California Energy Commission Investments in Sustainable, Low Carbon Biofuels

Jim McKinney, Manager

Emerging Fuels and Technologies Office

Fuels and Transportation Division

www.energy.ca.gov

September 22, 2011

California Nation-State Statistics

- Population: 37.7 million
- GDP: $1.9 trillion - 9th largest global economy
- GHG Emissions: 440 MMT (2004)
  - 7.2% of U.S. Emissions (Pew Center)
  - 10th largest emitter on global scale
  - Transportation accounts for 42 % of all GHG emissions
- Vehicles: 26.5 million cars + 0.92 million trucks
- Annual Fuel Consumption: 18.3 billion gallons
  - 15 billion gallons gasoline
  - 3.3 billion gallons diesel
  - 3rd largest consumer of vehicle fuels after China and US

CA Ethanol: Consumption and Supply

Ethanol Demand in 2010 was 1.5 B gallons

- Currently blended into gasoline at E10 (10%)
- 10 M gallons consumed as E85
- Consumption could increase to 2.7 B gallons by 2015 (largely due to RFS2)

In-State Production Capacity

- 5 plants with 250 MGY production capacity
  - Midwest corn grain as feedstock
- 3 facilities operational, 2 idle
- 60 M gallons produced in 2010

CA Biodiesel: Consumption and Supply

Biodiesel Demand in 2010 was 14.5 M gallons

- Typically blended with diesel at B5 (5%) level
- Soy oil is predominate feedstock
- Consumption could rise to 56 M gallons by 2030

In-State Production Capacity

- 16 facilities with 84.5 MGY production capacity
- 5.5 M gallons produced in 2010
- 6 plants idle

Alternative and Renewable Fuel and Vehicle Technology Program (AB118)

- **Purpose**

  To transform California's transportation market into a diverse collection of alternative fuels and technologies and reduce California's dependence on petroleum.

  *"…**develop and deploy innovative technologies that transform California's fuel and vehicle types to help attain the state's climate change policies."***
  (Health and Safety Code Section 44272(a))

- **$150 Million Annual State Funding Program**

  For the *Alternative & Renewable Fuel and Vehicle Technology Program*, the Energy Commission will receive $100 million/year for over 7 years.

  California Air Resources Board will receive $50 million/year for over 7 years for *Enhanced Fleet Modernization* and *Air Quality Improvement.*

Key Policy Objectives

Objectives	Goals and Milestones
GHG Reduction	Reduce GHG emissions to 1990 levels by 2020 and 80% below 1990 levels by 2050
Petroleum Reduction	Reduce petroleum fuel use to 15% below 2003 levels by 2020
In-State Biofuels Production	Produce in California 20% of biofuels used in state by 2010, 40% by 2020, and 75% by 2050
Low Carbon Fuel Standard	10 percent reduction in carbon intensity of transportation fuels in California by 2020
RFS2	36 Billion Gallons of renewable fuel by 2022

ARFVT Program Investments 2008 to 2011

Fuel Type and Program Area	Total Funding Encumbered by July 2011 ($ millions)	No. of Projects
Electric Drive	62.4	32.5
Biofuels	64.0	28
Gaseous Fuels (Natural Gas and Propane)	31.3	13.5
Hydrogen	22.7	5
Workforce Development	15.8	3
Program Support	2.1	9
Totals	**198.4**	**91**

ARFVTP Funding for Biofuels

Biofuel Category	Total Funding ($ millions)	Percent of Biofuel Funding	No. of Projects
Biomethane Production	35.3	59	10
Gasoline Substitutes / Advanced Ethanols	5.4	9	3
Diesel Substitutes / Bio & Renewable Diesel	4.3	7	5
CEPIP	6	10	3
E-85 Retail Fueling Stations	5	8.3	2
Biodiesel Bulk Storage Infrastructure	3.9	6.5	3
Totals	**59.9**	**100**	**26**

ARFVTP Biofuels Investments

Biogas – 10 Projects

All projects use waste-based feedstocks

- Ag manures & wastes, woody biomass, landfill gas and pre-landfill MSW
- GHG scores average 15 gCO2-e/MJ or 85% reduction

Gasoline Substitutes – 3 Projects

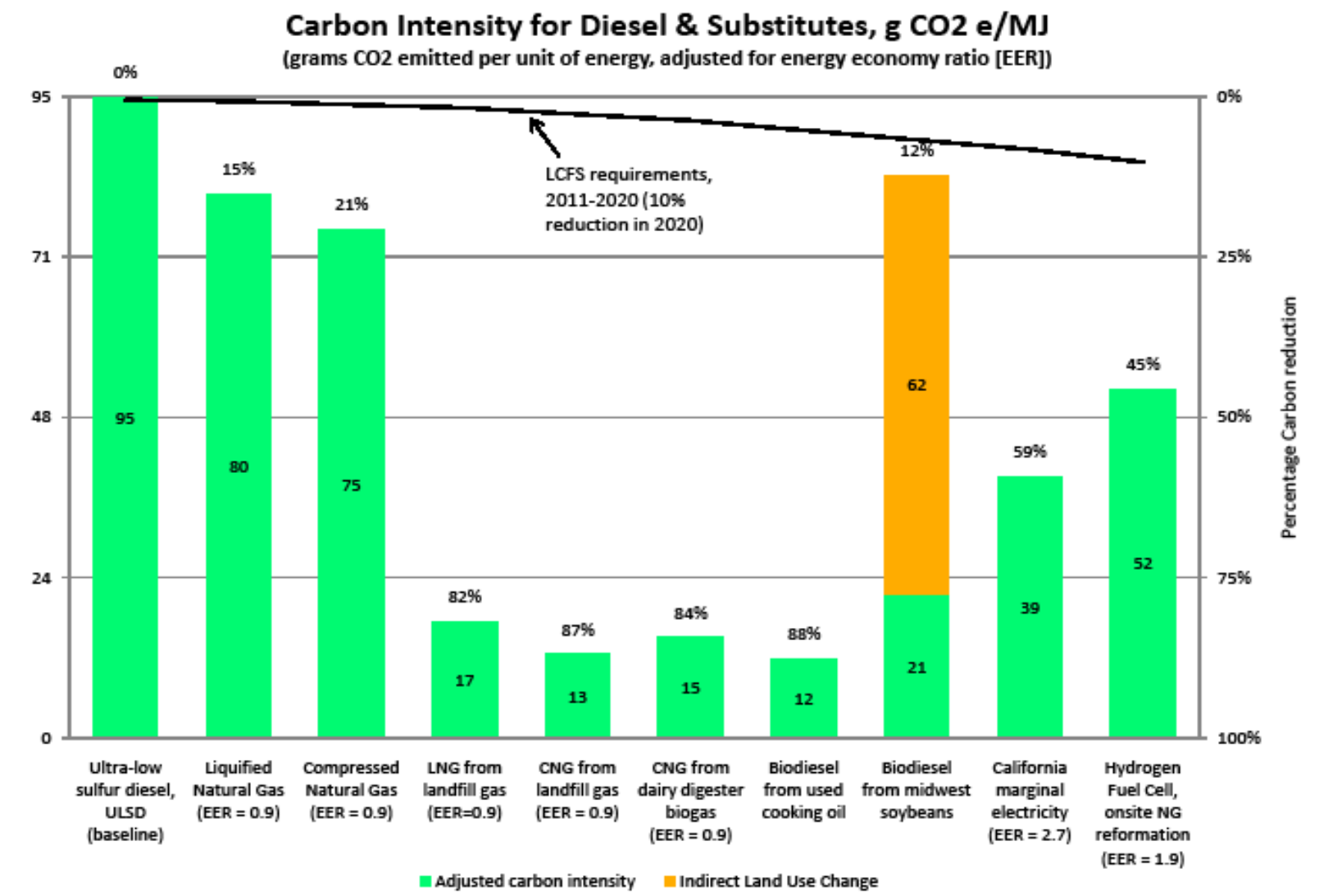
- Cellulosic ethanol from ag wastes
- Ethanol and biogas from beets and ag wastes
- Sweet Sorghum feasibility study

Diesel Substitutes – 5 Projects

- 3 using ag waste streams
- 2 algae-based fuel assessments

PIER-Funded Biofuels Projects

- Biomethane Landfill Gas for Transportation Fuel
- California Transportation Fuels Crops Development and Demonstration Program
- Hydrogasification Research and Demonstration
- California Initiative: Large Molecule Sustainable Fuels
- Life Cycle GHG & Energy Analyses of Algae Biofuels
- Algae OMEGA: Offshore Membrane Enclosures for Growing Algae
- Soladiesel RD ™ from Celulosic Feedstocks
- On-Site Aerobic Fermentation of California Cellulosic Agricultural Waste into Biofuel



Prepared by CEC staff from LCFS fuel pathways

30 April 2010

Waste-Based Feedstock Volumes and Fuel Potential

Feedstock	Volume Technically Available	Biomethane Potential (BCF)	Biofuel Potential (million gge)	DGE Potential (million)
Agricultural Residue	4.3 MBDT	9.3	302	261
Animal Manure	3.8 MBDT	14.6	127	110
FOG	14.4 M lbs	Unknown	63.6	55
Food Wastes	0.8 MBDT	1.9	56	48
Forest Biomass Waste (via cellulosic ethanol)	14.2 MBDT	N/A	784	678
Forest Biomass Waste (via gasification)	14.2 MBDT	30.7	1000	864
Landfill Gas	79 BCF	39.5	368	318
Municipal Solid Waste	10 MBDT	25.9	704	608
Waste Water Treatment Plants	9.6 BCF	4.8[155]	45	39
Total		**126**	**2,566**	**1,755**[158]