

Greening the Auto

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The evolution of the auto industry to hybrid - electric vehicles, started in earnest when General Motors announced production plans for their “Impact” electric vehicle (later called the EV1). Soon thereafter, in the early 1990’s the California Air Resources Board (CARB) passed new regulations that mandated zero-emission vehicles (ZEV) in California. Several other states followed California’s lead.

Many carmakers argued then that regulating the advancement of technology, consumer demand and companies’ business plans simply won’t work. But today, you can purchase hybrid-electric vehicles made by some of the largest automakers. And until very recently you could buy battery electric vehicles as well. California state regulations had a lot to do with this progress. One maker in particular, Toyota, has even gone so far as to state that all their vehicles would take on the hybrid-electric format in the not-to-distant future, and General Motors announced its goal to be able to produce 1 million hybrid-electric vehicles by 2007.

Meanwhile, battery EVs are all but dead. We now await the emergence of hydrogen fuel cells, the next *holy grail* needed to attain “zero emissions”. Hydrogen and fuel cells suggest a way of achieving the original aims of the “zero-emission” mandate set by CARB.

But the CARB mandates, to many observers, were about more than air emission reductions. Many EV supporters also believed that EVs presented an opportunity to re-invent the auto industry and our modes of personal transportation. In the 1990’s, a host of companies and governments envisioned an industry make-over that would change the basic nature of how cars were designed, built, sold, serviced and fueled.

There has been progress on many fronts, but a transformation of the auto industry and its refueling infrastructure has not materialized. Hydrogen fuel cells are promised to change that. But there are many skeptics, and for good reason.

The story of what happened to battery EVs is interesting. The auto and oil industries adopted classic lines of business strategy and have not be outdone, even by multilaterally aggressive business shapers in the risky arrogance of the Dot.Com 1990’s. The lessons of the 1990’s can help us anticipate how the auto industry will continue to grow, and shape our environment. There are ways we as consumers and voters can influence this process.

The Critical Role of Infrastructure

Infrastructure plays a vital, integral, and often over-looked role in our systems of transportation and the forces that shape them. In 2003, when CARB scaled back its ZEV requirements, there were less than 8,000 EV charging stations installed across the United States. A pitifully-low number when compared to the 200,000 gas stations in America¹. EV’s were promised to be charge-at-work, charge-at-home, never-go-to-the-gas-station-again vehicles. For the few thousand EV drivers, however, finding a charge station that worked, and that fit their particular EV, became a frequent concern. It wasn’t until 2000 that an industry standard for recharge connections was set by CARB, through industry input.

In the end, the demise of the battery EV was blamed on battery technology. Batteries were reported to be expensive, heavy, and offered poor driving range. Yet, in 2001 and 2002 when General Motors, Honda and other automakers asked consumers to turn in their electric vehicles, many EV-owners (or leasers) tried to find ways to hang on to their EV’s – vehicles they had grown to enjoy as an integral part of their daily lives. Those EV drivers had charging stations at their home, at the office, and knew where to find other recharge points in the vicinity of routine travels. Lack of range, while still a reality, was not cause for these EV drivers to give up their cars.

But, by this time efforts by utilities, state regulators, and automakers to install recharge stations had fallen short of what was required to

make EVs practical for the wider population. Without a convenient, reliable way to recharge battery EVs range truly is a problem.

Hybrid-electric cars on the other hand, offer the consumer a vehicle that is quietly asleep at stop lights, has ultra-low emissions, comes with a federal tax credit, and is a fuel economizer. These are attributes similar to a battery EV. But, hybrids use the good old gas station, even if infrequently. Hybrid-electric cars fit the existing infrastructure, and this makes a world of differenceⁱⁱ.

Changing our transportation fuels requires changes in infrastructure. This presents a “chicken or the egg” dilemma, between automakers and providers of refueling infrastructure. Automakers will not build cars if the infrastructure is not available. Likewise, fuel providers are not inclined to invest in new infrastructure projects if the return on these investments is not clear. CARB’s mandates for ZEV’s were the premise on which automakers and utilities based their investment decisions in the early and mid 1990’s. However, by 1998, it was becoming clear that CARB’s support of EVs was weakening, and infrastructure projects slowed to a crawl in Californiaⁱⁱⁱ. This leaves one wondering how the “hydrogen economy” will be realized, especially since investments in hydrogen infrastructure are monumental in their cost and complexity, as compared to electric recharging stations.

The Hydrogen Hoax?

Hydrogen and the promise of fuel cells have now stolen the ZEV spotlight, as batteries are written off as underachievers. This may be a misleading message, crafted to a large extent by auto and oil companies, and the Bush administration, who joined the automakers in suing California, then announced the “Freedom Car” program to develop hydrogen fuel cell cars.

Here’s why the message consumers are getting about EV’s and hydrogen fuel cells is misleading.

Infrastructure: Storing and distributing hydrogen is entirely more complicated than recharging batteries, especially on automobiles. After ten years of work in California, a convenient, trustworthy EV recharging infrastructure did not materialize, even though EVs can use the existing electricity grid. But hydrogen will require all new infrastructure at a

cost estimated to be in excess of \$400 billion installed over decades^{iv}.

Range: To justify the demise of the battery EV, batteries were reported in press releases to have not lived up to automaker and consumer expectations. Meanwhile, new reports suggest great strides have resulted in improved life and capacity for batteries^v.

The reality is that hydrogen vehicle range remains low (about the same as the battery EV), and hydrogen fuel cell vehicles cost orders of magnitude more than battery EVs. The Toyota RAV4 Electric was offered for about \$34,000 (after rebates and incentives), and had a driving range of about 120 miles. Hydrogen fuel cell vehicles, on the other hand, cost hundreds of thousands of dollars (if you can even buy one), offer similar driving ranges to the Toyota electric – but just try to find a refueling station for hydrogen, now or in five or even ten years.

While batteries get lighter and smaller, methods to extend the range of hydrogen vehicles may require that we carry super-compressed hydrogen gas or even liquid hydrogen on-board. This is a liquid stored at -383.8 F that needs sophisticated equipment and storage systems to be used safely and effectively on automobiles and in public refueling stations^{vi}.

Efficiency: Hydrogen needs to be made from other energy sources, mainly electricity. Therefore, using hydrogen is now, and probably always will be, fundamentally less efficient than using electricity directly stored in a battery.^{vii}

As Jason France, President of EVI said to me after returning from a state-of-the-art hydrogen refueling center at Ford Motor Company in 2002, “Hydrogen is an advertisement for battery EVs”. Show people a hydrogen car and a battery EV, with its refueling system, and the consumer will likely pick the battery EV.

Alignment Over Hydrogen

Nevertheless, the powers that be are mostly in alignment with regards to the move toward a hydrogen economy. Rousing support has been provided by auto and oil companies, government, and environmental groups.

The auto industry never truly embraced battery EV’s. But today we see public displays of commitment by automakers to hydrogen fuel cell vehicles. The fundamental reasons are likely because the production, storage and sale of

hydrogen fits neatly into the “fill ‘er up” business structure of the large and powerful oil and auto industries. Also, the new focus on hydrogen stretches the horizon for the oil industry, and takes off the ZEV pressure automakers felt from mandates like those passed by California. It’s even giving new life to the coal industry.^{viii}

Hydrogen, unlike electricity, can be stored and sold, just like oil and gas. And the points of distribution are also expected to be like those of gasoline stations. While work on home-sized hydrogen refueling systems continues, it is more likely that the cost and complexity of hydrogen refueling will result in large, gas-station-sized, refueling systems in the future; more like distributing gasoline, and less like delivering electricity. These are costly and complicated systems that will likely be owned and controlled by oil companies.

Although battery EV’s never came close to “tipping the market”, they were an industry-changing threat to oil companies, who would rather see them out of their radar screen.

The auto industry’s business model did not fit well with EVs either. With electric vehicles, automakers needed to “pre-sell” energy with the car in the form of relatively large and expensive battery packs. This does not fit well into existing financial models, where residual values of cars is a denominator to the market, and the financing of cars a denominator to the health and welfare of the auto industry. But automakers are seemingly in support of fuel cell vehicles, for they fit nicely into the existing automaker business model, and are decades off in the future.

Likewise, environmentalists are generally in support of the move toward a hydrogen economy. Books, like that published by Jeremy Rifkin helped to build this consensus in environmentalist circles.^{ix}

Local and state governments also see opportunities for investment, jobs and economic growth coming from the transition to a hydrogen economy. At the annual gathering of the auto industry in Detroit in 2003, representatives from several states proclaimed their support for hydrogen research and their goals to use this opportunity for job creation and economic stimulation.^x

Super Powers of Industry

Drill, pump, refine, store, fill-‘er-up, burn into the air. This is essentially the chain of transactions that control cost and profits in the oil and gas industry. It is a global industry, run by publicly-owned, for-profit companies. Like the auto industry, the oil industry is one of the world’s largest industries and it is run by just a handful of powerful companies. The electric utility industry, on the other hand, buys gas, oil or coal from those energy companies, as a commodity, and resells another commodity, electricity. But electricity can’t be stored. And because of this, and other factors, the production and trade of electricity is largely a regional system, often even a small, city-scale activity.

The political clout electric utilities wield in a global marketplace is, relative to oil and auto companies, feeble. This usually correlates to low levels of political power beyond the region or state. The electric utility industry operates within a complex web of overlapping regulatory and jurisdictional battles between the Federal Energy Regulatory Commission (FERC) and state regulators.^{xi}

The auto and oil industries, on the other hand, operate in a global environment, and many of the factors affecting their industries are regulated by federal agencies, or at least on a state level. City and county politics are not important circles of influence for the automakers and oil companies.

In 2003 the top ten corporations within the *Fortune 500* included 2 automotive companies and 2 petroleum companies. There were no electric utility companies in the list of the top 100 corporations, but several more oil and auto companies.

With ZEV mandates in place, California, reported to be the 6th largest economy in the World, came under intense pressure from the auto industry, and bent to some of that pressure. The automakers powerful lobbying group, the American Automobile Manufacturers Association (AAMA), is suing California over its ZEV regulations. This is a suit supported by the Bush Administration^{xii}.

CARB has now all but eliminated battery EVs from its rulings. Meanwhile, California is being sued on another front by the automakers who do not like the greenhouse gas reduction bill signed into law in California. These realities demonstrate the powerful, national clout of the

auto industries, and how even a large state like California finds it difficult to reshape this industry in the best interest of the state and its citizens.

In America's media environment, powerful industries greatly influence what consumers see and hear. Today, very few Americans have ever driven a battery EV. Many of those that have love them. In fact in most of the EV companies I worked for, we found that giving people test rides was one of the surest way of making a sale.

But most Americans are now led to believe that batteries don't work for cars, and hydrogen is the answer to our transportation future. What American consumers (and politicians) know about battery EV's or hydrogen was learned largely from corporations that paid to put those messages in the minds of consumers.

Influencing Change

Today, no major automaker offers battery EVs for sale in the United States. Ford, was the last hold-out, but in August, 2002 announced the closing of its TH!NK electric vehicle division.

While we wait and are hopeful that another 20 or 30 years of hydrogen and fuel cell research will make these vehicles a reality, what can we as consumers do to influence change in our transportation systems? Indeed, there are some ways we as consumers can influence change.

Consumer Purchasing Power is touted as the force that drives companies to offer new products. Automakers, when they cancelled their battery EV programs noted a lack of consumer demand. But what is the true power we as consumer have to shape the auto industry? In a fierce global marketplace, where many automakers, even as large as Ford, find it difficult to compete and survive, is it realistic to think that a smaller auto company, perhaps a start-up, can compete? And, as consumers, should we be forced to buy inferior or expensive products to make our point to the auto industry, or perhaps hold off a new car purchase until an auto that meets our ideals emerges?

Consumers, working in coordinated action groups can make a difference. The historic case of Nestle, who changed their business practices after public outcries, makes this point. But individual consumers, like individual voters, can be most successful when organized into a cohesive group that has enough power in the

political process to effectively shape changes, on the political front.

Public Education is important. The U.S. Environmental Protection Agency found that a 62% majority of U.S. adults mistakenly felt that gas mileage is still annually improving, when in reality fuel efficiency has declined 6% in the past 15 years.^{xiii} We as consumers should strive to check our sources, make informed choices, and teach our fellow citizens. We should also work as voters and advocates to insure our sources of news remain balanced and the influence of corporations or other biasing perspectives are minimized.

Industry Regulation has its supporters and its challengers. The telephone and airline industries have been deregulated and costs have been reduced and service generally changed as a result. When California and other states deregulated their energy industries, it was also done with the goals of improving service and lowering costs for consumers. But, today these industries have developed other problems, which may be linked, directly or indirectly to the longer-term effects of industry deregulation.

Cost reductions for consumers is a relatively near-term goal. Shaping our infrastructure in ways that lays the groundwork for new products that have other, less tangible, benefits to consumers and society is another goal. These goals may not be served equally well by a regulated, verses unregulated industry.

The auto industry is clearly shaped by our built environment; infrastructure – both for fueling and road travel. We, as citizens, should carefully consider our desires for deregulation in some industries, or for more regulation in others.

Campaign finance reform has been a top issue for many years now, and for good reason. Corporate power is in some cases out of balance and drowning out the voice of citizens and society. We should strive to help maintain a balance with regards to the power of global corporations, who do not necessarily hold allegiance to any particular region, or necessarily to a particular country.

The Shape of Things to Come

The great tragedy is the abandonment of real progress toward zero-emission vehicles, and the new focus on hydrogen and fuel cells. We went

from a hard product development effort to an ambiguous “star wars” R&D effort.

On March 13, 2003 - Hans Blix, UN Chief Weapons Inspector said, “To me the question of the environment is more ominous than that of peace and war.” Mr Blix was not successful in a less ominous task, that of Iraq, working against the wishes of a global super power. And, the state of California fell into a similar quandary against the super powers of global industry, the oil and auto companies.

Today we may feel a new sense of oil abundance, thanks to the liberation of Iraq and a new political dynamic in the Middle East. With hybrid-electric cars in the market, we may also feel like we have clean and green choices. But the vision set by California has not been realized. We remain addicted to oil, and this clouds our political processes.

We can talk about batteries and hydrogen and bio-diesel, but until we as consumers and voters take back our political future, the greening of the

auto is unlikely to happen under any path other than that designed by automakers and oil companies.

Scott Cronk is President of Energy Matters LLC, a television and web production firm specializing in renewable energy and energy efficiency topics. Over a 12-year period he held numerous domestic and international positions within General Motors Corporation. He then went on to help lead several electric vehicle start-up companies, including Electric Vehicle Infrastructure Inc., Electric Motorbike Inc, Zapworld, and eNova Systems. His perspectives have been featured on several radio and TV programs, and he is the author of numerous papers and the book Building the E-Motive Industry, published by the Society of Automotive Engineers.

See: www.energybuilder.net

The realities of our built environment (infrastructure) along with economic, environmental, and educational forces have been squeezing the move toward ultra-low and zero emission vehicles. Table 1 is a snapshot of how these factors have changed over the past eight years.

Table 1. Changing Perspectives 1995 – 2003

	1995	2003
Energy Industry	With the support of electric utilities, battery EVs would have a strong, widespread and convenient infrastructure for recharging.	Electric utilities are fragmented and mechanical in their inter-industry dealings. Especially as compared to the oil and gas industry.
Economic Forces	The loss of defense business in California, together with the Dot.Com era would create a business paradigm shift in the auto industry.	Dot.coms took the limelight (both on the way up and on the way down) and old paradigm businesses survived and are thriving. The new “war on terror” is further shifting the focus toward oil and exploration, and with it a new sense of oil abundance and security. But, the demise of Dot.Com’s and telecommunication industries has created a new vacuum in the economy.
Environmental Forces	Global warming, unacceptable air pollution levels, and traffic congestion are realities and worsening.	These realities continue to influence makers and buyers in a dynamic marketplace. But, new car buyers today consider their automobiles “clean”, further shifting the focus away from the desire to attain zero emissions.
Consumer Education	An electronics savvy consumer will adopt an electric car without inconvenience or significant learning curves.	A hand-held electronics savvy consumer that values convenience (“fill ‘er up”) and finds the concept of a “hybrid” intriguing.

Notes:

ⁱ sbdcnets.utsa.edu/industry/gas_stations.pdf

ⁱⁱ In the future, hybrid-electric vehicles might even burn bio-diesel, a fuel embraced by many environmentalists and farmers. And a fuel, that can be stored and pumped using traditional infrastructure, now favored by the oil and auto industries. Meanwhile, an EPA reports suggest that diesel fuel can cause cancer. But with the passage of California's Greenhouse Gas Reduction law, automakers are lobbying to have diesel fuel as an option – diesel gets better fuel economy than gasoline, and could help automakers reach the CO2 reduction goals proposed by California.

ⁱⁱⁱ The original program in 1990 called for 100,000 zero- emissions cars on California highways by 2003. In April 2003, CARB voted to implement a program that will allow carmakers to produce a mix of relatively clean-burning cars, like the Honda Accord, and hybrids in the next five years. About 10 percent of each auto manufacturer's sales in California would have to be those types of vehicles. By 2017, the auto industry would be required to produce 50,000 zero- emission cars for California.

^{iv} “GM, Shell Plan Hydrogen Pump in D.C. Area for 6 Minivans' Use”, Detroit Free Press, March 5, 2003.

^v “Outlook Promising for Advanced Batteries for Electric Vehicles”, EPRI Journal, February 19, 2003.

^{vi} Press Release, General Motors Corporation, April 10, 2003.

^{vii} Alan Caruba, “The Great Hydrogen Myth”, www.energypulse.net, April 21, 2003.

^{viii} In April 2003, an industrial alliance was announced between electric utilities and the coal industry. This alliance is focused on generating hydrogen from coal. See www.battelle.org

^{ix} *The Hydrogen Economy*, Jeremy Rifkin, Penguin Putnam Inc., 2002.

^x SAE World Congress, Detroit, 2003.

^{xi} Jim Bushnell, “Looking For Trouble: Competition Policy in the U.S. Electricity Industry”, Center for the Study of Energy Markets, April , 2003.

^{xii} It is interesting to note that Andrew Card, now Chief of Staff for President Bush, was the President of the AAMA, and Vice President of Government Relations at General Motors.

^{xiii} “Americans Need to Brush Up On Energy IQ”, Greenbiz.com, Oct., 22, 2002.