Transportation Advisory Board
of the Metropolitan Council of the Twin Cities

TO: Transportation Advisory Board

FROM: Kevin Roggenbuck, Transportation Coordinator

DATE: May 5, 2011

RE: Electric Vehicles and the Gasoline Tax.

TAB Policy Committee co-chair Ken Johnson asked me to provide the two items listed below to facilitate discussion of agenda item IV. d. on the May 12 Policy Committee agenda:

- Gasoline Gallon Equivalent (GGE) Definition; and
- Outlook for Biofuels, EV Charging Infrastructure Dim

Gasoline Gallon Equivalent (GGE) Definition

What's a BTU?

As a basis for determining energy content of a fuel, it is helpful to understand exactly what a BTU (British Thermal Unit) is. Its scientific definition goes something like this: *British Thermal Unit - The amount of heat (energy) required to raise the temperature of 1 pound of water by 1 degree Fahrenheit.*

Fuel Type	Unit of Measure	BTUs/Unit	Gallon Equivalent
Gasoline (regular)	gallon	114,100	1.00 gallon
Diesel #2	gallon	129,500	0.88 gallon
Biodiesel (B100)	gallon	118,300	0.96 gallon
Biodiesel (B20)	gallon	127,250	0.90 gallon
Compressed Natural Gas (CNG)	cubic foot	900	126.67 cu. ft.
Liquid Natural Gas (LNG)	gallon	75,000	1.52 gallon
Propane (LPG)	gallon	84,300	1.35 gallon
Ethanol (E100)	gallon	76,100	1.50 gallon
Ethanol (E85)	gallon	81,800	1.39 gallon
Methanol (M100)	gallon	56,800	2.01 gallon
Methanol (M85)	gallon	65,400	1.74 gallon
Electricity	kilowatt hour (Kwh)	3,400	33.56 Kwhs

From this we see that one gallon of gasoline has the same energy as 33.56 Kwhs of electricity.

Minnesota's gas tax of 28¢/gal is equivalent to 0.834¢/Kwh.

Outlook for Biofuels, EV-Charging Infrastructure Dim

By James M. Amend
WardsAuto.com, Apr 13, 2011 9:05 AM

LA JOLLA, CA – Environmental experts offer a sobering assessment of efforts in the U.S. to curb carbon-dioxide emissions, calling current biofuels-production processes illogical and revealing staggering costs related to the budding electric-vehicle infrastructure.

Jan Kreider, a professor of engineering at the University of Colorado-Boulder, reports the cost of retrofitting a downtown parking structure today with mostly 240V chargers for EVs would cost $12,400 per connection.

"The costs are mindboggling," Kreider tells the annual Toyota Sustainable Mobility Seminar recently held here.

Kreider's university study asked for bids from three Boulder-area contractors to retrofit 90% of an existing, 300-spot parking deck in the suburban Denver with 240V chargers.

As part of the study, he also asked the contractors for estimates to outfit the remaining 10% of the structure with 480-volt high-speed chargers. The tab: $106,000 per unit.

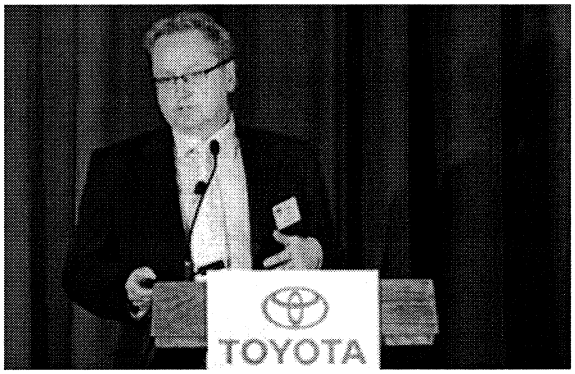
"So people talk about fast-charging, but you cannot make a (business) case for it," he says.

A web of recharging stations in urban area across the nation represents a key element to reaching President Obama's ambitious goal of putting 1 million EVs on U.S. roads by 2015.

But Kreider sees the costs related to building an infrastructure for charging range-challenged EVs as the greatest obstacle to their adoption. "The end-of-the-line infrastructure cost is shockingly high."

A study released by the U.S. Department of Energy in February put the per-unit cost of a high-speed charging unit between $106,000 and $110,000 and speculated "businesses investing in these stations would likely pass these costs on to consumers."

The DOE study, which was conducted with the University of Indiana, calls the need for fast-charging in the community and on the highway "essential for mass-commercialization" of EVs and admits the scale of such a project would be immense.



Steven Kay: Difficult to say when advanced biofuels, such as algae, will be made in volume.

"As of late 2009, there were fewer than 1,000 recharging stations in the United States," the DOE says. "By way of comparison, there are 170,000 gasoline refueling stations. A viable business model for recharging is not yet apparent."

Equally disconcerting was the local power company's reaction to the new bids for such a project, not knowing they were for a university study. "They went ballistic," Kreider says.

Experts here also argue against the viability of biofuels and express doubt the U.S. will ever reach its stated goal of producing 36 billion gallons (136 billion L) of biofuels annually by 2022.

Advocates of biofuels, especially second-generation cellulosic blends that make fuel from waste products, instead of food crops such as corn, argue these fuels could go a long way in alleviating the nation's reliance on foreign oil from countries hostile to the U.S.

Critics argue biofuels use up too many natural resources in their production and take more energy to blend than they provide in the end.

They also claim the government's mandate merely subsidizes the agricultural industry and that auto makers build flex-fuel vehicles just for the national fuel-economy credits they receive. Those credits soon will expire and with them will go the incentives to offer FFVs.

"You've got to displace the land and you've got to use water, and both are in scarce supply," says Peter Wells, an international oil and gas expert and consultant to Toyota. "And the additional problem is its energy density is so small. It looks like a dead end to me and...a dead end to many people."

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Unlike rivals General Motors, Ford and Chrysler, Toyota builds few vehicles capable of running on ethanol.

Ward's data shows of the 14.8% of all light vehicles sold in the U.S. in the '10 model year with a flex-fuel engine, 61.4% came from GM, 32.6% from Ford, 2.4% from Toyota, 2.1% from Nissan and 1.5% from Chrysler.

GM owns major stakes in two biotechnology companies seeking to commercialize their processes for making cellulosic biofuels.

At the same time, just 3% of the nation's overall vehicle fleet is equipped with a flex-fuel engine, the Alliance of Automobile Manufacturers says.

The AAM, which represents GM, Ford, Chrysler, Toyota and a number other auto makers on Capitol Hill, recently argued against a bill requiring members to make 90% of their vehicles capable of running on 85% ethanol by the '16 model year.

The AAM says the cost would be passed on to consumers, and the availability of E85 fuel is limited and mostly concentrated in the Midwest. The bill comes from Sen. Tom Harkin, a Democrat from corn-rich Iowa.

"We can't keep using food crops to make fuel; it just doesn't make sense," says Toyota's consultant, Wells, who estimates 40% of the U.S. corn crop goes to ethanol. To satisfy U.S. transportation demand, the entire yield would need to go for ethanol.

Biofuel from algae show more promise, he says. "It does not take up a lot of land; it uses wastewater (and) uses up carbon-dioxide. It has a lot going for it.

"The problem is, how do you go from a plant the size of a desk to one that makes a million barrels a day? Because if it doesn't make a million barrels a day, it is not going to be of use to anybody."

Steve Kay, a geneticist at the University of California-San Diego, says a number of cellulosic ethanol makers are approaching the pivotal production cost of $2.50 per gallon, which would make the fuel more viable.

And, he reports, a number of biofuels facilities capable of producing 400 million-500 million gallons (1.5 billion-1.9 billion L) annually are coming on line soon.

But it's difficult to say when advanced biofuels, such as algae, will be made in volume, because the venture capital their developers rely on is drying up.

Investors, in short, are impatient with the long timelines to commercialization and the little government-backing that exists.

Algae also require large tracts of land for growing ponds and more CO2 than the atmosphere naturally can supply.

Says Kay: "Most of the models for algae (biofuels) that make sense are still incredibly challenging to grow cheaply enough and densely enough."

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