AB 1007 Workshop

ETHANOL IMPLEMENTATION SCENARIOS

California Energy Commission
Sacramento, California

MAY 31, 2007

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May 30, 2007

Ethanol Implementation Storyline

I. Executive Summary

a. Low Level Blends

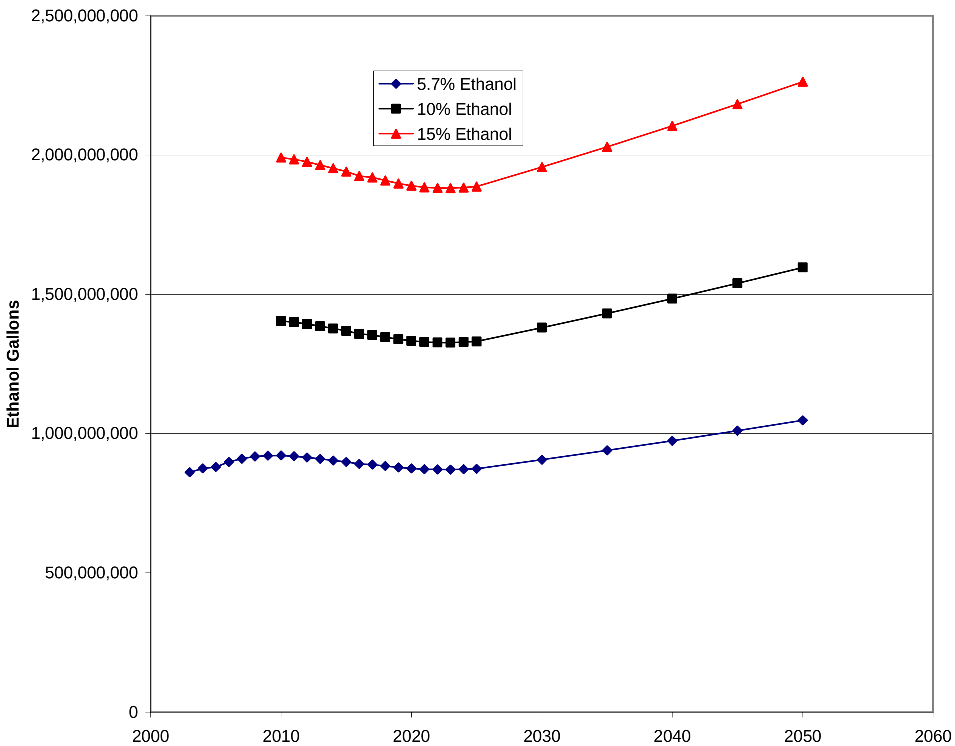


Figure 1-1: Low Level Blend Penetration Scenarios

Table 1-1 Low Level Ethanol Blends Performance Metrics

		2012			2017			2022		
	Scenario—Blend %	**5.7%**	**10%**	**15%**	**5.7%**	**10%**	**15%**	**5.7%**	**10%**	**15%**
Low Level Blends	Gasoline Consumption (million gals)	16,046	16,281	16,554	15,589	15,816	16,081	15,285	15,508	15,768
	Ethanol (million gals)	915	1,628	2,483	889	1,582	2,412	871	1,551	2,365
	Gasoline Displaced (million gal.)	915	1,394	1,976	889	1,354	2,147	871	1,327	1,882
	GHG Reduction (tons/day) MW Corn NG		11,434	15,896		11,107	15,442		10,891	15,141
	GHG Reduction (tons/day) Cellulosic CA Poplar		33,334	49,296		32,383	47,889		31,751	46,955

E85 Blends

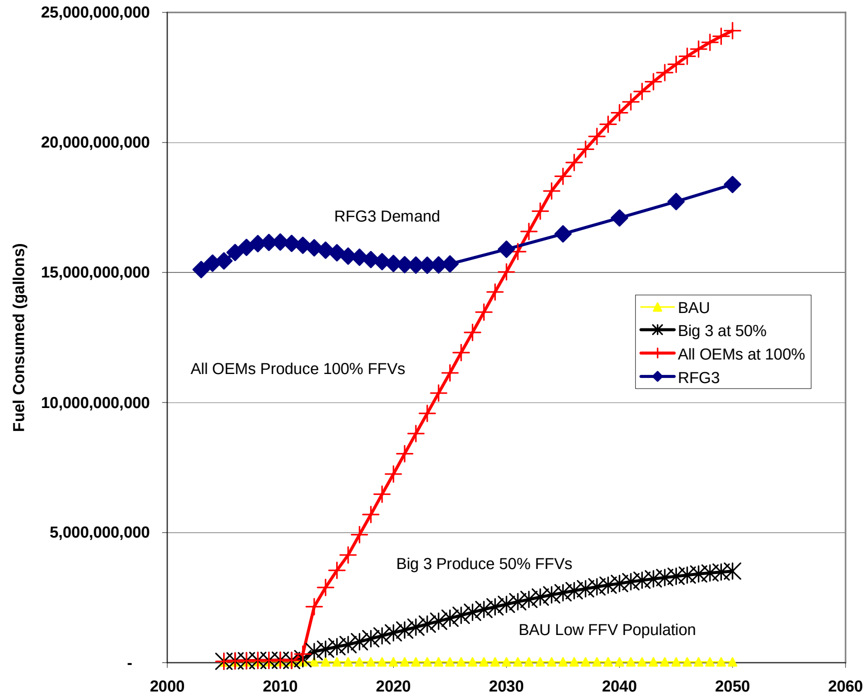


Figure 1-2. E85 Volume Estimates

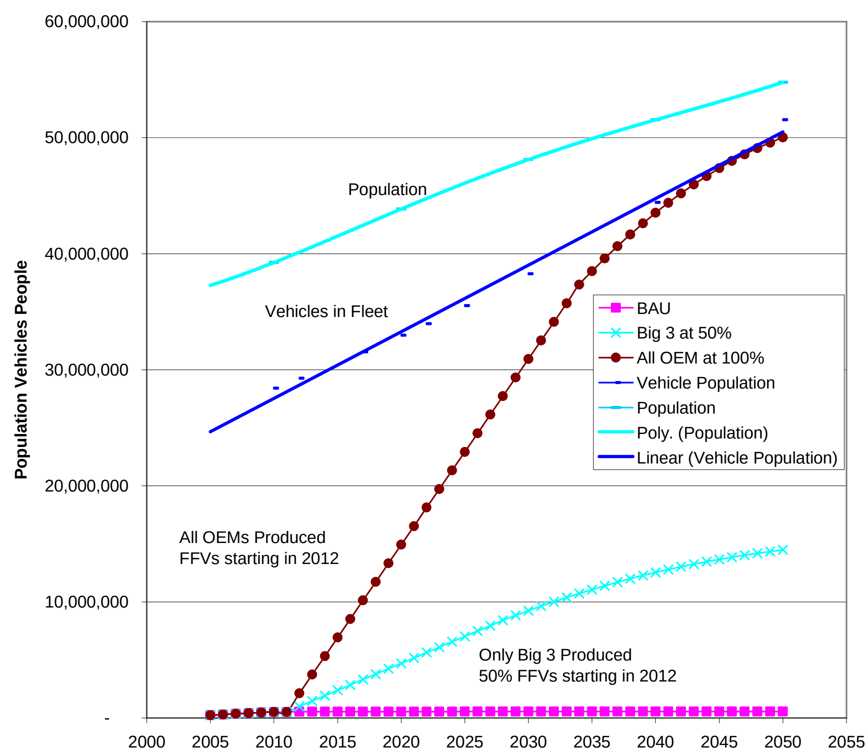


Figure 1-3. E85 People and Vehicle Population Estimates

Table 1-2. E85 Performance Metrics

Scenario*		2012				2017				2022			
		RFG3	E85			RFG3	E85			RFG3	E85		
		5.70%	BAU	50%	100%	5.70%	BAU	50%	100%	5.70%	BAU	50%	100%
E85 Fuel	Number Vehicles gasoline/FFVs (million)	29	0.53	1.00	2.13	32	0.54	3.32	10.13	34	0.55	5.64	18.13
	Gasoline-Ethanol Consumption (million gals)	16,046	33	153	328	15,589	26	805	4,922	15,285	27	1,369	8,808
	Ethanol (million gals)	915	26	122	260	889	21	639	3,903	871	21	1,085	6,985
	Gasoline Displaced (million gal.)	915	18	82.61	177	889	14	434	2,652	871	14	738	4,746
	GHG Reduction (tons/day) MW Corn NG		129	600	1,285		103	3,153	19,270		104	5,359	34,486
	GHG Reduction (tons/day) Cellulosic CA Poplar		480	2,236	4,787		385	11,742	71,768		389	19,960	128,439
	Vehicle Costs (Million $/year)		53.4	99.5	213.1		54.3	331.5	1,013.1		54.9	563.5	1,813.1

b. Mid Level Blend 30% Ethanol and 70% Gasoline

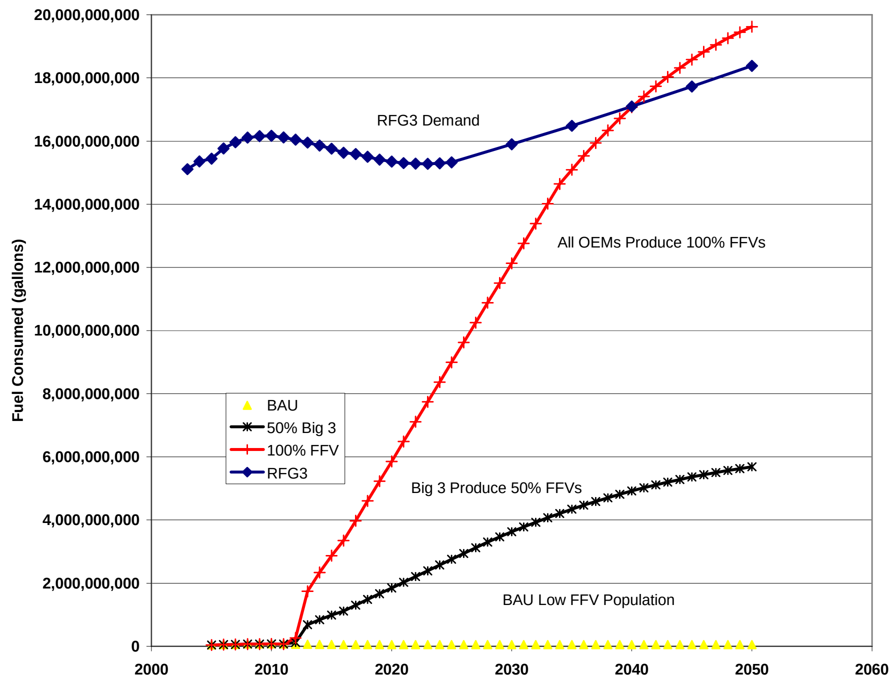


Figure 1-4. Mid Level E30 Blend Volume Estimates

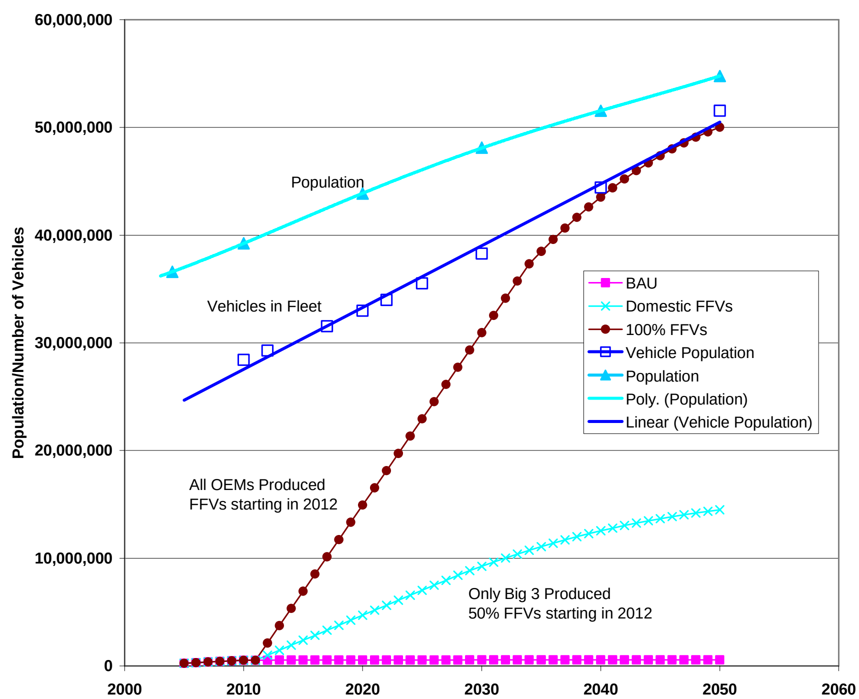


Figure 1-5. Mid Level E30 People and Vehicle Population Estimates
(note same as Figure 1-3)

Table 1-3. Mid Level E30 Performance Metrics

Scenario*		2012				2017				2022			
		RFG3	E30			RFG3	E30			RFG3	E30		
		5.70%	BAU	50%	100%	5.70%	BAU	50%	100%	5.70%	BAU	50%	100%
Mid Level Blends	Number Vehicles gasoline/FFVs (million)	29	0.53	1.00	2.13	32	0.54	3.32	10.13	34	0.55	5.64	18.13
	Gasoline-Ethanol Consumption (million gals)	16,046	66	124	265	15,589	53	1,300	3,974	15,285	54	2,210	7,112
	Ethanol (million gals)	915	20	37	80	889	16	390	1,192	871	16	663	2,134
	Gasoline Displaced (million gal.)	915	15	28	59	889	12	291	889	871	12	494	1,591
	GHG Reduction (tons/day) MW Corn NG		121	226	484		97	2,372	7,250		98	4,032	12,974
	GHG Reduction (tons/day) Cellulosic CA Poplar		389	725	1,553		312	7,620	23,286		315	12,952	41,673
	Vehicle Costs (Million $/year)		53.4	99.5	213.1		54.3	331.5	1,013.1		54.9	563.5	1,813.1

II. Present Technology and Deployment:

a. Include present technology status from 2006 Market Assessment Report
b. There are three market segments for light duty vehicles
    i. Low level blends 5.7% (current use), 10%, and 15% by vol
    ii. Mid level blend (>10% and < 85%; E30)
    iii. Neat or E85 market
c. One market segment for ethanol blended with diesel (E-Diesel)

III. Scenario 1: Low Level Blends: Business-As-Usual (5.7%), 10%, and 15%

a. Characteristics of current market
    i. No changes required to vehicles. OEM manufacture vehicles which are compatible with up to 10% vol ethanol blends in gasoline
        - Will need testing program to check 15% blend or higher
    ii. No changes needed in fueling infrastructure up to 15%
        - Current fueling station equipment UL certified to 15% (ref. Dennis Smith, DOE at SAE Govt and Industry Meeting, May 15, 2007)
        - Underground storage tank (UST) compatibility needs checking
    iii. Currently blending about 1 billion gallons in gasoline; 10% will bring demand to 1.4 billion gallons (a sizeable percentage of current US supply of about 6 billion gallons)
    iv. Ethanol can be priced at blend market values (wholesale CARBOB + $0.51/gal)
    v. Causes some refinery modifications since RVP has to be adjusted to meet RFG3 standards. This requires removing pentanes in summer which can be used in other gasoline products or stored and used in the winter grade.
        - Higher level blends should reduce RVP constraints somewhat
b. Permeation is currently a problem but being mitigated on the on road sector by changes in the predictive model and how to reformulate gasoline
    i. ARB RFG3 will set limits on RVP, reduce sulfur content, and allow higher ethanol blends (up to 10 percent)
    ii. It is expected that increase ethanol content will reduce HC and CO; and reduced sulfur will reduce NOx offsetting the increased HC emissions due to permeation
    iii. May need additional testing to understand 10% or 15% permeation effects (CRC Rpt No E-65-3)
c. How will LCFS affect the blend market if at all
    i. Appears that credit will be given to blends greater than 5.7% baseline

d. GHG percent reduction small: 2.5% with corn based ethanol and 7.6% for cellulosic or sugar cane based ethanol. Although small in percentages the reductions are large since ethanol is blended into the entire California gasoline pool. Table 2-1 shows the level of reductions for both corn and cellulosic/sugar cane based ethanol

Table 3-1. CO2 equivalent Emission Reductions in tpd for low level blends

Blend Level	2012		2017		2022	
	Corn Based	Cellulosic Sugar Based	Corn Based	Cellulosic Sugar Based	Corn Based	Cellulosic Sugar Based
E10 (10%)	11,343	33,334	11,107	32,383	10,891	31,751
E15 (15%)	15,896	49,296	5,442	47,889	15,141	46,955

e. Gasoline displacement some what less than ethanol added due to lower energy content of higher ethanol blends. On energy basis fuel economy of the higher blends should be reduced by:
   i. E10 effect is 1.015 or 1.5%
   ii. E15 effect is 1.032 or 3.2%
   iii. Table 2-2 shows the gasoline displaced with these two blends (it is assumed that E5.7 blends have no affect on fuel economy so there is a 1:1 relationship between ethanol blended and gasoline displaced)

Table 3-2. Gasoline displaced for low level blends in million gasoline gallons

Blend Level	2012	2017	2022	2050
E10 (10%)	1,394	1,354	1,327	1,597
E15 (15%)	1,976	2,147	1,882	2,263

   iv. The amount displaced is relatively constant since the RFG demand is also relatively constant over the analysis period. This is a result of Pavley regulations being implemented starting in 2009.
   v. Figure 2-1 shows the ethanol needed for these low level blends for the RFG case with Pavley regulations in placed. As shown the Pavley regulations substantially reduce the RFG demand.

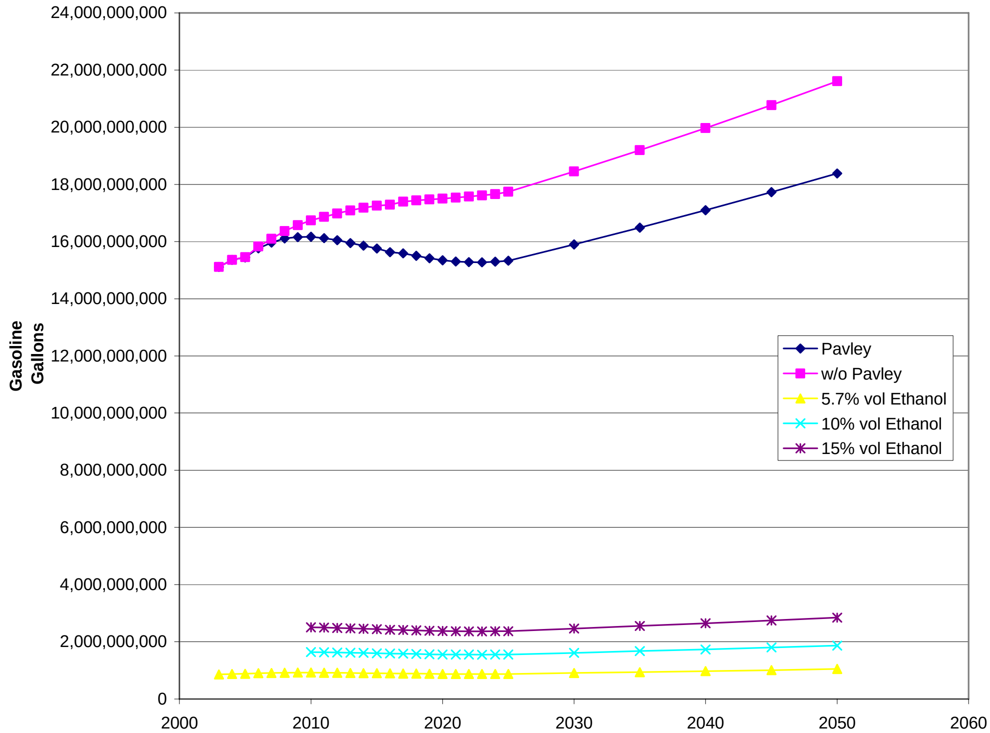


Figure 3-1. Total RFG consumption levels compared to ethanol required for low level blends

f. Costs are mostly on the fuel suppliers/energy companies. With current pricing ethanol is cheaper than CARBOB and other blending components and therefore reasonably cost effective as a blend component to the refiners and fuel distributors. Figure 2-2 shows the most recent ethanol vs. CARBOB and alkylate component pricing on the west coast.
   i. Low level blend scenario has no costs to automakers (unless higher levels require material changes)
   ii. Consumers should benefit when ethanol pricing with $0.51 per gallon credit is less than CARBOB
   iii. UST replacements may be required

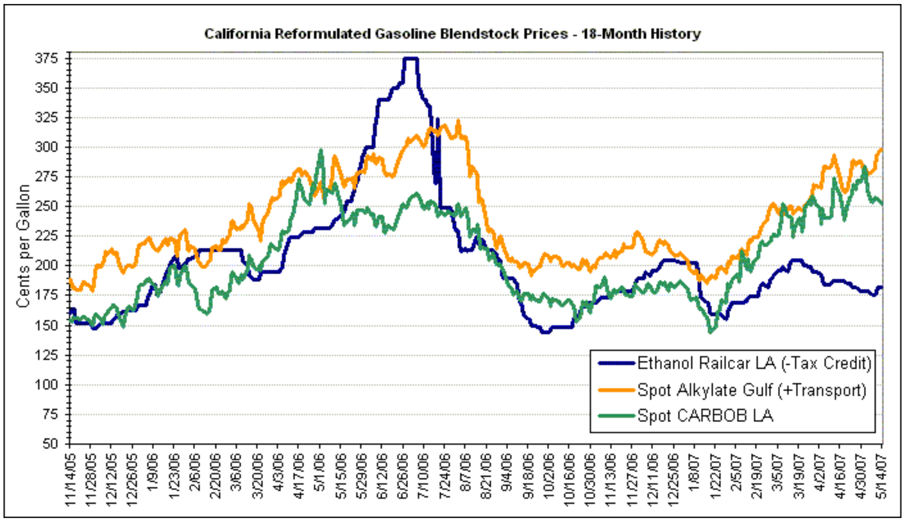


Figure 3-2. Blend component prices in California (source CEC--http://www.energy.ca.gov/gasoline/graphs/component_prices.html)

g. Key Stakeholders
    i. Oil companies—terminals where ethanol is blended
    ii. Ethanol producers—corn, cellulosic, imported sugar cane
        - Limit of corn production for fuel
    iii. Auto's

h. Incentives
    i. Current $0.51 per gallon blenders credit and 30% tax credits up to $30,000 for ethanol plants
        - 2005 EPAct
        - Sunsets in 2008
    ii. It is a high priority for the ethanol producers to get the current blenders credit and tax credits continued
        - Producers also want the current tariff of $0.52 per gallon continued; especially those producers on the West Coast who have to deal with feedstock transportation costs and higher California labor costs and in general higher plant operating costs
    iii. Renewable fuel standard was pivotal in developing ethanol demand which the industry has more than met. President's announcement to move the RFS to 35 billion gallons will continue to provide motivation for supply expansion
        a. Ethanol seen as additive to gasoline and not as competitor to gasoline

i. Supply for low level blends
    i. Current consensus of corn based ethanol production is estimated at about 14 billion gallons or about 10% of current U.S. gasoline demand

- Higher transportation demand probably upsets other corn markets in the long run (some current supply demand dislocations now occurring)
- Some possibilities of increasing corn to ethanol supply with higher corn/acre yields (ongoing work by Monsanto and others). Production could increase to 20 billion gallons under some scenarios
- Corn based ethanol production is sufficient to blend 10% ethanol with current gasoline (U.S. consumes some 140 billion gallons of ethanol per year)

ii. Current U.S. corn based production over 6 billion gallons and is projected to pass 7.5 billion gallons (current RFS) late summer 2007
- No signs of building slow down

iii. California currently capturing about 900 million gallons for RFG3 or about 1/7 of the current production or about 14% of U.S. corn based production
- Not all regions will blend ethanol at 10% so California should be able to capture >10% of supply in future

iv. Some possibility of ethanol production from cellulosic resources in California and other U.S. locations
- Probably not a near term (up to 2014) supply option for low level blends
- Cellulosic production will require break through on enzymatic processes as well as thermal chemical conversion processes. Nevertheless, California has large potential resources and waste streams that could be used for fuel production

j. Infrastructure

i. Current California infrastructure in place for 1 billion gallons
- Rail terminals
- Trucking
- Blending and storage tanks

ii. Increased levels of blending will require expansion and additional capital
- 10% blending levels will require some additional investments—not quantified at present
- 15% blending levels at 2.5 billion gallons per year will require substantial investment to move more than 2x the current ethanol volumes

iii. Infrastructure at higher levels blends could be a possible barrier especially if fuel changes are adopted in short timeframes

k. Low level blend summary

i. Easiest most successful approach to getting alternative fuels into the transportation market;
- Modest infrastructure changes and investments

- Can use in all gasoline fuel cars not just new cars (incorporates so called legacy fleet of older vehicles that using the most fuel)
- Displaces billion of gallons of gasoline depending on blend level—1 billion at 5.7%, 1.5 to 1.8 billion at 10% , and 2.5 to 2.8 billion at 15%
- GHG emission benefits small on a percentage basis but large overall and like gasoline displacement occur immediately throughout fleet
- GHG emission benefit depends on ethanol production pathway—corn as possible lower bound and cellulosic/sugar cane production as upper bound
    a. Corn based GHG reductions (equiv CO2 emissions) compared to E5.7
        i. E10 (2012-2050) range from 11,400 tpd to 13,400 tpd
        ii. E15 (2012-2050) range from 15,900 tpd to 18,800 tpd
    b. Cellulosic based GHG reductions compared to E5.7
        i. E10 (2012-2050) range from 33,300 tpd to 41,000 tpd
        ii. E15 (2012-2050) range from 49,300 tpd to 63,000 tpd
- Other pathways of ethanol production will most like fall between these two estimates like corn shipped to California and wet mill fed to nearby cattle

ii. Current and future barriers

- Need research on how to optimize low level ethanol blends with gasoline feedstocks
    a. Driveability and environment effects
    b. Need coordinated "auto oil" research projects
- Need some infrastructure investment especially at terminals but also at fueling stations if USTs not compatible
- Supply adequate to 1.5 billion gallons will need additional sources beyond corn at higher demands

IV. Scenario 2, E85 used in FFVs

a. Introduction (use write up in market assessment report)

i. Some 6 million FFVs in US with about 260,000 in California

ii. Nearly all FFVs in California use gasoline

iii. Only 3 stations in CA but expanding in LA Basin and Sacramento

- Calstep in Southern California
- SMAQMD in Sacramento (AB1811)
- Chevron, Caltrans, Pacific Ethanol demonstration

iv. FFV technology can use gasoline or E85 or any combination of gasoline and E85.
- Vehicle modifications relatively straight forward – changing materials and modifying computer logic.
- Low costs ~ $100 per vehicle
- Some issues with emission certification
  a. 50°F cold start tailpipe + evap tests
  b. Evap issues with blends down to PZEV levels
  c. Impact on vehicle costs?

b. E85 FFV Scenarios

i. Incentives currently in place for OEMs to produce FFVS
- AMFA 1988 and renewed to 2010 and could be expanded to 2013

ii. Domestic OEMs have suggested (committed) that 50% of their production will be FFVs by 2012. This will greatly increase the number of FFVs in the LDV fleet.

iii. Low costs to manufacturers indicates possibility of all new vehicles being FFVs starting in 2012
- Brazil experience shows this is possible at least given the success of FFVs in the market place

iv. Figure 4-1 shows a comparison of the above three possible scenarios

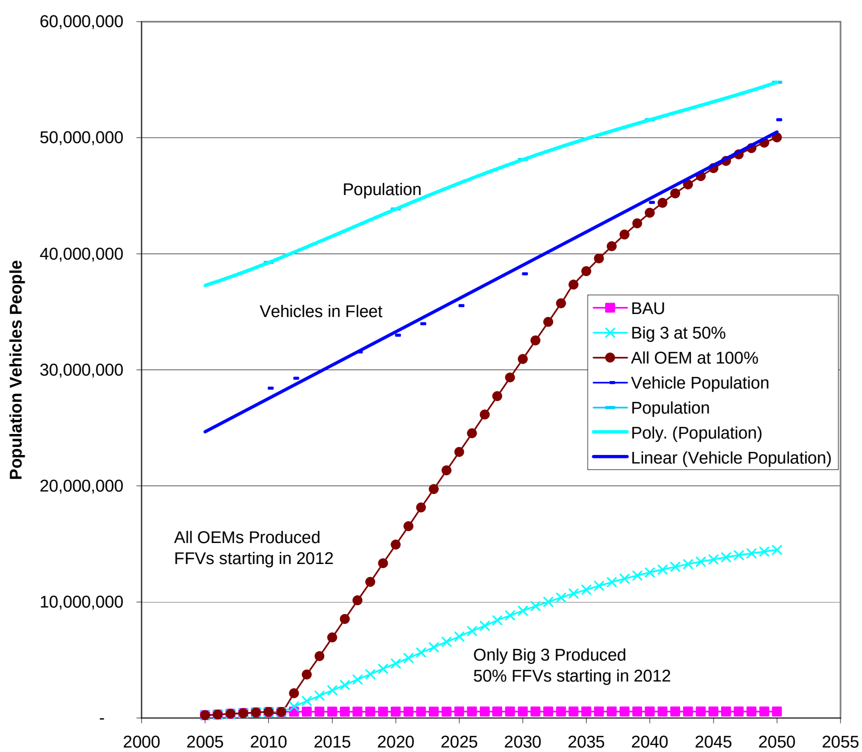


Figure 4-1. FFV Population Estimates Compared to Future Number of Vehicles and California Population

c. Projected GHG benefits are shown in Table 4-1 for the three E85 scenarios
    i. Small effect for BAU case which maintains a FFV fleet of 500,000 vehicles
    ii. Larger effect if GM, Ford, and Chrysler make 50% of new vehicles FFVs. This corresponds to about 25% of new car sales in California
    iii. Very large benefits for 100% FFVs and using E85 100% of the time
        - Scenario is unrealistic but can be scaled based on possible E85 fueling frequency; e.g. if FFV fueled 50% on E85 and 50% on gasoline the benefits in Table 4-1 would be halved
    iv. Unlike low level blends GHG benefits follow the introduction and use of E85. This ramp up takes time as new vehicles enter the market and as older vehicles are retired

Table 4-1. CO2 equivalent Emission Reductions in tpd for FFVs using E85

FFV E85 Scenarios	2012		2017		2022	
	Corn Based	Cellulosic Sugar Based	Corn Based	Cellulosic Sugar Based	Corn Based	Cellulosic Sugar Based
BAU	85	394	68	316	69	320
50% Big 3	395	1839	2076	9658	3528	16416
All FFVs	846	3937	12686	59027	22703	105637

(Insert figure on ethanol consumed; see Table 1-3 for ethanol consumed)

d. Projected gasoline displaced from implementing E85 scenarios are shown in Table 4-2
    i. As with GHG emission reductions the reductions are modest for BAU case
    ii. Displacement growths as new vehicles are purchased and put into vehicle fleet reaching about 10% in 2050 for the 50% scenario and about 70% for the 100% scenario
    iii. Benefits follow the introduction of the alternative fueled vehicles into fleet and using E85

Table 4-2. Gasoline displaced for E85 Scenarios in million gasoline gallons

FFV E85 Scenarios	2012	2017	2022	2050
BAU	18	14	14	14.5
50% Big 3	83	434	738	1889
All FFVs	177	2652	4746	13044

e. Barriers to introducing FFVs in California
    i. OEMs have suggested there are some technical hurdles in certifying FFVs to PZEV standards. Current FFVs are certified in California but at less stringent standards.
    ii. Customer needs to have a value proposition for using E85
        - Financial
        - Vehicle performance (i.e. premium fuel)
        - Green thing to do
        - Other
    iii. Manufactures have the technology to introduce FFVs but infrastructure will be required—so called chicken and egg
        - FFVs solve this issue but E85 still needs to be available to and customers need to purchase

f. Distribution and Fueling Infrastructure
    i. Need fueling stations modifications to use E85. Extend of modifications will range from retrofits of piping and dispensers to ground up installations including UST, piping and dispensers.
    ii. Need to modify gasoline terminals to blend E85
        - Have to adjust CARBOB RVP – probably by adding pentanes
    iii. Need tanker trucks to distribute fuel. Gasoline tankers will work but eventually will need to increase fleet due to less volumetric energy content
    iv. Substantial costs of adding infrastructure
        - $100K to 250K per station
        - This investment has to be recovered by E85 sales so important to have adequate sales as early as possible.
        - Might be able to use some of the existing gasoline equipment if alcohol compatible. For example, stations with 3 underground tanks for regular, midgrade, and premium could use one of these tanks for E85 and then use blend pump/dispenser to provide midgrade (not many stations are configured this way any more)
        - Add cost spreadsheet on station costs and recovery of investment
    v. Number of E85 stations and distribution
        - Need at least 10% coverage is the old wisdom for introducing alternative fuels. With FFV where the customer can choose either gasoline or E85 suggests that the coverage should be increased to 20% of the gasoline stations
        - Could concentrate in areas of high FFV populations like SF, Sacramento, LA, San Diego
    vi. Need oil companies to back strategy and remove barriers currently imposed on station owners

- For example, add dispensers under canopy (WSJ article April 2, front page)

vii. Equipment Issues:

  a. UL certification of dispensers (currently cert to 15% alcohol blends)
  b. Certification of stage II vapor recovery on fueling nozzles/dispensers

viii. Key stakeholders

- Major oil companies, branded stations, independents
  a. Majors: Chevron, BP, Shell, etc.
  b. Branded: privately owned but with Chevron, Arco, etc.
  c. Independents: Rotten Robby, big box—Wal-Mart
- Fuel station equipment suppliers: tanks, dispensers, pumps etc
- Others: construction companies, A&E, etc.

g. Price of E85

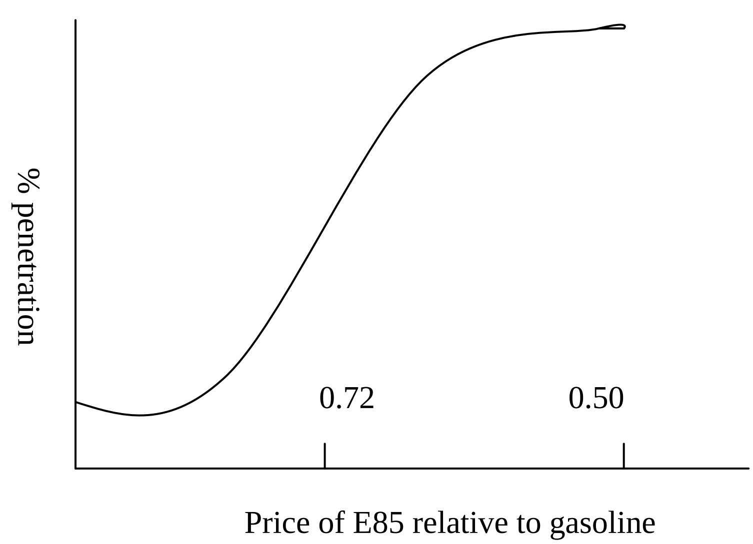
i. Price on energy equivalent basis 72% of RUL.

- Pricing is tricky since E85 always needs to compete with gasoline (RUL or octane adjusted?)

ii. Question on RUL: E85 has higher octane can this be capture in pricing of fuel? May require engine modifications like turbocharging or variable valve to get customer benefit

iii. Need to evaluate the value proposition for customers using E85

- Green benefit
- Economic (cheaper)
- Disbenefit lack of station infrastructure
- E85 use will depend on perceive benefits-- “s” curve on % penetration vs. price



h. Incentives
    i. EPACT 2005
        - Blenders credit of $0.51 per gallon
        - Tax credit for infrastructure (30% capital costs)
    ii. Sales tax, or excise tax treatment
    iii. Use as compliance with LCFS (what's the value)
    iv. FFV user education
        - Yellow fuel caps
    v. Free fuel
    vi. More station incentives—grants, fuel pricing etc

i. E85 Scenario Summary
    i. Success of this strategy depends on building the E85 infrastructure. Justifying this investment is the major reason dedicated alternative fuel use has not been successful in California.
        - Have to match fuel use to infrastructure changes to recover investments
        - Displaces billion of gallons of gasoline depending number of FFVs introduced into the market place and how much E85 fuel is used by these vehicles; but is probably limited by supply of ethanol
        - GHG emission benefits also depend on number of FFVs and their use of E85. Also GHG benefit will be limited by supply of ethanol
        - GHG emission benefit depends on ethanol production pathway—corn as possible lower bound and cellulosic/sugar cane production as upper bound
        - Other pathways of ethanol production will most like fall between these two estimates
    ii. Current and future barriers
        - Need to solve FFV certification to PZEV
            a. Change of materials for fuel wetted system components
        - Need large infrastructure investments
            a. Estimated at $2.4 billion if all stations in California have E85 capability
        - Not enough ethanol supply to completely convert to E85
            a. Demand price relationship may not favor high volume use in California
            b. Need production break through to provide competitive cost ethanol at very high volumes (>10 billion gallons/yr)
        - Not clear competition with gasoline will provide consistent GHG reductions and gasoline displacement

V. Scenario 3 – Medium Level Blends--30% Ethanol or other Bio-derived Molecules

a. Pick fuel to minimize fuel infrastructure changes and costs
    i. This concept would attempt to cost effectively reduce the number of fuels in the market place
        - Current infrastructure is a 3 tank system (RUL, PUL, and diesel) mid grade is blended from regular and premium
        - Mid level blend strategy might be able to replicate this 3 tank system
            a. Regular unleaded (octane level unclear but may need higher than 86 R+M/2
            b. Mid level ethanol blend at octane in mid 90's
            c. Blend mid or premium by mixing RUL and mid level
    ii. Assume underground tanks alcohol compatible in California so may not have to change out; this needs to be verified
    iii. At E30 may only need to change materials in pumps, dispenser, etc. Equipment change out. No construction
    iv. Estimate costs about $10,000 per station. 9600 stations in Ca implies with 8% discount investment of $237 million or about 1/10 the costs of a full E85 infrastructure

b. Mid Level FFV Scenarios (same as E85)
    i. BAU no growth
    ii. 50% by Big 3 in 2012
    iii. 100 % FFV by all manufacturers in 2012
    iv. Figure 5-1 shows a comparison of the above three possible scenarios (same as Figure 4-1)
    v. All FFVs would have to use the E30 Mid Level blend
        - E30 priced at its market value
            a. Might have higher octane so could get higher efficiency from vehicles
        - Unleaded priced probably more than E30 (ethanol cheaper than gasoline)
        - Introduced like unleaded in the 1970's
        - Maintains two tank system
    vi. Need to decide at what level ethanol is blended into unleaded gasoline (sold at 10% or 15% or what?)

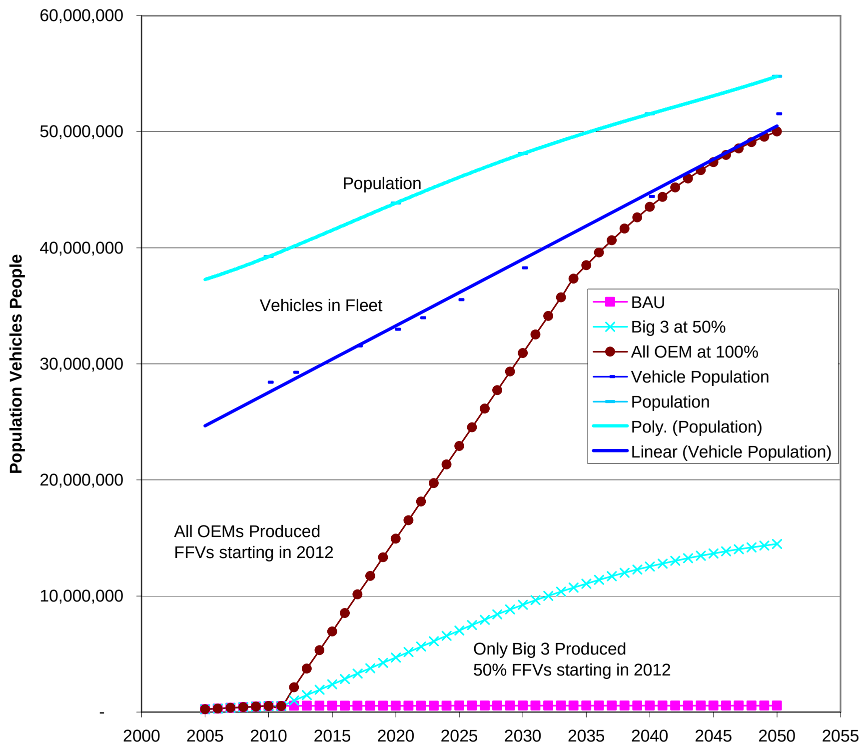


Figure 5-1 FFV Population Estimates Compared to Future Number of Vehicles and California Population

c. Projected GHG benefits are shown in Table 5-1 for the three Mid Level E30 scenarios
   i. Small effect for BAU case which maintains a FFV fleet of 500,000 vehicles
   ii. Larger effect if GM, Ford, and Chrysler make 50% of new vehicles FFVs.
   iii. Large benefits for 100% FFV case with 100% use of E85
   iv. Unlike low level blends GHG benefits follow the introduction and use of E85. This ramp up takes time as new vehicles enter the market and as older vehicles are retired

Table 5-1. CO2 equivalent Emission Reductions in tpd for FFVs using Mid Level E30 Blend

FFV Mid Level E30 Scenarios	2012		2017		2022	
	Corn Based	Cellulosic Sugar Based	Corn Based	Cellulosic Sugar Based	Corn Based	Cellulosic Sugar Based
BAU	121	389	97	312	98	315
50% Big 3	226	725	2372	7620	4032	12952
All FFVs	484	1553	7250	23286	12974	41673

(Insert figure on ethanol consumed; see Table 1-3 for ethanol consumed)

d. Projected gasoline displaced from implementing Mid Level E30 scenarios are shown in Table 4-2
    i. As with GHG emission reductions the reductions are modest for BAU case
    ii. Displacement grows as new vehicles are purchased and put into fleet
    iii. Benefits follow the introduction of the alternative fueled vehicles into fleet and using E85

Table 5-2. Gasoline displaced for E85 Scenarios in million gasoline gallons

FFV E85 Scenarios	2012	2017	2022	2050
BAU	15	12	12	12
50% Big 3	28	291	494	1271
All FFVs	59	889	1591	4389

e. Mid Level Scenario Summary
    i. Point of strategy is that infrastructure costs are minimized and existing infrastructure can be leveraged
        - If underground tanks have to be changed out then infrastructure costs similar to E85
    ii. Marketing of fuels is easier with this strategy
        - No competition between Mid Level and gasoline
    iii. Get comparable albeit lower GHG and gasoline displacement as E85
    iv. Vehicle FFV costs assumed to be about $100 per vehicle
        - Might want to optimize to E30
    v. Even this strategy will be limited by ethanol or other sources of biofuels
    vi. Current and future barriers
        - Need to solve FFV certification to PZEV
            a. Change of materials for fuel wetted system components
        - May need to change out USTs which might result in infrastructure investments comparable to E85
            a. Costs to be determined
        - Not enough ethanol supply to completely meet total E30 demands

VI. Scenario 4– EDiesel:

a. Option is to blend ethanol in diesel fuels
    i. Up to maximum 15% vol

    ii. O2 Diesel in market place with 7.7% vol blend with proprietary additives in the 0.6 to 1% vol range
    iii. O2 Diesel has received interim verification from ARB

b. Key assumptions affecting use
    i. Continuation of $0.51 blenders tax credit
    ii. Moderate growth case assumes market penetration <10%
        - Engine manufacturer problems but not show stopper
    iii. Higher growth case has broader customer and engine manufacturer acceptance building to 25% acceptance in targeted fleets
    iv. EPA Tier II health effects testing funded and outcome positive
    v. Engine durability no different than diesel
    vi. ASTM standard developed
    vii. Verification retained and ethanol diesel blends continue to show emission benefits

c. Table 6-1 shows possible results for O2 Diesel for the above two cases

Table 6-1 Projections of Market Potential of O2 Diesel

Fleet Application	2010		2025	
On-Road Centrally Fueled	Diesel Gal Displaced (1)	Ethanol Volume	Diesel Gal Displaced	Ethanol Volume
Moderate	1.8	3.0	6.6	11.0
Higher Growth	2.7	4.5	10.2	17.0
Off-Road Centrally Fueled				
Moderate	2.4	4.0	6.6	11.0
Higher Growth	6.0	10.0	21.0	35.0

(1) Millions of gallons of diesel displaced and ethanol