

## Brainstorm- Advanced Technology Vehicles

*Apart from MPG, what's a fair way to measure the efficiency of advanced technology vehicles?*

**Sam Weinstein, Analog Devices, [www.analog.com](http://www.analog.com) [1]**



For plug-in hybrid electric vehicles (PHEV) and pure electric vehicles (EV), a single rating like MPG is no longer sufficient for measuring efficiency benefits. Advanced electric powertrains and new battery technologies are certainly key drivers of these efficiencies. However, the measurement and control of these systems using advanced signal processing ICs – such as high-voltage battery monitors, isolators, precision references and current monitors – are becoming just as important in achieving maximum performance. As automotive engineers begin to take advantage of all of the available technology, they need a rating system that can communicate these new efficiency benefits to car buyers.

Today, car buyers think about an MPG rating in three main ways:

1. Cost: How much fuel will be used?
2. Environmental impact: What quantity of pollutants will be produced?
3. Convenience: How often must I refuel (and where can I refuel)?

Tomorrow's electric vehicles represent a significant departure along all three of these dimensions. They can run a long time without using gasoline, produce few or no emissions, and can be refueled at home. However, the electricity they consume will likely be created in a way that produces pollutants. Further complicating the issue, exceeding a PHEV's electric-only range still necessitates the cost and inconvenience of a trip to the gas station.

Ideally, a new efficiency rating system would measure cost, environmental impact, and convenience separately while incorporating some comprehension of the vehicle range. The EPA may choose to only provide a rating for environmental impact,

## Brainstorm- Advanced Technology Vehicles

Published on Electronic Component News (<http://www.ecnmag.com>)

although even that could vary widely depending on the electricity source. Certainly, buyers do their homework when choosing a car, and, in the Internet age, more product information is available than ever before. Whether or not a government agency provides all of these metrics, car buyers will rely less on MPG ratings in the future.

**Steve Nelson, Freescale Semiconductor, [www.freescale.com](http://www.freescale.com)** [2]



It's amazing to consider how far we've come in such a short time. We used to be able to make a fairly easy comparison between various cars and determine which was more efficient. Yes, you had to look at both highway and fuel efficiency numbers, and they had some well documented shortcomings, but you could make an educated decision based on the EPA estimates posted right on the window sticker. But now, there is much more in play. "Miles per gallon" is clearly a concept that has become outdated.

At first glance, the problem is fairly straight forward. A car has a mass that will consume a certain amount of energy to move a given distance. So far so good. But now we have more ways to provide that energy. Gasoline and diesel fuel, of course, and LPG and maybe hydrogen in the future. But more and more, you'll probably fill up a tank full of electrons.

The most direct measurement will be \$'s per mile, combining both city (high start/stop cycles) and highway (long distance) driving. Just as fuel flow rates into an engine can be accurately measured, the electric consumption into the vehicle can be measured and converted to a cost using average electrical rates. This also points to the growing importance of reducing the electrical consumption of systems within the car as they become more complex. Power that goes into electronic systems will compete with what is needed to drive the powertrain.

As more energy for transportation comes through the electric grid, it's a safe bet that governments will find a way to tax that energy. Also, electric rates vary around

## Brainstorm- Advanced Technology Vehicles

Published on Electronic Component News (<http://www.ecnmag.com>)

the country, so it's a good idea to have a regional benchmark that is updated every year.

Clearly, I've only discussed energy consumption at this point. A more difficult problem is how to rate the emissions of a vehicle, when the power is generated (and the emissions created) far from the vehicle. And that's a subject for another editorial!

**Jens Eltze, NEC Electronics America, [www.am.necel.com](http://www.am.necel.com) [3]**



From the semiconductor point of view, there are several ways to measure advanced-technology vehicle efficiency in addition to MPG, including:

- Resources required for building the vehicle
- Product reliability and maintenance requirements
- Emissions (e.g. electro-magnetic radiation, heat dissipation)

For example, by optimizing products for automotive applications, NEC Electronics America enables customers to reduce the component count in their ECUs, resulting in less complex printed circuit boards (PCBs) and/or smaller board space. Delivering products with built-in, low electro-magnetic emissions (EMI) also helps customers reduce the number of steps required to achieve compliance with industry standards.

When evaluating efficiency, advanced-technology vehicles also should be measured against their need for vehicle servicing and maintenance. High-quality components are the base for developing highly reliable modules and products. Semiconductor suppliers like NEC Electronics America, with its zero-defect initiative and industry-leading product quality, help to ensure that ECU manufacturers can deliver products that require little to no maintenance over their long life cycles.

Automotive emissions also need to be considered, including engine emissions that are generated during vehicle operation, as well as other emissions. EMI can not only cause interference with other components, it contributes to the overall energy being transmitted to the environment. While not as obvious, heat emissions are

## Brainstorm- Advanced Technology Vehicles

Published on Electronic Component News (<http://www.ecnmag.com>)

another consideration. Any electronic component in operation generates heat that needs to be dissipated. This either requires cooling efforts or results in unintentional warming, increasing the stress on the module. Semiconductor manufacturers can help reduce these emissions by developing products that focus on low power operation and are optimized for low EMI.

While advanced-technology vehicles might be judged at first glance by their MPG rating, considering these other aspects as well can provide a more comprehensive view of a vehicle's efficiency, and semiconductor manufacturers like NEC Electronics America are working to deliver the high-quality, high-reliability and low-EMI components needed to achieve the desired efficiency results.

**Chris Minter, Components Corp, [www.componentscorp.com](http://www.componentscorp.com) [4]**



As a manufacturer of components for the electronics industry, our company has seen the focus on, what I would term, <sup>3</sup>eco-compliant<sup>2</sup> materials and processes over the past years. Society as a whole realizes the impact our actions can have on the environment and basically the future of the planet, so I feel one fair way to measure the efficiency of advanced technology vehicles lies in the emissions these vehicles produce.

Every advanced technology vehicle relies on a fuel source. Alternative fuels i.e., biodiesel, ethanol and nitrogen are being developed to lessen the amount of carbon emissions from these vehicles. As plug-in electric cars are entering the marketplace with no combustible fuel necessary to power the vehicle, we must remember a power plant produced the electricity to charge the vehicle. To give a truly fair measure of efficiency, each step in the process of producing fuels must be considered.

Another fair way to measure their efficiency is in convenience, how the usage of these vehicles affects our everyday lives. Obviously a vehicle, which runs on fuel that is readily available and does not rely on searching for stations that carry alternative fuels, would be more convenient as it relates to time and distance spent on refueling. An electric car that needs to be plugged in to recharge is not as convenient as a vehicle that automatically recharges the battery while driving. To

## Brainstorm- Advanced Technology Vehicles

Published on Electronic Component News (<http://www.ecnmag.com>)

---

me these factors are very important in measuring the efficiency of an advanced technology.

Hybrid Vehicles that combine two or more sources of energy such as gasoline/electricity to power the vehicle promote efficiency by reducing carbon emissions through the use of a battery recharged while driving and are more user friendly by operating on readily available gasoline.

There is also cost to consider as a measure of efficiency, while advanced technology vehicles average considerably higher miles per gallon, the initial investment in, and maintenance of the vehicle can be high, and savings will not be realized for a number of years.

In conclusion, I feel that no one factor can truly measure the efficiency of advanced technology vehicles. It's a combination of lessening the environmental impact of emissions, cost-effectiveness and convenience.

**Source URL (retrieved on 10/31/2014 - 6:13am):**

<http://www.ecnmag.com/articles/2009/11/brainstorm-advanced-technology-vehicles>

### Links:

[1] <http://www.analog.com/>

[2] <http://www.freescale.com/>

[3] <http://www.am.necel.com/>

[4] <http://www.componentscorp.com/>