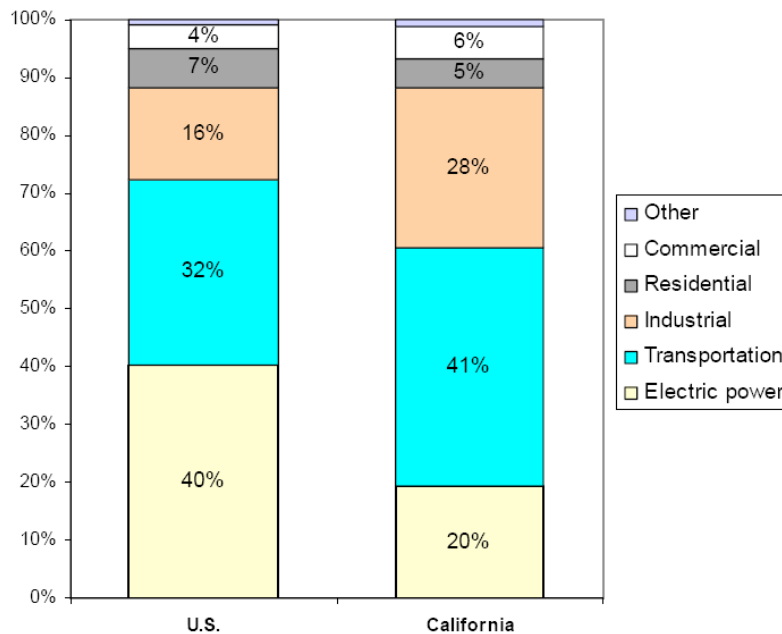

An evaluation of the technical analysis
presented in the report
“A Low-Carbon Fuel Standard for California –
(7 May 2007 Draft)”

Kreider & Associates, LLC
1221 Pearl Street
Boulder, CO 80302

Greenhouse gas emissions by sector

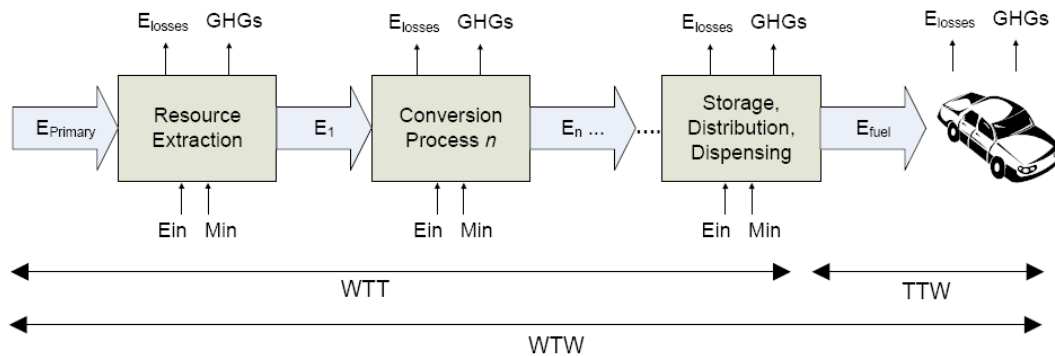


California transportation fuel greenhouse gas emissions in 2004

(Emission values given in millions of tons CO₂ equivalent per year)

Fuel	Emissions	Percent of total	Included in study
Motor gasoline (includes EtOH)	131.92	70%	Yes
Diesel	32.16	17%	Yes
Jet fuel	22.24	12%	No
Lubricants	0.75	0.40%	No
Residual oil	0.61	0.33%	No
LPG	0.19	0.10%	No
TOTAL	187		

Fuel life cycle analysis



- The *well-to-tank* (WTT) phase includes resource extraction, feedstock production, fuel production, refining, blending, transportation and distribution.
- The *tank-to-wheels* (TTW) phase includes refueling, consumption and evaporation.
- The complete fuel cycle analysis is also referred to as a *well-to-wheels* (WTW) analysis

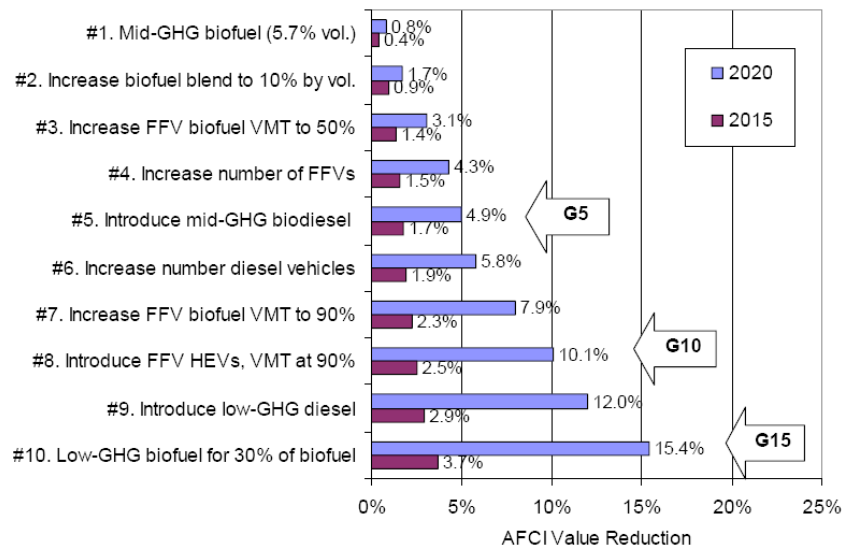
Representative global warming intensity values used in evaluations

Fuel type	Global warming intensity (g CO ₂ eq./MJ)	Efficiency adjust. factor	Average fuel C intensity	Description / notes
Gasoline (with E5.7)	92.8	1	1	93.5 gCO ₂ eq./MJ for gasoline, with 5.7% average ethanol
Diesel	91.6	1	1	California ultra low sulfur diesel
Electricity	121	0.19	0.25	Average California grid electricity (reduced by 0.25% per year)
Hydrogen	108	0.46	0.22	Onsite natural gas steam methane reformation
Average 2004 Biofuel	76	1	0.53	Midwest average corn ethanol
Mid-global warming intensity Biofuel	58	1	0.82	Average of <ul style="list-style-type: none"> midwest corn ethanol from a natural gas-fired dry-mill, midwest corn using a NG-fired dry-mill w/ wetcake coproduct, midwest corn ethanol using stover as fuel in a dry-mill, and California corn w/ a NG-fired dry-mill and wetcake coproduct
Low-global warming intensity Biofuel	4	1	0.04	Average of <ul style="list-style-type: none"> cellulosic ethanol from California poplar, cellulosic ethanol from California switchgrass, and cellulosic ethanol from midwest prairie grass
Mid-global warming intensity Biodiesel	41	1	0.44	Comparable to fatty acid methyl ester biodiesel from Midwest soybeans
Low-global warming intensity FT Diesel	12	1	0.13	A mixture of fatty acid methyl ester biodiesel from Midwest soybeans and Fischer-Tropsch Diesel from California poplar

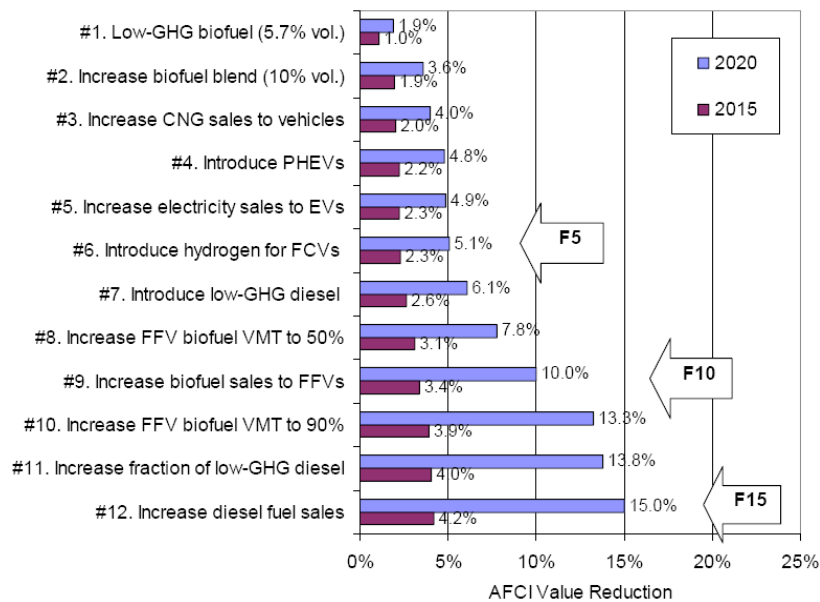
Light duty vehicle scenarios considered

Scenario name	Fuel Innovations	Vehicle Innovations	fuel carbon intensity reduction		
			5%	10%	15%
Baseline	Current technologies	Gasoline ICE dominates Increased diesel, HEVs	A		
Electric Drive	Electric charging & H2 refueling	Significant innovation in PHEV, EV and FCV technologies	C5	-	-
Existing Vehicles with Advanced Biofuels	Significant biofuel innovation. Low-greenhouse gas biofuels (5.7% vol.) Low-greenhouse gas FT diesel blends	None required	D5	D10	-
Evolving Biofuels and Advanced Batteries	No fuel innovation. Mid-greenhouse gas biofuels (10% vol.) Mid-greenhouse gas biodiesel blends	Advances in PHEV, EV and FCV technologies	F5	F10	-
Biofuel Intensive (see next 2 pgs)	No fuel innovation. Mid-greenhouse gas biofuels (10%, 85%) Mid-greenhouse gas biodiesel blends Low-greenhouse gas fuels for G15	None required	G5	G10	G15
Multiple Fuels & Vehicles (see next 2 pgs)	Low-greenhouse gas biofuels (10%, 85%) Low-greenhouse gas FT diesel blends Electric charging & H2 refueling	Advances in PHEV, EV and FCV technologies	H5	H10	H15

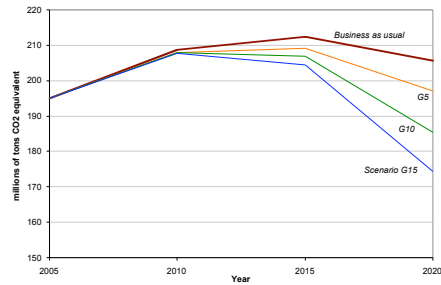
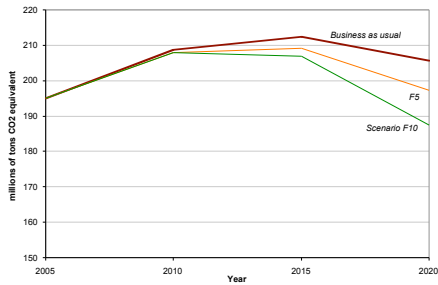
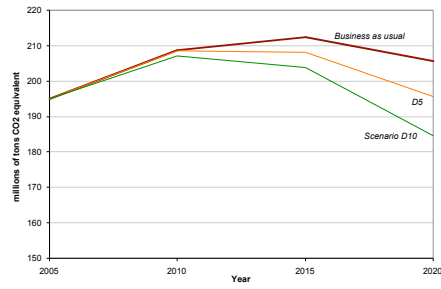
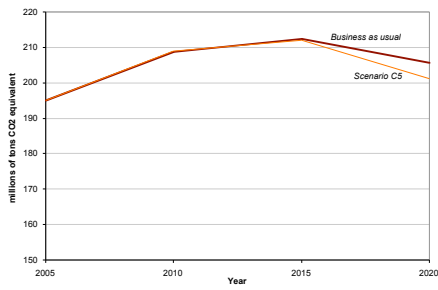
Assumptions for scenario G



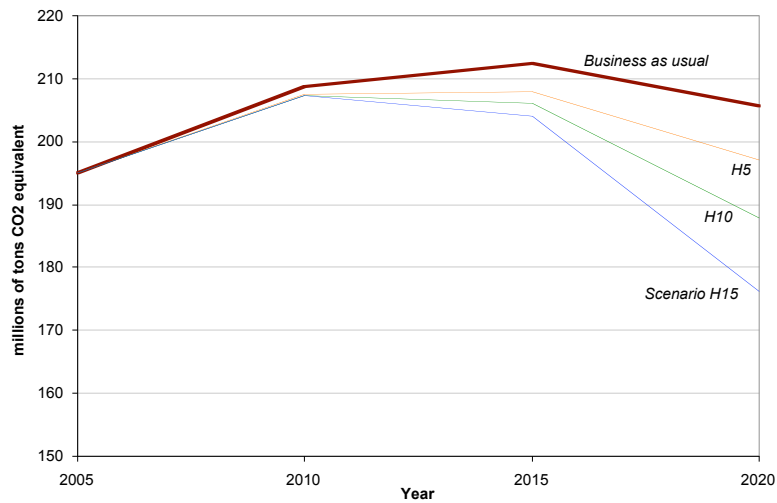
Assumptions for scenario H



CO2 Reduction Results for scenarios C, D, F & G



Results for scenario H



Key points and comments

- Consistency concerns in several tables
 - These have significant effects on carbon impacts
 - Diesel and gasoline life cycle emissions seem to be too high
 - Biofuels given a larger advantage than previous research suggests
 - Global warming indices of future biofuels given as five percent of conventional fuels
 - Far, far lower than previous research
 - Sequestration numbers are unrealistically too optimistic
-