

CaH2Net 2008 Report to the Legislature

JANUARY 2009

THE CAH2NET— MOVING FORWARD

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This report highlights California Hydrogen Highway Network (CaH2Net) program activities in 2008. It includes updates to the legislature on activities that affect hydrogen fueling infrastructure and hydrogen vehicle deployment. It also captures the efforts of local and state agencies, and non-profit and private entities to grow hydrogen infrastructure, and showcases automakers advancements toward fuel cell vehicle (FCV) commercialization. In short, 2008—the fourth year of CaH2Net program activities was defined by a number of successes and challenges.

Program Successes

Successes in 2008 were characterized by a refining of program priorities, placement of next generation fuel cell vehicles, the opening of new hydrogen stations, funding of fuel cell transit buses, and awarding of funds for next-generation hydrogen fueling stations.

Based on feedback from the CaH2Net Advisory Panel and program stakeholders at a forum in January of 2007 held by Air Resources Board (ARB), a strategic refocusing of the program's infrastructure deployment strategy was initiated.

The refined strategy put additional emphasis on creating clusters of hydrogen fueling stations in the key urban areas of Greater Los Angeles/Orange Counties and the San Francisco Bay Area. Auto-

makers worked with CaH2Net program staff to identify critical placement of stations to create "mini-networks" able to support near-term fuel cell vehicle deployments. ARB awards to fund three next-generation hydrogen stations reflect this refined strategy and will support the next wave of fuel cell vehicles. In early 2009, ARB will award additional funding for more stations that follow this same strategy.

During 2008, a number of the major automakers announced details of plans for placement of fuel cell vehicles with customers in these key markets, including General Motors (GM) and Honda. In addition, these next generation vehicles show tremendous technical advances over their previous generation in terms of driving range (250 – 350 mile), power density, cost, durability, and weight. As an example, the fuel cell stack in Honda's FCX Clarity is 30 percent lighter, 20 percent smaller, has a power density improvement of 50 percent, and a 30 percent increase in driving range to 270 miles. Other automakers have made similar fuel cell technology advancements.

On the infrastructure side of the equation, 2007 and 2008 initiated a move to 700 Bar (10,000 psi) fueling. Acknowledging that an increase in fueling pressure to 700 Bar would enable greater driving

range, the first 700 Bar fueling station in the Hydrogen Highway Network opened in February of 2007. Located at UC Irvine, and a project of the National Fuel Cell Research Center, Air Products, Department of Energy (DOE) and the South Coast Air Quality Management District (SCAQMD), the station is operational and fueling Toyota, GM and Honda fuel cell vehicles. Additionally, the Burbank hydrogen station has been upgraded to 700 Bar fueling and is scheduled to reopen in early 2009, and GM opened three private 700 Bar fueling stations to support their Project Driveway fuel cell vehicle test program. In June 2008, Shell opened California's first fully public, retail hydrogen station when they added hydrogen to an existing gasoline station in West Los Angeles. Hydrogen stations were also opened in Rosemead (Chevron), Sacramento (BP), and Arcata. All combined, eight public and private hydrogen fueling stations opened in Calendar years 2007 and 2008, with two more scheduled to open in early 2009.

Finally, in June 2008, ARB awarded \$7.6 million for three next-generation hydrogen fueling stations in Los Angeles, Orange County, and Emeryville. The stations, all sited to support the strategic "mini-networks" of stations, will include 700 Bar fueling capability, higher output, enhanced public access, and renewable generation of hydrogen. Two of the stations will produce hydrogen from 100 percent

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renewable resources. In December 2008, ARB released a grant solicitation to provide up to \$8 million in funding for modular stations, also to support the “mini-network” strategy. Awards will be announced in February 2009.

Program Challenges

The challenges encountered in early FY07 were due to both real and perceived challenges of contracting with the State and inexperienced bidders. The State awarded co-funding to three contractors through a public process for three hydrogen fueling stations in the San Francisco, Los Angeles, and San Diego areas. Two of the awards were to public entities, specifi-

cally Cal State University Los Angeles and San Diego City Schools, both of which encountered significant contracting and project challenges resulting in the withdrawal of both awards. Key lessons learned from this experience are the need for clearer contracting requirements, better screening, and the ability to award grants rather than contracts for deployment of infrastructure.

Fortunately, the funding that was not used for hydrogen stations in FY06 was applied toward co-funding the three new stations that were awarded in June 2008. ARB used the lessons learned from the first funding attempt when developing bid specifications for the 2008 solicitations. The progress occurring right now at the

three stations awarded in June 2008 is a testimonial that the process is working.

Moving Forward

FY08 marks the last year when funding for CaH2Net program activities will be allocated directly to ARB. Assembly Bill 118 authorized the legislature to appropriate to the California Energy Commission (CEC) up to \$120 million annually to disburse incentives to projects that produce alternative and renewable low-carbon fuels in California, and expand fueling infrastructure, fueling stations, and equipment. At this point, we fully expect that AB 118 disbursements will include money for CaH2Net program activities.

For more information about the CaH2Net, contact Gerhard Achtelek at (916)323-8973.

ARB AWARDS \$7.6 MILLION FOR THREE NEW HYDROGEN STATIONS

In June 2008, ARB awarded \$7.6 million for three new hydrogen stations. These new stations will increase publicly accessible infrastructure to support increasing numbers of hydrogen fuel cell vehicles from General Motors, Honda, Daimler and others. Two stations are located in the greater Los Angeles area, and the other near Oakland, in Northern California. All three stations will provide hydrogen at 350 and 700 Bar pressures (5,000 and 10,000 psi), and will have easier access and more convenient hours of operation when compared to current hydrogen fueling stations.

Fountain Valley

\$2.7 million was awarded to co-fund a station in Fountain Valley located at the Orange County Sanitation District (OCSD) Facility. Air Products and Chemicals, Inc. will be installing a new station that will dispense 100 percent renewable hydrogen produced from digester gas from waste water utilizing a molten carbonate high temperature fuel cell. The station, co-located with Compressed Natural Gas (CNG) dispensing, will provide

up to 100 kilograms per day (kg/day) dispensing seven days a week.

Fuel Cell Energy’s high temperature fuel cell is currently being prepared for field testing where it will simultaneously produce electricity and hydrogen. Permits are pending for placing the fuel cell at the OCSD site. When digester gas is used, the fuel cell will produce 100 percent renewable electricity and hydrogen. Air Products plans to commission this 100 percent renewable station in December 2009.

Emeryville

\$2.7 million was awarded to the Alameda-Contra Costa County Transit District (AC Transit) to establish, operate and maintain a new hydrogen station in Emeryville. The station will have the capacity to dispense at least 60 kg/day of hydrogen that is produced via electrolysis using 100 percent renewable solar electricity from new and existing photovoltaic arrays located on-site and throughout the Bay Area. The station will be co-located with a second hydrogen facility that will dispense an

additional 120 kg/day exclusively for transit and heavy duty vehicle use.

Three workshops/public meetings were held in Emeryville in late 2008 to give the city council and public an opportunity to ask questions regarding design and emissions benefits of the proposed station. The city council approved the project and a permit was issued. The station should be fully operational by first quarter 2010.

Los Angeles

\$2.2 million was awarded to California State University, Los Angeles (CSULA) who will build and operate a new 60 kg/day station using electrolysis powered by 33.3 percent renewable solar and wind energy. The station will be built on the east edge of the campus, adjacent to the electric vehicle (EV) charging station and will complement the university’s Power, Energy and Transportation curriculum.

For more information, please contact Michael Kashuba at (916) 323-5123.

ARB TO AWARD GRANT FUNDING FOR MORE STATIONS

In December 2008, Air Resources Board released a grant solicitation of approximately \$7 million for additional hydrogen refueling infrastructure. The solicitation requested grant proposals from qualified teams to build, operate and maintain “rapid deployment” modular or skid mounted stations. Workshops were held in November to encourage contractors, equipment suppliers, and energy provid-

ers to bid. Due to the great deal of interest in this solicitation, the total amount was increased to \$8 million. Proposals are due on January 30, 2009, with awards to be announced in February. Information on this grant solicitation is being maintained on the California Hydrogen highway website.

For more information, please contact Michael Kashuba at (916) 323-5123.

“ARB’s bid criteria reflect lessons learned from our experiences and input from automakers who are deploying fuel cell vehicles in California.”
Gerhard Achtelik, ZEV Infrastructure Section Manager

ENVIRONMENTAL STANDARDS FOR HYDROGEN PRODUCTION

Senate Bill (SB) 1505 requires ARB to develop regulations for environmental standards of hydrogen production. The regulation will require producers of hydrogen transportation fuel to reduce criteria pollutant and greenhouse gas (GHG) emissions relative to that of gasoline and gasoline-powered vehicles. The regulation will also require that a percentage of the hydrogen produced for transportation be made from eligible renewable energy resources.

Initially, only hydrogen stations funded by the state must meet the requirements. After 3,500 metric tons of hydrogen is dispensed for transportation in a consecutive 12 month period, the requirements will apply to hydrogen produced for transportation.

The regulation will also require hydrogen producers to ensure at least 33.3

percent of transportation hydrogen be made from eligible renewable energy resources. Unfortunately, the development of the regulation has been delayed because of how a renewable resource is defined in the legislation – which limits renewable hydrogen to mean hydrogen produced from renewable electricity. ARB is awaiting clarification of this definition, possibly through a legislative fix, that would allow the direct use of renewable feedstocks for renewable hydrogen production and encourage allowing by-product gas (i.e., hydrogen waste gas from existing processes) to count as renewable.

Assuming the renewable definition is expanded as suggested, the following benefits could be realized when the 3,500 metric ton threshold is reached and the regulation is implemented statewide:

- Over 25,000 ton reduction in well-to-wheel GHG emissions compared to gasoline vehicles;
- Over 2 ton reduction in well-to-tank criteria pollutant emissions, specifically Oxides of Nitrogen and Reactive Organic Gases;
- Additional criteria pollutant emission reductions from the operation of fuel cell vehicles; and
- Hydrogen production methods utilizing a variety of renewable resources (both energy and feedstocks) will be employed in California, making California a leader in renewable hydrogen.

To find out more, please contact Ben Deal at (916) 322-8449.

Keep in touch with the latest news on the CaH2Net by signing up for our list serve at <http://www.hydrogenhighway>

HYDROGEN STATION OPENINGS IN 2008 WITH MORE ON THE HORIZON

2008 saw the opening of six new hydrogen stations with the promise of many more in the next three years.

Shell Hydrogen LLC, opened California’s first hydrogen refueling station at a conventional Shell gasoline forecourt in West Los Angeles. Located on Santa Monica Boulevard near the 405 freeway, the station joins the California Hydrogen Highway Network, and gives consumers a taste of the future, with refueling services for hydrogen powered fuel cell vehicles becoming just as convenient as conventional gasoline motors.



Hydrogen dispenser at Shell’s West LA gasoline station.

Hydrogen at the Shell station is produced on-site by electrolysis using green electricity purchased from the Los Angeles City Department of Water & Power. Due to space constraints, Shell opted to place the hydrogen production and storage components on the canopy above the dispenser. The station can dispense 30 kilograms of hydrogen per day.

Graeme Sweeney, Executive Vice President for Shell Future Fuels and CO2 said: “California is leading the way with clean fuels, as it moves one step closer to realizing its hydrogen program, FCVs powered by hydrogen will provide a sustainable transportation

choice for the future, opening up new markets across the globe. This requires the sustained effort of energy companies, auto manufacturers and federal and state governments working together. We are pleased to be playing our part to help develop a safe and reliable fueling infrastructure for future clean energy vehicles, as the only major energy company involved in FCV vehicle demonstrations in all three major hydrogen markets.”

Schatz Energy Research Center christened the northern most point of the California Hydrogen Highway at their station’s grand opening on September 4, 2008. Situated on the Humboldt State University (HSU) Campus in Arcata, this station is meeting the needs of a Quantum Prius conversion provided to Schatz by ARB’s Hydrogen Highway funding. Chevron Technology Ventures, Caltrans, North Coast Unified Air Quality Management District, and O&M Industries also collaborated on this project.

This station can produce 2.3 kilograms per day using grid electricity and store 12 kilograms of hydrogen. Schatz is currently researching opportunities to tap into landfill gas and solar power to meet the station’s electricity needs. Schatz is no stranger to pro-

ducing hydrogen from solar power having built California’s first solar hydrogen fueling station at Sunline Transit headquarters in Thousand Palms.

BP in partnership with Ford and Sacramento Municipal Utility District (SMUD) opened a solar electrolysis station in Sacramento in March 2008. Hydrogen at this station is operating almost completely on solar panels that shade the parking structure surrounding the building. Its easy freeway access, lack of security fencing and simplified touch screen dispenser has made a significant step toward a “retail-like” experience.

Three private GM stations opened in the Los Angeles area in 2008 to support GM’s fleet of Chevy Equinox FCVs deployed this year as part of Project Driveway. One is a permanent dispenser situated at the Clean Energy alternative fuel station near LAX. The other two are modular stations. All three stations dispense hydrogen at 700 Bar and fuel only GM vehicles.

On the horizon, several new stations either are close to operational or in the design and permitting process. State funding from past and present budget cycles is encouraging universities and experienced station developers to build hydrogen stations where they are needed to meet. The following is a summary of existing stations, closed stations, and future stations.

December 2008 Hydrogen Station Status	
Operating Stations	
25	Public and Private Stations (6 in northern and 17 in southern California)
3	R&D Stations in Southern CA
28	Total
Station Closures in 2008	
2	Mobile Fuelers (one replaced with permanent station)
3	Electrolyzer stations (one being replaced with reformer)
5	Total
Future Stations - most public with <60 kg/day and 700 Bar dispensers	
2	Stations opening in LA area in early 2009 (BP station and GM modular)
3	Renewable stations opening in late 2009/early 2010 (H2Hwy funds)
4-6	Modular/skid mounted stations opening in summer 2010 (H2Hwy funds)
8-10	Stations opening by 2011 (AB 118 funds, specs to be determined)
17-21	Total

With so much potential to grow the hydrogen fueling infrastructure, it is critical for the State to maintain focus on funding stations that meet the needs of the hydrogen vehicles being deployed. Location, convenient access, hydrogen throughput, dispensing pressure, and retail-like qualities are equally important factors for success and state funding can help lead the way.

Contact Leslie Goodbody at (916) 323-2961.

CLEAN AND COOL—HYDROGEN OUTREACH AT THE CAPITOL

On May 28, 2008, the Second Annual Hydrogen and Fuel Cell Reception and Outreach Event took place on the North Steps Lawn at the State Capitol. The event, organized jointly by Energy Independence Now (EIN) and the California Hydrogen Business Council with support and coordination from the California Fuel Cell Partnership and California Air Resources Board, served as a forum for decision-makers and the public to learn about hydrogen and fuel cell technology. In particular, the goal of the event was to provide an educational forum for dis-

cussion of the economic, environmental, and public health benefits of hydrogen and fuel cell technology for California, to highlight progress and recent achievements, and to urge continued support from the public.

Sponsored by a range of hydrogen and fuel cell stakeholders including General Motors, Honda, Air Products, Hydrogenics, Intelligent Energy, AC Transit, Center for Energy Efficiency and Renewable Technology, and Coalition for Clean Air, there were information displays as well as a “ride and drive” organized by the California Fuel Cell Partnership. Finally,

as part of a coast-to-coast innovation tour looking at advanced transportation technologies, the U.S. Department of Transportation Research and Innovative Technology Administration joined the event with department officials and U.S. congressional staffers. The event, attended by an estimated 300 individuals this year, is becoming an important annual opportunity to keep decision-makers and the public up to date on technology advances and deployment progress.

For more information, contact Daniel Emmett, EIN, at (805) 899-3399.



Clean and Cool. Legislative Outreach Day for the CaH2Net. Photo courtesy of the CaFCP.



Ford Focus FCV. Photo courtesy of the CaFCP.



Ford Focus FCV and Chevy Equinox Fuel Cell Vehicle on the steps of the Capital. Photo courtesy of the CaFCP.



Chevy Equinox Fuel Cell Vehicle on the steps of the Capital. Photo courtesy of the CaFCP.

HYDROGEN'S BENEFITS AS FUEL BECOMING OBVIOUS

San Jose Mercury News Op Ed By
Mary D. Nichols

Article Launched: 01/21/2008 01:32:35
AM PST



Mary Nichols, ARB Chairman

As we continue to battle smog and soot in too many parts of the state and as gas continues to creep toward \$4 per gallon, Gov. Arnold Schwarzenegger's Hydrogen Highway is looking more like the future of transportation in California. While hydrogen vehicles are still in the early stages of deployment and fuel production is costly, the partnership of auto manufacturers, fuel suppliers and related government agencies is strong.

Hydrogen has the potential to offer monumental benefits by reducing both health-damaging pollutants that create smog and greenhouse gas emissions. When hydrogen is produced by renewable energy such as solar, wind or biomass, it is nearly pollution-free and has little impact on the environment. Even when produced from natural gas, as most hydrogen is today, the reduction in greenhouse gases

and pollution is substantial.

Since 2000, automakers have placed more than 175 vehicles, traveling more than 1 million miles, on California roads. More hydrogen vehicles are now registered here than in any other state or country in the world, and we have more fueling stations than any other state. Combined with other emerging alternative fuel technologies - including hybrids, battery electric and compressed natural gas vehicles - the picture looks even more impressive.

This state is working aggressively with its partners to wean ourselves off petroleum.

Californians should look ahead with optimism to greater numbers of hydrogen vehicles and stations in the Golden State. We have strong commitments and working relationships with all of the crucial parties that need to be involved: energy companies, automakers, state and federal government, academia and the environmental community. The California Fuel Cell Partnership in West Sacramento consists of 33 organizations that believe fuel cell vehicles powered by hydrogen have the potential to change the future of transportation.

California is the hub for hydrogen vehicle research and development projects. Due to substantial investments by the automotive industry, fuel cell vehicles have made remarkable technical progress in the areas of efficiency, range, cost and durability. For example, the Honda's FCX Clarity fuel cell vehicle has a range of more than 250 miles, which already meets the Department of Energy's 2010 goal.

Energy companies have also made substantial investments in multiple hydrogen production and delivery options and now believe that clean hydrogen fuel can be offered at competitive prices to fuel cell consumers when they are commercially deployed. With vehicle efficiency accounted for, analysts project hydrogen costs comparable to \$1.50 a gallon of gasoline. It's also worth noting that - contrary to public perception - hydrogen as a fuel source is at least as safe as gasoline and the safety record of the industry is impeccable.

The hydrogen program has been remarkably successful at getting the most for a relatively small state investment: We have invested \$25 million in the Hydrogen Highway since 2005 while automakers have spent upward of \$300 million a year on vehicle research, development and demonstration.

The next several years will usher in an exciting new area in the use of hydrogen as a fuel source:

- GM will introduce over 100 vehicles nationwide, 60 of which will be placed in Southern California. They will be leased to private parties and municipalities.
- The Sacramento Municipal Utilities District and BP are opening a 100 percent renewable photovoltaic hydrogen station in Sacramento.
- Honda will, later this year, begin leasing its new Clarity to private citizens in Southern California.

(Continued on page 16)

HYDROGEN ROAD TOUR '08 FINISH LINE

After 31 stops in 18 states, stretching from Maine to California, the Hydrogen Tour '08 crossed the finish line on Saturday, August 23, 2008, at the L.A. Coliseum. A 13-day, cross-country trip showcased hydrogen fuel cell cars from nine automakers, hydrogen transit buses, and mobile refueling stations marking a historic trek of clean, efficient hydrogen vehicles. The goal of the Hydro-



Chevy Equinox FCV on display at the California State Science Center, Los Angeles.

gen Road Tour was to showcase the progress that industry and government have made together, and emphasize the next steps to commercialization even as research and development continues.

Hydrogen Road Tour '08 was a collaborative effort between the California Fuel Cell Partnership, U.S. Department of Transportation, U.S. Department of Energy and National Hydrogen Association giving people across America a chance to interact with the hydrogen vehicles and learn how they are fueled.

Hydrogen vehicles from BMW, Daimler, GM, Hyundai-Kia, Nissan, Toyota, Honda and Volkswagen made the journey, and were joined by hydrogen buses from Sunline Transit Agency. Air Products and Chemicals, Inc. and Linde provided mobile

refueling stations and hydrogen throughout the trip. The caravan of hydrogen-powered vehicles drove roughly 20,000 combined miles and used domestically produced hydrogen. During the trip, the vehicles produced zero tail pipe emissions. Contact Josh Boone at (916) 323-0004.



Nissan's FCV crossing the finish line at the L.A. Coliseum.

ARB CONTINUES TO PUSH FOR ZERO EMISSION VEHICLES

On March 27, 2008, Air Resources Board voted to retain the 25,000 pure zero emission vehicle (ZEV) requirement between 2012-2014 and provided a compliance option that would result in more than twice as many advanced technology vehicles.

This compliance option allows manufacturers to comply with the ZEV program with 7,500 Type IV ZEVs such as full function battery electric vehicles (EV) and fuel cell vehicles while meeting the remainder of the ZEV requirement with approximately 60,000 plug-in hybrid electric vehicles (PHEVs). Dan Sperling, the Board's automotive expert, believes that this three-fold increase in pure ZEVs over the staff proposal will stretch automakers to the limits of their abilities. And it actually provides a greater benefit to both climate change and criteria pollutants than the exist-

ing program's 25,000 ZEV requirement. It is also expected to accelerate pure ZEV production because electric drive train economies of scale are more quickly met when PHEVs are a compliance option. Each ZEV compliance option forces manufacturers to either place a growing number of ZEVs and PHEVs, or use excess banked ZEV credits for compliance.

The Board has also directed staff to redesign the 2015 and subsequent model year ZEV program requirements. Under the redesign, the ZEV program would better serve ZEV technology as an incubator, to launch innovative zero emissions vehicles into the marketplace. Achieving the Governor's goal of reducing greenhouse gases by 80 percent in the year 2050 is dependent on the continued success of these types of

vehicles.

For more information on the ZEV program, contact Anna Gromis at (916) 323-2410.

PROJECT DRIVEWAY LETS CONSUMERS BE PART OF SOMETHING BIG

Getting behind the wheel of the Chevrolet Equinox Fuel Cell electric vehicle isn't an average test drive, but it's one that more than 3,400 individuals have already experienced. They have raised their hands to be a part of Chevrolet's "Project Driveway" – the largest market test of fuel cells ever – and their feedback could help shape the very future of automotive transportation.

Now in its second year, most Project Driveway participants say they signed up to make history, to test advanced technology and to do their part to make the world a better, cleaner place. Remarkably, at the end of 2008, nearly 500,000 miles have been driven on public roads.

"I have the distinct honor of venturing into new territory with the promise of a better way of life and the certainty that others will soon follow," said Davi Kutz, a web designer from North Hollywood, California. Kutz said he's excited about being what he calls a pioneer: "For the first time, I realize how it must feel to make history."

Project Driveway hand raisers in greater New York City, Los Angeles and Washington, D.C. have taken delivery of the petroleum-free, zero emissions Chevrolet Equinox Electric Fuel Cells. Each driver spends up to three months chronicling real-world experiences such as going to work, driving carpool, and even refueling. GM engineers and marketers are very

interested in determining what customers like – and don't like – about fuel cell electric drive vehicles.

California was one of the three markets chosen for Project Driveway for a number of reasons: It's an important area for influencing public policy; potential early adopters live in California; and some hydrogen refueling stations and service facilities already exist. Chevrolet has deployed 50 Equinox Fuel Cell vehicles in California as part of Project Driveway. General Motors has also placed temporary 10,000 psi (700 Bar) hydrogen fueling stations, and supported opening others, in southern California for Project Driveway.

More than 75,000 people have visited Chevrolet's website www.chevrolet.com/fuelcell/signup to sign up. As part of the requirements, drivers must be licensed and at least 21 with a good driving record.

Project Driveway participants work with specially trained Chevy Driver Relationship Managers (DRMs), who provide education and support. The DRM oversees the delivery process as well as all training, including refueling guidance.

Every single aspect of the Project Driveway experience – from the use of the vehicle to the hydrogen fuel and even the insurance – is free of charge in exchange for drivers providing invaluable insight into the details of their overall experience with this innovative vehicle.



Project Driveway customers driving the Chevrolet Equinox Fuel Cell Vehicle

"I have the distinct honor of venturing into new territory with the promise of a better way of life," said Davi Kutz, a web designer from North Hollywood, California.



Project Driveway customers with their new Chevrolet Equinox Fuel Cell Vehicle

HYDROGEN BUSES MAY BE COMING TO YOUR NEIGHBORHOOD

Zero emission hydrogen transit buses play an important role in achieving the State's goals for air quality, global warming and energy security. Transit agencies are also a great place to test new technologies since they have centralized fueling and fixed routes. In addition, the buses get a lot of exposure to the public. To date, 7 hydrogen fuel cell transit buses are in operation in California to demonstrate the durability and reliability of the technology; six buses operating in the San Francisco Bay Area and one bus operating in Southern California. So far, most transit agencies using hydrogen buses have had enormous success with the buses. People will often wait to ride a hydrogen bus over the diesel bus because it is so quiet and pleasant to ride.

Based on this success, hydrogen highway funds of \$5 million from the fiscal year of 2006-2007, and an additional \$2 million from the Alternative Fuel Incentive Program (AFIP) were awarded for expanded demonstration projects for hydrogen transit buses. From these combined funds, four transit bus projects were selected:

1. Sunline's American Fuel Cell Bus Project in the Palm Springs area.
2. Sunline's Thor Fuel Cell Bus Project also in the Palm Springs area.
3. Burbank's Fuel Cell Bus Project.
4. Zero Emission Bay Area Project which coordinates five bay area transit operators' efforts to demonstrate a fleet of 12 fuel cell buses.

All buses will be placed in revenue service, used on regular transit routes, and will operate full shifts. In addition, staff will be reporting to the Board in July 2009 on the status of the Zero Emission Bus (ZEB) technologies and to update the progress-to-date on the effects of the ZEB regulations.

For more information, contact Craig Duehring at (916) 323-2361.



One of AC Transit's three operating fuel cell buses

THE STATE'S HYDROGEN VEHICLES AND SHUTTLES ARE HITTING THE STREETS

The State's hydrogen vehicle and shuttle bus demonstrations are well underway. In 2008, two Ford E450 hydrogen powered shuttle buses operated in California; one in the San Francisco Bay Area and the other in Southern California. Each bus is capable of carrying up to 12 passengers and has a range of 150 miles. The shuttle bus demonstration will continue through the end of 2009.

The demonstration program also includes four Toyota Prius' that have been converted to operate on hydrogen. One vehicle is operating in Northern California at the Schatz Energy Research Center at the Humboldt State University. The remaining three are all located in Southern California being operated or soon to be operated, by UCLA, CalTrans and ARB. This demonstration is set to expire in June of 2010.

ARB is also demonstrating one hydrogen fuel cell powered GM Equinox operated by UC Irvine. This demonstration will conclude in February of 2009.

In addition, ARB participated in GM's Project Driveway during summer 2008. California also has several fuel cell vehicles available for fleet use including a Ford Focus FCV, Daimler F-Cell, Hyundai

Tucson Fuel Cell Electric Vehicle and Kia Sportage Fuel Cell Electric Vehicle. Drivers provide manufacturers with valuable feedback on the vehicles while exposing the general public to this technology.

For more information, contact Craig Duehring at (916) 323-2361.



Ford E450 hydrogen shuttle bus, now part of San Mateo's transit fleet

HYDROGEN VEHICLE ANNOUNCEMENTS

HONDA

In July 2008, Honda started delivering FCX Clarity hydrogen-powered fuel cell vehicles to their first lease customers in Southern California. Actresses Jamie Lee Curtis and Laura Harris; Producer Ron Xerxa; car enthusiasts Jim Salomon and Jon Spallino; and LA County Deputy District Attorney, Karen Thorp are six of the lucky leasers. "The FCX Clarity lease program is one more step toward meeting the societal goals of climate sustainability, renewable energy supplies and zero emission transportation," said John Mandel, executive vice president of American Honda.



Jamie Lee Curtis with her FCX Clarity at the Shell Hydrogen Station in West Los Angeles

Honda plans to deliver about 200 FCX Clarities in the first three years of production. The FCX Clarity has a combined EPA fuel economy of 72 miles per gallon gasoline equivalent and a 280 mile range per tank. Honda will continue the process of identifying additional lease customers from a group of over 50,000 individuals in the Irvine, Torrance, and Santa Monica areas who have expressed interest in the FCX Clarity on the company's website fcx.honda.com. To support these vehicles, Honda is working with three dealerships in these areas to implement processes for vehicles leases, delivery and service support.

- From Honda Press Releases, July 25 and September 11, 2008

GENERAL MOTORS

As part of a comprehensive deployment plan called "Project Driveway," Chevrolet has supplied almost 70 Chevrolet Equinox Fuel Cell electric compact SUVs to private, commercial and government customers in New York, Sacramento, Los Angeles and Washington, D.C., where there are hydrogen stations. The EPA-certified zero emission Equinox Fuel Cell SUV is powered by GM's fourth-generation fuel cell propulsion system and meets all applicable 2007 U.S. Federal Motor Vehicle Safety Standards. The vehicle includes a range of safety features found on other Chevrolet cars, including driver and front passenger air bags, anti-lock brakes, and GM's OnStar telematics service, which will offer drivers advice on operating the cars as well as information on nearby hydrogen filling stations.

In the 14 months since GM launched Project Driveway, the program has been putting fuel cell powered Chevy Equinoxes in the hands of regular customers. Some of the vehicles are also being used by Disney and Virgin Atlantic. Virgin is using them to chauffeur first class customers to and from Los Angeles International Airport. GM will be continuing to the program through the end of 2010.

- From GM Press Releases, June 2 and December 26, 2008

DAIMLER

In 2010, Daimler will begin series production of one fuel cell vehicle per day in the B-Class, according to Dieter Zetsche, Chairman of the Board of Management of Daimler AG and Head of Mercedes-Benz Cars. Zetsche was quoted in the May 28, 2008 issue of AEI Online, "While

some time ago we came to the conviction that we could offer a totally competitive product based on a fuel cell in the foreseeable future, we did not consider this could be done on an economically feasible basis. Meanwhile, we have invested a lot of time, brains, and money into the development and ultimately mass production for fuel cells, with the result that today we are convinced that by 2014-15 we can offer technically and economically competitive fuel-cell vehicles in the range of 100,000 plus units a year." "We are very, very serious about fuel cells," he said. "We will have mass-production vehicles without emissions in the timeframe I have outlined. We have to."

- From AEI-Online "Technology Report," May 28, 2008



Benz B-Class with fuel-cell drive has passed its winter testing in northern Sweden with flying colors.

- March 19, 2008 media release.

FORD

Ford Motor Company announced that they are extending their hydrogen fuel cell electric vehicle program through the end of 2009. Ford's fleet of 30 Focus fuel cell vehicles, launched in 2005, has exceeded expectations of the company's hydrogen research engineers by accumulating more than 865,000 real world miles without

significant maintenance issues since the fleet's launch three years ago. These test vehicles have also earned accolades from the company's global fleet partners for outstanding durability, reliability and capability. Ford is developing a next generation fuel cell vehicle that will build on the success of the current program with improved performance, reliability and efficiency.

- From Ford Press Release, August 19, 2008

KIA MOTORS

Kia Motors Corporation unveiled their next generation fuel cell electric vehicle, the Borrego FCEV, at the Los Angeles International Auto Show in November. Innovations including a higher output 154 horsepower fuel cell and a new 450-volt supercapacitor, give the vehicle higher performance and cold-weather starting capability compared to Kia's earlier generation FCEVs. These innovations combined with a 202 liter 700 Bar storage system has resulted in their latest research vehicle having an approximate 426 mile range.



Kia Borrego FCEV

"Entering this new phase of our program is really exciting," said Dr. Hyun Soon Lee, president of research and development of Hyundai-Kia Automotive Group. "Now we will be able to build fuel cell electric vehicles in higher volumes and lower cost for fleet testing and the latest Borrego FCEV drives us closer to making fuel cell vehicles available for customers."

- From Kia press release, November 20, 2008

TOYOTA

Toyota Motor Corporation announced that it has developed a fuel cell hybrid vehicle (FCHV) equipped with a newly designed high-performance Toyota FC Stack. The Toyota FCHV-adv was developed based on data obtained from various utilization studies conducted in Japan, tests conducted in West Sacramento at the California Fuel Cell Partnership, and cold-weather tests in Timmins, Canada. As a result, the Toyota FCHV-adv can start and operate in regions with temperatures as low as -30°C. The fuel cell efficiency was increased by 25 percent by improving fuel cell unit performance, enhancing the regenerative break system and reducing energy consumed by the auxiliary system. Equipped with 700 Bar high pressure storage system, this vehicle can travel over 500 miles on a single fueling – essentially doubling it's predecessor, the Toyota FCHV.



Toyota FCHV –adv

While steadily conducting research and development to resolve how to improve the durability and reduce the cost of the Toyota FC Stack, Toyota is working with government, energy companies, and other concerned parties to actively bring about widespread fuel cell vehicle use.

- From Toyota press release, June 6, 2008

NISSAN

Nissan Motor Company, Ltd. announced that they have developed a new lighter fuel cell stack with double the power density of their previous generation stack. The new stack uses 50 percent less platinum and a more densely-packed cell structure, both enabling a 25 percent reduction in fuel cell stack size and 35 percent reduction in cost.

This next generation fuel cell stack is one of the eco-friendly technologies being pursued under the Nissan Green Program 2010, aimed at developing new technologies, products and services that can lead to real world reductions in vehicle climate change emissions and recycling of resources.

- From Nissan press release,

CALIFORNIA FUEL CELL PARTNERSHIP—BUILDING MARKET FOUNDATIONS

2008-2012 marks Phase III of the California Fuel Cell Partnership (CaFCP). CaFCP's focus in the next four years is to make the transition from passenger-vehicle and transit demonstration programs to an early commercial market. CaFCP members will use collaborative efforts and a collective voice to identify early markets where hydrogen stations are needed, guide codes and standards development, define business models and identify projects for government investment.

In July, 2008, CaFCP released a consensus vision of how the transition from demonstration programs to the early commercial market can take place. The groundbreaking document provides clear projections about the numbers of stations, numbers of vehicles and investment needed from government and industry over the coming years. The vision document recommends building a small network of hydrogen stations that will support the first commercial fuel cell vehicles—hundreds

through 2011 growing to thousands by 2014 and tens of thousands by 2017. In addition to supporting the early commercial market, the California hydrogen program is creating a model that can be implemented across the country.

For people to accept any new product, it must be safe, convenient, familiar and easy to use. Through 2012, CaFCP members will work together to prove and communicate that fuel cell vehicles and hydrogen fuel meet these requirements.

During Phase III, CaFCP has four overarching goals:

- Identify and address market opportunities and challenges.
- Promote a safe, customer-friendly refueling experience.

- Work toward a common fuel delivery architecture.
- Provide information and hands-on experience.

The California Fuel Cell Partnership is a collaboration of member organizations working together to promote the commercialization of hydrogen fuel cell vehicles. CaFCP members include automotive manufacturers, energy providers, government agencies, fuel cell technology companies and transit agencies. Through collaboration, the members share what they have learned, develop common practices and prepare California communities for hydrogen-powered fuel cell vehicles.

For more information about the CaFCP, go to www.cafcp.org or call (916) 371-2870.



Photo: DUmale

The West Sacramento facility provides service bays for all eight automotive members. Here, they service and test the vehicles in Northern California. Photo courtesy of the CaFCP.



Photo: CaFCP



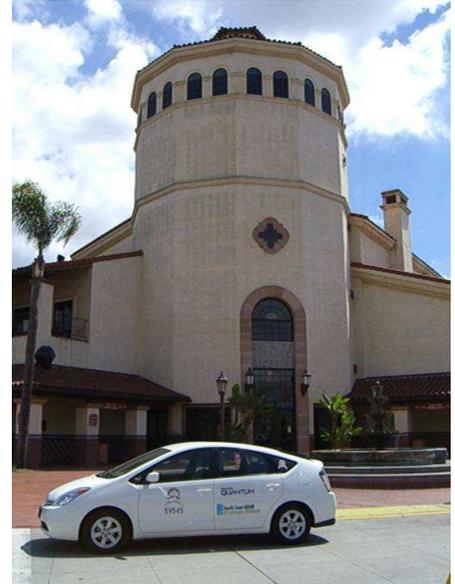
Photo: CaFCP

SCAQMD FIVE CITIES PROGRAM

The implementation of zero-emission vehicles (ZEVs) is a key component in the effort to achieve air quality attainment in the South Coast Air Basin (Basin). Although Fuel Cell Vehicle (FCV) technology is emerging at an accelerated pace, a potential nearer-term solution for hydrogen deployment could be in the use of hydrogen internal combustion engine (ICE) vehicles. The South Coast Air Quality Management District (SCAQMD) allocated a total of \$3.38 million towards funding the “Five Cities” program for the installation and operation of a network of five hydrogen fueling stations throughout the Basin to support the operation of 30 electric-hybrid ICE vehicles converted to

use hydrogen as the fuel.

The five stations included: Santa Monica, Riverside, Burbank, Santa Ana, and Ontario. Stationary fueling sites were installed with a proton exchange membrane (PEM) electrolyzer system for Burbank, Riverside, and Santa Monica, and a self-contained transportable fueling unit that could be refilled at a hydrogen production facility for Santa Ana and Ontario. All five stations successfully opened and are currently operational. With funding from BP and U.S. DOE, an upgraded station capable of dispensing vehicles at 5,000 and 10,000 psi is being installed at Burbank.

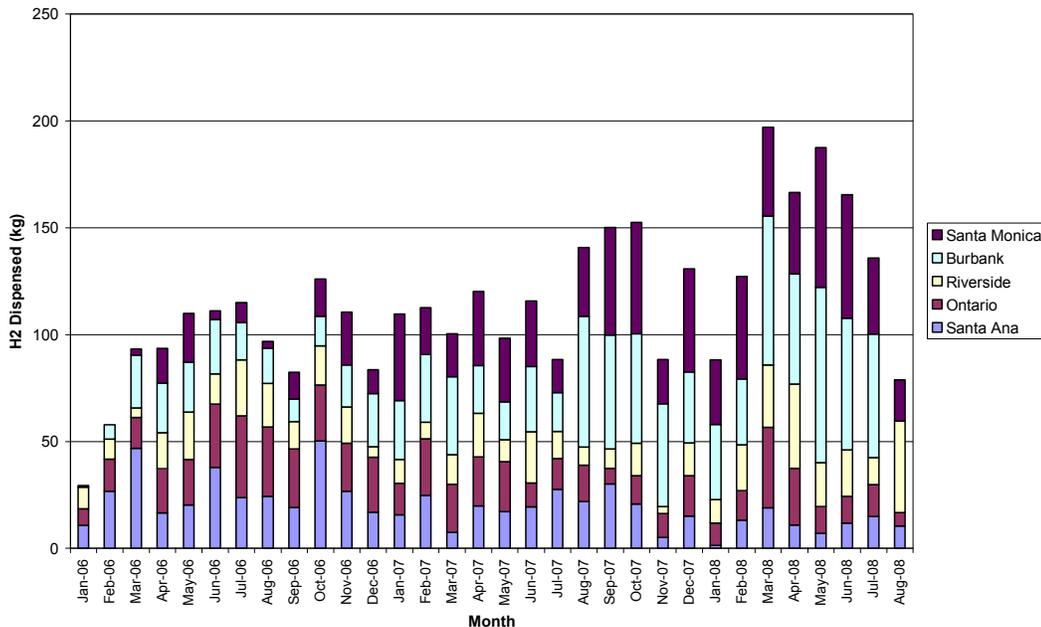


Quantum hydrogen ICE Prius in Riverside. Photo courtesy of the SCAQMD.

During the period of performance, the hydrogen fueling stations for the Five Cities Program were used a total of 3,653 times (through August 2008) and dispensed a total of 3,952 kilograms of hydrogen.

For more information about the Five Cities Program, contact Larry Watkins, SCAQMD at (909) 396-3246.

Weight of H2 Dispensed

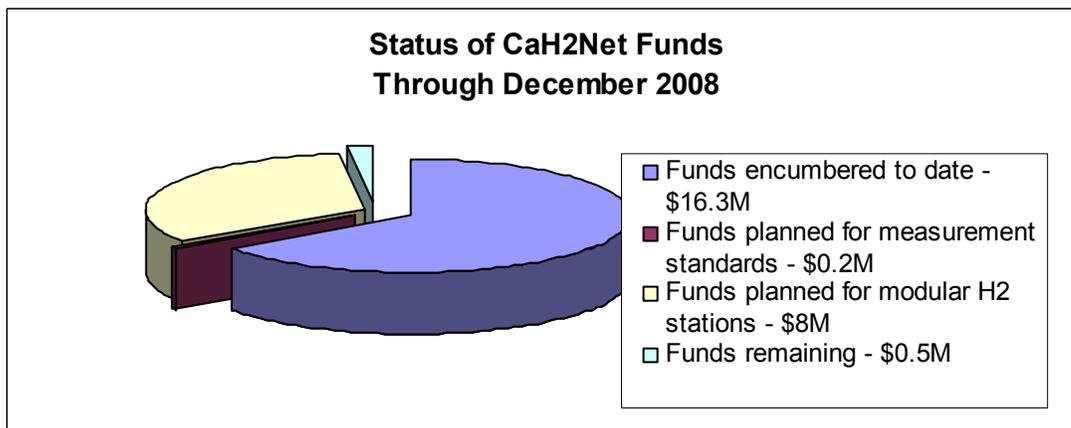
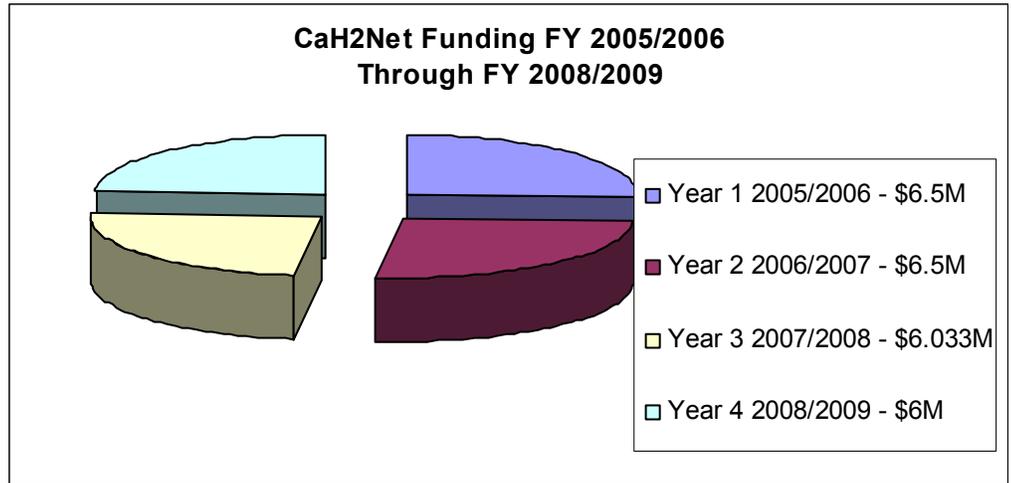


Keep in touch with the latest news on the CaH2Net by signing up for our list serve at <http://www.hydrogenhighway>

HYDROGEN HIGHWAY FINANCIAL SNAPSHOT

Since 2005, the California Hydrogen Highway (CaH2Net) has been appropriated \$25.033 million to fund the State's share of various activities related to hydrogen vehicles and infrastructure. This graph describes the total funding received from fiscal year 2005/2006 through fiscal year 2008/2009.

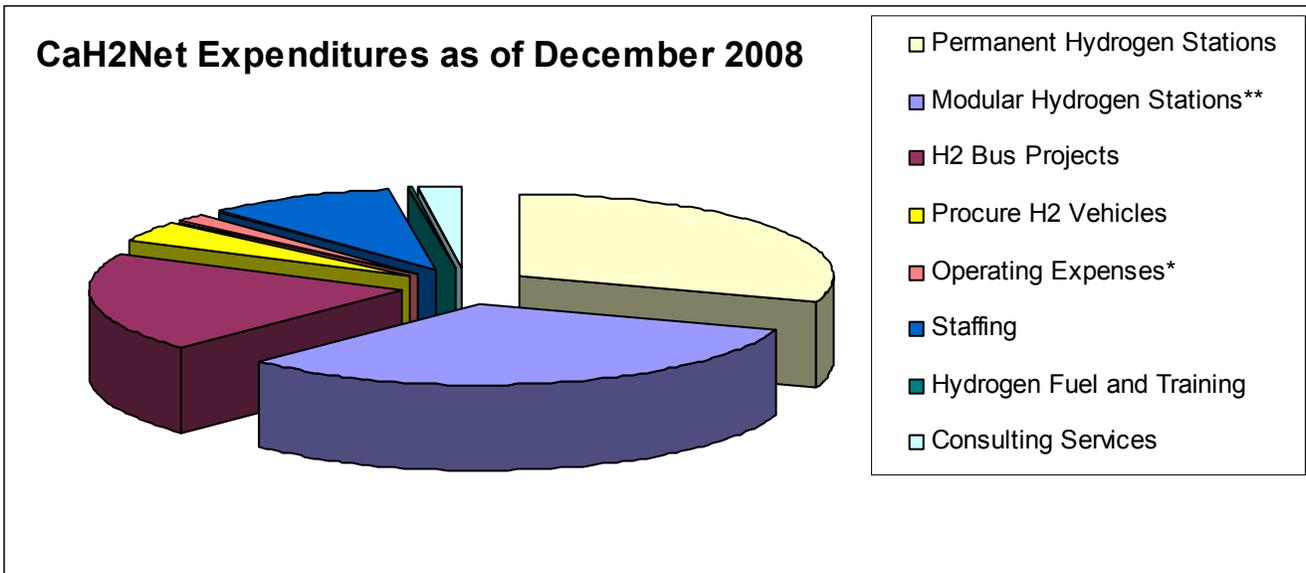
Future funding for CaH2Net will be dependant upon allocations through the Alternative and Renewable Fuels and Vehicles Program (AB 118), which is currently under development by the California Energy Commission.



To date, the State has encumbered almost \$16.3 million of the CaH2Net funds. Another \$8 million will be awarded in early 2009 for the installation of modular hydrogen fueling stations.

The graph below describes what the CaH2Net funds have been used for as of December 2008:

- Developing permanent and temporary hydrogen fueling stations that are publicly accessible, meet the needs of a growing hydrogen vehicle fleet, and meet the environmental requirements of Senate Bill 1505.
- Deployment of hydrogen bus projects.
- The procurement of hydrogen vehicles and shuttle buses.
- Operating expenses including a contract with the California Department of Food and Agriculture to develop fuel specifications for hydrogen.
- Staffing.
- Supplying the State’s fuel cell vehicles with hydrogen fuel and provide training for vehicle refueling.
- Consulting services to assist the State with implementing infrastructure and demonstration targets identified in the Blueprint Plan; conduct targeted communication with environmental, industry, and public stakeholders; and assist with the development of education and communication materials.



* Includes contract with the CA Dept. of Food and Agriculture

** Funds will be awarded for modular hydrogen stations in early 2009.

www.HydrogenHighway.ca.gov

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The California Hydrogen Highway Network is an initiative to establish hydrogen infrastructure to support commercialization of sustainable, zero and near zero emission hydrogen vehicles.

The CaH2Net is a key part of California's strategy to achieve the State's vision of a secure energy future that simultaneously addresses our environmental, public health and economic challenges working in partnership with other components of the State's programs to advance energy efficiency and renewable energy.

HYDROGEN'S BENEFITS AS FUEL BECOMING OBVIOUS

(Continued from page 6)

- Several hydrogen fuel cell-powered transit buses are already operating as pilot projects in the Bay Area.
- For our part, the Air Resources Board will release a request for proposals for \$7.7 million for three new hydrogen stations and upgrades that will increase the capacity of two existing stations. We have also unveiled a rebate program for

Californians buying certain models of alternative fuel vehicles.

Realizing the vision for a clean transportation future will take the sustained efforts of all partners, and we will certainly experience many bumps along the way. We anticipate fuel cell commercialization to occur sometime early in the next decade. And much more progress by the vehicle and infrastructure providers and the state will be needed to make this happen. The challenge before us is to chart a path that recognizes the realities and diffi-

culties in transforming our energy system from one dependent on polluting sources of energy to one that can take full advantage of clean, renewable sources. We are confident that California is up to the challenge.

San Jose Mercury News
Article Launched: 01/21/2008
01:32:35 AM PST

- *MARY D. NICHOLS chairs the California Air Resources Board. She wrote this article for the Mercury News*