

A Low Carbon Fuel Standard For California

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NOTE: These are recommendations are our views based on currently available data. The California Air Resources Board, Energy Commission, Public Utility Commission, and other agencies will determine all policy choices and quantitative values in accordance with California law.

California has developed a comprehensive, sectoral strategy to cut GHG emissions

- **Overall goals**
 - Executive Order S-3-05 (2005)
 - Global Warming Solutions Act 2006 (AB32)
- **Energy research portfolio**
- **Buildings and appliances**
 - Energy efficiency standards
- **Electricity other large sources**
 - Carbon Adder (CPUC)
 - Renewable portfolio standard for electricity (SB 107)
 - GHG performance standard and cap (CPUC decision, SB1368)
- **Transportation**
 - Vehicle GHG performance standard (AB 1493 Pavley)
 - Low Carbon Fuel Standard (Executive Order S-1-07)
 - Vehicle use and transportation options
- **Other policies**

Low Carbon Fuel Standard (LCFS) compliance

- **Compliance by blenders, refiners, and importers**
- **Government sets performance standard and does not pick technological winners**
- **Global warming intensity must decline**
 - All climate forcing effects (not just GHGs)
 - Average Fuel Carbon Intensity (AFCI) for firm
 - Measured in terms of impact per unit energy, $\text{gCO}_2\text{e/MJ}$
 - At least 10% reduction by 2020
 - $\text{gCO}_2\text{e/MJ}$ adjusted for driveline efficiency
 - Default and opt-in approach
- **Scope: all gasoline and diesel (no jet or marine)**
- **Additional to AB1493 (Pavley)**
- **Overcompliance creates credits can be traded or banked**

Baseline, default and opt-in

- **Baseline: weighted average of the carbon intensity of all fuels**
- **Default: all fuel inputs are assigned a carbon intensity**
 - Fuel inputs must be categorized
 - Highest value in common use is the default value
 - Encourages opt-in
 - Requires arbitrary decisions
- **Opt-in: suppliers with lower carbon intensity can get certified at a lower value**
 - CARB-approved protocols and 3rd-party certification
 - Different levels of detail are possible:
 1. Ethanol
 2. Corn ethanol made in a dry mill
 3. Corn ethanol made in a dry mill that uses natural gas
 - ...etc...
 4. Ethanol made in *this* plant with the following GHG profile
- **Very similar to emerging UK/EU system**

Scenario analysis shows combinations of innovation and investment to reduce AFCI

Name	Description (beyond Business As Usual)	AFCI
Business As Usual		
Electric Drive	Battery, plug-in hybrid, and hydrogen vehicles California average electricity	-5%
Existing Vehicles and Improved Biofuels	Diesel vehicles Low-GHG ethanol, low-GHG diesel	-5%, -10%
Evolving Biofuels and Improved Batteries	Battery, plug-in hybrid vehicles and FFVs Mid-GHG ethanol, mid-GHG diesel, Electricity	-5%, -10%
Biofuel Intensive	Diesel, flex-fuel, flex-fuel hybrid vehicles Mid- and low-GHG ethanol, mid- and low-GHG diesel	-5%, -10%, -15%
Multiple Vehicles and Fuels	CNG, plug-in hybrid, battery, fuel cell, flex-fuel, diesel Low-GHG ethanol & diesel, CNG, electricity, hydrogen	-5%, -10%, -15%

Findings

The Low Carbon Fuel Standard 10% target is feasible

- Current technologies can meet the standard, but are not optimal
- Resources for low-carbon fuels are adequate
- The LCFS will focus innovation to improve technology
- With modest innovation, California can reach the 2020 goal without significant expansion of land use for biofuel production

The Low Carbon Fuel Standard is cost-effective

- Direct measurement of the intended effect
- Technologies compete, government does not pick winners
- Incentive for innovation will increase the number of options and lower costs
- Market-based approach minimizes costs of compliance

Complementary policies may be needed

- Environmental justice and sustainability
- Research and development
- Other aspects of transportation (vehicles and travel options)

LCFS developments worldwide

- **Renewable Fuel Standard (RFS)**
 - United States: double biofuel use by 2012 to ~6% of gasoline.
 - UK Renewable Transportation Fuel Obligation (RTFO): 5% by 2010
- **Low Carbon Fuel Standard (LCFS)**
 - California: regulations to be in effect 2010
 - Federal bills: Boxer, Feinstein, Obama, Inslee, etc.
 - European Union: monitoring in 2009, reductions start in 2011
 - United Kingdom: RTFO requires GHG monitoring, pilot in 2007
 - Others: BC, WA, OR, AZ, NM, MN, and...?
- **Current and forthcoming analysis**
 - *Draft Carbon Reporting Methodology under the RTFO.* E4Tech. Dec06
 - *Sustainability Reporting within the RTFO.* ECOFYS. Feb07
 - *Creating Markets for Green Biofuels.* UC Berkeley study. April07
 - *AB1007 Well-to-Wheels Analysis.* CEC/CARB study. May07
 - *Low Carbon Fuel Standard for California.* UC Berkeley/Davis. May07

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