

progress

progress report **1999-2003**



“I am going to encourage
the building of a hydrogen
highway to take us to the
environmental future.”

– Governor Arnold Schwarzenegger,
State of the State, January 2004



Members:

DaimlerChrysler • Ford • GM • Honda • Hyundai • Nissan • Toyota • Volkswagen • BP
ChevronTexaco • ExxonMobil • Shell Hydrogen • Ballard Power Systems • UTC Fuel Cells
California Air Resources Board • California Energy Commission • South Coast AQMD
U.S. Department of Energy • U.S. Department of Transportation • U.S. Environmental Protection Agency
AC Transit • Santa Clara VTA • SunLine Transit Agency • Air Products and Chemicals • Methanex
Pacific Gas & Electric • Praxair • Proton Energy Systems • Stuart Energy • Ztek



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Energy and Environment Statement of Intent

The California Fuel Cell Partnership is committed to promoting fuel cell vehicle commercialization as a means of moving towards a sustainable energy future, increasing energy efficiency and reducing or eliminating criteria pollutants and greenhouse gas emissions.



goals

Organization Goals

The California Fuel Cell Partnership members will demonstrate in California the potential for fuel cell-powered vehicles as a safe, practical, clean and efficient alternative to vehicles powered by internal combustion engines through:

- 1) Conducting fleet demonstrations by operating and testing vehicles in the hands of real-world users.
- 2) Conducting fuel demonstrations to support fuel cell vehicles, including hydrogen and other fuels as needed by the demonstration vehicles.
- 3) Facilitating the path to commercialization by preparing local communities for fuel cell vehicles and fueling, promoting practical codes and standards, and defining needed support and incentives.
- 4) Enhancing public awareness and education about the benefits and challenges of fuel cell vehicles and fuels, targeting communications in fleet demonstration communities, and coordinating with stakeholders and other fuel cell vehicle programs worldwide.



Firoz Rasul
Chairman, Ballard Power Systems
2004 CaFCP Chairman

Since 1999, the California Fuel Cell Partnership (CaFCP) has made extraordinary progress. Public and private sector members – government and industry – are working shoulder to shoulder in common pursuit of ambitious goals to create the conditions for the successful introduction of fuel cell vehicles and hydrogen as a transportation fuel. Collaboration and “coopetition” are the forces leading the fundamental changes required in the environmental and economic dynamics of transportation.

This progress report on the CaFCP’s activities from 1999 through 2003 is designed to accomplish two goals:

- 1) to familiarize followers of fuel cell developments with the real-world demonstrations that have taken place in California to date; and
- 2) to highlight the key issues we believe must be addressed to successfully transition to the widespread use of fuel cells and hydrogen fuel.

The CaFCP recently announced plans for continuing the successful collaborative work through 2007. Over the next four years, our members will work to facilitate the placement of fuel cell vehicles in independent, fleet demonstration projects in California. Hydrogen stations will demonstrate early applications of hydrogen fueling technology while supporting the fleet projects. More fuel cell-powered buses will operate in revenue service as well, raising awareness not only with transit customers, but also with regulators and the public.

Members of the CaFCP will also continue to promote the development of practical codes and standards for fuel cell vehicles

and hydrogen fueling stations, help prepare local communities for the vehicles and fueling, and expand public awareness through education and outreach activities.

As fuel cell-powered cars and buses move into the hands of users, CaFCP members will gather valuable operating data and lessons. The application of this experience is an integral step in preparing these fuel cell vehicles and the fuel infrastructure for commercialization. Our members are committed to supporting these efforts so that everyone gains knowledge and moves forward from this learning.

As the 2004 Chairman of the CaFCP, I have the privilege and honor to follow in the steps of my predecessors who have contributed substantially to the growth of the CaFCP. The members of the Steering Team, supported by the dedicated executive team, provide innovative approaches, cooperative tone and a commitment to success of the CaFCP through consensus. We expect more accomplishments throughout this year and the balance of our next operational phase.

We look forward to sharing those results in 2005, as we advance fuel cell vehicle commercialization and move towards a sustainable energy future.

Sincerely,

Firoz Rasul
Chairman, Ballard Power Systems
2004 CaFCP Chairman

CaFCP Chairs



1999-2000
John Wallace,
Ford Motor Company



2001
Prof. Dr. Ferdinand Panik,
DaimlerChrysler



2002
Don Huberts,
Shell Hydrogen



2003
Alan C. Lloyd, Ph.D.,
California Air Resources Board

CaFCP Accomplishments

1999-2003 Highlights

The path to commercializing fuel cells for transportation may be long and challenging, but the California Fuel Cell Partnership has made a significant start in the nation's most populous state. When the members set out to work together in April 1999, they established the following goals:

1. Demonstrate fuel cell vehicle technology
2. Demonstrate alternative fuel infrastructure
3. Explore the path to commercialization
4. Increase public awareness

To date, the CaFCP has made great strides toward each of these goals. Specific accomplishments include:

- Automotive members placed **55 fuel cell vehicles** on California roads and highways;
- Transit agency members have tested two fuel cell buses on city streets, and have placed orders for **seven fuel cell buses** to begin regular transit service in 2004;
- Energy members installed and operated **two hydrogen-fueling stations and one methanol fueling station** in California, with nine other hydrogen stations installed and operated independently by individual members. A key objective is to **promote fuel station interoperability** among all of these stations;
- CaFCP members constructed a **state-of-the-art testing and demonstration facility** in West Sacramento, California;
- CaFCP members jointly developed an **emergency response guide for fuel cell vehicles**. This guide is used to train local fire departments and other first responders. **Over 230 emergency response agencies** have been trained to date;
- CaFCP members jointly commissioned and completed a **fuel scenarios study** through an independent consultant. This study examined the benefits and challenges of hydrogen, methanol, gasoline and ethanol;
- The CaFCP hosted **two technology forums** that helped build relationships between CaFCP members and companies that develop and market advanced technology;
- CaFCP members initiated a **hydrogen vehicle facilities study** to examine practical facility design for housing and maintaining hydrogen fuel cell vehicles;
- CaFCP members coordinated with key stakeholder groups (e.g. environmental, academic and political leaders) and other fuel cell vehicle projects worldwide. Members hosted the **first worldwide fuel cell vehicle project forum** in October 2002. A **communications summit** was held in November 2003;
- In 2002, CaFCP members organized and participated in a **300-mile road rally** that took fuel cell vehicles to local communities along California's Central Coast. In 2003, a **400-mile road rally** rolled through California's Central Valley (Sacramento to Los Angeles) over three days, reaching more than 100,000 people;
- Together the CaFCP has **reached over 700,000 people** with information regarding fuel cell vehicle and fueling technology. Nearly 12,000 people have driven in a fuel cell vehicle;

- As part of its outreach program, the CaFCP distributed **2,000 fuel cell learning kits** to California teachers and brought **over 3,800 visitors** to the headquarters facility;
- CaFCP surveys show that **awareness of fuel cell technology has increased** from less than 25% of Californians knowing about fuel cells in 2000 to about four in ten Californians having heard about the technology in 2003.

Along with these accomplishments, the CaFCP has proven its value as a forum where the challenges of fuel cell vehicle commercialization are tackled by a diverse group of industry and government representatives with one common goal – to maximize the potential for fuel cell vehicles and fueling technology to help California and the world achieve a cleaner, more sustainable future.



Steering Team

Vision for the Future

Building on its past success, the CaFCP will continue its collaborative work through 2007. Over the next four years, the 30 members will work to facilitate placement of up to 300 fuel cell vehicles in independent, fleet demonstration projects within the state – primarily focused on the greater Los Angeles area and the Sacramento-San Francisco region – and develop a hydrogen fueling infrastructure to support the vehicles.

Through daily use by real-world drivers, fleet programs provide valuable operating data for both vehicles and fueling. They also raise awareness in communities likely to serve as first commercial markets. As fuel cell cars and buses increase in number, educating stakeholders – those who can make a difference in reaching commercial success – will take on renewed emphasis so that challenges are understood and addressed together.

It will also be an important time to exchange experiences with other fuel cell demonstration projects worldwide, so that timely advances are made in technical knowledge, as well as public awareness.

The CaFCP's Steering Team believes the following key points will help to keep the momentum moving forward:

- 1) New technologies like fuel cells and hydrogen production must be nurtured. Participating companies are "pioneers" blazing a new trail into the future. Success relies upon gaining more experience with practical demonstration and cooperative learnings.
- 2) Government has an important role in providing dedicated, coordinated long-term funding to support research and demonstration projects, and in building public interest and support.

3) The CaFCP strongly supports a sustained level of R&D to maximize the availability of clean and renewable hydrogen sources. In the near term, the use of conventional fuels to produce H₂ can provide a transition to a renewable hydrogen future. By developing both vehicles and their associated infrastructure, the necessary elements can be readied to use hydrogen produced from renewable and clean sources when it becomes widely available.

4) It is important to keep a realistic "expectations perspective": the timeline to the broad commercial market introduction is 10 to 20 years. Earlier introductions will take place in fleet and transit applications.

5) Using hydrogen as a transportation fuel introduces new challenges; safety, liability and insurance concerns must be addressed and accepted before true expansion can begin to take hold.

6) More public awareness must be cultivated now in order to gain marketplace acceptance in the future.

7) Customer understanding is vital to market success, and must be emphasized – the public and private sectors should highlight and advance the favorable attributes of fuel cell vehicles and hydrogen fueling infrastructure.

From gaining acceptance to promoting infrastructure and understanding, the CaFCP will continue to set the standard for real-world demonstration through its unique collaboration. The overarching goal remains the same: to build momentum for fuel cell vehicles and hydrogen fueling technology – and help California and the world achieve a cleaner, more sustainable future.

timeline

Fall 1998

Early discussions to form a public-private collaboration begin.



April 1999

Official announcement at the State Capitol

December 1999

West Sacramento chosen for HQ



April 2000

HQ groundbreaking

Taking It to the Streets

Fuel Cell Vehicles

The power of the CaFCP's collaboration is illustrated through the work of the automotive companies based in the headquarters facility in West Sacramento, California. This group of automotive company representatives is the driving force behind the success of a primary CaFCP goal – to demonstrate fuel cell vehicles on California roads. With assistance from other members, in particular the hydrogen providers, the automotive companies have accomplished much in the pre-competitive arena, from identifying and advancing highly technical fueling issues, to conducting joint vehicle testing and demonstration.

Accomplishments

Vehicles on the Road – Since 2000, members have placed 55 light duty FCVs in California, and traveled over 145,000 miles on California's roads and highways. Vehicles – one of the most visible faces of the CaFCP – have been used to support more than 120 public outreach events, carrying nearly 12,000 test riders.

Providing Data and Learnings – Despite their competitive positions, the CaFCP's automotive members have worked cooperatively to overcome the challenges inherent to implementing a new vehicle and fueling technology. As a distribution point of technical information, they

have communicated valuable data and experience addressing codes and standards, safety, and fuels issues. Important feedback regarding pressure relief devices (PRDs, a safety-related valve used on vehicles) was provided for the CaFCP-commissioned Hydrogen Vehicle Facilities Study. Vehicle diagrams, extrication pathways, and emergency shut-down procedures were provided for the CaFCP Emergency Response Guide, a resource to supplement training materials for professionals who may respond to FCV accidents. Automotive company representatives have also conducted briefings to outside organizations such as environmental advocates and standards development organizations.

Vehicle-Fueling Interface – Today there is no question that any car can drive into any gasoline fuel station and receive fuel safely, quickly, and conveniently. To ensure that the same is true for hydrogen fuel cell vehicles, members have devoted significant time and energy to the development of guidelines to establish interoperability, or "common fit" protocols. Since 1999, the CaFCP has advanced through six revisions of a Fueling Interface Guideline. In 2003, the CaFCP expanded its work to cover the performance and



safety validation of hydrogen stations being utilized by its members. Additionally, discussions began on hydrogen purity standards in order to address fuel cell vehicle performance and durability issues.

Program Learnings

CaFCP members have placed more FCVs on the road in California than have been placed in any other region of the world. Along the way, members have learned many lessons.

Safety First – Safety must always be the first consideration when establishing new programs or protocols. The experience and knowledge that manufacturers have gained through their own operations will be extended as common guidelines for the public fleet demonstrations.

Common Interest – In the pre-commercial development phase of a new technology, independent stakeholders and experts must be willing to share certain proprietary experience in areas that serve the common interest (particularly safety and interoperability) so that all participants can advance.

Quality not Quantity – Demonstration of fuel cell vehicles and fueling infrastructure must work in step. Successful partnering in focused, coordinated programs is more important than striving for numerical targets, and decreases the risk of premature deployment.

Fuel Cell Buses

Fuel cell bus demonstrations allow for high visibility, real-world testing on controlled, in-service routes, supported by centralized fleet refueling and maintenance. CaFCP's bus demonstration program includes government representatives, fuel cell technology experts, and three California transit agencies who operate the demonstration sites: SunLine Transit Agency (Coachella Valley), Santa Clara Valley Transportation Authority (Silicon Valley), and AC Transit (Northeast San Francisco Bay).

Accomplishments

The CaFCP's bus demonstration program has realized many noteworthy accomplishments over the past four years.

Demonstration Tests – Two prototype fuel cell buses were operated in California for test demonstrations at the transit companies, providing first-hand experience for drivers, maintenance staff, and passengers.

Public Outreach – Numerous visitors to the transit facilities, as well as special events, provided opportunities for thousands to see fuel cell transportation technology at work. Ballard's ZEBus participated in the 2001 Michelin Challenge Bibendum, flawlessly traversing the 275-mile, cross-desert drive from Los Angeles to Las Vegas.

Funding for Next-Generation Buses – Contracts have been secured for seven fuel cell buses: four using Ballard fuel cells (for Santa Clara VTA), and three using UTC fuel cells (for AC Transit and SunLine Transit). The first Santa Clara VTA bus, built in 2003, is currently in the testing phase at Ballard's Vancouver, Canada facility. Santa Clara VTA and AC Transit have begun construction of hydrogen fueling stations.

Emergency Response Guide – Similar to the guide developed for light-duty vehicles, the CaFCP created an Emergency Response Guide for fuel cell buses.

World-wide Coordination – To increase cooperative learnings with other bus demonstrations, members developed a comprehensive method for gathering performance data. This data collection protocol has been shared worldwide.

Future Targets – In anticipation of future needs, the CaFCP drafted technical specifications for second generation fuel cell buses, setting challenging targets for better performance, increased reliability, and reduced costs.

Program Learnings

Through early experiences with two buses and the interaction among active members, the CaFCP has gathered many learnings that will help address future challenges.

Champion – To ensure the success of a demonstration project, a transit agency needs a champion to promote the technology along its long road to commercial viability, and to be an advocate throughout the process, from locating sources of funding to building facilities and training staff.

Data Collection – To ensure the delivery of comprehensive and relevant demonstration data, programs must adhere to a sound data collection plan. The plan should provide objective in-use performance and reliability results, evaluate hydrogen infrastructure development and operation, and describe

transit facility modifications required for safe operation.

Outside Support – Organization support (e.g. CaFCP) can increase a project's credibility within the transit organization and with local officials, and can also potentially increase funding availability. Such support is needed over a long term.

Promoting a Successful Demonstration – Working teams should establish clear project goals and realistic technology expectations, implement training and orientation plans, simulate placement of a bus in service routes, and set up on-site and nearby technical and mechanical support.

Securing Financial Resources – Strong financial support, reduced cost, and improved reliability are critical to make fuel cell buses a viable low or zero emission option for transit agencies in California.



timeline



August 2000
ZEBus arrives in California



November 2000
Grand opening of HQ facility and fueling station

December 2000
Sponsor, the California International Marathon



April 2001
Technology Forum hosted at HQ



June 2001
1st 5000 psi H₂ Fill

Deliver Now to Shape the Future

Hydrogen Fueling Infrastructure

Implementing a new fueling infrastructure is an enormous undertaking. But CaFCP members have taken important steps to lay the foundation for this eventual transition, such as ensuring the vehicles and stations interact in a safe, predictable manner, engaging national and international organizations that write standards relating to fueling infrastructure, educating local permit officials and training first responders to respond to fuel cell vehicle incidents.

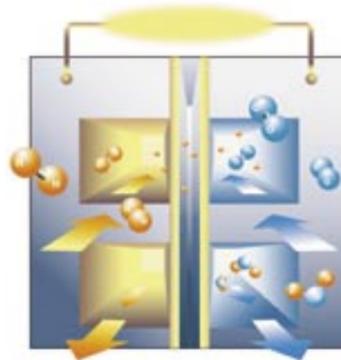
Accomplishments

Fueling Stations – CaFCP members have constructed two hydrogen fueling stations and one methanol fueling station.

- The West Sacramento hydrogen fueling station was jointly designed and installed in 2000 by six of the world leaders in energy and industrial gas supply (BP, ExxonMobil, Shell Hydrogen, ChevronTexaco, Air Products and Chemicals, and Praxair). To meet the fueling needs of the auto members, it provides three hydrogen-dispensing modes: cryogenic liquid, 3600 psi gaseous, and 5000 psi gaseous. To date, over 2,700 fueling events have been completed.
- The Richmond hydrogen fueling station was designed and installed in 2002 by Stuart Energy at AC Transit's Richmond bus yard. It provides two hydrogen dispensing modes: 3600 psi gaseous and 5000 psi gaseous. This station provides auto members extended driving range outside of the Sacramento area and provides hydrogen for AC Transit's fuel cell bus project.
- The West Sacramento methanol fueling station was constructed and commissioned in April 2002 by the Methanol Fuel Cell Alliance of DaimlerChrysler, Ballard, BP, Statoi, BASF and Methanex.



- Mobile hydrogen fueling supports CaFCP events where hydrogen stations are not available. This service has been very useful during Road Rallies I and II and during hot weather testing in Death Valley.



Ensuring Interoperability – At the CaFCP's inception, there was no widely accepted fueling procedure for hydrogen vehicles. Vehicle manufacturers have different engineering strategies for such variables as electronic communications with the fuel station, fill rate, and tank pressure. To ensure safe and convenient fueling for all vehicles, CaFCP members took the initiative to create procedures that would allow all types of hydrogen-powered vehicles to fuel at the same station. The energy members continue to work closely with vehicle manufacturers to further develop safe and consistent hydrogen fueling protocols.

Engaging Standards Development Organizations (SDOs) – SDOs are organizations that develop codes and standards for industries or sectors where there is a need to have commonly understood requirements. Standards promote interoperability within industries and help move new industries, like hydrogen and fuel cells, forward.

Through its demonstration projects, the CaFCP provides SDOs valuable real world experience and data to better define those codes and standards. In addition, the CaFCP has an open line of communication with several national and international SDOs including: Society of Automotive Engineers, International Code Council, International Organization for Standardization and National Fire Protection Association.

Educating Local Permit Officials – Permit officials help communities ensure that development projects meet established codes and standards, such as protecting human and environmental health and safety. Permitting authorities include planning departments, public works, fire/HazMat departments and

building departments. Most of these organizations are unfamiliar with hydrogen as a transportation fuel. Therefore, permitting a hydrogen fueling station can require extended periods of time and effort to proceed through the entire approval process.

For each of its fueling station projects, CaFCP members helped identify permitting issues and educate local officials on hydrogen safety, codes and standards. By addressing concerns in a proactive manner, station developers can reduce the amount of time and effort required to obtain permits.

Training First Responders – The CaFCP is actively educating first responders about hydrogen and fuel cell vehicles. First responders - including local police, fire, and emergency medical personnel - arrive first on the scene of an incident and take action to save lives, protect property, and meet basic human needs. To do their job safely and effectively, they need the most current information regarding new vehicle technologies operating on California roads and highways. CaFCP members have worked closely with local fire departments, the Office of the California State Fire Marshall and other stakeholders to develop a comprehensive emergency response guide and corresponding training materials to familiarize first responders with hydrogen and fuel cell vehicles so they are prepared when these new technologies are introduced into their communities.

To date, CaFCP members and staff have trained over 230 first responders in 10 communities, including El Cerrito, El Segundo, Hermosa Beach, Long Beach, Redondo Beach, Richmond, Sacramento, Torrance, UC Davis and West Sacramento. The program will expand as more vehicles are introduced into California



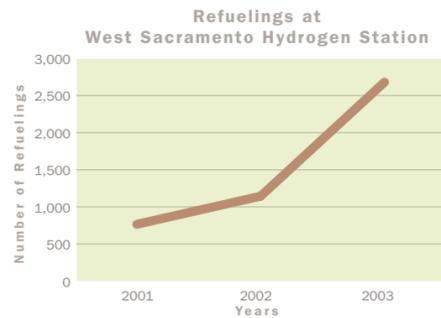
communities. Training is based on the information in the emergency response guide and includes the properties of hydrogen, fuel cell vehicle safety and design, specific emergency response procedures for HFCVs, and a hands-on presentation of fuel cell vehicles. CaFCP staff and member organizations perform the training with assistance from experienced first responders as needed.



Program Learnings

Application of existing codes to new uses – Historically, hydrogen has been used as an industrial gas. Until new codes are developed for hydrogen as a transportation fuel, existing industrial codes must be used to establish commercial fueling stations. Greater coordination and education of the code writing bodies is needed to make a successful transition. CaFCP members have active participants on hydrogen fueling station code development boards to help develop commercial hydrogen codes.

Consensus between industries on standards, approaches, timing – Each industry sector and each individual company tends to have its own "culture". Different cultures interact in different ways, have diverse priorities and varying comfort levels when it comes to sharing meaningful information. The CaFCP has encouraged its members to think and act outside their cultural norms in tackling common issues.



timeline



October 2001
Participants, Michelin Challenge Bibendum



November 2001
Fuel Scenario Study is released



March 2002
1,000 Fuel Cell Teacher Learning Kits distributed



April 2002
Second Technology Forum hosted at HQ, Methanol station opens

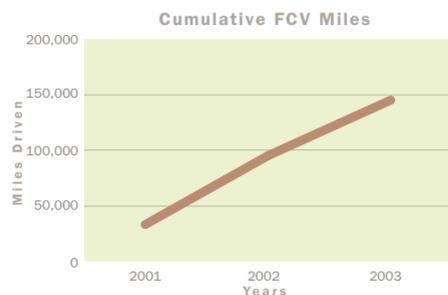
Building Bridges to Sustainability

Stakeholder Outreach



The CaFCP has conducted targeted stakeholder outreach initiatives to raise awareness of fuel cell vehicles and hydrogen among key opinion leaders and decision makers. This outreach effort takes on heightened importance as major announcements supporting this new technology make headlines, such as President Bush's hydrogen car initiative and Governor Arnold Schwarzenegger's plans for hydrogen infrastructure in California.

By focusing education and outreach efforts towards policy makers and other key audience groups, CaFCP is building bridges to those who will play an especially critical role on the path to successful commercial introduction.



Accomplishments

National Policy Makers – Through annual briefings in Washington, D.C., CaFCP strives to keep policy makers informed on current developments at the world's largest fuel cell vehicle demonstration site. In the past two years, CaFCP briefings have addressed more than fifty congressional and administration staff – primarily (but not exclusively) aimed at the California delegation. Lawmakers were also briefed last year on the

CaFCP's activities by 2003 Steering Team Chairman Alan Lloyd, in testimony before the Committee on Science of the U.S. House of Representatives.

State Policy Makers – CaFCP was launched on the steps of the State Capitol; since then, vehicles and member representatives have returned several times for outreach events, including a legislative reception and vehicle exhibit. More than 20 state legislators, or their representatives, and executive branch officials have visited the CaFCP headquarters, gaining a first-hand view of potential challenges for bringing this technology forward.

Community Officials – Before placing fuel cell vehicles into communities for fleet testing and demonstration programs, local officials must thoroughly understand the technology so that their communities are primed for success. CaFCP is increasing its focus on developing resource materials for local officials, and conducting training and other outreach programs for greater understanding and acceptance in the community.

Educators – Students today will likely be part of the first, large-scale wave of fuel cell vehicle customers. Working with the California Science Teachers Association and other education organizations, CaFCP has conducted introductory workshops for more than 1,000 teachers and has distributed 2,000 *Fuel Cell Learning Kits* to middle school and high school teachers. The Learning Kits include a resource CD with links to educational sites; short videos describing the technology and its implications for society; sources for complete classroom curricula; and other useful information.



Environmental Community – To assure that the CaFCP's projects take into account environmental perspectives, and to help keep the environmental community informed, CaFCP created and supports an Environmental Team comprised of representatives from California's top environmental organizations. The E-Team serves as a sounding board for policy issues and project decisions. To date, six briefings have been held with CaFCP executives and environmental leaders.

Technology Supplier Industry – To reach the growing base of companies and organizations providing goods and services supporting fuel cell and hydrogen development, CaFCP conducted two *Technology Forums*. These Forums provide two-way communications between CaFCP members and those interested in the opportunity for informal exchanges with the members, including one-on-one meetings.

Joint Studies on Commercialization Challenges – CaFCP's multi-sector government/industry structure provides a unique forum for joint discussion of issues and activities of common interest among the members. CaFCP has funded two studies to date:

- 1) "Fuel Scenarios Study: Bringing Fuel Cell Vehicles to Market" – a summary of economic and environmental benefits and challenges for utilizing hydrogen, gasoline, ethanol, and methanol as potential fuels for fuel cells. The study was not intended to identify the best option, but to provide a snapshot in time of the issues and

opportunities associated with each fuel. The process of carrying out this study was instrumental in coalescing the members around hydrogen as the fuel for the early fleet demonstration vehicles.

- 2) "Support Facilities for Hydrogen-fueled Vehicles" – a ground breaking study to better understand the safety issues associated with housing fuel cell vehicles in home garages, public garages and maintenance facilities. The study is due to be published in 2004.



Program Learnings

Across-the-board Outreach – Stakeholder outreach must remain a top priority of demonstration organizations; it's equally important to build bridges with the local permit officials as it is with the top rungs of the political ladder.

Cultivate Credible Sources and Champions – as general awareness of fuel cells and hydrogen grows, it is increasingly important to establish a strong network of knowledgeable experts able to address and respond to technical and policy issues as they arise.



timeline



September 2002
Road Rally I, California Central Coast



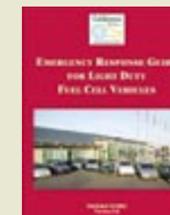
October 2002
1st International Fuel Cell Summit



October 2002
Richmond Refueling Station opens



December 2002
First Fleets established



January 2003
Emergency Response Guide completed

Real-World Demonstration, Building Momentum



Accomplishments

Road Rallies – CaFCP’s annual road rallies have brought fuel cell vehicles, and public excitement, to dozens of small towns and big cities. In the California Coast 2002 Road Rally, seven fuel cell cars drove the state’s Central Coast, from Monterey to Santa Barbara through Big Sur and San Luis Obispo. During the three-day road rally, thousands turned out for ride-and-drive opportunities and fueling displays in communities along the route. In 2003, CaFCP’s Rally Thru The Valley took the fuel cell cars from Sacramento to Los Angeles, through California’s breadbasket, the Central Valley. Ride-and-drives, fueling, and events were held in Stockton, Ripon, Merced, Fresno, and Bakersfield. Before ending with public rides in Los Angeles, the fuel cell cars traversed the grueling Grapevine mountain pass on their way south.

Earth Week Events – Each April, thousands turn out at community environmental stewardship events in commemoration of Earth Day. CaFCP – which was formally announced during

Earth Week in 1999 – helps its members identify events where displays of fuel cell cars, fueling and environmental exhibits are a welcome addition. Sacramento, San Francisco Bay Area, Davis, Los Angeles, Orange County and San Diego are some of the areas where the CaFCP has joined in Earth Day events.

County Fairs and Other Public Events – On numerous occasions, CaFCP has exhibited vehicles and learning displays at events that draw a large cross-section of Californians. Highlights include the Orange County Fair and the San Diego County Fair; the Anaheim Auto Show; SolFest (an environmental-themed festival); and two marathons (the L.A. Marathon and the California International Marathon in Sacramento) where a fuel cell vehicle has served as the zero-emission pace car.

Public Tours – One day each month, the doors are opened at the CaFCP headquarters in West Sacramento and the public is invited for public tour day. During the past four years, more than 1,200 people have attended these “Fourth Friday” public tours. They learn about hydrogen and fuel cells, see CaFCP’s hydrogen fuel station in operation, and can take a short spin in a fuel cell car.

Conferences – Large-scale conferences provide direct access to key audiences. CaFCP has participated in the following conferences with speakers, workshops, exhibits, and vehicle ride-and-drives: Electric Drive Transportation Association; California Science Teachers Association; Fuel Cell Seminar; U.S. Clean Cities; Future Car Congress; Society of Automotive Engineers World Congress; and Congressional Fuel Cell Expo.

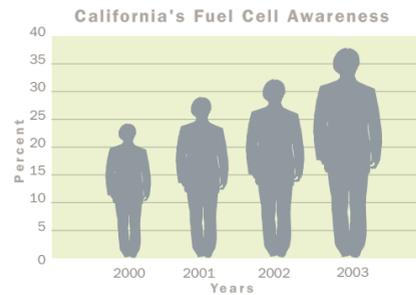


California Cities visited for Outreach Events



Public Outreach

Nothing opens the eyes of the public to the promise of this new transportation technology quite like seeing, touching or driving in a fuel cell car. CaFCP is reaching out to as many people as possible to do just that. The CaFCP outreach programs have brought more than 700,000 people face-to-face with fuel cell vehicles over the past four years.



News Media – Through its members and onsite staff, CaFCP has cultivated important relationships with print and electronic journalists. Many have toured the headquarters facility, while others have attended events where fuel cell vehicles and fueling stations are available for demonstration. Continuing to work with both mainstream and niche-market media is important to keep the public apprised of challenges and breakthroughs with the technology.



Program Learnings

Sustaining Interest – Initial exposure to this new technology and its potential environmental, energy and economic benefits stirs a flash of excitement; however, it is increasingly important that demonstration programs keep public expectations from exceeding reality. Pro-active communications addressing emerging issues as well as the technology’s current status will be useful tools.

Demystifying the Technology – As the basics of fuel cell technology are understood, new questions are inevitable about its costs, safety, energy consumption, and how its fuels are made and distributed. The CaFCP must work with industry, key stakeholder groups, and media to identify accurate and effective means of communicating public information on these issues.



Quick Facts

- Over 3,800 visitors from more than 16 countries visiting the CaFCP headquarters facility
- Over 2,700 refuelings at the CaFCP hydrogen station
- 57 fuel cell cars and buses over the last 4 years
- 43 fuel cell cars and buses on the road in California right now

timeline



May 2003
Road Rally II, California Central Valley



July 2003
Four more years for the California Fuel Cell Partnership!



September 2003
Michelin Challenge Bibendum in San Francisco Bay Area



November 2003
Fuel Cell Organizations Communications Summit



2000 – 2003
230 First Responders trained (2000-2003)

Cumulative miles from 1999 – 2003



Case Studies

CaFCP Facility

On a typical spring day in April 2000, about 250 CaFCP representatives, dignitaries, and interested public gathered on a dirt lot by a busy freeway in West Sacramento to break ground on a project that would soon become a global center for transportation fuel cell demonstrations.

CaFCP members chose to locate a demonstration center in the state's capital region in order to be close to regulatory and political decision makers. Additionally, the area provided superb access to a wide range of driving conditions – from the high-altitude Sierra Nevada to the urban congestion of the San Francisco Bay area – which was crucial for much-needed on-road vehicle testing.

Once the ceremonial shovels had turned the soil, work began in earnest to erect a 55,000 square-foot, state-of-the-art facility which would house the leading automotive and technology companies. Using a national firm's design specification, construction was managed by a local development company. A hydrogen fueling station was installed to provide a ready source of fuel for the on-site vehicles. This station – which provides liquid and gaseous hydrogen – meets or exceeds safety standards set by the National Fire Protection Association (NFPA), the

American Society of Mechanical Engineers (ASME), and other technical guidelines.

On November 1st, 2000, the building opened to much fanfare and enthusiasm with more than 700 guests in attendance. The first facility tours illustrated the facility's purpose: to serve as a demonstration base for the CaFCP automotive members, a place where vehicles are housed, serviced, and refueled. Hydrogen detection and mitigation systems are incorporated into the building design to provide a safe working environment for staff. Other features include a public gallery area, open daily, with educational displays; and a dynamometer bay for on-site test purposes.

To symbolize the global reach of CaFCP, eight flags fly in front of the building, representing the countries or states native to the 30 members (U.S., Canada, South Korea, Japan, Germany, Netherlands, Great Britain, and California). Today, the CaFCP facility features a combined working staff of nearly 50 people, and continues to draw visitors from around the world.



Richmond Fueling Station

CaFCP member Stuart Energy installed and commissioned its "intelligent" hydrogen fueling station technology in the city of Richmond, California, at the AC Transit bus yard on October 30, 2002. This is the first satellite station to supply hydrogen fuel for CaFCP's fuel cell vehicles. Stuart provides electrolyzer technology, using grid power and city water to manufacture hydrogen on-site, which is then stored for use by vehicles.

Pre-commissioning

Planning began in fall 2001, with both AC Transit and Stuart Energy working closely with the Richmond Planning and Building Departments, Public Works, Fire Departments, several local community groups, the local fire marshal and a variety of contracting agencies to obtain approvals and permits required for installation. A zoning/land use, environmental information form, California Environmental Quality Act negative declaration, design review, hydrogen storage, and permits for conditional use, building, and operation

were among the long list of applications processed and submitted by the CaFCP's members. Outreach to community groups, including educational tours of the CaFCP headquarters facility, were also important steps for familiarizing the community with the station's purpose and function.

Post-commissioning

Throughout 2003, Stuart Energy worked alongside CaFCP members to advance the station towards full interoperability with all fuel cell vehicles, similar to that of the CaFCP's headquarters hydrogen station. This dialogue continues to identify better practices in fueling interface protocols, station performance validation practices, and other steps necessary to expanding hydrogen technology infrastructure.

Station Characteristics

The station employs Stuart Energy's patented Hydrogen Energy Station (HES) system, generating about 1 kg of hydrogen per hour and storing up to 47 kg of hydrogen, which is capable of supplying the daily fueling needs of a small fleet of vehicles. The entire integrated station consists of a high-pressure, high-purity hydrogen electrolyzer, a storage unit, and a gaseous hydrogen fuel dispenser that resembles a common gasoline dispenser. The dispenser offers both 250 and 350 bar refueling pressures. To fuel a vehicle, the driver simply swipes a "smart" card to activate the dispenser, and attaches the nozzle to the vehicle's tank.

Meeting challenges is part of the commercialization process. The drive of CaFCP's member companies to pursue interoperability for the Richmond Station has generated many learnings in this first nationwide example of multi-user/multi-station fuel cell vehicle infrastructure expansion – learnings that will benefit future station implementation.

Bus Program

The first fuel cell bus to enter revenue service in California is a hybrid-electric fuel cell bus produced by ThunderPower (a joint venture between Thor Industries and ISE Research). Service began at SunLine Transit Agency on August 20, 2002. The El Dorado National EZ Rider II chassis was integrated with a UTC Fuel Cells 60kW PEM fuel cell, an electric drive system by Siemens and ISE Research, Quantum compressed hydrogen tanks, and 48 lead acid batteries by Panasonic. To date, the "Thor Bus" has been demonstrated at SunLine Transit Agency (Palm Springs),



Fleets

In 2002, two auto manufacturers started placing fuel cell vehicles in customer fleets. Other members have announced they will start demonstration fleet programs beginning in 2004.

Honda FCX

As part of its efforts to bring fuel cell technology to the market, Honda is well along in the placement of about 30 fuel cell cars in the U.S. and Japan by the end of 2004. The City of Los Angeles became the nation's first customer for Honda fuel cell vehicle technology when Los Angeles Mayor James Hahn took delivery of two Honda FCX fuel cell vehicles from Honda Motor Co., Inc. President Hiroyuki Yoshino on Dec. 2, 2002. Today, Los Angeles has five FCX vehicles in regular daily operation as part of its fleet of alternative fuel and advanced technology vehicles. Air Products provides a 60-kilogram hydrogen mobile refueler to provide high pressure fuel for the 5 FCXs leased by

the City. Later in 2003, Honda announced its intention to expand the FCX fleet applications in California, and today the City of San Francisco is operating two FCXs in their fleet.

The Honda FCX is the world's first fuel cell car certified for regular commercial use by the U.S. EPA and California Air Resources Board. The FCX is also distinguished by being the first fuel cell vehicle to earn a place in the EPA fuel economy ratings (51 city / 48 highway) for 2003 models.

Honda FCX Specifications:

- Zero emissions
- Ballard fuel cell stack and Honda developed ultra-capacitor assist power plant
- 80 horsepower
- 201 foot-pounds of torque
- 170 mile EPA certified range (2003 model)

Chula Vista Transit, Los Angeles County Metropolitan Transportation Authority, and AC Transit (Richmond).

Funding Partners

Funding partners include Thor, ISE Research, the South Coast Air Quality Management District, WestStart-CALSTART, Sacramento Municipal Utility District, and the US Department of Transportation.

Bus Targets achieved

Since coming to California, the Thor Bus has accrued over 16,000 miles, the majority of those in passenger-carrying revenue service. Two of the CaFCP's transit associate members put the bus through its paces, from SunLine's suburban desert conditions to AC Transit's urban hilly terrain.

	SunLine Transit Agency	AC Transit
Miles/GGE* hydrogen	9.6	7.3
Total mileage	8800	3000
Total FC stack hours	640	300
Availability	71%	82.5%

* Gasoline Gallon Equivalent (approximately 1 kg of H₂ is equal, on a lower heating value energy basis, to 1 gallon of gasoline).

FCB Specifications

Acceleration (0-30)	17 seconds
Acceleration (0-50)	54 seconds
Top Speed	55 mph (89 kph)
Weight	25,180 lbs (11,445 kg)
Interior Noise (35 mph)	65 db(A)
Emissions	Zero

Toyota FCHV

On December 2nd, 2002, Toyota placed two Toyota fuel cell hybrid vehicles (FCHV) with the University of California, one each at the Davis and Irvine campuses. Along with Honda, Toyota became the first OEM to place a fuel cell vehicle into a third-party demonstration program in California.

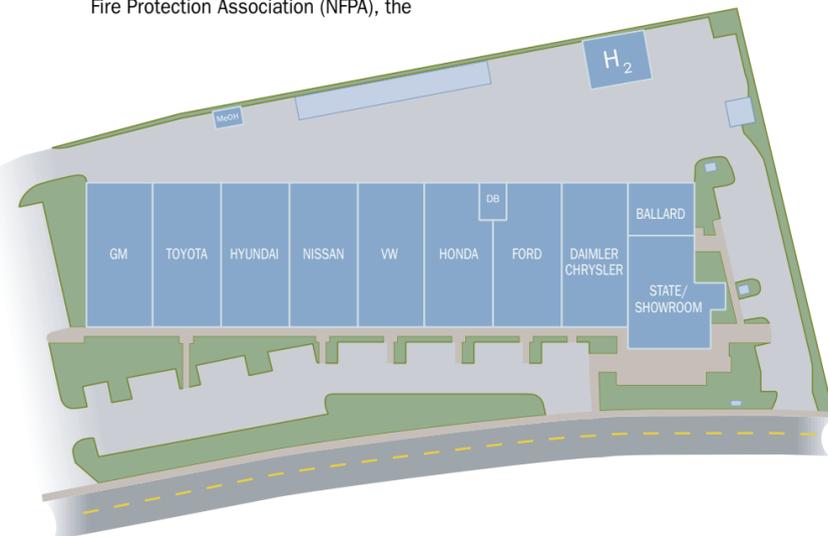
University of California, Irvine (UCI) – Today, UCI manages two Toyota FCHVs generating real-world data in regular commute use by Irvine faculty. Air Products provides a mobile fueling unit to supply up to 20 kilograms of hydrogen per day.

University of California, Davis (UCD) – The University of California, Davis-Toyota Fuel Cell Vehicle Program is a cooperative effort with Toyota Motor Sales to further research and public education/outreach efforts on the advantages of hydrogen-based transportation. As part of this program the university utilizes two Toyota FCHVs to demonstrate fuel

cell technology throughout Northern California. Toyota's support of the program will allow the university to focus new research activities on fuel cell vehicle market studies, lifecycle cost analyses and FCV infrastructure evaluations. To support these vehicles, Air Products built a 1,500 kilogram hydrogen station at the UCD bus transit yard, offering hydrogen to support the FCHVs and coupling with an existing natural gas station to provide blended fuel for buses.

Toyota FCHV Specifications:

- Zero emissions
- Toyota proprietary 90 kw FC Stack and battery integrated series/parallel hybrid system
- Traction Motor output is 107 hp @ 191 ft lbs. of torque
- 180 mile range combined US city and highway



Organization Summary

The CaFCP is a unique, voluntary, non-legal entity whose success to date has been directly related to the energy and enthusiasm of the participating companies, agencies and individuals. Members choose to participate in the aspects of the program that are most important and interesting to them, often making extraordinary contributions of time, resources and commitment to achieve progress for not only their own organization, but also for the benefit of all members. The CaFCP has matured over the past 4 years, but has always remained responsive to the needs of its members, who have shaped and made the CaFCP the successful organization that it is today.

An executive Steering Team meets quarterly to direct the work of the CaFCP. The Chair of the Steering Team is rotated annually among the four sectors represented in the CaFCP – vehicle



manufacturers, fuel providers, technology providers and government agencies. This shared leadership reflects the diversity of representatives in the organization and results in an increased appreciation among the members of their various interests and perspectives.

The Steering Team directs the activities of the Working Group, which is managed by the Executive Director. The activities of

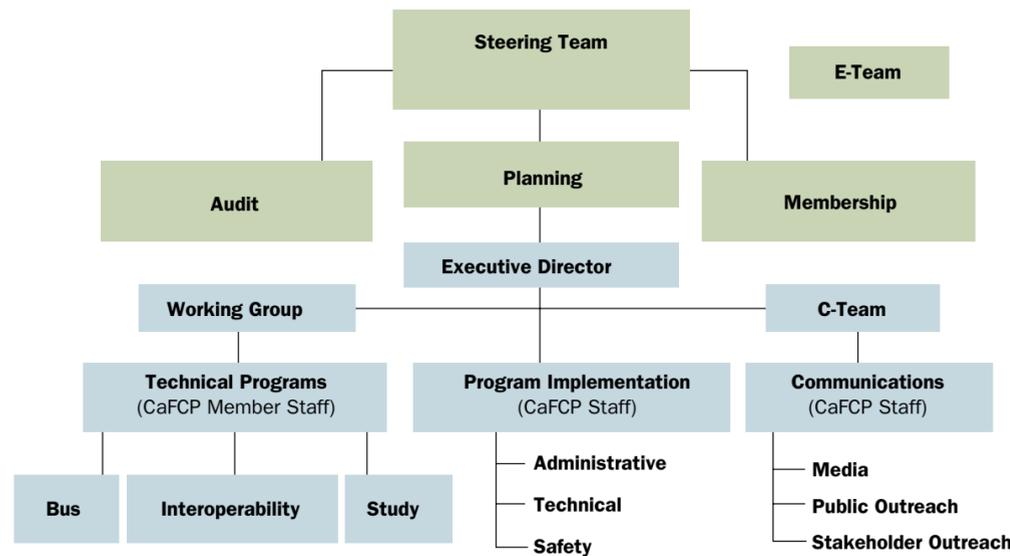
the Working Group and staff are organized into three general areas:

1. Technical Programs – led by CaFCP members through the project groups
2. Communications – led by CaFCP staff
3. Program Implementation – led by CaFCP staff

The Executive Director manages a staff of eight technical, communications and administrative professionals. The working group is composed of CaFCP members, providing a forum for the project groups and other working group members to interface with each other and the CaFCP staff carrying out the communications and program implementation functions.



The CaFCP has been described by organizational experts as a post-modern organization. In a post-modern organization, the form of the organization follows its function. This type of organization is characterized by highly interactive communications among its members, and a strong base of knowledge and expertise that is brought into the joint collaborative effort toward a common purpose. The post-modern organization promotes shared leadership that leads to innovation and change in a complex environment.



California Fuel Cell Partnership

Members

Automotive

- DaimlerChrysler
www.daimlerchrysler.com
- Ford
www.ford.com
- GM
www.gmability.com
- Honda
www.honda.com
- Hyundai
www.hyundai-motor.com
- Nissan
www.nissan-global.com
- Toyota
www.toyota.co.jp
- Volkswagen
www.vw.com

Energy

- BP
www.bp.com
- ChevronTexaco
www.chevrontexaco.com
- ExxonMobil
www.exxonmobil.com
- Shell Hydrogen
www.shellhydrogen.com

Fuel Cell Technology

- Ballard Power Systems
www.ballard.com
- UTC Fuel Cells
www.utcfuelcells.com

Government Agencies

- California Air Resources Board
www.arb.ca.gov
- California Energy Commission
www.energy.ca.gov
- South Coast AQMD
www.aqmd.gov
- U.S. Department of Energy
www.eere.energy.gov
- U.S. Department of Transportation
www.dot.gov
- U.S. Environmental Protection Agency
www.epa.gov

Transit Agencies

- AC Transit
www.actransit.org
- Santa Clara VTA
www.vta.org
- SunLine Transit Agency
www.sunline.org

Fuel Technology

- Air Products and Chemicals
www.airproducts.com
- Methanex
www.methanex.com
- Pacific Gas & Electric
www.pge.com
- Praxair
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