



Electric Cars Are the Key to Energy Independence

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At Gore's heroic speech challenging us to make our electrical system 100 percent renewable promised it would simultaneously address three major crises: the weak economy, catastrophic climate change and the dire national security problems inherent in our dependence on imported oil.

He got two out of three right. A crash renewable electricity initiative would provide an immediate boost to our economy and could slow climate change, since electricity accounts for about a third of our overall greenhouse gas emissions.

But it would do little to enhance our national security.

Oil generates only 3 percent of our electricity. Therefore a 100 percent renewable electricity system does little to reduce our oil dependency -- unless that electricity is used to substitute for oil in our transportation system.

Al Gore knows this. In other venues he has mentioned electrified vehicles. But he needs to make electrifying our transportation the central element in his 10-year plan, for at least two reasons.

One is that it is an initiative that would prove far more compelling to the vast majority of Americans. Climate change is abstract, and the strategies to resolve it are

remote. Our relationship to our vehicles, on the other hand, is both concrete and visceral. We desperately want to get off oil, especially when gasoline prices rise to \$4 per gallon.

But it is more than a pocketbook issue for many of us; it is a moral issue. Americans hate being dependent for our mobility, and therefore for our livelihoods, on countries often hostile to our way of life. Electric cars promise to end that dependency.

And as a bonus, with rooftop solar cells, we can become independent not only from OPEC but from remote and often unresponsive utility companies. We can become energy producers as well as energy consumers.



And then there is the plain fact that once significant numbers of electric vehicles are on the roads, word of mouth will be a powerful marketing tool. The reason? As Marc Geller, a longtime advocate of electric

vehicles, told me a year ago as we were traveling up Route 1 in Northern California in his all-electric small SUV, "Anyone who drives an electric car falls in love with an electric car." That love affair will be aided and abetted by a population eager to embrace a homegrown fuel and vehicles that offer quicker propulsion, a quiet drive and zero tailpipe emissions.

There is another persuasive reason for Gore to focus on an electrified transportation system: It is simply physically impossible to convert our entire electricity system to renewables in 10 years, but it is possible to convert our entire ground transportation system to renewable electricity within a similar time frame. That would require a national mobilization, to be sure, but it can be done.

Converting our electric system fully to renewables would require us to shut down about 80 percent of our current electricity-generating capacity, much of it low-cost, already paid off and capable of generating electricity for another 25 years or more. Moreover, to reach very high penetration rates of renewable electricity would require that we overcome the principal shortcoming of wind and sunlight: intermittency.

To electrify our transportation system, on the other hand, we could displace rather than shut down the existing system, and we would be replacing a physical stock with a relatively short life expectancy. Given the average seven-year life expectancy of existing vehicles and the high probability that we would offer an incentive for owners of older gasoline-powered vehicles to trade them in, new electric vehicles could constitute the entire fleet within a decade, and that doesn't take into account the potential for conversions of existing vehicles.

Powering 100 percent of our transportation system would require about 30 percent of the electricity generated in 2006. With a massive effort, using a combination of solar and wind power, we could generate about that much electricity by 2020.

The fact that we can even contemplate the rapid electrification of transportation is a testament to 20 years of grassroots activism at the local and state level. The enactment by Congress of a renewable electricity tax incentive in 1992 was important, but the wind energy industry did not take off until states began to mandate renewable electricity. Today more than 25 states boast such mandates. A recent report put together by a task force of California leaders urges the state to double its renewable electricity mandate to 50 percent by 2020.

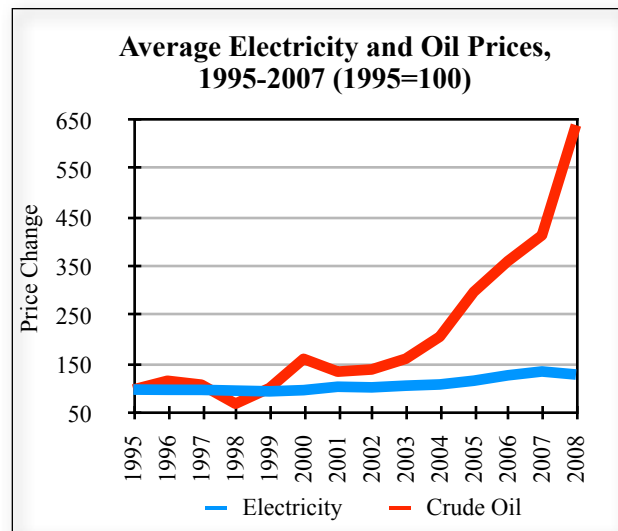
We have done a great deal, from the bottom up, to increase the supply of renewable electricity. Less well known is how much we have done on the demand side of the equation, that is, the use of electricity in transportation.

A brief historical review might be in order here. The first electric utilities were born largely to serve the transportation sector, which in the late 19th century

meant urban streetcars. Until 1920, transportation remained the nation's utilities' single largest customer. And as the birth of the automobile age began, electric vehicles were by far the most popular. In the late 1890s electric vehicles (EVs) outsold gasoline cars ten to one. Many of the first car dealerships were exclusively for EVs.

The future of transportation abruptly changed in the 1910s. Mass production of gasoline-powered cars dramatically lowered their price. The introduction of automatic ignition removed the difficult and dangerous task of cranking to start the gasoline engine. Meanwhile the infrastructure for electricity was almost nonexistent outside city boundaries, limiting the utility of electric vehicles.

For the next 70 years, electric transportation all but disappeared.



Then, in 1990, two events occurred to revive the prospects of electrified vehicles. One was a private sector initiative; the other a public sector initiative. One was technology driven; the other politically driven.

In 1990, Sony introduced the lithium ion battery. Its higher energy density quickly made it the battery of choice for electronic equipment. Over the next 10 years, as portable electronic equipment demanded more powerful and longer-lasting batteries, the lithium ion battery industry saw many technological advances. In the last five years, many variations of that battery have begun to vie for supremacy as the foundation for a new generation of electric vehicles.

The public initiative was California's Zero Emission Vehicle (ZEV) Mandate. Enacted in 1990, the mandate required that 2 percent of all new vehicles sold by major car manufacturers in that state be all-electric by 1998, and 10 percent by 2003. By 1994, 12 additional states had adopted its mandate.

If that mandate had remained in place, more than 10 million EVs might be traveling our roads today. But as the marvelous documentary "Who Killed the Electric Car?" reveals in depressing detail, the ZEV mandate was weakened in the 1990s and finally killed in 2003.

Notwithstanding its demise, the mandate did result in several important and positive outcomes. One was the hybrid vehicle, whose development was in part an outgrowth of the vigorous developments in electrical and electronic vehicle systems spurred by the ZEV mandate. Another was the advance in large-format battery technology after many decades of stagnation. The new Nickel Metal Hydride (NiMH) battery replaced the lead acid battery for ZEVs sold in California, and by the late 1990s, a second-generation NiMH promised to last the life of the car, almost halving the capital cost of an electric vehicle. (Tragically, patent disputes have stifled NiMH development.)

Perhaps the most important enduring legacy of the ZEV mandate was the creation of tens of thousands of Californians who experienced the pleasure of driving or being driven in full-size electric vehicles capable of high-speed, long-distance highway driving. "Who Killed the Electric Car?" portrays what seemed to be a futile grassroots effort to stop car companies from taking back their EVs and crushing them.

Yet even as the movie ends, the uprising began to gain traction. GM proved incorrigible. But creative and extensive protests here and abroad persuaded Ford and then Toyota to cease crushing their vehicles and begin offering them for sale. Reportedly, Chris Paine, the director of "Who Killed the Electric Car?" is making a new movie titled "Who Saved the Electric Car?" It promises to be a very uplifting sequel.

At its peak, the ZEV mandate brought some 5,500 electric vehicles onto California roads, ranging from Ford's small Think Car to Toyota's small SUV, the RAV4, to Ford's light pickup truck, the Ranger.

After the protests ended and the dust cleared, more than 800 electric vehicles were saved, most of them

RAV4s. Some have now traveled more than 110,000 miles, validating both the durability of the batteries and the vehicles' remarkably low maintenance costs.

The EV movement was aided and abetted by the introduction, in 2004, of the second iteration of the Toyota Prius. The best-selling car sported a mysterious blank button on the dashboard. Via the Internet, Americans were told that in Japan the button was operational. Pushing it allowed the car to travel solely by electricity for a mile or so. Engineers in Texas and California quickly learned how to convert the Prius to drive solely on electricity, and they added sufficient battery capacity to travel 10 and then 20 and then 30 miles before recharging was needed.

Several start-ups began to offer plug-in hybrid electric (PHEV) conversions. Felix Kramer, the Paul Revere of the movement, spent the next two years trying to convince national reporters, members of Congress, Silicon Valley businesses and even EV advocates, many of whom believed a car with a gas engine was a sacrilege, that a plug-in hybrid electric vehicle could become the foundation for a transition to an electrified transportation sector. Kramer convinced a leading car industry reporter based in Michigan to run a story, which quickly translated into dozens of stories in the national media. In the spring of 2006, he spent \$15,000 to transport his own converted Prius PHEV to DC and allow several senators and leading policymakers and opinion leaders to literally kick the tires and drive in it.



At the time fewer than a dozen Prius conversions existed in the entire country. But the work of organizations like Plug-In America and Plug-In Partners and Kramer's own CalCars began to seize the popular imagination.

In just the last 12 months, the dam against electrified vehicles seems to have broken. For the first time since 1910, an oil-free transportation system is on the table.

New announcements by businesses large and small have become almost a weekly occurrence. Hymotion, a small company affiliated with Internet giant Google and the MIT spin-off, battery maker A123, has begun to roll out a nationwide network of certified plug-in hybrid converters.

Toyota, which for the first six years of Prius sales used the advertising tag line, "You Never Have to Plug It In," announced in 2007 an abrupt change of mind. In

2010, Toyota will begin leasing plug-in Priuses in Japan. GM, which had originally loudly and sarcastically dismissed the concept of hybrids, announced it will offer a plug-in hybrid with a 40-mile driving range in 2010. Nissan, VW, Renault and other car manufacturers have all announced their intention to introduce electric vehicles in the same time frame.

In July 2008, San Jose announced the beginning of a network of easily accessible and useable EV-charging stations in parking garages around the city. San Francisco followed with its own request for proposals for a similar citywide network.

On the political front, the current energy bill stalled in Congress because of Republican opposition: The bill contains a tax incentive for plug-ins sufficient to make the first cost of such vehicles nearly competitive with conventional vehicles.

The energy bill signed into law just before Christmas in 2007 includes a little-noticed but very powerful incentive for all-electric vehicles. For purposes of meeting the new higher fuel efficiency standards, all-electric vehicles will be awarded an efficiency rating based largely on the amount of gasoline displaced, which translates into an overall fuel efficiency rating for a typical mid-size EV of about 350 miles per gallon.



And on the customer level, gasoline prices of \$4 per gallon have generated a palpable hunger for alternatives and changed the comparative economics of EVs and gasoline-powered vehicles. Driving a mile on electricity today costs about 3 cents while traveling a mile on gasoline costs about 15 cents. This can translate into annual fuel savings of more than \$1,000.

The advent of EVs may change not only the contours of our transportation system but also the structure of our electricity system. The unique characteristic of the electricity system is that the product must be instantaneously transmitted and no storage capacity is available. This is the reason Enron and others were able to manipulate the system in deregulated California 10 years ago, a manipulation that led to the near bankruptcy of the state and continues to burden the state budget.

The prospect of a large battery capacity contained in tens of millions of electrified vehicles could be, in the words of one utility executive, "a game changer." Utilities, eager to nurture a potentially large new customer, are also vigorously assessing how this new electric capacity can be integrated into the existing distribution and subtransmission parts of the grid system.

Some studies have estimated that utilities could pay an EV owner several thousand dollars a year to tap into the car's batteries when needed for energy used to keep the local grid stable. The vehicle would be available for such tapping a considerable percentage of the time. A typical vehicle sits idle some 23 of 24 hours a day. Millions sit in commuter parking lots for eight hours a day.

A large storage capacity could also ameliorate the intermittency problem of renewable energy, which in turn could allow a much higher proportion of renewable electricity on the grid. One study of the Sacramento, Calif., electricity network concluded that a significant penetration of battery-powered vehicles could boost the potential wind energy contribution to about 50 percent of total electricity generation.

EVs might spur a profound relocation of our electricity system. I discovered the intimate link between electric vehicles and decentralized electricity in the

spring of 2007, when I spent a week in California driving or being driven in a variety of electrified vehicles, from glorified golf carts to PHEVs to the "0 to 60 in less than 4 seconds" Tesla. I was invited by a national travel magazine to investigate the future of the car based on my 2003 report on the subject, "A Better Way." Everyone I met who had an EV or a PHEV also had solar cells on their roofs. And why not? Not only does it make them more energy self-reliant, but the value of the electricity generated by the solar array is far higher when it displaces gasoline than when it displaces conventional electricity.

Indeed, a symbiotic relationship between car and house may be emerging. California has time-of-day tariffs under which electricity consumed at peak hours, say, midday on a hot summer's day, can be several times more expensive than electricity consumed during nighttime odd-peak hours. If EV owners must use electricity at peak times, they can tap into the stored

electricity in their vehicles. The EV serves as a source of backup power for the house. More than one EV owner boasted about how his was the only house with lights on when the neighborhood suffered a blackout.

If Congress enacts its electrified vehicle incentive, we should see an immediate surge in conversions and new PHEV and EV sales. In 2010 several EV and PHEV models should be available from major car companies, albeit in small quantities, and these should allow us to gauge the costs of an all-electric transportation system.

If I were Al Gore, I would ask Congress not only to pass the EV incentive but also to phase in a mandate for an all-renewable-fueled transportation fleet, perhaps beginning with 5 percent of all new vehicles by 2012 and moving toward 100 percent by 2020. A call to arms would resonate with the American public. And as both consumers and citizens, Americans could quickly translate their support into a mass movement to finally eliminate our addiction to oil.

*David Morris is vice president of the Institute for Local Self-Reliance. His report on the future of transportation, *Driving Our Way to Energy Independence*, was published in April 2008. He is also the author of *Self-Reliant Cities* (Sierra Club Books, 1982).*

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