

May 17, 2010

Via electronic mail – docket@energy.state.ca.us

California Energy Commission
Dockets Office, MS-4
Re: Docket No. 09-ALT-1
1516 Ninth Street
Sacramento, CA 95814-5512

| | |
|-----------------|-------------|
| DOCKET | |
| 09-ALT-1 | |
| DATE | MAY 17 2010 |
| RECD. | JUN 14 2010 |

SUBJECT: Docket No. 09-ALT-1: 2010-2011 Investment Plan

Thank you for the opportunity to comment on the staff's proposed 2010-2011 Investment Plan for the Alternative and Renewable Fuel and Vehicle Technology Program.

I previously submitted comments through the docket process on February 11, 2010 and have discussed these with staff. The February 11, 2010 comments (see attached) emphasize the importance of accounting for actual accessible supply of hydrogen for customers in the early market clusters when planning for future needs. The draft 2010-2011 Investment Plan still counts hydrogen supply from stations that are closed to the public, not currently operating or planned to close in the near future. As well, the draft 2010-2011 Investment Plan relies on supply available in non-cluster areas, which is helpful but insufficient to meet the needs of the early commercial market. Put simply, location matters.

Please also accept these additional comments:

1. The California Fuel Cell Partnership recently published a "Progress and Next Steps" report, attached for submission to this proceeding. This report is the first refinement of our 2009 Action Plan which details the investments and actions needed to transition to an early commercial market for fuel cell vehicles and hydrogen in California. The Progress and Next Steps report includes updated vehicle survey numbers from the CaFCP's 2009 automaker survey. We request these figures be included in the 2010-2011 Investment Plan in place of the 2008 survey results.

2009 CaFCP FCV Deployment Survey Results: Passenger FCVs in Operation in CA

| | Hundreds | Thousands | Tens of thousands |
|---------------------------|-----------------|------------------|--------------------------|
| | Through 2012 | 2013-2015 | 2016-2018 |
| Total Passenger Vehicles* | 450 | 4,200 | 54,300 |

* Total number projected on the road at the end of each timeframe

Number of Fuel Cell Buses Based on Transit Agency Plans and ZBus Regulation

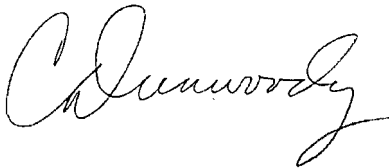
| | Field Testing | Full-scale Demonstration | Commercialization |
|-----------------|----------------------|---------------------------------|--------------------------|
| | 2009-2011 | 2012-2014 | 2015-2017 |
| Number of FCBs* | 15 to 17 | 20 to 60 | 60 to 150 |

* Total number projected on the road at the end of each timeframe

2. While the upcoming solicitation for hydrogen stations (\$22 million from the 2008-2009 Investment Plan) will make a significant contribution to preparing the early market for fuel cell passenger vehicles and transit buses in California, we expect additional investment will be needed to adequately prepare communities for thousands of vehicles in the next five years. The CaFCP members are preparing specific station needs for the 2012-2013 timeframe and we expect this information to be available for submission to the docket by the end of May 2010.

Thank you again for the opportunity to participate in this process.

Sincerely,



Catherine Dunwoody
Executive Director

**2010-2011 Investment Plan for the Alternative and Renewable Fuel
and Vehicle Technology Program**

Comments of Catherine Dunwoody

Executive Director, California Fuel Cell Partnership

February 11, 2010

Thank you for the opportunity to comment on the staff's proposed 2010-2011 Investment Plan for the Alternative and Renewable Fuel and Vehicle Technology Program. I want to commend the staff for a thorough analysis, basing hydrogen infrastructure needs on automaker survey results that project when, where and how many fuel cell vehicles will be deployed in California. I am pleased that the CEC plans a hydrogen solicitation for \$22 million in the coming months, using funds from the 2008-2009 Investment Plan, to build customer-friendly, publicly accessible and retail-oriented stations as well as support transit applications. This funding will help ensure that the first fuel cell vehicle customers, including transit customers, in the six early market communities (Northern and Southern California) have sufficient access to hydrogen fuel.

CaFCP was pleased to participate in the September 29, 2009, workshop for the investment plan. Our presentation is listed on the website and comments entered into the docket, although CaFCP's name does not appear in the list of workshop participants in the draft plan.

The California Fuel Cell Partnership action plan, published in February 2009, details the investments and actions needed to transition to an early commercial market for fuel cell vehicles and hydrogen in California. The action plan calls for 40 new hydrogen stations by 2014 to provide fuel for thousands of FCVs and up to 100 buses. CaFCP estimates the cost of this plan at \$180 million industry and government funding. The action plan is based on a survey of automotive members conducted at the end of 2008, which CEC has referenced in the 2010-2011 Investment Plan. CaFCP surveyed our automotive members again at the end of 2009, and these results confirm the phased introduction of fuel cell vehicles, moving from hundreds, to thousands and then tens of thousands of vehicles. CaFCP will soon publish the results of this latest survey in a report detailing the progress made in 2009 and the actions and steps needed in 2010 and 2011. We expect the report to be available in the next few weeks, at which time I will submit it to the docket.

The 2010-2011 Investment Plan proposes to allocate \$14 million for hydrogen infrastructure, stating "this funding could establish six to eight 'retail' stations (either inside or outside designated clusters), support existing stations requiring funds for continuing operations and maintenance, expand capacity/upgrade existing and strategically useful stations, and help establish needed transit demonstration fueling capability."

I have several comments regarding the analysis that leads to the CEC staff's recommendation:

1. Appendix C identifies four early market communities in Southern California and uses the CaFCP's action plan map. CaFCP's action plan includes Northern California as well,

- with early market communities for passenger vehicles and transit buses in the San Francisco Bay Area and Sacramento.
2. Appendix C lists the status of hydrogen fuel stations in California, along with an analysis of hydrogen fuel demand and capacity. Based on CaFCP's knowledge of current and planned hydrogen stations, our analysis projects lower hydrogen supply in each of the years 2010-2014 compared to CEC's assessment. (Please see the tables on the following pages.)
 3. The time required to establish a new hydrogen station must include the process of planning, partnering, funding and contracting (e.g. between business and government entities) in addition to the design, permitting and construction process. Based on experience with past projects, CEC should allow two years between solicitation and station opening.

Thank you again for the opportunity to comment, and I look forward to submitting CaFCP's progress report for your consideration of our recommended next steps.

Table C-1: Hydrogen Fuel Demand and Capacity (with CaFCP revisions)

| Year | Region | Vehicle Rollouts (From Table 8) | Hydrogen Demand (kg/day) | CEC Hydrogen Capacity (kg/day) | CEC Add'l Hydrogen Needed (kg/day) | Revised Hydrogen Capacity (kg/day) | Revised Add'l Hydrogen Needed (kg/day) | Comment(s) |
|------|----------------------------|---------------------------------|--------------------------|--------------------------------|------------------------------------|------------------------------------|--|--|
| 2010 | Santa Monica (cluster) | 25 | 25 | 12 | 13 | 0 | 25 | No City of Santa Monica |
| | Torrance (cluster) | 25 | 25 | 58 | 0 | 0 | 25 | Toyota and Honda stations not public access |
| | Newport Beach (cluster) | 23 | 23 | 0 | 23 | 0 | 23 | |
| | Irvine (cluster) | 32 | 32 | 25 | 7 | 25 | 7 | |
| | Los Angeles (non-clusters) | 30 | 30 | 339 | 0 | 54 | 0 | Santa Ana, Ontario, Chino, Culver City, LAX not public access, Burbank currently closed. Revised supply includes Diamond Bar, Riverside, and West LA only. |
| | San Diego | 4 | 4 | 0 | 4 | 0 | 4 | |
| | Bay area | 20 | 20 | 150 | 0 | 0 | 20 | Oakland transit only |
| | Sacramento | 17 | 17 | 158 | 0 | 100 | 0 | UCD closed, West Sac 100 kg/day |
| | Other | 16 | 16 | 172 | 0 | 100 | 0 | Thousand Palms 100 kg/day available for passenger vehicle fueling, Arcata limited access |
| | Total | 192 | 192 | 914 | 47 | 279 | 104 | |
| 2011 | Santa Monica (cluster) | 45 | 45 | 12 | 33 | 0 | 45 | |
| | Torrance (cluster) | 45 | 45 | 108 | 0 | 150 | 0 | Torrance Pipeline and Harbor City/Mehtahi |
| | Newport Beach (cluster) | 38 | 38 | 100 | 0 | 100 | 0 | |
| | Irvine (cluster) | 47 | 47 | 25 | 22 | 25 | 22 | |
| | Los Angeles (non-clusters) | 57 | 57 | 639 | 0 | 330 | 0 | Revised supply includes West LA, Fountain Valley, UCLA, CSULA only |
| | San Diego | 8 | 8 | 0 | 8 | 0 | 8 | |
| | Bay area | 34 | 34 | 330 | 0 | 180 | 0 | Emeryville and SFO only |
| | Sacramento | 25 | 25 | 158 | 0 | 0 | 25 | West Sac funding ends 2010 |
| | Other | 31 | 31 | 272 | 0 | 100 | 0 | |
| | Total | 330 | 330 | 1644 | 63 | 885 | 100 | |

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| | | | | | | | | |
|-------------|----------------------------|------|------|------|-----|------|-----|--|
| 2012 | Santa Monica (cluster) | 73 | 73 | 12 | 61 | 0 | 73 | |
| | Torrance (cluster) | 64 | 64 | 108 | 0 | 150 | 0 | |
| | Newport Beach (cluster) | 53 | 53 | 100 | 0 | 100 | 0 | |
| | Irvine (cluster) | 67 | 67 | 25 | 42 | 0 | 67 | UC Irvine funding ends 2011 |
| | Los Angeles (non-clusters) | 88 | 88 | 639 | 0 | 330 | 0 | |
| | San Diego | 8 | 8 | 0 | 8 | 0 | 8 | |
| | Bay area | 48 | 48 | 330 | 0 | 180 | 0 | |
| | Sacramento | 38 | 38 | 158 | 0 | 0 | 38 | |
| | Other | 56 | 56 | 272 | 0 | 0 | 56 | Thousand Palms funding ends 2011 |
| | Total | 495 | 495 | 1644 | 111 | 760 | 242 | |
| 2013 | Santa Monica (cluster) | 107 | 107 | 12 | 95 | 0 | 107 | |
| | Torrance (cluster) | 91 | 91 | 108 | 0 | 150 | 0 | |
| | Newport Beach (cluster) | 70 | 70 | 100 | 0 | 100 | 0 | |
| | Irvine (cluster) | 104 | 104 | 25 | 79 | 0 | 104 | |
| | Los Angeles (non-clusters) | 117 | 117 | 639 | 0 | 330 | 0 | |
| | San Diego | 23 | 23 | 0 | 23 | 0 | 23 | |
| | Bay area | 91 | 91 | 330 | 0 | 180 | 0 | |
| | Sacramento | 60 | 60 | 158 | 0 | 0 | 60 | |
| | Other | 106 | 106 | 272 | 0 | 0 | 106 | |
| | Total | 769 | 769 | 1644 | 197 | 760 | 400 | |
| 2014 | Santa Monica (cluster) | 193 | 193 | 12 | 181 | 0 | 193 | |
| | Torrance (cluster) | 180 | 180 | 108 | 72 | 50 | 130 | Harbor City/Mehtahi funding ends 2013 |
| | Newport Beach (cluster) | 208 | 208 | 100 | 108 | 0 | 208 | Newport funding ends 2013 |
| | Irvine (cluster) | 268 | 268 | 25 | 243 | 0 | 268 | |
| | Los Angeles (non-clusters) | 382 | 382 | 639 | 0 | 30 | 352 | Fountain Valley, UCLA, CSULA funding ends 2013 |
| | San Diego | 33 | 33 | 0 | 33 | 0 | 33 | |
| | Bay area | 264 | 264 | 330 | 0 | 0 | 264 | Emeryville and SFO funding ends 2013 |
| | Sacramento | 117 | 117 | 158 | 0 | 0 | 117 | |
| | Other | 194 | 194 | 272 | 0 | 0 | 194 | |
| Total | 1839 | 1839 | 1644 | 637 | 80 | 1759 | | |

Table C-2: Hydrogen Fuel Stations (with CaFCP revisions)

| Station | Region | CEC Plan-Nominal Capacity (kg/day) | CaFCP projected supply for passenger vehicles (kg/day) | CaFCP projected supply for Transit (kg/day) | Pressure (Mpa) | Operational Status | Funding Status - Secured Through / (Expected Open) |
|-----------------------------|-------------------------|------------------------------------|--|---|----------------|--|--|
| Oakland - AC Transit | Bay Area | 150 | 0 | 150 | 35 | <i>Limited public access Transit only. CLOSING Sept 2010</i> | Sept 2010 |
| San José - Santa Clara VTA | Bay Area | 1000 | 0 | 0 | 35 | <i>Transit station only CLOSED</i> | 2009 |
| Emeryville - AC Transit | Bay Area | 60 | 60 | 200 | 35/70 | EXPECTED - 24/7 public access (for passenger FCVs) | (Opens Q3 2010) |
| San Francisco - SFO Airport | Bay Area | 120 | 120 | 0 | 35/70 | 24/7 public access | (Opens Q3 2010) |
| Irvine - UCI | Cluster - Irvine | 25 | 25 | 0 | 35/70 | 24/7 public access | 2011 |
| Irvine - UCI | Cluster - Irvine | 3 | 0 | 0 | 35 | <i>No public access</i> | N/A |
| Newport Beach | Cluster - Newport Beach | 100 | 100 | 0 | 35/70 | 24/7 public access | (Opens Q2 2010) |
| Santa Monica | Cluster - Santa Monica | 12 | 0 | 0 | 35 | <i>Limited public access</i> | 2010 |
| Torrance - Honda | Cluster -Torrance | 4 | 0 | 0 | 35 | <i>No public access; OEM only (Honda)</i> | N/A |
| Torrance - Honda | Cluster -Torrance | 4 | 0 | 0 | 35 | <i>No public access; OEM only (Honda)</i> | N/A |
| Torrance | Cluster -Torrance | 50 | 0 | 0 | 35/70 | <i>No public access; OEM only (Toyota)</i> | N/A |
| Torrance | Cluster -Torrance | 50 | 50 | 0 | 35/70 | 24/7 public access | (Opens Q4 2010) |

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| | | | | | | | |
|----------------------------|-------------------|-------------|-------------|------------|-------|--|-----------------|
| Harbor City | Cluster -Torrance | 100 | 100 | 0 | 35/70 | 24/7 public access | (Opens Q2 2010) |
| Riverside | LA Non-Cluster | 12 | 12 | 0 | 35 | 24/7 public access. No plans to continue past 2010. | 2010 |
| West LA | LA Non-Cluster | 30 | 30 | 0 | 35 | 24/7 public access. Privately funded. | 2011 |
| Diamond Bar - SCAQMD | LA Non-Cluster | 12 | 12 | 0 | 35 | Limited public access. Plans for upgrade/continuation. | 2010 |
| Ontario | LA Non-Cluster | 50 | 0 | 0 | 35 | Limited public access | 2010 |
| Santa Ana | LA Non-Cluster | 50 | 0 | 0 | 35 | Limited public access | 2010 |
| Chino | LA Non-Cluster | 9 | 0 | 0 | 35 | No public access; OEM only (Hyundai) | 2010 |
| Culver City | LA Non-Cluster | 30 | 0 | 0 | 70 | No public access; OEM only (GM) | N/A |
| Los Angeles - LAX | LA Non-Cluster | 30 | 0 | 0 | 70 | No public access; OEM only (GM) | N/A |
| Los Angeles - CSULA | LA Non-Cluster | 60 | 60 | 0 | 35/70 | EXPECTED - 24/7 public access | (Opens Q4 2010) |
| Fountain Valley - OCSD | LA Non-Cluster | 100 | 100 | 0 | 35/70 | 24/7 public access | (Opens Q2 2010) |
| Westwood - UCLA | LA Non-Cluster | 140 | 140 | 0 | 35/70 | 24/7 public access | (Opens Q1 2011) |
| Burbank | LA Non-Cluster | 116 | 116 | 0 | 35/70 | CURRENTLY CLOSED | 2010 |
| Thousand Palms | Other | 160 | 100 | 60 | 35 | 24/7 public access. Supply different for LD and Transit. | 2012 |
| Arcata - HSU | Other | 12 | 0 | 0 | 35 | Limited public access | N/A |
| Oceanside - Camp Pendleton | Other | 30 | 0 | 0 | 35 | Delayed opening with limited public access | (Opens TBD) |
| West Sacramento - CaFCP | Sacramento | 150 | 100 | 0 | 35 | Daylight hours public access | 2010 |
| Davis - UCD | Sacramento | 8 | 0 | 0 | 35 | CURRENTLY CLOSED | 2009 |
| TOTAL | | 2677 | 1125 | 410 | | | |

Hydrogen Fuel Cell Vehicle and Station Deployment Plan: A Strategy for Meeting the Challenge Ahead

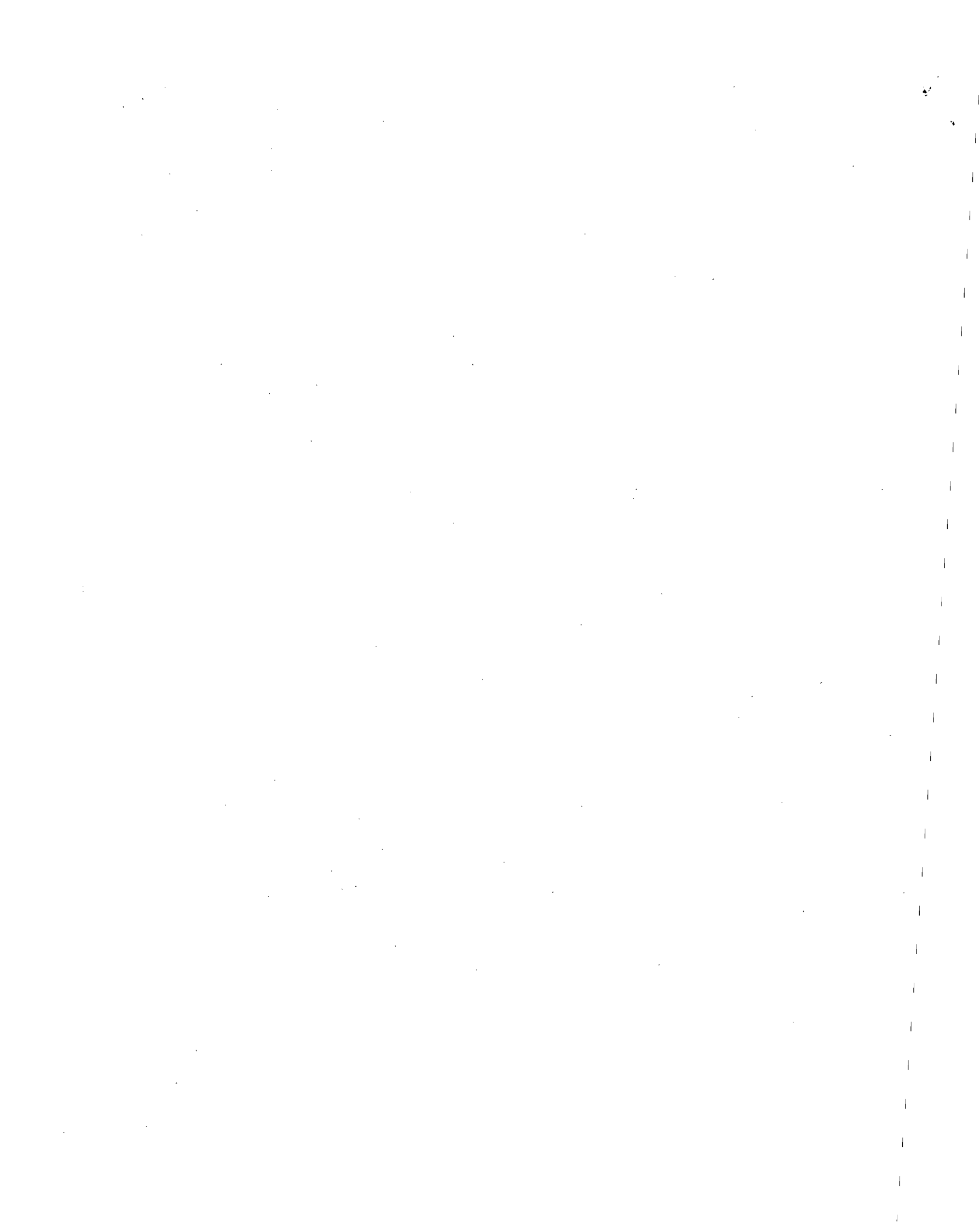
Progress and Next Steps

April, 2010



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This document refers to CaFCP's current consensus plan for deploying fuel cell vehicles and hydrogen stations in California. This consensus vision does not necessarily represent the organization views or individual commitments of CaFCP members.



Introduction

In February 2009, CaFCP released the *Hydrogen Fuel Cell Vehicle and Station Deployment Plan: A Strategy for Meeting the Challenge Ahead*.¹ The “action plan” is based on real-world learning and data, and details the major investments and actions needed to transition to a commercial market for fuel cell vehicles and hydrogen. The action plan has three primary areas of focus:

- Build retail hydrogen stations in the communities where passenger fuel cell vehicles will first be introduced.
- Support the expanding fuel cell bus program.
- Develop and implement the codes, standards, regulations and permitting processes that will enable the retail sale of hydrogen as fuel and adopt best-available fueling technology.

The future of transportation requires multiple fuel technology paths that match technical capabilities to customer needs and expectations. Hydrogen fuel cell vehicles are one of the few vehicle technologies that can meet the needs of a broad consumer market while significantly reducing greenhouse gas emissions and local air pollutants and diversifying our energy sources. Hydrogen is a domestically produced low-carbon fuel and has demonstrated the ability to be a zero-carbon fuel when produced from renewable resources.

California is a world leader in fuel cell vehicle and hydrogen infrastructure development and demonstration. The state is positioned to continue that leadership by successfully initiating the commercial launch of hydrogen fuel cell vehicles. This will occur through a coordinated and transparent partnership between industry and government, allowing industry to learn and develop self-sustaining business practices that will reduce and ultimately eliminate the need for future public funding support. Automakers, station providers and funders must work closely to make smart investments with limited resources, meet customer fueling needs and build toward a successful commercial launch in 2015.

Commercializing fuel cell vehicles is a dynamic process. Actions and priorities will change as deployment proceeds, requiring refinements and adjustments as progress is made. The action plan identifies the need for ongoing review to adapt and refine strategies. This report presents the first such refinement by reporting progress and identifying immediate next steps required in 2010 and 2011.

Recent Progress

Most automakers have placed fuel cell vehicles with customers, and many plan to introduce fuel cell vehicles to the early commercial market around 2015. Transit agencies have been operating fuel cell buses in revenue service and are moving to next-generation technology. Customers have been fueling at private, fleet demonstration stations, and are awaiting a retail-ready network.

¹ CaFCP 2009 Action Plan cafcp.org/sites/files/Action%20Plan%20FINAL.pdf

Since the release of the action plan in February 2009, CaFCP members have made progress toward commercialization, including the following examples:

Fuel Cell Vehicle Progress

- GM announced a fifth-generation fuel cell stack that is smaller, lighter and uses 50% less platinum than the fuel cell stack currently powering the Project Driveway vehicles. The new fuel cell stack is expected to have 120,000 miles durability.²
- The Toyota FCHV-*adv* achieved an estimated range of 431 miles and an average fuel economy of 68.3 miles/kg during field evaluation testing with the federal government.³
- The Honda FCX Clarity was named 2009 World Green Car at the New York Auto Show and Honda continues to lease vehicles to drivers in Southern California.⁴
- Hyundai and Kia announced they will produce fuel cell vehicles within 2-3 years as part of their plan to develop more environmentally friendly vehicles.⁵
- A Nissan fuel cell vehicle accumulated 100,000 actual road miles using the original fuel cell stack and components. Nissan also began its first North American customer demonstration program leasing a vehicle to the Sacramento Coca-Cola Bottling Company.⁶
- Daimler is preparing for the global launch of 200 serial produced B-Class F-Cells in 2010 following 2.8 million miles of real-world driving experience with previous fuel cell vehicle demonstrations.⁷
- UTC Power accumulated more than 5,000 operating hours on a fuel cell bus system.⁸
- As fuel cell buses increased hours in operation and average monthly miles in several demonstration programs across the nation, they showed fuel economy improvement up to 141% when compared CNG and diesel buses.⁹

Hydrogen Station Progress

- Five new retail-oriented stations were funded and began planning and design during 2009. Four were co-funded by California Hydrogen Highway and one was funded solely by industry. This brings the total to eight new public stations funded in 2008 and 2009. These stations will begin operating in 2010 and early 2011. (See Table A)

² GM press release, Sept. 24, 2009

publish.media.gm.com/content/media/us/en/news/news_detail.html/content/Pages/news/us/en/2009/Sep/0924_Gen_Two_Fuel_Cell

³ Toyota press release, August 6, 2009 multivu.prnewswire.com/mnr/toyota/39419/

⁴ Honda press release, April 9, 2009 automobiles.honda.com/news/press-releases-article.aspx?Article=4986

⁵ Hyundai announcement, August 13, 2009 www.tradingmarkets.com/site/news/Stock%20News/2479348/

⁶ Nissan press release, Nov. 24, 2009 www.prnewswire.com/news-releases/nissan-announces-first-fuel-cell-vehicle-lease-in-north-america-coca-cola-zero-x-trail-fcv-promotes-zero-emissions-72576897.html

⁷ Daimler press release, August 28, 2009 <http://media.daimler.com/nc/dcmmedia/0-921-614248-1-1232236-1-0-0-0-0-1-12759-614216-0-0-0-31-0-0-0.html?TS=1272055218257>

⁸ UTC press release, Jan. 13, 2010 cafcp.org/sites/files/UTCPowerFCBsystemattainsdurabilitymilestone.pdf

⁹ *Fuel Cell Buses in U.S. Transit Fleets: Current Status 2009*, Oct. 2009 www.nrel.gov/hydrogen/pdfs/46490.pdf

- Several privately funded stations opened in the Los Angeles area (e.g. Shell Culver City and Clean Energy LAX). While providing fuel to limited fleet and retail customers, these stations supported technology development, expanded hands-on fueling experience and provided learnings about retail-like installations.
- The AC Transit hydrogen station in Emeryville received federal economic stimulus funds for solar panels to support production of renewable hydrogen.¹⁰
- In March 2010, SAE International published TIR J2601, which establishes safety and performance requirements for gaseous hydrogen fuel dispensers.¹¹
- CaFCP Bus Team participants and GTI developed the *Hydrogen Bus Fueling and Pressure Vessel Analysis* report to provide heavy-duty fueling input into the SAE J2601 fueling protocol standards development process.
- International standards organization ASTM published D7750-09,¹² the first method specific to hydrogen fuel quality for fuel cell vehicles.
- California Department of Food and Agriculture, Division of Measurement Standards received \$3.5 million from CEC AB118 funds to develop a type approval and field evaluation process for hydrogen dispensers, validate hydrogen quality analytical methods, and purchase and develop test equipment. These actions will enable retail sales of hydrogen as a transportation fuel.

Table A: Public Hydrogen Stations Funded in 2008 and 2009

| Station | Capacity (kg/day) | Pressure (MPa) | Expected opening date |
|--------------------------------------|--|-------------------|--------------------------|
| Harbor City – Mebtahi | 100 | 35/70 | Q3 2010 |
| Newport Beach – Shell | 100 | 35/70 | Q4 2010 |
| San Francisco – SFO | 120 | 35/70 | Q2 2011 |
| Torrance – Shell | 50 | 35/70 | Q3 2010 |
| Westwood – UCLA | 140 | 35/70 | Q2 2011 |
| Emeryville – AC Transit ¹ | 60 (passenger vehicles) 150 (transit) | 35/70 | Q4 2010 |
| Fountain Valley – OCSD ¹ | 100 | 35/70 | Q3 2010 |
| Los Angeles – CSULA ¹ | 60 | 35/70 | Q1 2011 |

¹ – Station included in action plan

¹⁰ AC Transit press release, Sept. 21, 2009 rideact.blogspot.com/2009/09/ac-transit-awarded-for-solar-power.html

¹¹ SAE International TIR J2601 www.sae.org/technical/standards/J2601 201003

¹² ASTM D7550 – 09 Standard www.astm.org/Standards/D7550.htm

Other Progress

- The National Renewable Energy Laboratory published updated composite data about the US Department of Energy National Hydrogen Learning Demonstration, during which 140 fuel cell vehicles travelled more than 2.5 million miles and used 150,000 kg of hydrogen from 20 stations.¹³ Hydrogen and fuel cell technologies have demonstrated excellent progress towards meeting DOE's goals.¹⁴
- The International Partnership for Hydrogen and Fuel Cells in the Economy, with CaFCP, DOE and NREL, held a workshop focused on realistic, practical business issues faced by fuel retailers¹⁵ Attendees identified key challenges and opportunities for market implementation through discussions and analysis of a fuel retailers focus group regarding hydrogen business case scenarios.
- UC Davis and UC Irvine published reports and released tools that provide analysis and planning guidance for hydrogen fuel cell vehicle commercialization, including station placement analysis, infrastructure network cost assessment and air quality and greenhouse gas emissions modeling.^{16, 17, 18, 19}
- The F-STEP program, California's emergency response training and education program for all alternative fuels, integrated CaFCP's hydrogen training materials for first responders, making it part of the state-wide training program for all fire departments.

Numbers of Vehicles

CaFCP conducts annual surveys of its automaker members to gain an accurate projection of planned vehicle deployments in the coming years. The surveys yield information that individual automakers would not normally make publicly available given the highly competitive environment of new vehicle development and commercialization. In December 2009 CaFCP conducted its second annual survey. The results show trends similar to the 2008 survey, confirming automaker plans for hundreds, thousands and then tens of thousands of fuel cell vehicles. Table B presents a summary of CaFCP's 2009 automaker survey results for passenger FCVs, which are consistent with CEC and CARB's recent automaker survey.²⁰

¹³ NREL hydrogen and fuel cells research http://www.nrel.gov/hydrogen/cdp_topic.html

¹⁴ US DOE Fuel Cell Technologies Program accomplishments and progress
www1.eere.energy.gov/hydrogenandfuelcells/accomplishments.html

¹⁵ IPHE Infrastructure Workshop www.iphe.net/workshops.html

¹⁶ Roadmap for Hydrogen and Fuel Cell Vehicles in California: A Transition Strategy through 2017
http://www.cafcp.org/sites/files/H2-FCV_Roadmap%20Report_FINAL_21dec09.pdf

¹⁷ An Analysis of Near-Term Hydrogen Vehicle Rollout Scenarios for Southern California
http://pubs.its.ucdavis.edu/publication_detail.php?id=1370

¹⁸ Systematic Planning to Optimize Investments in Hydrogen Infrastructure Deployment, S. Stephens-Romero, T. Brown, J. Kang, W. Recker, S. Samuelsen. *International Journal of Hydrogen Energy* (in Press)

¹⁹ Determining Air Quality and Greenhouse Gas Impacts of Hydrogen Infrastructure and Fuel Cell Vehicles
pubs.acs.org/doi/pdf/10.1021/es901515y

²⁰ 2010-2011 Investment Plan For The Alternative And Renewable Fuel And Vehicle Technology Program, Jan. 2010
www.energy.ca.gov/2010publications/CEC-600-2010-001/CEC-600-2010-001-SD.PDF

TABLE B: 2009 CaFCP FCV Deployment Survey Results: Passenger FCVs in Operation

| | Hundreds | Thousands | Tens of thousands |
|---------------------------|--------------|-----------|-------------------|
| | Through 2012 | 2013-2015 | 2016-2018 |
| Total Passenger Vehicles* | 450 | 4,200 | 54,300 |

* Total number projected on the road at the end of each timeframe

In 2010, a collaboration of five San Francisco Bay Area transit agencies will begin operating a fleet of 13 fuel cell buses. SunLine Transit in Palm Springs and the City of Burbank will also operate fuel cell buses. To meet CARB's zero-emission bus (ZBus) regulation requirements, 10 California transit agencies are expected to start purchasing zero-emission buses as 15% of their fleet purchases in just a few years. Table C shows the number of fuel cell buses expected in each phase, based on the numbers required in regulation and transit agencies' reported plans.

TABLE C: Number of Fuel Cell Buses Based on Transit Agency Plans and ZBus Regulation

| | Field Testing | Full-scale Demonstration | Commercialization |
|-----------------|---------------|--------------------------|-------------------|
| | 2009-2011 | 2012-2014 | 2015-2017 |
| Number of FCBs* | 15 to 17 | 20 to 60 | 60 to 150 |

* Total number projected on the road at the end of each timeframe

Next Steps: Position California for Success

CaFCP has identified specific steps that industry and government need to take in 2010 and 2011 to continue California's leadership in bringing fuel cell vehicles to the commercial market. Most prominent is the need to fund additional hydrogen stations so communities will be prepared and automakers can offer vehicles to more customers. It is important that government enable the retail sales of hydrogen as fuel, invest in early hydrogen infrastructure and better coordinate the regulations impacting fuels and vehicles. Steps are also needed to support the private sector as they develop viable business strategies for hydrogen fuel stations so future public funding can be reduced and ultimately eliminated. These and other actions are geared to support a launch of the commercial market in 2015. CaFCP plans to issue subsequent reports to detail additional needs and actions as commercialization proceeds.

Immediate Station Needs

The action plan identifies early market clusters in Los Angeles County, Orange County, Sacramento and the San Francisco Bay Area. CaFCP's 2009 vehicle survey confirmed that these

communities will be the locations where automakers expect to engage their first fuel cell vehicle customers. The eight new hydrogen stations opening in the next year (see Table A) will support the first customers, but will fall short of needs after 2011.

Automakers and transit agencies identified seven new stations needed in specific communities before 2012, and four existing stations that need upgrades, expansions or extended operations. Table D lists the locations of new and upgraded stations needed by the end of 2011.

Table D: Additional Hydrogen Stations or Upgrades/Expansion Immediately Needed*

| County | Cluster area | Community | Operator | Capacity (kg/day) | Note |
|-------------------|-------------------|---|-----------------|------------------------------|------------------------------|
| Los Angeles | Network connector | Burbank | City of Burbank | 116 | Provide O&M support |
| | Santa Monica | West LA | Shell | 30 | Expand capacity and pressure |
| | | <i>Santa Monica</i> | <i>TBD</i> | <i>100</i> | <i>New station</i> |
| | | <i>Beverly Hills</i> | <i>TBD</i> | <i>100</i> | <i>New station</i> |
| | Torrance | <i>Beach area (Redondo, Hermosa, Manhattan)</i> | <i>TBD</i> | <i>100</i> | <i>New station</i> |
| Network connector | Diamond Bar | SCAQMD | 12 | Expand capacity and pressure | |
| Orange | Irvine | Irvine | UCI | 25 | Expand capacity |
| | | <i>Irvine</i> | <i>TBD</i> | <i>100</i> | <i>New station</i> |
| | | <i>Laguna Niguel/Hills</i> | <i>TBD</i> | <i>100</i> | <i>New station</i> |
| Sacramento & Yolo | Sacramento | <i>Sacramento/West Sacramento</i> | <i>TBD</i> | <i>100</i> | <i>New station</i> |
| Alameda | Bay area | <i>Oakland (transit station)</i> | <i>TBD</i> | <i>180</i> | <i>New transit station</i> |

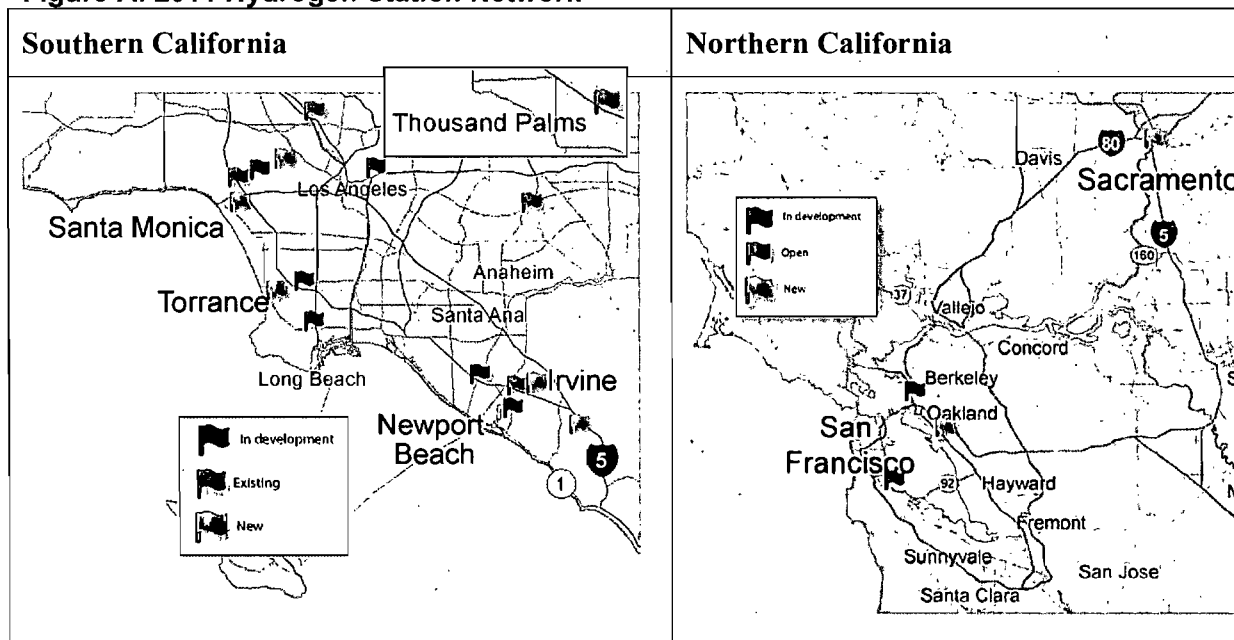
* Station needs identified by CaFCP automakers and transit members. If a new station or upgrade need cannot be met, another equivalent station in approximately the same location will be required. Automakers and transit agencies should be closely involved in station placement decisions, for while there is some flexibility in placement the inability to secure one location can have profound impacts on the infrastructure network and commercialization activities.

Automakers identified these locations as best suited to provide “home” stations to their first customers, including existing stations that can be upgraded or expanded to meet customer needs. The goal is to maximize station utilization, make the best use of limited funding, and provide adequate fuel and convenience for customers. The current transit-only station in Oakland will close at the end of 2010 and a new station needs to take its place. If one or more of the recommended existing stations cannot be upgraded or expanded, a new station in close proximity will need to take its place in the network to successfully deploy vehicles.

These stations, along with existing stations and those in development, will provide sufficient fueling opportunities and convenience for the first customers. Stations within each cluster form a network that will enable customers to use a fuel cell vehicle as their primary vehicle. Specific

locations are important in a small station network, as moving any one piece can impact the whole network. Figure A shows the locations of the California network in Northern and Southern California.

Figure A: 2011 Hydrogen Station Network



Currently, hydrogen stations open 12-24 months from the funding date, meaning these 11 stations must be initiated immediately so they are open by the end of 2011. Infrastructure development funding, including the \$22 million for hydrogen stations described in the *2009-2010 Investment Plan For The Alternative And Renewable Fuel And Vehicle Technology Program*, should focus on the locations listed in Table D.

With each new round of stations funded and opened, and with more customers driving fuel cell vehicles, the network must grow and evolve. CaFCP will monitor progress and conduct annual surveys to identify gaps and opportunities in the station network. This dynamic process will help ensure that future funding, such as the \$14 million proposed in the draft 2010-2011 Investment Plan,²¹ will be targeted toward the most important next investments and actions needed to move commercialization forward.

Retail Station Criteria

New and upgraded stations must be retail-ready, providing best-available commercial technology and a customer experience similar to (or better than) fueling at retail gasoline stations. CaFCP has defined these new stations as “showcase stations;” using practical retail criteria even as

²¹ CEC 2010-2011 Investment Plan, draft staff report www.energy.ca.gov/2010publications/CEC-600-2010-001/CEC-600-2010-001-SD-REV2.PDF

standards development organizations work to finalize commercial standards. Showcase stations offer:

- Retail customer experience—similar to existing gasoline/diesel/E85 stations, including reasonably priced hydrogen, no fueling agreements and locations near home or work.
- Right sized and ready for growth—capable of supplying at least 100 kilograms of hydrogen a day to provide sufficient fuel for the first customers and maximize throughput for the retailer. Growing vehicle deployments will strain supply, so new station capacities should increase over time and all stations should be expandable.
- Retail-oriented technology—the latest technology for dispensing hydrogen fuel, meeting current codes, standards and guidelines, including those published by SAE, ASTM, NFPA, DMS and others.

Additional Needs and Activities

Commercial launch in 2015 will require more than building stations. CaFCP members have identified other actions that need to be started or concluded in 2010 and 2011 to ensure successful rollout.

Synchronize and augment regulations and policies

As government increases focus on reducing greenhouse gas emissions, improving air quality and reducing dependence on petroleum, federal, state and local agencies are harmonizing regulations and policies and considering new ways to reach goals.

- The California Air Resources Board staff will propose renewable hydrogen regulations to the Board in October 2010; propose updates of the regulations for Zero-Emission Vehicles in late 2010 and Zero-Emission Buses in 2011; and evaluate how the Clean Fuels Outlet and other programs can be optimized to help ensure hydrogen and other alternative fuels are available to customers as vehicles enter the market.
- In 2010, through the Annual Merit Review and working with the International Partnership for Hydrogen and Fuel Cells in the Economy, the U.S. Department of Energy plans to continue coordinating information and learnings from fuel cell and hydrogen programs worldwide, including Germany, Japan and Korea, to promote early market commercialization of fuel cells for material handling, stationary power and vehicles
- The U.S. Department of Transportation, Federal Transit Administration, will finish the research and analysis phase of its Electric Drive Strategic Plan in 2010. The plan defines a five-year electric drive research plan in the context of a 20-year strategic outlook to provide guidance toward public transit electrification, including fuel cell buses.
- The California Energy Commission will issue their first solicitation for funding hydrogen stations by mid-2010 and will finalize their 2010-2011 Investment Plan supporting multiple fuel pathways, including hydrogen, to achieve the State's energy and climate goals.

Complete codes and standards for retail sales of hydrogen

Codes and standards for all fuels and fueling technologies continue to be developed and refined. For hydrogen, it is important to finish the first codes and standards for fuel metering and quality so that hydrogen can be a retail fuel. CaFCP and its members will continue to participate in the standards development process with specific goals that include:

- The National Institute of Standards and Technology will propose changes to Handbook 130²² and 44²³ in June 2010, enabling the National Conference of Weights and Measures to approve these changes in 2011 and allow the retail sale of hydrogen.
- California Division of Measurement Standards, with support from NIST and the U.S. National Working Group and funding from CEC, expects to finalize hydrogen metrology standards by early 2011.
- ISO and SAE expect to publish draft hydrogen quality standards by late 2010.
- ASTM will publish supporting hydrogen quality analytical standards, in addition to those already published, and initiate round-robin testing with DOE by the end of 2010.

Support business models developed by the private sector

To be successful, all new technologies require a path to profitability that is self-sustaining and does not require support from government or ratepayers. CaFCP will continue to collect and share real-world information so stakeholders and entrepreneurs can begin developing business models for retail hydrogen infrastructure. In 2010 and 2011, CaFCP and its members will:

- Collect and distribute vehicle and station deployment data so current and future station owners can accurately project growing fuel demand.
- Conduct land surveys in early market communities to identify new station opportunities.
- Align hydrogen station technical information and real-world data with fuel retailers' needs so industry can develop business models for hydrogen as a transportation fuel.
- Identify synergies among fuel cells for material handling, stationary power and transportation that businesses can use in developing new models.
- Investigate long-term financing models that move away from government support toward private industry financing, including methods that other countries are using to build hydrogen infrastructure (e.g. infrastructure challenge grants, trust funds, tax exemptions, revenue bonds and/or public and private land donations).

Support early market communities

Hydrogen and fuel cell projects can help communities reduce environmental impacts, improve resource efficiency, use local renewable energy sources and develop green jobs. Increasing

²² Handbook 130 ts.nist.gov/WeightsAndMeasures/h130-06.cfm

²³ Handbook 44 ts.nist.gov/WeightsAndMeasures/h44-07.cfm

awareness and support at the local level will enable communities to develop these projects sooner. To support communities, CaFCP will:

- Refine and implement the Community Hydrogen Action Plan in the six early market communities identified in the action plan
- Work with other community-based groups such as DOE Clean Cities, California Electric Transportation Coalition and environmental organizations to provide information and coordinate activities
- Continue outreach and education of local leaders and the general public

Conclusion

CaFCP members have made significant progress toward the commercial launch of hydrogen fuel cell vehicles. FCVs have achieved range and performance comparable to conventional vehicles, developers have reduced size and cost, and some automakers have started serial production. The first retail-oriented hydrogen stations have been funded and are in development, with additional infrastructure funding expected by mid-2010. Standards development organizations have begun publishing codes and standards, public agencies began harmonizing regulations and policies, and universities have developed new reports and tools to further analyze and assess rollout strategies.

Progress must continue if California is to retain leadership in fuel cell vehicle commercialization, bringing environmental and economic benefits, including a potential 25,000 new jobs the DOE estimates the industry could create.²⁴ This report identifies actions needed in 2010 and 2011:

- Fund the identified seven new and four existing retail-ready “showcase” stations
- Synchronize and augment regulations and policies
- Complete codes and standards for retail sales of hydrogen
- Support business models developed by the private sector
- Support early market communities

Commercialization is a dynamic process that requires current information and effective communication among all stakeholders. CaFCP and its members are collaborating to inform, assess and refine future activities needed to stay on track towards the launch of a commercial fuel cell vehicle market in 2015.

²⁴ Department of Energy. *Effects of a Transition to a Hydrogen Economy on Employment in the United States Report to Congress*. July 2008, www.hydrogen.energy.gov/pdfs/epact1820_employment_study.pdf

Appendix A: Scenario for Hydrogen Station Rollout in California 2010-2011

The following table provides the retail station scenario for existing, upgraded, in development and newly proposed hydrogen stations outlined in this document. Details include expected supply in kg/day and the expected status of each station by the end of each year. Stations that are not open to all automaker vehicles or are expected to close in 2010 are not listed.

| County | Cluster Area | Community | Operator | 2010 | 2011 | Pressure (MPa) | Capacity (kg/day) | Note |
|---|--------------|----------------------------|------------|-------------|-----------|----------------|-------------------|--------------------------|
| Los Angeles | Santa Monica | West LA | Shell | Open | Open | 35 | 30 | Expand capacity/pressure |
| | | Westwood | UCLA | Development | Open | 35/70 | 140 | |
| | | Santa Monica | | New | Open | 35/70 | 100 | |
| | | Beverly Hills | | New | Open | 35/70 | 100 | |
| | Torrance | Harbor City | Mehtahi | Development | Open | 35/70 | 100 | |
| | | Torrance | Shell | Development | Open | 35/70 | 50 | |
| | | Beach area | | New | Open | 35/70 | 100 | |
| | Connector | Diamond Bar | SCAQMD | Open | Open | 35* | 12 | Expand capacity/pressure |
| | | Los Angeles | CSULA | Development | Open | 35/70 | 60 | |
| | | Burbank | Burbank | Open | Open | 35/70 | 116 | Provide O&M support |
| Orange | Irvine | Irvine | UCI | Open | Open | 35/70 | 25 | Expand capacity |
| | | Irvine | | New | Open | 35/70 | 100 | |
| | | Laguna Niguel/Hills | | New | Open | 35/70 | 100 | |
| | | Newport Beach | Shell | Development | Open | 35/70 | 100 | |
| | Connector | Fountain Valley | OCSD | Development | Open | 35/70 | 100 | |
| Sacramento/Yolo | Sacramento | Sacramento/West Sacramento | | New | Open | 35/70 | 100 | |
| SF/Alameda | SF Bay Area | South San Francisco | SFO | Development | Open | 35/70 | 120 | |
| | | Emeryville | AC Transit | Development | Open | 35/70 | 60/200* | FCV and transit |
| | | Oakland | | New | Open | 35 | 0/150* | Transit only |
| Other | Destination | Thousand Palms | SunLine | Open | Open | 35 | 60/100* | |
| Total operational stations (anticipated) | | | | 12 | 20 | | | |

* FCV/transit supply

Open – operational

Development – previously funded and in development as of April 2010

New – proposed locations for 2010 funding