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Preparation of the
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Staff Workshop on Transportation
Fuel Prices and Energy Demand
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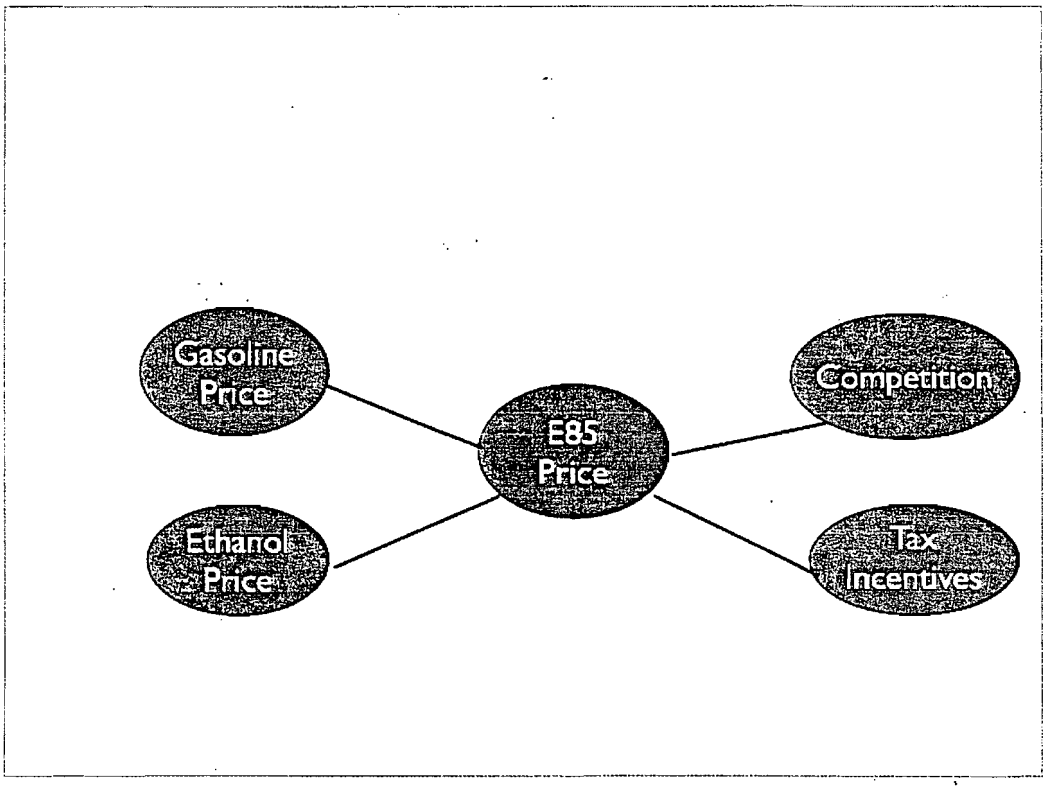
Background: The California Energy Commission has scheduled a "Staff Workshop on Transportation Fuel Prices and Energy Demand". This workshop will address both conventional and alternative fuels including E85. I was invited to present at this workshop but, unfortunately, I have a scheduling conflict. Consequently, I am providing these comments in advance of the meeting as I believe they will be useful to staff in developing criteria upon which to make projections for E85.

Demand and Price Forecasting E85: Forecasting the demand and price of E85 is quite difficult because each has specific variables. Of course price itself is a variable in forecasting demand. As such, price forecasting variables are covered first.

E85 Price Forecast Variables: The price of E85 is influenced by the price of the ethanol from which it is made as well as the price of the gasoline (or other hydrocarbons) making up the smaller portion of the E85 gallon. The price of gasoline at retail also impacts E85 prices because consumers will not purchase E85 if it's going to cost them more per mile driven than gasoline. Since a FFV can use gasoline or E85 most consumers will purchase the fuel that is the least expensive on a gasoline gallon equivalent (GGE) basis. Finally, tax incentives also play a role since they reduce the cost of producing E85. Each of these categories are discussed more thoroughly below.



Ethanol Price: Obviously, the price of ethanol contributes a major portion of the cost of producing a gallon of E85 (note that when discussing E85 this term encompasses E75 and E80 and refers to products meeting ASTM D 5798). For instance, on 2/4/08 the national average price for ethanol was $1.56 a gallon and for gasoline $1.15 per gallon. Excluding tax considerations, this would result in the following E85 economics.

2008 Scenario	**Gasoline**	**E85**
Gasoline Portion	$1.15	$.1725
Ethanol Portion	0	$1.3260
Total	$1.15	$1.4985

Obviously, in the above scenario, E85 costs more than gasoline. Looking at another example from May 2007 (in Chicago) unleaded gasoline was $2.63 a gallon and ethanol was $2.24. This would result in the following E85 economics.

	Gasoline	**Ethanol**
Gasoline Portion	$2.63	$0.3945
Ethanol Portion	0	$1.9040
Total	$2.63	$2.2985

In the May 2007 Chicago scenario E85 can be produced at about 33¢ pg below gasoline (exclusive of tax credits).

Tax Incentives: Using the same reference prices as above but applying the $0.45 cent per gallon Volumetric Ethanol Excise Tax Credit (VEETC) results in the following price comparisons.

2008 Scenario	**Gasoline**	**E85**
Gasoline Portion	$1.15	$0.1725
Ethanol Portion	0	$0.9435
Total	$1.15	$1.116

With VEETC applied to the 2008 scenario the cost of E85 is below the cost of gasoline albeit not enough to account for energy content differences as discussed later.

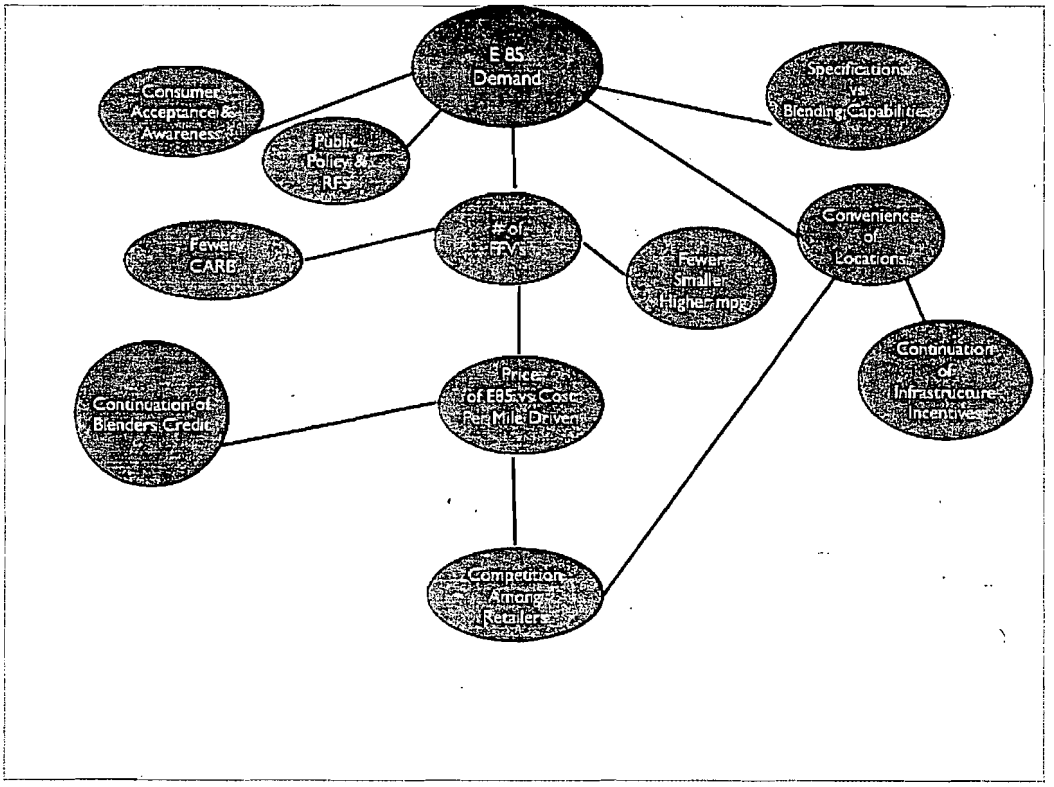
2007 Scenario	**Gasoline**	**E85**
Gasoline Portion	$2.63	$0.3945
Ethanol Portion	0	$1.5215
Total	$2.63	$2.1845

In the 2008 scenario the price of E85 is about 44.5 pg lower than gasoline. An improvement of about 11.5 cpg compared to no VEETC.
It is obvious that VEETC will play a role in how E85 will be priced.

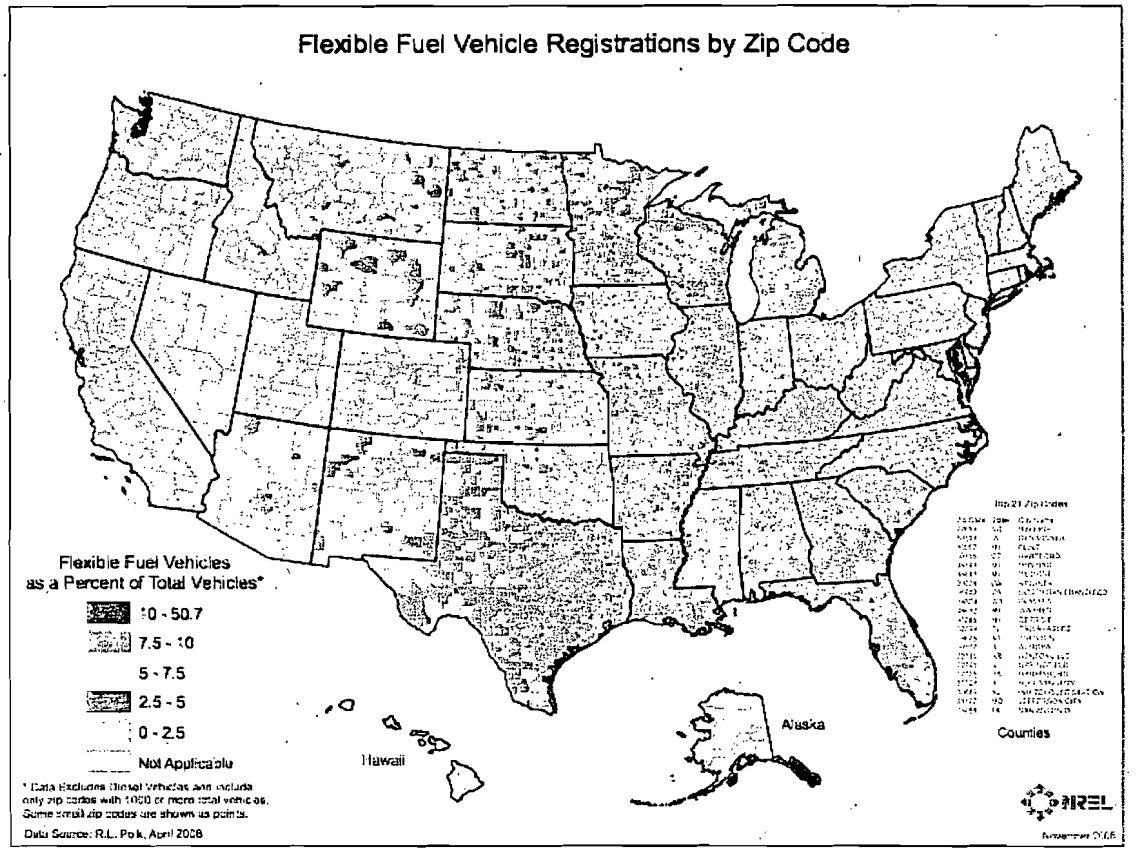
Gasoline Price: From the above it can also be seen that the price of gasoline affects the production cost of E85. But the price of gasoline affects E85 prices in an even more important way. Since FFV's operate on gasoline or E85, customers can choose between either fuel. Most consumers will choose the fuel that takes them the farthest for the lowest cost. E85 contains about 83,400 btu/gallon or about 73% that of a gallon of gasoline at 114,000 btu/gallon. Using the more favorable 2007 scenario with VEETC, gasoline is $2.63 per gallon. For E85 to deliver the same distance driven on a cost basis, the consumer would need to be able to purchase E85 at $1.92 per gallon versus the $2.1845 in the calculation.
If the purchase of E85 is at $2.1845 they lose about 26¢pg compared to gasoline. This equates to $5.20 on a 20 gallon purchase, not a cost most consumers will be willing to absorb.
It is clear from the above that E85's price compared to gasoline (on a gasoline gallon equivalent) would impact either price (lower) or demand (less if over priced).
Note: It is worth mentioning here that while these examples discuss consumer cost, actual retail prices are set by individual retailers. To date, many retailers of E85 (nationally) have not priced E85 low enough when GGE is considered. For instance, a check of E85 prices on www.e85prices.com on February 3, 2009 revealed the national average price of gasoline was $1.85 while the E85 average price was $1.68 or 90.8% that of gasoline. Retail pricing patterns will be difficult to determine. In some instances such as February 2009 the lack of a GGE price is reflective largely of the price of ethanol but even in times of low ethanol prices (relative to gasoline) GGE pricing is rarely found. This issue, which impacts demand, is difficult to address because it is illegal for marketers and suppliers to discuss pricing issues.

Competition: In todays market, with relatively few E85 fueling facilities, marketers of E85 rarely compete against each other. E85 is treated as somewhat of a low volume specialty product and not aggressively priced. However, as the number of E85 outlets grow and marketers are actually competing against each other it is likely that this would contribute to more aggressive pricing patterns (i.e. lower prices). Projections for fueling facility growth could, therefore impact pricing forecasts.

E85 Demand Forecasting: Even more variables come into play here. These include: public policy such as continuation of the RFS; the number of FFV's in the market place; the GGE pricing of E85; specifications versus blending capabilities; and convenience. In turn, many of these topics are influenced by other factors.



E85 Demand: According to EIA, California gasoline sales reached 15.59 billion gallons for 2007, at present only a few hundred thousand vehicles in California are FFV's. The NREL map below shows that as of November 2006 there was no area of California where FFV's represented more than 2.5% of vehicle population.



FFV Population: Obviously, with approximately 30 million registered vehicles of which over 18 million are automobiles, the potential to expand the FFV population is great. At present, the three domestic automakers (Ford, GM, Chrysler) have tentatively committed to produce up to 50% of their vehicles as FFV's. There is, however, no assurance that all FFV models will be able to achieve CARB emission certification so the percentage of vehicles remains unknown. A reasonable estimate might be to assume that 30% of all domestic passenger vehicles sold in California will have FFV capability. By determining annual vehicle purchases and turnover and the percentage of vehicles that will be sold by the domestic producers, the annual increase in FFV population can be

estimated. (Note that plans of foreign producers regarding FFV production tend to be in a state of flux). A decision by foreign producers to offer FFV's or public policy initiatives to induce more widespread FFV offerings would allow an acceleration of FFV population projections.

As a subset to this topic, it is not only the availability of FFV's that comes into play but the type of FFV's. A quick review of model offerings demonstrates that most FFV offerings are larger, less fuel efficient offerings. These offerings will not be received well in a high gasoline price environment. As such, unless more fuel efficient FFV's are offered, sales of these vehicles could plummet if gasoline prices return to recent highs.

E85 Cost Per Mile Driven: E85 pricing on a GGE basis was thoroughly discussed in the E85 price forecast variables section as was the importance of the VEETC. In the more distant future competition among retailers could play a role.

Convenience of Locations: The retail gasoline facility count in California is approximately 9,970. Most experts agree that 20% of a given markets retail outlets would need to offer E85 to be deemed convenient. This would equate to about 2,000 facilities. If E85 is not convenient to purchase, consumers will simply purchase gasoline. Presently, there are only 23 E85 fueling locations in California.

Consumer Awareness, Acceptance: Conveniently located, competitively priced, E85 will not capture large market share unless the consumer is aware of the fuel's availability. Moreover, this is a new fuel they may hesitate to purchase if they are not aware that it is suitable for their vehicle. Consequently, demand projections must take this variable into account.

Specifications Versus Blending Capabilities: At present, it is not possible to meet the minimum vapor pressure specification by blending ethanol and CRBOB to produce E85. It is necessary to adjust the fuel by adding light ends (e.g. pentane). This limits such blending to facilities that have pressurized storage for the light ends. Such storage is rarely found at terminals. This limits E85 blending to a few facilities and results in long

shipping distances by truck. If this issue remains unresolved it could impact the availability and cost of E85 and therefore could reduce demand.

Public Policy and Renewable Fuels Standard: Last, but certainly not least, is the Federal Renewable Fuels Standard (RFS) and other public policy issues. The RFS required 9 billion gallons of total renewables in 2008. That level rises to 36 billion gallons annually in 2022. While a small portion of the requirement will be met with biodiesel, the majority will be met first with corn based ethanol and later with additional ethanol from cellulosic feedstocks. The conventional biofuel requirement reaches 13.8 billion gallons in 2013 at which time the requirement for cellulosic biofuel reaches 1 billion gallons. So, by 2013 the market for E10 is completely saturated. Unless higher blend levels are permitted for use in non-FFV's, the remainder would be directed to E85. This would tend to drive dramatic expansion of E85 programs. If one assumes 35 billion gallons of annual ethanol use that is 25 billion gallons of additional ethanol. That will replace about 16.2 billion gallons of gasoline reducing E10 demand by 1.62 billion gallons. Thus about 26.62 billion gallons need to be used in higher level blends in FFV's. Assuming an average 80% blend level in E85, this equates to 34 billion gallons of E85. If an average FFV travels 12,000 miles per year at 18 miles per gallon, this equates to 667 gallons of E85. Thus consuming 34 billion gallons of E85 would necessitate a fleet of over 50 million FFV's operating 100% of the time on E85. At present, announced rates of introduction we would only reach perhaps a 35 million FFV population by 2022.

Consequently, additional public policy initiatives that encourage expanded FFV production and expanded E85 retail availability will be needed to reach the current RFS which would in-turn impact demand.

Projection Scenarios: Obviously, with so many variables, an approach that employs worst case – best case scenario is desirable.

E85 Pricing Worst Case

VEETC removed

High ethanol prices — E85 cannot be sold at GGE price

Low gasoline prices

Insufficient competition

E85 Pricing Best Case

VEETC extended

Low ethanol prices — E85 can be priced at or below a GGE

Price

High gasoline prices
increased competition

E85 Demand Worst Case:

- Number of FFV's in California market increase by 50,000/year.
- FFV's continue to be larger, less fuel efficient models
- Not all FFV's achieve CARB emission certification
- E85 outlets expand at 20 per year in California
- Meeting vapor pressure continues to be a problem
- Low consumer awareness / acceptance
- High E85 price (above GGE)

E85 Demand Best Case:

- Number of FFV's in California market increase by 100,000/year 2009-2011 and then 300,000/year in future years
- FFV's available as smaller more fuel efficient models
- All models FFV's achieve CARB emissions certification
- E85 outlets expand at 50 per year in 2009, 2010, 2011, 2012, and at a rate of 150/year in 2013-2022 (1700 total by 2022)
- Vapor pressure issue is resolved

- High consumer awareness and acceptance
- Low E85 price (below GGE)
- 25% of FFV's operate on E85 – 25% of fuel 2011-2014 and 50% of FFV's operate on E85 – 75% of fuel in future years

By applying the above scenarios assumptions worst case / best case scenario boundaries could be developed.