California’s Transportation GHG Policy Model

...as seen by a policy wonk, regulator, and academic

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21 May 2012
Setting the scene...

Soaring Global Demand for Vehicles (and Oil)

Sperling and Gordon (2009), based on DOE, JAMA, other
California GHG Emissions (2008)

- Transport: 37%
- Electric Power: 24%
- Commercial and Residential: 9%
- Industrial: 19%
- Agriculture: 6%
- High GWP: 3%
- Urban Waste: 2%
- Agriculture: 6%
- Urban Waste: 2%
Three Principal Strategies to Reduce GHGs from Transportation

- Transform vehicles
- Transform fuels
- Transform mobility (and land use)
Vehicle strategies are easier and more effective than others.
Automaker CEOs Support Aggressive 2025 Vehicle GHG Standards

Government-industry agreement (July 29, 2011)
Obama administration, automakers, and California agree to national US standards
Need to “Kickstart” Advanced (Efficient, Low Carbon) Vehicles

- California ZEV mandate
- Special incentives in GHG/CAFE stds (EVs count as 0 g/mi)
- Rebates for EVs ($2500/veh, plus $7500 from feds) and other low-carbon, low-energy vehicles via AB118 (CARB and CEC)
Beyond 2025, rapid shift to electric and fuel cell vehicles needed to achieve 60-80% (or more) GHG reduction by 2050

Figure: 2050 Scenario from California Air Resources Board

CARB scenario for light duty vehicles, to determine ZEV requirements
Fuel du jour Phenomenon

• 30 years ago – Synfuels (oil shale, coal)
• 25 years ago – Methanol
• 20 years ago – Electricity (Battery EVs)
• 10 years ago – Hydrogen (Fuel cells)
• 5 years ago – Ethanol
• Today – Electricity (again)
• What’s next?

Without policy intervention, we would start over with “unconventional oil”. And thus need flexible, performance-based, technology-forcing policy
California Low Carbon Fuel Standard (LCFS)
(Adopted April 2009, took effect 2011)

Policy Design

- 10% reduction in carbon intensity of transport fuels by 2020
- Doesn’t pick winners: includes all fuels (unlike national RFS)
- Harnesses market forces (via tradable credit market)
- Stimulates innovation and investment
- Performance based
- Relies on lifecycle analysis
California Low Carbon Fuel Standard (LCFS)

Carbon Intensity for Gasoline & Substitutes, g CO₂ e/MJ
(grams CO₂ equivalent per unit of energy, adjusted for energy economy ratio [EER])

LCFS requirements, 2011-2020 (10% reduction in 2020)

- California Gasoline, CaRFG (baseline)
- Corn Ethanol, Midwest production (98 g)
- Corn Ethanol, California production (81 g)
- Ethanol, Brazilian sugarcane (58 g)
- Ethanol, California sweet sorghum (12 g)
- Cellulosic ethanol, forest residue (84%)
- California marginal electricity (EER = 3.0)
- California average electricity (EER = 3.0)
- Hydrogen, SB 1505 compliant, onsite reformed NG (EER = 2.3)
- Hydrogen, SB 1505 compliant, liquefied reformed NG (EER = 2.3)
California Leadership in Reducing VMT and Sprawl

• SB375 Sustainable Communities Act of 2008
  ▪ Requires reductions in GHGs associated with passenger vehicle use via changes in land use, transit, and pricing)
  ▪ GHG targets for major cities (adopted sept 2010):
    • 2020: 6-8% reduction/capita (mostly VMT)
    • 2035: 13-16% reduction/capita (mostly VMT)

• But weak incentives

• Why good policy?
  ▪ Provides performance-based mechanism for funding cities
  ▪ Defers to local governments
  ▪ Empowers local governments to do good planning and investment
    • Policies to reduce VMT and GHGs are aligned with good planning practices (generate large co-benefits (reduced infrastructure costs, healthy communities)

Model for rest of country?
Carbon Cap and Trade for Transport Fuels

• Cap on refinery emissions (2012+)
• Cap on carbon content of fuels (2015+)

Injects price signal (along with LCFS) and provides more incentive to shift to low-carbon fuels (as well as to reduce vehicle efficiency and VMT)
California’s Comprehensive Program to Reduce GHG Emissions from Transportation

VEHICLES
- GHG light duty vehicle stds (soon extended to 2017-2025) (Jan 2012)
- GHG requirements for trucks (mostly to improve aerodynamics)
  - Feds in process of adopting CAFE for heavy trucks
- ZEV requirements (to be updated Jan 2012)
- $ for EVs and others (AB118)

FUELS
- Low carbon fuel standard req’t for oil companies (10% reduction in carbon intensity by 2020, requiring roughly 1/3 alternative fuels)
- Hydrogen fuel station requirements (“Clean Fuel Outlet”) (Jan 2012?)
- 33% renewable electricity stds for utilities

VMT
- Reduce VMT and sprawl (SB375)

Plus carbon cap and trade (imposed on refineries and fuels)
Why Gov’t Initiative is Needed … and why prices are not enough

A Long List of Market “Failures”

- Environmental and energy externalities
- **Principal agent problem** (rental cars, truck trailers, leased vehicles, cars for legislators/execs)
- **Network externality.** Complementary products requiring large *non-recoverable* investments and investments that cannot be made by individual consumers—such as when different vehicles or different infrastructures are required (H2, bike paths for biking, smart paratransit, etc)
- Technology lock-in
- Market power (cartels, oligopolies, etc)
- High entry barriers in auto industry
- R&D under-investment due to:
  - industry diffusion (ag industry)
  - R&D spillovers. When R&D findings cannot be fully captured (leading to under-investment in R&D)
  - Learning-by-doing spillovers where mfg savings not fully captured
- Consumer cognition (eg, buying cars), resulting in under-investment in efficiency (related to information and loss-aversion)
- Volatile oil prices create uncertainty which leads to under-investment in alternatives
California pioneered car-dependent cities and lifestyles, but is now a policy leader in creating low-carbon transportation. It is premised on innovation and relies on a mix of market and regulatory instruments.
By 23% margin, California, voted in favor of climate policies

- Voters rejected a proposition 61% vs 38% to block implementation of AB 32 until California's unemployment rate drops to 5.5% or below for four consecutive quarters
- Unemployment was 12.4% at the time
- Bigger margin than any other proposition and politician (governor, etc)
Is California Showing the Way to Promised Land…. or Going to be Swept Away?