Lawyer, certified public account and well known battery industry pundit John Petersen, shows that the venerable Prius-class hybrid is at least five times more effective at reducing global gasoline consumption than its plug-in cousins. Are batteries too valuable to waste on plug-in vehicles?

The first great fraud of the new millennium

PT Barnum would have been proud.

While hype-masters loudly proclaim that plug in cars will save the planet by slashing oil consumption and CO_2 emissions, the numbers tell a different story; that plug-ins are all sizzle and no steak. The result is the industrial equivalent of a snipe hunt, a wild goose chase based on flawed assumptions.

Let me explain how I reached this conclusion. On December 31, 2009 *Forbes* published an opinion piece titled *System Overload* that questioned whether the battery industry was overbuilding global manufacturing capacity. The third paragraph noted:

> *"By 2015 the new factories will have the global capacity to produce 36 million kilowatt-hours of battery capacity, enough to supply 15 million hybrid vehicles, or 1.5 million fully electric cars, says Deutsche Bank."*

While the article went on to question whether there would be buyers for all those batteries, the capacity estimate got me thinking: "In a world that wants to save fuel and reduce CO_2 emissions, but can only make 36 million kWh of batteries per year, what is the highest and best use for the batteries?"

I hate unanswered questions. So I fired up my computer and went to work. Within a few minutes, I found myself wondering whether anybody in Brussels or Washington DC owns a calculator and understands grade school math.

The calculations were simple but the answers were amazing — at least to me. The sweet and simple summary is that the venerable Prius-class hybrid is five to six times more effective at reducing global gasoline consumption than its plug-in cousins and, in the US, it's seven to 10 times more effective at reducing CO_2 emissions.

In other words, plug-in vehicles are not the effective albeit expensive saviours of the planet that have been sold to credulous reporters and intellectually lazy regulators. They're unconscionable waste masquerading as conservation.

I'm agnostic when it comes to the relationship between CO_2 emissions and global warming. I simply don't know enough to have a firm conviction.

I'm not the least bit agnostic when it comes to the fact that six billion people on this planet want a small piece of the lifestyle that 500 million of us have and take for granted.

For all of recorded history, the poor toiled in ignorance and didn't know that there was more to life than subsistence.

Thanks to information and communications technology, the cat's out of the bag and fully half of the world's poor know that there is something better. The biggest challenge of this century will be making room at the table for six billion new consumers.

Accomplishing that without horrific environmental consequences and catastrophic conflict requires ***relevant scale*** solutions to persistent shortages of water, food, energy and every commodity known to man.

Using 100% of the forecast global battery production capacity to make plug-in vehicles will save less than five hours of oil production and CO_2 emissions per year. I can't see how any thinking man would consider that scale sufficiently relevant to justify the plunder of far scarcer mineral resources.

In my opinion, the plug-in vehicle industry is perpetrating the first great fraud of the new millennium by using one-on-one vehicle comparisons instead of fleet comparisons.

Yes, indeed PT Barnum would have been proud. ■

Put it all together and plug-ins will save less than five hours of oil production and CO_2 emissions per year.

REASONING AND METHODOLOGY

As the first step I calculated of the number of electric-assist/electric-drive vehicles that could be built using 36 million kWh of batteries.

Battery production capacity and possible uses	
Global battery manufacturing capacity (2015 Deutsche Bank estimate in kWh)	36,000,000
Maximum number of EV battery packs (24 kWh battery pack for Nissan Leaf)	1,500,000
Maximum number of PHEV battery packs (16 kWh battery pack for GM Volt)	2,250,000
Maximum number of HEV battery packs (1.5 kWh battery pack for Toyota Prius)	24,000,000

As the second step I calculated the power plant-to-wheel CO_2 emissions for an electric drive vehicle that gets 4 miles per kWh and is plugged into an electric grid that's equivalent to the U.S. national average.

$C0_2$ emmissions per gallon of gasoline equivalent	
Annual CO_2 emissions from electricity generation (million metric tons)	2,433.4
Annual electricity generation (billion kWh)	4,157.0
Kilograms of CO_2 per kWh	0.6
Typical electric drive range per kWh	4.0
kWh required for 30 mile electric drive range	7.5
Kilograms of CO_2 per gallon of gasoline equivalent	4.4
Pounds of CO_2 per gallon of gasoline equivalent	9.7

As the third step I calculated the baseline fuel consumption and well-to-wheel CO_2 emissions for a conventional car that has a fuel efficiency of 30 mpg and is driven 12,000 miles per year.

Baseline performance of internal combustion engine	Gasoline used (US gallons)	CO2 emissions (Pounds)
Gasoline required for 12,000 miles of travel	400	
Well-to-wheel CO_2 emissions per gallon		25.35
$C0_2$ Emissions Per Year		10,140

As the fourth step I calculated the baseline fuel consumption and CO_2 emissions for a Prius-class HEV, a Volt-class PHEV and a Leaf-class EV assuming a fuel efficiency of 50 mpg, a 25% ICE utilization for the Volt-class PHEV, and total travel distance of 12,000 miles per year.

Baseline performance of electric alternatives	Gasoline used (US gallons)	CO_2 emissions (Pounds)
Nissan Leaf class electric vehicle 12,000 electric drive miles	0	3,872
GM Volt class plug-in electric vehicle 9,000 electric drive miles 3,000 gasoline drive miles (50 mpg) Annual total	 0 60 60	 2,904 1,521 4,425
Toyota Prius class hybrid electric vehicle 12,000 gasoline drive miles (50 mpg)	240	6,084

As the fifth step I calculated the annual per vehicle fuel savings and CO_2 emissions reduction for each type of vehicle.

Single vehicle fuel savings and emissions reductions	Gasoline saved (US gallons)	CO_2 reduction (Pounds)
Nissan Leaf class electric vehicle	400	6,268
GM Volt class plug-in electric vehicle	340	5,715
Toyota Prius class hybrid electric vehicle	160	4,056

As the sixth and final step I calculated the global fuel savings and CO_2 emissions reduction for each fleet of vehicles that could be built using 36 million kWh of batteries.

Annual savings for global vehicle fleet	Gasoline saved (million gallons)	CO_2 reduction (million pounds)
1.5 million Nissan Leaf class electric vehicles	600	9,403
2.25 million GM Volt class plug-in electric vehicles	765	12,859
24 million Toyota Prius class hybrid electric vehicle	3,840	97,344

Net impact on global oil consumption	
Barrels per day	85,100,000
Barrels per hour	3,545,833
Gallons per hour (42 gallons per barrel)	148,925,000
Hours of global oil production saved annually by plug-ins	4.58

Net impact on global CO_2 emissions from fossil fuels	
Metric tons per year	9,000,000,000
Metric tons per day	24,657,534
Metric tons per hour	1,027,397
Pounds per hour	2,265,023,219
Hours of global $C0_2$ emissions saved annually by plug-ins	4.91

I told you the answers were amazing!

John L Petersen, is a US lawyer based in Switzerland who works as a partner in the law firm of Fefer Petersen & Cie and represents North American, European and Asian clients, principally in the energy and alternative energy sectors. More of his thoughts can be found on *http://seekingalpha.com/author/john-petersen*