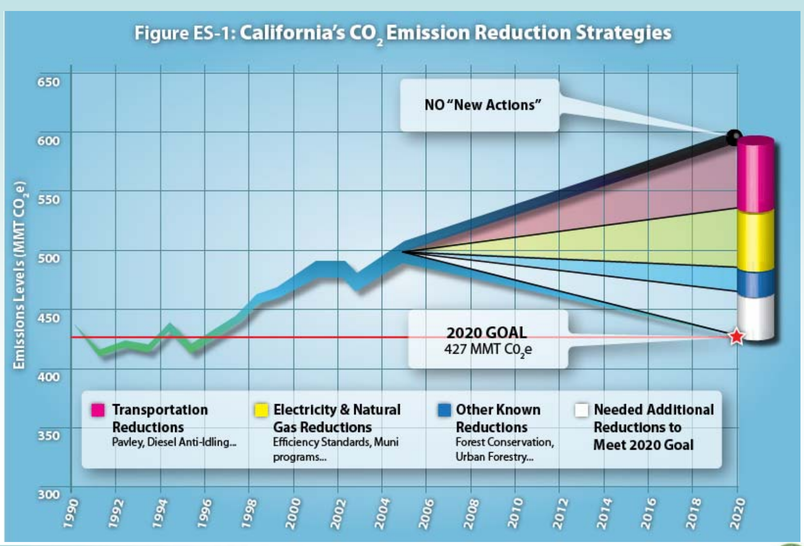
Sector	2004	1990 (2020 goal)	2050 goal
Agriculture	27.9	23.4	4.7
Commercial	12.8	14.4	2.9
Electricity generation	119.8	110.6	22.1
in-state	58.5	49	9.8
imports	61.3	61.6	12.3
Industrial	96.2	103	20.6
cement	9.8	8.1	1.6
landfills	5.6	6.3	1.3
petroleum refining	34.9	32.8	6.6
Residential	29.1	29.7	5.9
Transportation	182.4	150.7	30.1
Forestry	0.2	0.2	0.0

In some cases, proposed sector reductions transfer emissions from one sector to another—e.g., alternative fuels 2050 vision moves 70% to biofuels, hydrogen, and electricity grid

Parameter	Today 2005	AB1007 2022	Interim 2030	Vision in 2050
Per capita VMT/yr	8,600	8,900	8,600	8,200
Vehicle Mix (millions)				
Gas/diesel	25	20	10	5
FFVs	0.3	5	11	7
FCVs & PHEVs	--	2	11	28
Fleet Avg. MPG	20	26	36	66
Transportation Fuel (BGGE)	16	15	13	7
GHG Emissions (MMT CO2)	134	120	74	23
Fuel Carbon Intensity	0.99	0.89	0.73	0.38
Fuel Mix (% of total energy)				
Gas + Diesel	96%	80%	50%	30%
Biofuels	4%	16%	38%	30%
Electricity + Hydrogen	0	4%	12%	40%

Source: ARB State Alternative Fuels Plan, November, 2007 CEC-600-2007-011-CMD

"Wedges" Proposed for California to Reach 2020 Goal of 1990's Level of GHG Emissions

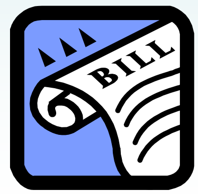


Assembly Bill 1925 Required a Report Assessing Geologic Carbon Storage for California

- Bill passed unanimously in August 2006
- Required the California Energy Commission, with the Dept of Conservation, to prepare a report containing:

  …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.
- Report due November 2007

Sam Blakeslee



AB1925 Asked for Specific Studies and R&D Within One Year

- Key components of site certification protocol
- Integrity and longevity standards for storage sites
- Mitigation, remediation, and indemnification strategies to manage long-term risks
- Identification and characterization of state geological sites that potentially are appropriate for long-term storage
- Comparative economics of technologies for capture and sequestration
- Identification of technical gaps in the science of sequestration
- Evaluation of potential risks associated with geologic sequestration
- Evaluation of potential risks if geologically sequestered CO_2 leaks into aquifers
- Evaluate and quantify (to the extent feasible) potential liability from leakage and potentially responsible parties

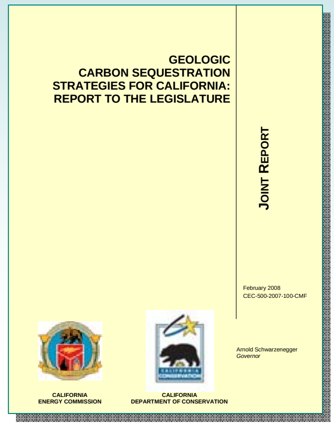
Agreement Reached for More Phased Approach Extending AB 1925 Report Development to 2010

- **Allow utilization of data and results from DOE partnerships, particularly WESTCARB Phase II**
- **Improve understanding of regulatory and statutory issues through multi-agency involvement**
- **Address CCS within regional context**

Initial 2007 report issued as the first of two reports

http://www.energy.ca.gov/2007publications/CEC-500-2007-100/CEC-500-2007-100-CMF.PDF

Second report due to Legislature in 2010



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First Report Focused on Technical and Economic Feasibility

1. **Role of CCS in California**
2. **Key implementation issues**
3. **California's sequestration capacity** — large
4. **Capture technologies**
5. **Site characterization and certification**
6. **Monitoring and verification**
7. **Risks and risk management**
8. **Remediation and mitigation**
9. **Economics** — It's expensive
10. **Statutory and regulatory frameworks** — Ambiguous and messy
11. **Recommendations**

(Items 4–8:) existing technology supports moving forward, but need proof-of-concept

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Summary Of First Report's Recommendations

- Synthesis and analysis of data from sequestration projects worldwide, including DOE Partnerships, and especially from WESTCARB
- Consideration of geologic sequestration within the energy-carbon framework of the Western region
- Further examination of early opportunities within the state
- Development of improved cost estimates and inclusion of carbon sequestration as a GHG reduction strategy in state planning
- Potential options for addressing existing regulatory and statutory ambiguities and providing protocols as needed to inform drafting of new regulations and statutes

2. Energy and Carbon Flow Regionally

- Electricity flows into California
  - 22-32 % of electricity used
  - 39-57 % of GHG emissions
- Transportation fuels are exported from California's refineries to neighboring states
  - 100% of Nevada's
  - 60% of Arizona's
  - 35% of Oregon's
- Does the carbon flow with the energy?

2. Early CCS Policy Has Focused on the Regional Context

- MOU in 2006 between governors of California and Wyoming to support development of advanced coal technologies with focus on commercial demonstration of IGCC-CCS at a Wyoming site
- Economic and Technology Advancement and Advisory Committee (ETAAC) 2008 report recommends CCS implementation for 2020 goals—focus on IGCC-CCS on coal plants out-of-state

3. Early In-State Opportunities: Offset CCS Cost Through Advancing CO_2-EOR Opportunities

Types of Oil Field Storage Reservoirs	Number of Fields	Estimated Total Storage Capacity (MMT CO_2)
Oil fields with CO_2 storage potential	176	3,563
Oil fields with miscible CO_2-EOR potential	121	3,186
Oil fields with immiscible CO_2-EOR potential	18	178
Oil fields with CO_2 storage capacity but no EOR potential (fields lacking API data also included)	37	199

80% of large emissions sources are within 30 miles (50 km) of a potential EOR site

Parameters—pipeline infrastructure, regulatory ambiguities, etc.

3. Early In-State Opportunities in Alternative Fuels Provide a Way to Address Transportation Sector

- Ethanol
  - Only a few large plants currently in California; more planned
  - About 2500 metric tons CO_2 per 1 million gallons of ethanol produced
  - Emissions are essentially pure CO_2 so avoids separation costs
  - Sequestration provides "net-negative" emissions
- Hydrogen
  - CO_2 capture integrated into syngas and hydrogen production by pre-combustion process

4. CCS Costs Remain Problematic Without a Value for Carbon

- Market Advisory Committee to the CA Air Resources Board: 2007 Recommendations for design of a cap-and-trade system
- Work beginning on CCS inclusion in cost of electricity generation studies and scenario planning at the Energy Commission

5. Various Agencies Are Now Working Together Toward Integrated Development of a Workable Regulatory Framework

- CA Dept of Conservation (DOGGR)—underground injection, power plant siting
- CA Air Resources Board—climate
- Office of the State Fire Marshal—pipelines
- U.S. EPA Region 9—underground injection
- Energy Commission—power plant siting (CEQA)
- Local agencies, etc.

Input to AB 1925 2010 report welcome!

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Thank you!

Auspices

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