



Energy+Environmental Economics



Cap and Trade & Complementary Climate Policies in California: AB32 and Beyond

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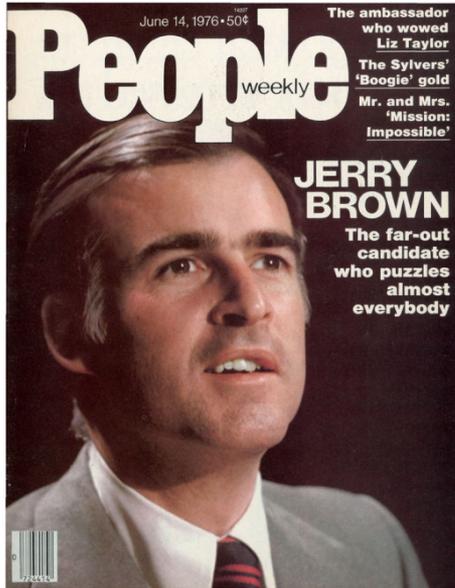


Agenda

- + What climate policies have California implemented?**
- + What's next?**
- + Key challenges & and a question**



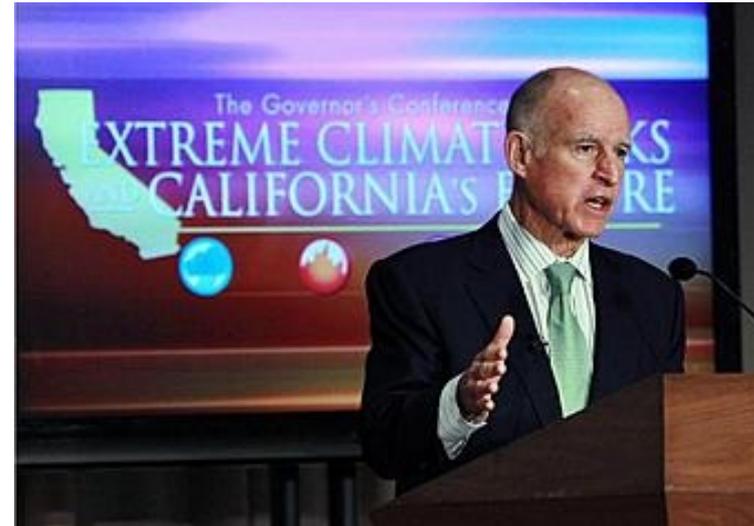
A Brief History of California's Climate Policy



**Governor Jerry Brown
1975 - 1983**



**Governor Arnold
Schwarzenegger
2003 - 2011**



**Governor Jerry Brown
2011 - 2019**

- + 1977: California adopts first building efficiency standards in the nation
- + 2006: California Global Warming Solutions Act (AB 32), GHG goals through 2020
- + 2011: 33% Renewables Portfolio Standard by 2020 (SBX1-2)
- + 2015: Governor Brown announces 2030 climate agenda in inaugural address



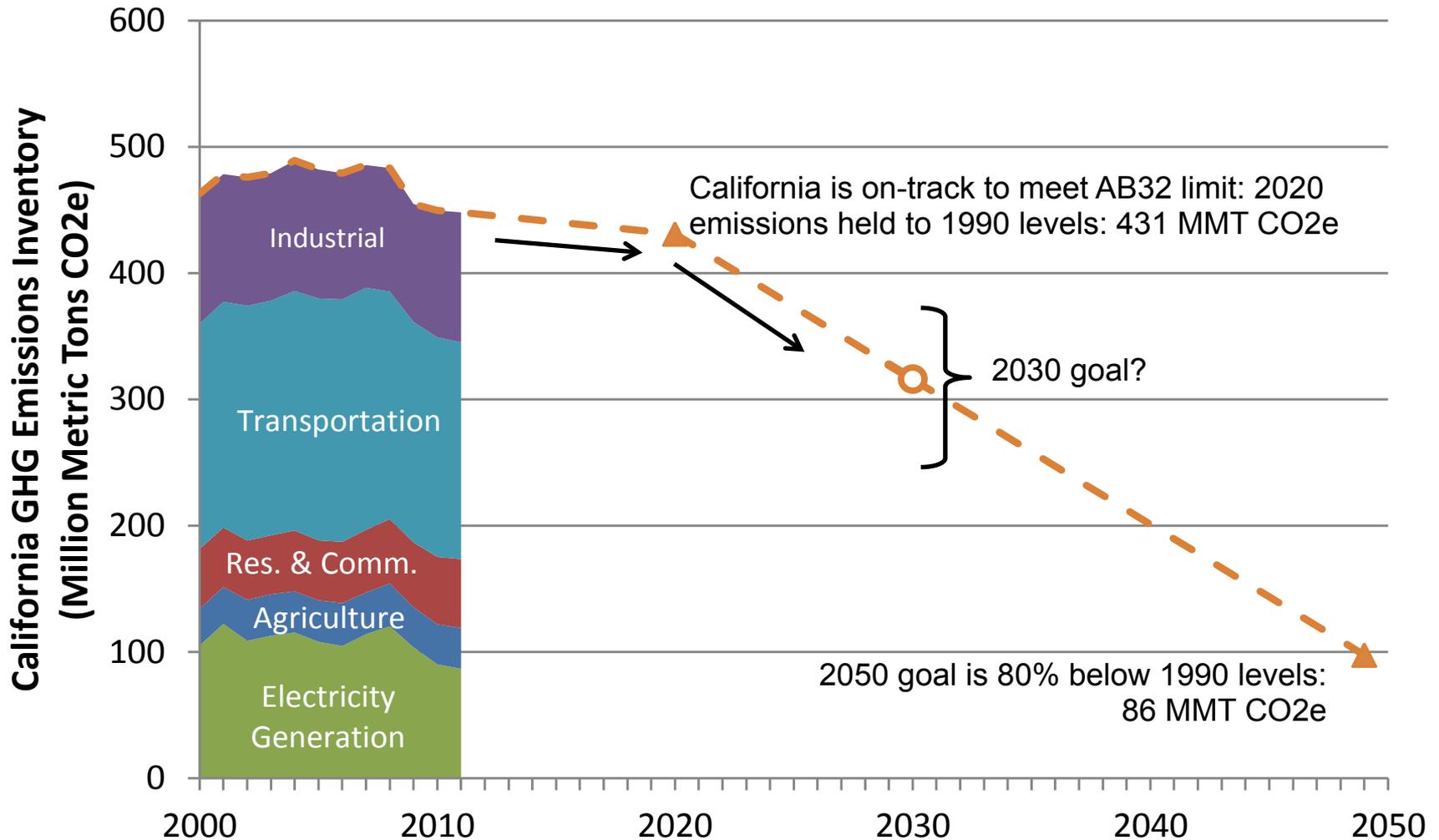
Governor Brown's Inaugural Address 2030 Climate Agenda

- + 50% of electricity from renewables sources;
- + Reduce today's petroleum use in cars and trucks by up to 50%;
- + Double efficiency savings in existing buildings & make heating fuels cleaner;
- + Reduce methane, black carbon and other potent pollutants across industries;
- + Manage farm and rangelands, forests and wetlands so they can store carbon.





AB32 and Beyond: California's GHG Emissions Goals



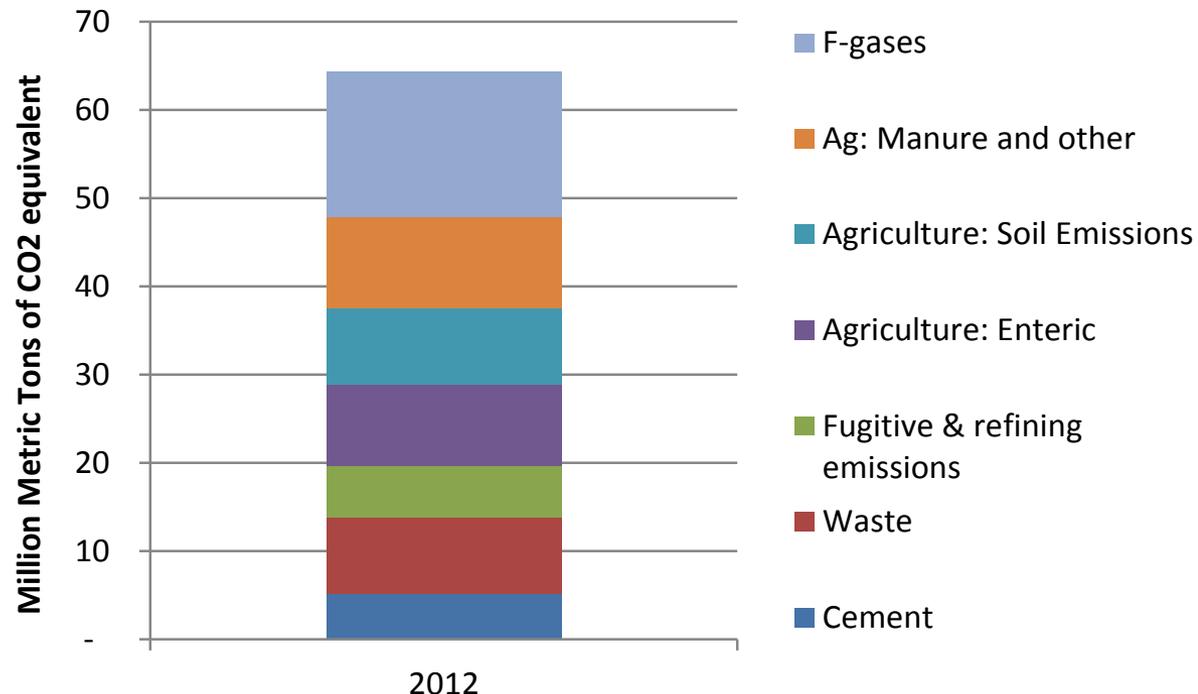
Source: E3, based on CARB 6th Edition GHG emissions inventory



Non-Combustion Greenhouse Gas Emissions in California

+ Limited mitigation potential for cement, enteric fermentation, certain types of soil & manure emissions. This means a greater share of emissions reductions are needed from the energy sector to hit 80% below 1990 levels.

+ Sources/sinks in forested lands & wood products, wetlands, working lands are not quantified in California's current GHG inventory. Neither is black carbon.

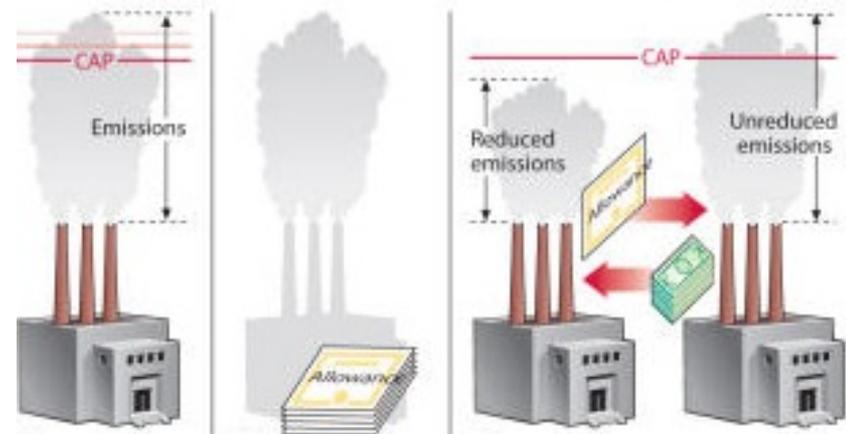


Source: E3, based on CARB 2012 GHG emissions inventory



California's Cap & Trade Program

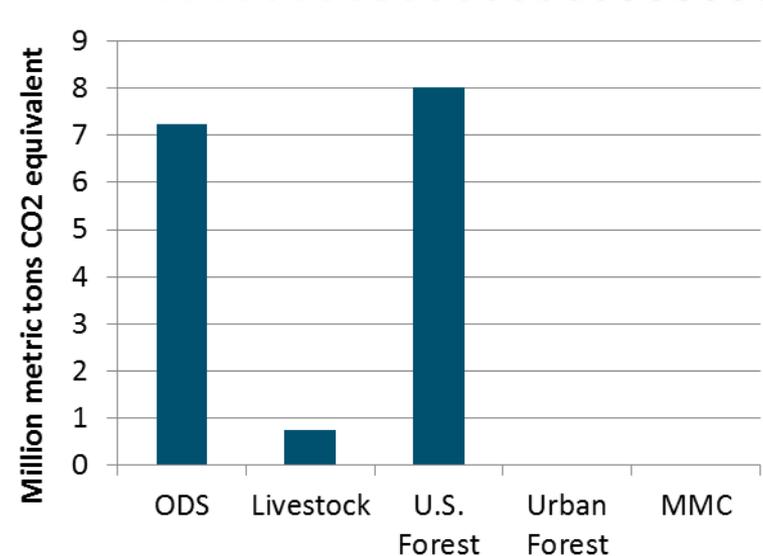
- + **First cap & trade auction in 2013, covers GHGs from power plants, imported electricity and industrial facilities**
 - Carbon price increased wholesale electricity prices ~\$6/MWh
- + **January 1st 2015: Transportation and natural gas fuels came under the cap**
 - Carbon price increased gasoline prices by ~\$0.10/gallon
- + **Prices have been trading near the price floor ~ \$13/ton-CO₂**
 - The price floor increases 5% per year plus adjustment for inflation





Offsets in California cap and trade program

- + **Offsets represent verified GHG reductions that occur outside of regulated sources under cap & trade program**
- + **Offsets can be used to meet up to 8% of an entities' cap and trade compliance obligation – demand is expected to outstrip supply at current carbon prices**
- + **Five adopted offset compliance protocols**
 - ✓ U.S. forest
 - ✓ Urban forest
 - ✓ Livestock
 - ✓ Ozone depleting substances (ODS)
 - ✓ Mine methane capture (MMC)
 - ☐ Rice cultivation projects under review as 6th offset category



Source: CARB, Jan. 14, 2015



Things to Know about California's Electricity Sector Choices

1. No in-state coal; out-of-state coal contracts are mostly rolling off (SB1368)

2. Nuclear

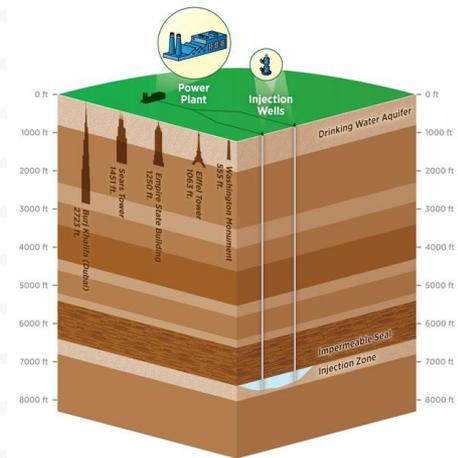
- State law prohibits construction of new nuclear facilities until the federal government has designated a permanent nuclear waste repository

3. Fossil generation with carbon capture and sequestration (CCS)

- No commercial projects in service; proposed projects and are struggling to make it to the finish line due to cost overruns and political opposition

4. Renewables

- Current default option, no shortage of supply

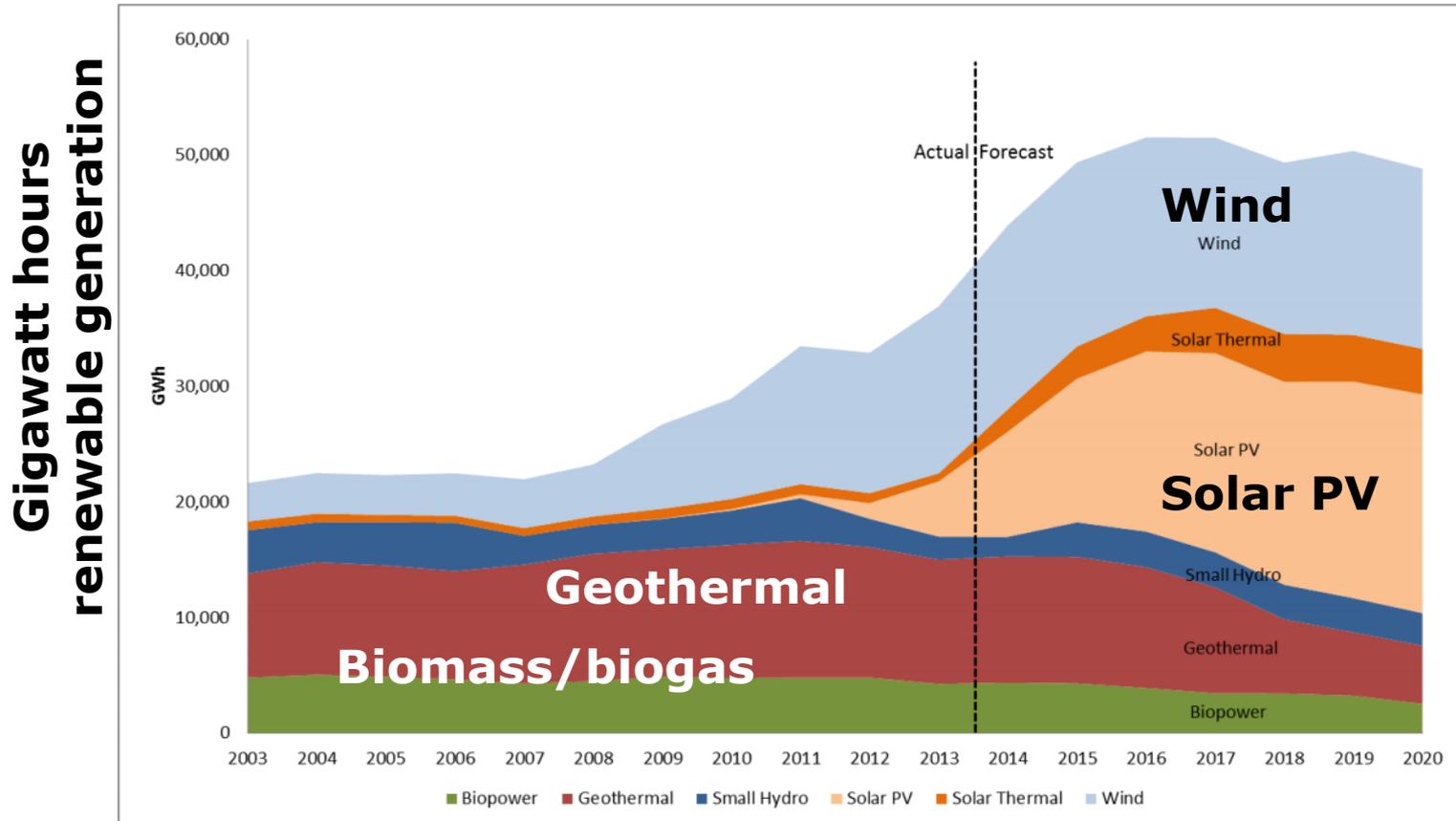




California's Renewable Energy Achievements To Date

- + **21% renewables in 2014; on-track to meet 33% by 2020** (excluding large hydro and rooftop solar); **New goal is to hit 50% renewables by 2030**

Figure 3: Renewable resource mix, actual and forecasted by year ¹⁰





Transportation Sector Goal: Reduce Petroleum Use by Up to 50% by 2030

- + 1.5 million zero-emissions vehicles in CA by 2025
- + Low-carbon fuel standard requires 10% reduction in the CO₂ intensity of transportation fuels by 2020

Additional options to meet 2030 goal:

- + Reducing growth in vehicle-miles travelled to 4%;
- + Increasing on-road fuel efficiency of cars to 35 mpg and heavy-duty trucks to about 7 mpg;
- + At least doubling use of alternative fuels like biofuels, electricity, hydrogen, and renewable natural gas. (ARB analysis)



California's Plan to Meet 2020 GHG Goal Relies Heavily on Complementary Climate Measures

Measures	% of total 2020 expected savings
Vehicle fuel efficiency (Pavely, model-yrs 2009-16)	22%
Renewable Portfolio Standard (12% - 20%)	10%
Renewable Portfolio Standard (20% - 33%)	10%
Advanced clean cars & Low Carbon Fuel Standard	16%
Uncapped emission source reductions, offsets	12%
Energy efficiency	10%
All other programmatic measures	8%
Combined heat and power	4%
Cap and trade and/or other sources of reductions	7%
Total	100%

Source: California Air Resources Board, Status of Scoping Plan Measures, July 2011 Update. Note that the "First Update to the Climate Change Scoping Plan" (February 2014) includes different estimates of 2020 savings and less granularity (see Table 5, pg. 102)



Conclusions & A Question

- + California is taking action across all energy sectors to reduce GHGs using a suite of policy tools**
 - Cap & trade is the “backstop” source of GHG reductions
 - Renewable electricity, vehicle & building efficiency standards, low-emissions vehicles, are the primary sources of carbon reductions today
- + The carbon mitigation actions that are needed, and being planned, in the energy sector depend on how large the terrestrial sink is today, and how large it might be in the future.**
- + Q: Are we there yet?...Is it in the GHG inventory?**



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Thank You!

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