Bethel College Mennonite Church Creation Care Committee
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THE ELECTRIC CAR: CAR OF THE FUTURE? [1]

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Remember the Ford Motor Company advertising slogan of 1945, "There's a Ford in Your Future"? Let's tweak that slogan a bit and ask, "Is there an electric car in your future?" This note provides some information to help address that question.

What is an electric car?

The most common electric cars are of two basic types: (i) the hybrid (gas and electric; e.g. Toyota Prius); or (ii) the all-electric (e.g., the forthcoming Nissan Leaf). Hybrids can be further divided into: (i) plug-ins which permit off-use recharging (e.g., the forthcoming Chevrolet Volt); and (ii) non plug-ins (e.g. the Toyota Prius). An "umbrella" term is "electric vehicle" (EV). An electric car is a subset of EVs.

Brief history of the electric car

In the US electric cars have been around for some 120 years! In 1900 about one-third of all cars in NYC, Boston and Chicago were electric. By the 1920s electric cars had largely disappeared from US streets, largely in response to cheaper gasoline-powered cars. In 1990 California passed the Zero Emission Mandate (ZEV) requiring that 2% of all vehicles have zero emissions by 1998. One result was GM's decision to produce the EV1. In 1997 the Toyota Prius became the first mass-produced hybrid. In 2001 the ZEV was repealed under pressure from the oil industry and the George W. Bush Administration. In 2005 all EV1s were collected and destroyed by GM. In 2009 the Obama Administration allocates $2 billion for the development of electric vehicle batteries. In that year GM announced the development of its plug-in hybrid, the Chevrolet Volt and Nissan unveiled its all electric car, the Leaf.

The battery—the heart of an electric car

One of the biggest barriers to adoption of electric cars is cost and the biggest part of that added cost is the battery. Today most hybrid car batteries are: (i) nickel metal hydride (NMH), or, (ii) increasingly, lithium ion (LI). Advantages of the LI compared to the NMH are quicker recharge ability, longer service life, and, more energy storage per unit of weight. In gasoline-powered cars (GPCs), virtually all batteries are of the environmentally-damaging lead-acid type. Battery replacement costs for hybrids have been in the $3,000 range, although replacement is rarely required as most are guaranteed for at least 100,000 miles. Battery technology is developing rapidly and unit costs are falling steadily. One estimate is that LI battery prices are expected to decline 25% by 2015 and up to 50% by 2020. At present, electric car batteries cost about $650/kwh. If this declined by 50%, i.e., to $325/kwh, the total cost of an electric car would be little more than a GPC of the same size.

What do electric cars cost today and what USG subsidies are available toward their purchase?

Electric cars made abroad are small, but relatively cheap, e.g., the Indian-made REVAi at $13,000 or the Norwegian-built Think City at $15,000-17,000. In the US the generally larger electric cars are more costly than GPCs for a given size and passenger capacity, e.g., a nicely-equipped Toyota Prius is about $27,000; the Nissan Leaf has been priced at about $32,000 and the Chevrolet Volt at $35,000. But tax credit subsidies by the USG help reduce costs of some electric cars and range from $650 for a 2010 Ford Escape Hybrid to as much as $7,500 for more costly American and foreign brands. Tax credits phase out after unit sales of a particular model reach 60,000. Such credits have expired for virtually all Honda and Toyota hybrids.

Let's compare running costs of an all electric car with those of a GPC

Assume a journey of 40 miles, an electricity price of $0.10/kwh; gasoline at $3/gal. and 25 mpg for the GPC. nder these assumptions a journey of 40 miles would cost about $1.12 for the electric car or about $4.80 for the GPC—or more than four times as much. Even with GPC mileage at, e.g. 35 mpg, journey costs for the electric car would be significantly less than those costs with a GPC.

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[1] **Detail on the underlying assumptions and calculations are available from the author at sgoering@juno.com.**

What is the cost per charge for an all electric car and are US electricity reserves adequate?

Electric rates in the US range from $0.33/kwh (peak) down to $0/07/kwh (off-peak). (Current Westar residential rates are about $0.08/kwh.) Cost per charge at peak rates is equivalent to gasoline costs of about $3.63/gal; at off-peak, about $0.77/gal. At current Westar rates, operating costs of an electric car would be considerably cheaper than those costs for a GPC. Most future electric cars will use LI batteries that require 220-volt wiring in the home. Recharging with a standard 110-volt wiring may take more than 15 hours. Nationwide there are ample electricity reserves to charge up to 230 million all-electrics or plug-in hybrids. But distribution of those reserves may be problematic—most ownership of electric cars will be in urban areas where electricity reserves are more limited.

How "green" is the electric car today compared with a GPC?

"Green" refers to CO2 emissions in operation, as well as type and cost of materials used in manufacturing the vehicle. If charged with electricity from a coal-fired plant, CO2 emissions with an electric car are probably moderately less than those from a GPC. If electricity comes from, e.g., solar or wind, CO2 emissions would be much less than from a GPC. The battery of an electric car is much larger than that of a GPC, creating concern about the environmental impact in its production and disposal. The newer LI batteries are long-lived and generally less environmentally-damage than other types such as lead acid or NMH. Considering only the energy source in driving (electricity vs. gasoline) the 2010 Prius is estimated to emit 3.7 tons of CO2/year. The figure for the 2010 Ford Fusion (non-hybrid) is 7.3 tons. All things considered, the electric car is significantly "greener" than its GPC counterpart.

Does an electric car make financial sense when compared with a GPC?

The answer depends in part on the underlying assumptions. Assume each car is driven 15,000 miles/year and gasoline is priced at $3/gal. Let's compare: (i) a 2010 Ford Fusion hybrid costing about $29, 150 after the USG tax credit, with EPA overall rating of 39 mpg; and (ii) a 2010 Ford Fusion SEL GPC costing $25,380, and EPA overall rating of 27 mpg. Annual fuel savings with the hybrid are about $513/year. The vehicle cost difference is $3,770. Abstracting from the time value of money, it would take about 7.3 years ($3,770/$513) to recover the additional cost of the hybrid—not a very attractive situation in financial terms. On the basis of financial considerations alone, a prospective buyer must place a high (non-monetary) value on the greater "greenness" of the hybrid to justify the purchase of the hybrid. Gasoline at $5-$6/gal. would make the hybrid much more attractive in financial terms.

Is there an electric car in the future of Elkhart, IN?

In recent years a mainstay of the Elkhart economy was the production of RV's. That industry was severely impacted by higher gasoline prices and the deep recession of 2008-9. Unemployment in the county peaked at 19.8% in March 2009. In January 2010 the Norwegian company, Think Global, announced that its first US assembly plant for its Think City car will be in Elkhart, with production to begin in late 2010 or early 2011. The company expects to have more than 400 employees in Elkhart by 2013. The Think City is a 2 + 2 seater, has a top speed of 65 mph, a range of 130 miles on a full battery charge, and an estimated price in the US of $15-$17k.

Speculation on the Future of the Electric Car in the US

Its future depends largely on three considerations: (i) progress made in developing robust, reasonably-priced batteries; (ii) cost of an electric car compared to a GPC; and (iii) development of a national battery charging infrastructure, conveniently located in high-use areas. Continued government subsidies are likely to be needed in the short- to intermediate-term to firmly commercialize this technology. Battery-only electric cars, such as the Nissan Leaf, will continue to be disadvantage by range limitations, something not applicable to a hybrid. In the medium-term electric cars (both hybrid and all electric) are likely to be more expensive than their GPC equivalents. In the meantime, a reasonably-priced hybrid such as the Ford Fusion or Toyota Prius is an acceptable substitute in terms of both fuel efficiency and emission reduction.

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