

Their infrastructure program is in parallel with GM's "Project Driveway" which places 100 fuel cell-powered Chevrolet Equinox' in southern California, Washington, D.C., and New York. Both of these projects will be launched this fall. We are proud to be part of the education program to help people understand what a renewable hydrogen energy economy entails and what it can do for our air quality and public health.

We invite our membership to get involved in this effort. Call (310) 472-8633 for more information



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Who Killed the Valid Premise? Film Review: *Who Killed The Electric Car?* By Woody Hastings

Every good documentary should have a valid premise. The premise in this film is that the electric car has been killed. The truth is, the *GM EV1* was killed, but not the *electric car*. Electric vehicle (EV) technology will only improve over time, and EVs continue to be produced and will play an important role in the transition out of the petroleum era and on into the future.

I do agree with the film's criticism of the oil and auto industries as the guilty parties in repeatedly undermining production of EVs, not just in the case of the EV1, but, as is touched on in the film, in the early 20th century and then in the case of the EV1 and others more recently. What this means is that it is up to entrepreneurs and independent start-ups to make it happen, not an appeal to the corporate giants deeply vested in gasoline internal combustion. And that's a good thing.

But it is a ludicrous contention that the hydrogen fuel cell is "guilty" of "killing" EVs. It is even a long stretch to argue that government policy supporting fuel cell electric vehicles (FCEVs) along with chemical battery vehicles was the culprit. It must be remembered that EVs and FCEVs are very closely related technologies. There is no reason why they should be considered mutually exclusive of one another. A FCEV is essentially an EV with an electricity-producing fuel cell installed in the place of the battery. Instead of requiring a recharge, the fuel cell requires a refill of its fuel – hydrogen. The major advantage? Rapid refueling and theoretical long range capability versus long recharge time and limited range of chemical batteries.

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In the film, Joseph Romm posits five "miracles" that must occur for hydrogen fuel cell vehicles to be viable. I will take each "miracle" case by case.

1) *Cost of the fuel cell and vehicle, currently around \$1,000,000*

All fuel cell vehicles produced today are produced one at a time. As with any new product, initial prototypes are very expensive. When the first FCV goes into production, economies of scale will bring the cost down. The first production vehicles will still be expensive, but over time, the price will come down. The price of computer memory is a good example of this price curve. No miracle needed.

2) *Onboard Storage*

The current conventional means of onboard storage involves high pressure tanks. Incremental improvements may make this method workable for acceptable range. Even today, GM's prototype Sequel has a 300 mile range with high-pressure on-board gaseous storage. Many new methods of solid state storage – metal hydrides for example – are emerging. Again, no miracle needed, only continued progress.

3) *Hydrogen Fueling Infrastructure*

Infrastructure development will begin with large commercial and governmental fleet operators and will take time and a substantial financial investment to become ubiquitous. But even if the stations cost \$1 million dollars each, to support all of California it has been estimated that only about 120 hydrogen stations would be needed throughout the state. That puts the cost at just \$120 million – about 2 hours of fighting the Iraq war. Take your pick. Time and money, not a miracle.

For those engaged in the work of advancing hydrogen technologies, these problems, characterized as requiring miracles to overcome, are merely well known challenges on which steady, measurable progress is being made.

Woody Hastings
Secretary of CAN

4) Energy Source for H2 Production

The energy source for hydrogen production is overhead and all around us. It is solar and wind energy. If the cost of these technologies is the Achilles Heel of renewable hydrogen, that heel is rapidly healing. Wind is now competitive with natural gas, and the cost of solar will continue to decrease. It is the cost per mile that really matters in transportation, and hydrogen already competes today with diesel. Eventually it will be very economical to use the sun to produce hydrogen to run a vehicle. No miracle required.

5) Hydrogen fuel cell vehicles are 15 years away at best

Fuel cell vehicles are already here, production vehicles are a few years out still. In the meantime, nothing stops us from retrofitting and/or building hydrogen internal combustion, or hydrogen ICE/EV hybrid vehicles, like the Quantum Prius hydrogen hybrids.

For those engaged in the work of advancing hydrogen technologies, these problems, characterized as requiring miracles to overcome, are merely well known challenges on which steady, measurable progress is being made. If the film, and/or Joseph Romm, were to argue that some technological breakthrough was needed, and could point to that breakthrough, they might have a point, but they don't. With all due respect to Mr. Romm, it is fundamentally incorrect to say that any miracle, let alone five, is needed for the hydrogen fuel cell vehicle to become commercially viable.

One aspect that was never touched on in the film is that, although battery electric vehicles can fill many needs for short range trips and can be filmed zipping silently on a road, many consumers had, and continue to have, valid concerns about the range limitations and recharging time. With the emergence over the past six years or so of vastly improved chemical battery technology, spurred largely by the demand for better batteries for portable electronic devices like laptops and cellphones, the range problem associated with battery EVs may be dissolving. If a safe, affordable battery can be developed that can be recharged in a reasonably short period of time, say, less than a half an hour, there may yet be potential for chemical battery vehicles to displace a significant portion of the gasoline-powered vehicle market.

In the early nineties the ZEV mandate was under periodic review by the California Air Resources Board (ARB). On several occasions, CAN representatives testified in favor of inclusion of hydrogen internal combustion engine (H2-ICE) vehicles in the mandate. As it stood, only battery electric vehicles qualified. Although H2-ICE vehicles emit water vapor and trace amounts of oxides of nitrogen, we argued that the emissions were essentially benign and thus the vehicles should qualify as "zero" emission if zero means zero harmful pollutants. Our efforts did not initially succeed. Hydrogen

technologies received zero benefit from the ZEV mandate. In that era, chemical battery technology was the technology being "hyped." The hydrogen community never attacked chemical battery EV advocates for receiving this publicity, deserved or not. CAN did eventually win the 'fuel cycle' 'well to wheels' argument as that has since been adopted by the ARB as policy.

The film focuses on the ARB's decision in 2003 to "abandon" the ZEV mandate. But the fact is, the ARB didn't abandon the ZEV mandate, they amended it in timeline and credit application to certain technologies, such as hybrids, FCEVs (Fuel Cell EVs), AT-PZEVs (Advanced Technology - Partial ZEVs), etc. The film-makers leap to the conclusion that this act single-handedly destroyed all hopes for the EV and laid down the red carpet for fuel cells. A point that they seem to miss is that the investment into



hydrogen technologies is a worldwide phenomenon. A ship sailing largely under its own power - commercial interest.

Part of the rationale at the time for revising the mandate was that with the emergence of several EVs and hybrid vehicle lines, it appeared that the battery EV ship itself was sailing. The mandate had done its job, had spurred the development and marketing of the vehicles, and the ARB could step back. It was never a conspiracy on the part of Alan Lloyd and other decisionmakers to "kill" the EV. That was the automakers' decision.

The film is notably silent on the issue of biofuels - ethanol, biodiesel, and the like - that have recently garnered a lot of attention from state and federal government. Some might even call it hype. Attention on these alternatives rose to prominence well before the film was finalized. In the sequel, will the filmmakers take it upon themselves to attack those alternatives for the many shortcomings associated with them? If you want to get the oil boys rolling in laughter in their boardrooms, tell them that the EV advocates are attacking the renewable hydrogen advocates, and that both are attacking biofuels. Are the film-makers trying to argue that battery EVs alone will extricate us from the petroleum era? People, we need some solidarity here. The enemy is petroleum, not renewable hydrogen.

Comments regarding this article can be sent to whastings@cleanairnow.us



CAN's Educational Outreach

By Dan Blose

The purpose of this article is to summarize the type of information we present to students as part of CAN's educational outreach. This program is a 45 minute presentation primarily for elementary and middle schools children. In the program we provide a verbal description of the causes of air pollution, the health effects, what is being done to minimize it (with emphasis on alternative fuels), and what individuals can do personally to reduce the effects of their activities. After a question period, we have an eight minute video with a humorous touch and some reinforcement of the information provided. After another question and answer period, a small fuel cell is demonstrated. The students can see water being converted to hydrogen and oxygen and electrons produced spinning a small propeller.

Unfortunately, local school district curricula requirements have seriously impacted our ability to schedule programs. In the past we were able to speak to 4,000 students. We have changed our focus to present these programs to private schools, child care groups, and are currently working with libraries for after school programs.

If you have are a school teacher, or have contact with teachers who might be interested in this program, please contact Don Blose at (951) 686-9981 or Clean Air now at (310) 472-8633



Initial Funding for Clean Air Challenge Curriculum Program Received

By James Provenzano

Clean Air Now is proud to announce it has received funding for the first full-phase of the implementation of our Clean Air Challenge Curriculum Program. Shell Hydrogen, LLC has contributed \$100,000 to CAN for participation in the program. The Shell monies augment the \$140,000 grant that was awarded to CAN by the South Coast Air Quality Management District late last year. This grant expands the program to all four counties in the District (Los Angeles, Riverside, San Bernardino, and Orange County). Over 200 teachers will be trained and given materials to bring the comprehensive math and science based laboratory activities and lessons to over 24,000 students in southern California. The cost of the program comes to a very competitive cost of under \$10 per student.

The Clean Air Challenge Curriculum Program was tested in southern California via a pilot program that entailed four professional teacher-training workshops, which were generously co-funded by the City of Riverside and the District. The success of the pilot program and the broad acceptance of the curriculum by the teachers led to CAN's ability to receive "add-on" funding to continue the program.

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More can be learned of the CAC program at CAN's website www.cleanairnow.us, and there is a dedicated site for the teachers and students at www.clean-air-challenge.net.

Along with the workshops, CAN is planning an "Energy Fair" which will showcase the technology that the students are exposed to in the classroom. This gives the teachers and students the opportunity to have a hands-on experience with new clean technologies that are in the marketplace or are close to commercialization. The Energy Fair will be held at the District headquarters thereby helping to introduce students to a public agency that is in charge of protecting the public's health from the detrimental effects of air pollution. The new phase of the CAC program begins this spring.

Shell Hydrogen is interested in the program because they want to get the word out about hydrogen, its use as a clean fuel, and educate the next generation about fuel cell vehicles and renewable energy. They specifically requested that the curriculum's scope on hydrogen, fuel cells, and renewable energy be increased, which we were more than happy to accommodate. Shell is putting in 4-5 hydrogen fueling stations in the District as part of their "Project Lighthouse."