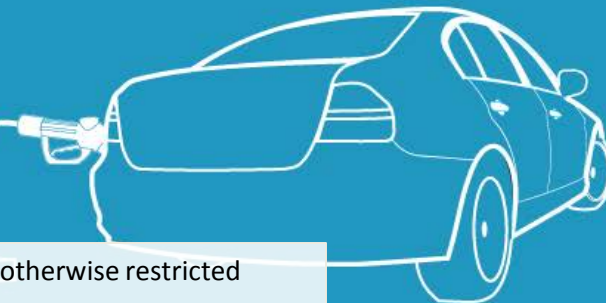
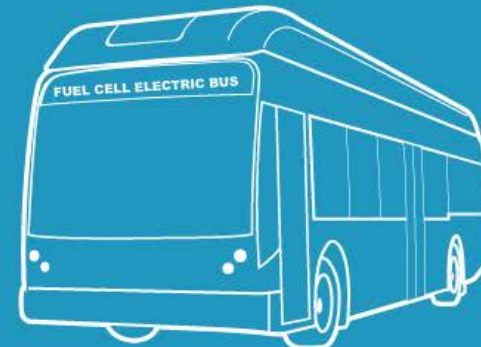


# Station Operational Status System (SOSS) 3.0 Upgrade

2014 DOE Hydrogen and Fuel Cells Program Review

June 11, 2015

PI: Ben Xiong, California Fuel Cell Partnership  
Operated by Bevilacqua Knight, Inc.



# Overview

## TIMELINE

- Start: June 1, 2014
- End: May 31, 2015\*
- 75% complete

## BUDGET

- Total project funding: \$200,000
- DOE share: \$155,000
- Contractor share: \$45,000
- Funding received in FY14: \$155,000

\* Funded project end time

## BARRIERS (D)

- Integration of complex systems
- Lack of Hydrogen Refueling Infrastructure Performance and Availability Data

## PARTNERS

- Funders
  - See Partners slide
- Collaborators
  - See Collaborations slide
- Developers
  - ImageX Media



# Relevance

## **OBJECTIVE:**

Upgrade SOSS to: a) improve user interface and data quality; b) increase data transmission interval from stations (once every 15 minutes at minimum) and data sharing capabilities.

## **IMPACT:**

Enhance access to hydrogen station status information by increasing the frequency and quality of data and improving user interface, thereby improving customer satisfaction and station demand.



# Approach - Steps/Phases

## PROJECT PHASES

- **Phase 1 (2010-2014):** SOSS 1.0 and SOSS 2.0 (completed)
  - Manual and automatic reporting of station status
  - Small number of station participation
- **Phase 2 (2014-2015):** SOSS 3.0 (current)
  - All automatic reporting of station status
  - Consistent and defined criteria
  - 15 minutes or less reporting intervals
  - **Go/No-Go:** Get 60% of open stations on SOSS
- **Phase 3 (2015 – beyond):** SOSS 4.0 (future)
  - Real-time reporting
  - Hardware upgrades

# Approach - Overview

## Station Operational Status System (SOSS)

### HOW IT WORKS

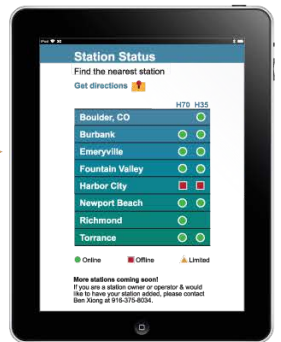


About every 15 minutes, stations send information to CaFCP's database.



CaFCP's secure server and station database

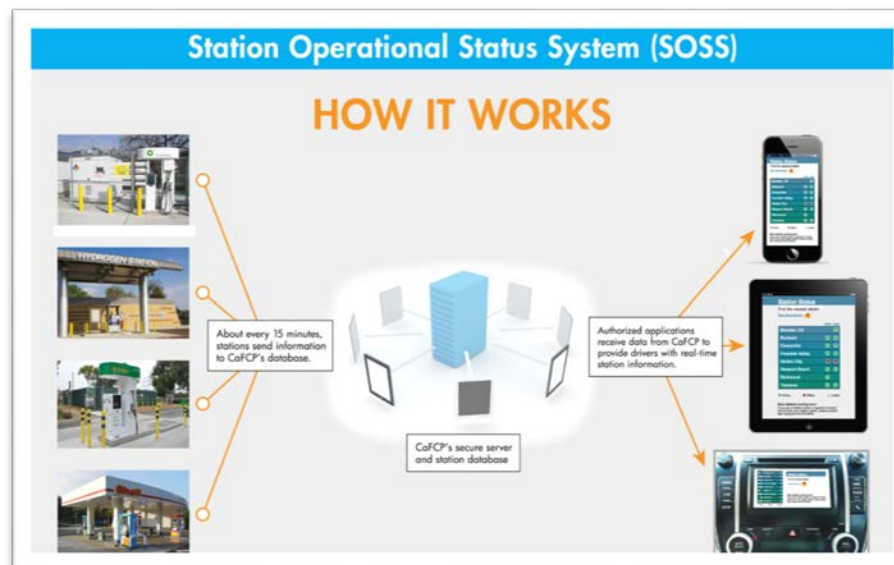
Authorized applications receive data from CaFCP to provide drivers with real-time station information.





# Approach - Components

- Linux, Apach, MySQL, PHP based web server
- User interface
  - Google map interface
  - Mobile online interface
  - SMS/Email notification
- System at each station to transmit operational status

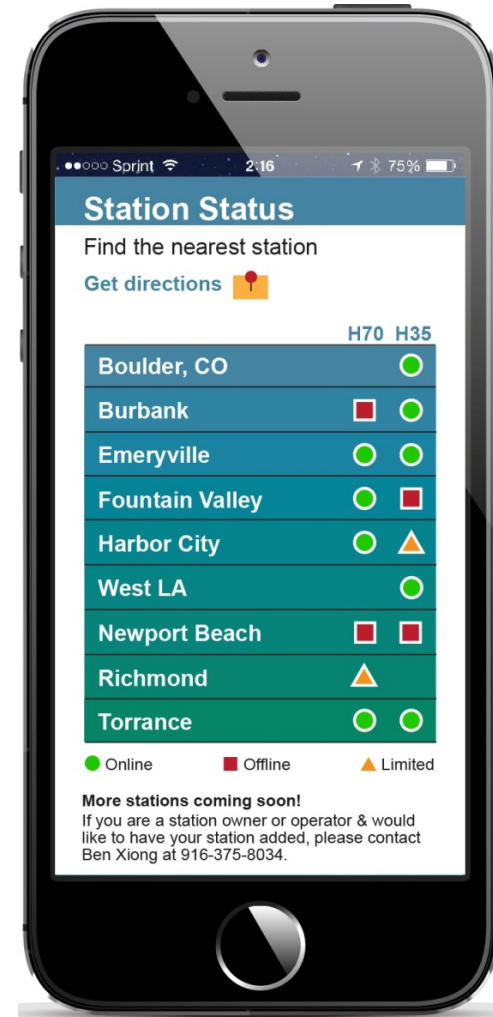


# Accomplishments

- Improved user interface
  - Google map interface
  - Mobile online interface

## My account

Title	All	SMS	Email	H35	H70	Online	Offline	Limited
Emeryville - AC Transit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Burbank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Torrance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Los Angeles - West LA 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fountain Valley - OCSD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Newport Beach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



<http://m.cafcp.org>



# Accomplishments (2)

## Station Status Criteria

### ONLINE

- Station can deliver SOC > 90%
- Boost compressor online
- High pressure storage online
- Chiller online
- H2 source online
- POS online

### LIMITED

- Station can still deliver fuel but SOC ≤ 90%
- Boost compressor offline
- High pressure storage offline
- Chiller online
- H2 source offline
- POS online

### OFFLINE








- Station cannot deliver fuel
- Boost compressor offline
- High pressure storage offline
- Chiller offline
- H2 source offline
- POS offline

### Acronyms

SOC: State of charge

POS: Point of sale

H2: Hydrogen

Newport Beach		
Torrance		
	 Online	 Offline
		 Limited





# Accomplishments (3)

## ✓ Tasks 1-4: Completed

- ✓ Project plan, Member agreement on customer focused criteria, Identify and secure resources, Implement code changes (including testing)

## □ Task 5: Status of implementation at current stations (*by June 2015*)

- ✓ Burbank (H2 Frontier) completed
- X West LA (Shell/Hydrogenics) decommissioned
- X Emeryville (Linde) no upgrade/workaround
- Fountain Valley (APCI) in progress
- Boulder, CO (NREL) in progress
- Torrance (Shell/APCI) in progress
- Newport Beach (Shell/Powertech) in progress





# Response to Reviewers' Comments

- New project – not reviewed before





# Collaborations

- **CaFCP Partners**

- Car manufacturers (Customer interface and definition dev't)
  - Daimler, Toyota, GM, Honda, Hyundai, Nissan, VW
- Station operators/Developers (SOSS integration & definition dev't)
  - Air Liquide, Air Products, H2 Frontier, Hydrogenics, ITM Power, Linde

- **Other Partners**

- Powertech, Shell



# Partners - CaFCP members

Air Liquide

Air Products

Alameda-Contra Costa Transit District (*AC Transit*)

Automotive Fuel Cell Cooperation

BAE Systems

Ballard Power Systems

Bay Area Air Quality Management District

California Air Resources Board

California Department of Food and Agriculture

California Energy Commission

California State University - Los Angeles

CALSTART

The Center for Energy Efficiency and Renewable  
Technologies (*CEERT*)

Center for Transportation and Environment (*CTE*)

Daimler

Energy Independence Now

General Motors

Honda

Hydrogenics

Hyundai

Institute of Transportation Studies, UC Davis

ITM Power

Linde North America, Inc.

National Fuel Cell Research Center, UC Irvine

National Renewable Energy Laboratory (*NREL*)

Nissan

Powertech Labs

Sandia National Laboratories

South Coast Air Quality Management District

Southern California Gas Company

SunLine Transit Agency

Toyota

U.S. Department of Energy

U.S. Environmental Protection Agency

US Hybrid

University of California, Berkeley

Volkswagen



# Remaining Barriers and Challenges

- Delayed station implementation/rollout
- Hardware standardization
- Security protocol at station
- Knowledge of station operator
- Currently used telematics
- Funding for labor & equipment
- Number of stations expected to come online



# Proposed future work

- ❑ Implementation at new stations (**by Dec 2015**)
  - ❑ West Sacramento (Linde) in progress
  - ❑ CalState LA (CalState LA) in progress
  - ❑ Diamond Bar (SCAQMD/APCI) in progress
  - ❑ Chino (H2 Frontier/ITM Power) planned
  - ❑ Anaheim (Air Liquide) planned
  - ❑ Palo Alto (Air Liquide) planned
  - ❑ LAX (Air Liquide) planned



# Proposed future work (2)

- Solicit new hydrogen stations to participate on SOSS
- User interaction and feedback system
- Mobile native app capabilities
- Implement backup system
- Real-time reporting
- Mobile map interface

Zip Code:  Radius: 5 miles   Filter by: ALL (59) OPEN (8) IN DEVELOPMENT (49) BUS (2)

**Burbank** ●  
145 W Verdugo Avenue,  
Burbank, CA, 91510  
Operational date: 2006-03-17  
Real-time Operational Status  
H35: ONLINE H70: ONLINE  
[View Station page](#)

**Newport Beach** ●  
145 W Verdugo Avenue,  
Burbank, CA, 91510  
Operational date: 2006-03-17  
Real-time Operational Status  
H35: ONLINE H70: ONLINE  
[View Station page](#)

**Cal State LA** ●  
145 W Verdugo Avenue,  
Burbank, CA, 91510  
Operational date: 2006-03-17  
Real-time Operational Status  
H35: ONLINE H70: ONLINE  
[View Station page](#)

**Diamond Bar** ●  
145 W Verdugo Avenue,  
Burbank, CA, 91510  
Operational date: 2006-03-17  
Real-time Operational Status  
H35: ONLINE H70: ONLINE  
[View Station page](#)

**Fountain Valley** ●  
145 W Verdugo Avenue,  
Burbank, CA, 91510  
Operational date: 2006-03-17  
Real-time Operational Status  
H35: ONLINE H70: ONLINE  
[View Station page](#)

\*Estimated operational date – provided for informational purposes only



# Summary

- Planning completed
  - Consensus criteria and minimum time interval
- Development completed
  - Tested and verified functionality
- Implementation completed on server
- Implementation at hydrogen stations in progress
- Multiple partners committed
- Station implementation/rollout delays create barriers
- CaFCP to continue including additional stations
- Next: SOSS 4.0 – real time reporting





# Station Operational Status System (SOSS) 3.0 Upgrade

## Questions & comments?

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