Blowing the Lid Off the 235-mpg Electric Vehicle Hoax

or

When is a gallon not a gallon?

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White Paper
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Introduction

Did you hear the joke about the 235-mpg Hybrid Electric Vehicle?

It goes something like this:

> A spokesman for a major automaker walks onto the stage and announces that his company's new HEV will go 235 miles per gallon in electric mode, for 40 miles, as long as the electric grid rate is only 5 cents per kilowatt hour.

The point of the joke is that most people will eat up this crap without ever questioning whether any of these statements have any truth in them. Most people are very poor at science and math, and also believe religiously that there are super-smart scientists and engineers employed by government & industry, hell-bent on doing the right thing for the public good.

Well I've got news for you, Scarlet, it just ain't so!

Without digging too deeply into science and math, let's take a simple realistic view of what's going on here.

First of all, let's look at how a gallon is defined. Is a gallon of gasoline a certain volume, a certain heat content value, or a monetary value?

A gallon of gasoline/diesel may be defined as 4 quarts or 8 pints of a volatile liquid hydrocarbon with a heat energy content of approximately 125,000 Btu's (British thermal units) per 6 pound gallon of gasoline, or 145,000 Btu's per 7 pound gallon of diesel fuel. – This is the real absolute view of a gallon of motor fuel.

In human society, however, a gallon of motor fuel is equated with the thing that dweebs love most – money. In cattle society a gallon is $2.77 today, or maybe $3.05 tomorrow, or maybe $8.50 five years down the road. Who's to say?

Knowing that the vast majority are given over to the love of money, the swindlers at the auto companies or the energy cartel can easily fool people into accepting their notion that a car can get 235 miles per gallon on an electrical gallon equivalency basis.

But even here, the illusion is that electricity is a monetary factor rather than a scientific Btu factor – and that's where they get you.

When is a watt not a watt?

Is a watt, or rather a kilowatt (1,000 watts) a scientific, absolute value that can be described in Btu equivalencies – or is it 10 cents? Again, with the general populace coming up with D's and F's in science, it must be equal to what they pay on the monthly electric bill.

About 40% of the world's electric power comes from coal today. With China's huge ramp-up in coal power plant construction (one new plant per week), and the lies of clean, green coal plants making their way into European and U.S. markets, that 40% figure will reach 60% to 80% by about 2020-2030, or thereabouts. But don't expect that to translate into cheaper power.

By 2015 all fossil fuels will reach parity – where global electrical supply and demand will be equal. Beyond that point, demand will drastically outstrip supply, causing power costs to skyrocket overnight. So that 5 cents kWh (kilowatt hour) touted by the auto industry salesman is a ridiculous fabrication today, and a hideous lie tomorrow.

The point the salesman is trying to make is that it is presently cheaper to tool your HEV down the road on electricity than it is on gasoline or diesel. The lie is in the 235-mpg figure.

An electric or hybrid electric car cannot deliver 235 miles per gallon on any fuel – even if the fuel were free!

Gallon Equivalency

Fuels can and must have a gallon equivalency factor whether they are solid, liquid or gas. The absolute equivalency factor is the thermal energy content of the various fuels –- as a function of mass, or weight, not volume.

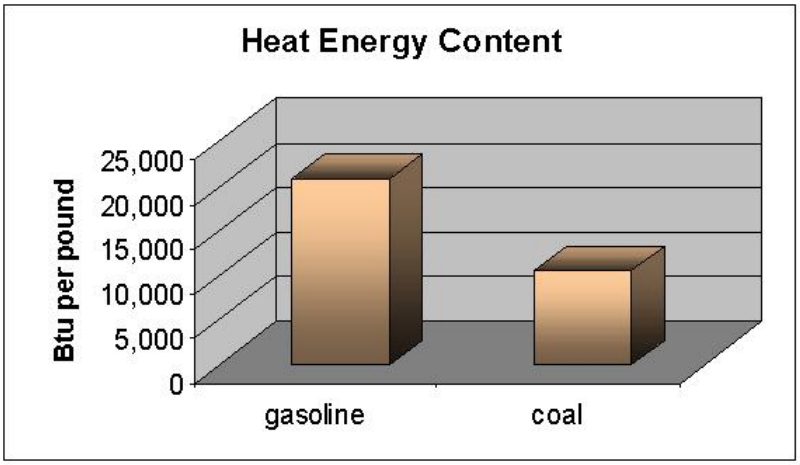
Since gasoline/diesel are metered in gallons (or liters), we start with a gallon of gasoline as the standard to compare everything else to.

Here in the States, cars & light trucks get an average of 21-22 miles per gallon. A number of new cars now get 32-34 mpg, so we will use this range as the new standard, since most of the world is beginning to achieve these higher figures.

So a gallon of gasoline will move an average new car down the road at 32-34 mpg, and at an overall efficiency of about 25%-28% (lean burn mode).

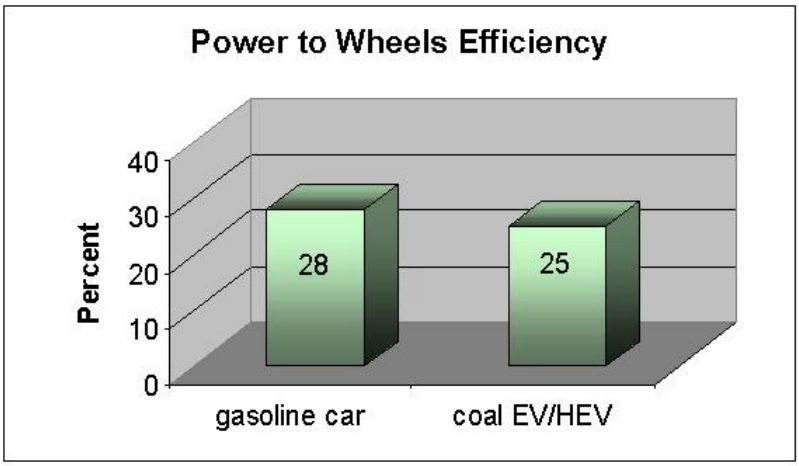
For pure electrics and plug-in hybrids, we have to look at the coal factor, since most of the world's electricity will soon come from health-destroying coal burning. (More on this later.)

Coal has an energy density of 15-32 megajoules per kilogram, compared to gasoline's 46.4 megajoules/kg. This translates into about 8,000-14,000 Btu per pound (10,555 average), compared to gasoline's 20,833 Btu. So gasoline contains roughly twice the energy per pound compared to coal (of all types).



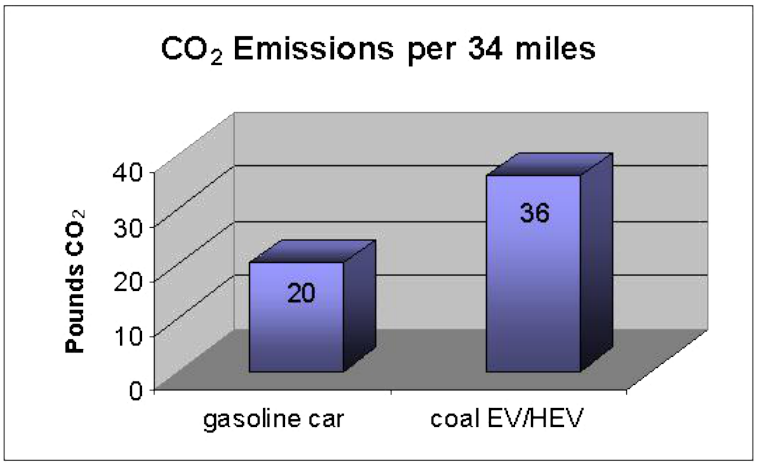
The average coal plant efficiency, worldwide, is about 31%-33% -- at the source. With line losses figured in, that 31%-33% looks more like 28%-31%.

On top of that, we have a battery charging loss of 5%-10%, and an electric motor loss of 5%-10%, so the power-to-wheels efficiency of the grid is only around 22%-25% at best – exactly that of a gasoline-powered vehicle!



But, since coal contains only half of the Btu content of gasoline, we are burning 12 pounds of coal to move that car 32-34 miles down the road, compared to 6 pounds of gasoline.

And, while the gasoline-powered car emits 20 pounds of CO_2 to move 34 miles down the road, the electric vehicle is giving off 36 pounds of CO_2 to go the same distance (on coal). So on a pound-per-pound, Btu per Btu, CO_2 per CO_2 basis, coal-powered electric vehicles are only half as efficient as gasoline/diesel powered, mechanically geared cars.



Where the salesman "gotcha" is the ever-elusive pocketbook factor.

Coal is relatively cheap at about $120 per ton, compared to about $480 per ton of crude oil.

Since one pound of coal delivers 1 kWh of electricity at your wall plug, a 6-cent pound of coal translates into a 10-cent kWh (with costing & profits to the producer). So, with today's coal prices, that fictitious 5-cent kilowatt to the end user is just that – a 20-year old figment of big biz imagination. (I think it's high time for the wealthy to spend a day in our real world.)

So we have a realistic 10-cent kWh. An electric or plug-in HEV will get about 2.7 miles per kilowatt hour of battery storage. It takes 12 pounds of coal to deliver 12 kilowatt hours of power, multiplied by 2.7 miles/kWh = 32.4 miles per gallon. (12 pounds coal = 6 pounds gallon of gasoline)

This true electric 32.4 mpg is identical to the true 32-34 mpg rating of today's geared, average new car but at a substantial price difference. The electric car moves 32.4 miles at a price of only $1.20 (12 kWh x 10 cents/kWh), whereas the gasoline car moves the same distance at an ever-changing $2.50-$3.00 USD.

So the electric vehicle really only gets 67-81 miles per gallon – viewed from a strictly monetary position.

As viewed from scientific Btu energy content, the two technologies are dead even.

What will happen in the near future when the general populace gets snookered into buying millions of electric vehicles, and then gets clobbered with a 2- to 3-fold increase in utility rates – as proposed by both politicians and power industry leaders?

If oil prices remain where they are for awhile, then electrics will soon cost just as much to run as standard geared cars, but with a lot less range and convenience.

Future HEV's

Presently a company is secretly working on a new generation of hybrids that will deliver a true 100+ mpg rating on any liquid or gaseous hydrocarbon, or pure hydrogen. They say that the key to ultra-high mpg cars is in both weight and power management. That's yet to be seen.

Conclusion

To conclude the matter, if after reading this analysis, you still believe that any auto maker can deliver a pure electric or hybrid electric average-sized car that gets 235 miles per gallon in any mode, you are one stupid ding-dong!