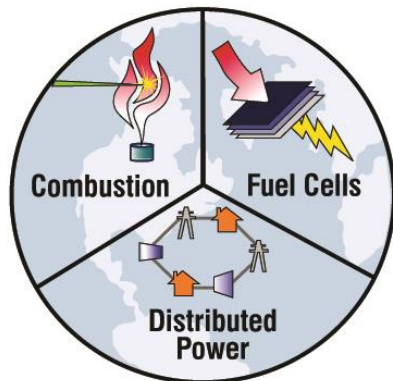


Toyota FCHV-adv Fleet Demonstration and Operations at UC Irvine

Advanced Power and Energy Program
University of California, Irvine



ACT 2014
EXPO
ALTERNATIVE CLEAN TRANSPORTATION

Prepared by:

Kersey S. Manlicic

Jean M. Grigg

Brendan P. Shaffer, P.E.

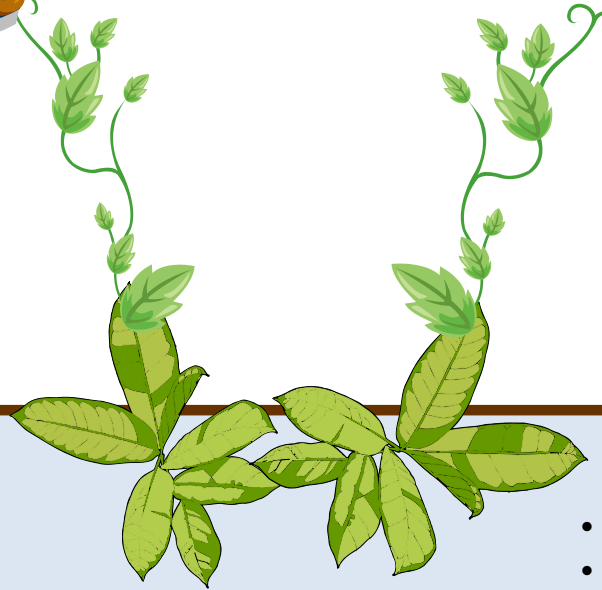
Professor Scott Samuelsen, Ph.D., Program Director

May 6, 2014

Analytical Tools



Practical Applications, Demonstrations, & Deployment



- Toyota
- General Motors
- Honda
- Mercedes-Benz
- Hyundai/Kia
- Nissan

Collaboration


- Linde
- Air Products

- U.S. Department of Energy
- California Energy Commission
- Air Resources Board
- South Coast Air Quality Management District
- U.S. Environmental Protection Agency
- National Renewable Energy Laboratory
- California Fuel Cell Partnership



Toyota Highlander FCHV-adv

- Range ~ 432 miles
- 96 mph top speed
- 90 kW PEM Fuel Cell
- 90 kW Electric Motor
- 6 kg of H₂
- 70 MPa (10,000 PSI) hydrogen storage tanks

A map of the United States with state and city names labeled. The text is overlaid on the central part of the map.

**One of the Largest
fleets in the U.S.**

A photograph of a waterfront residential area in Orange County, CA, with houses and buildings along the water. The text is overlaid on the image.

**Sub-leased to
companies, agencies,
and municipalities in
Orange County, CA**

A close-up photograph of several white SUVs parked in a row. The focus is on the front of the vehicles, showing headlights and grilles. The text is overlaid on the right side of the image.

Fleet ~ 17 FCHV-advs



*Awareness
&
Acceptance*



*Public
Perception
&
Open
Discussion*



*Driver
Behavior
&
Fueling
Logistics*



68

*Facilitate H₂
Refueling
Infrastructure*



*Familiarity
with H₂
Refueling*

Progression

Total Trained Drivers

15

21

29

Miles

116,500+

145,300+

159,500+

4 cars

6 cars

7 cars

Outside Deployment

- CTG Energetics
- Orange County Produce
- UCI Dir. of Transportation
- School of Engineering

- The Irvine Company
- MelRok - Energy Management
- Orange County Produce
- UCI Dir. of Transportation
- School of Engineering

- Air Products and Chemicals
- Orange County Sanitation District (OCSD)
- Beam & Associates
- The Irvine Company
- MelRok - Energy Management
- Orange County Produce
- School of Engineering

Outreach

- PIMCO "Take Your Kids to Work Day"
- LPA Sustainable Office & Showcase
- Saddleback College

- California Hydrogen Business Council trip to OCSD Tri-Gen Hydrogen Refueling Station

- Deputy Sec. of Energy (Dan Poneman)
- Austrian Ambassador (Hans Peter Manz)
- U.K. Minister of Transport (Baroness Susan Kramer)
- ICEPAG Conference
- Shibaura Inst. Of Tech (Japan)
- OLP Elementary School Visit

2011

2012

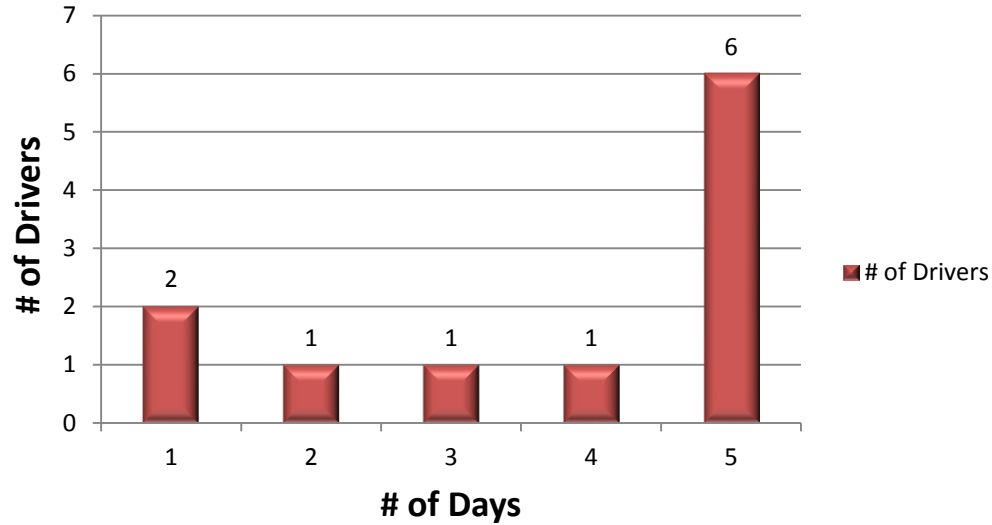
2013



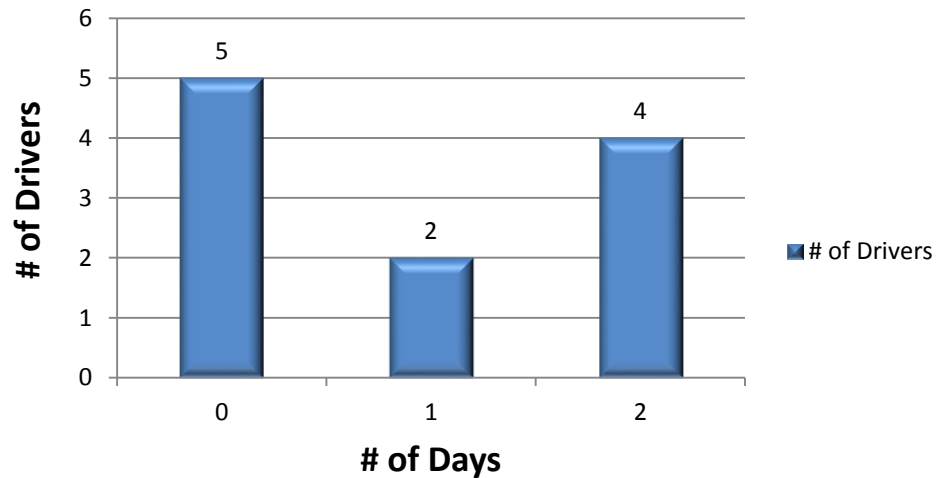
Driver Survey Data

(4th Quarter of 2013)

Weekday Use



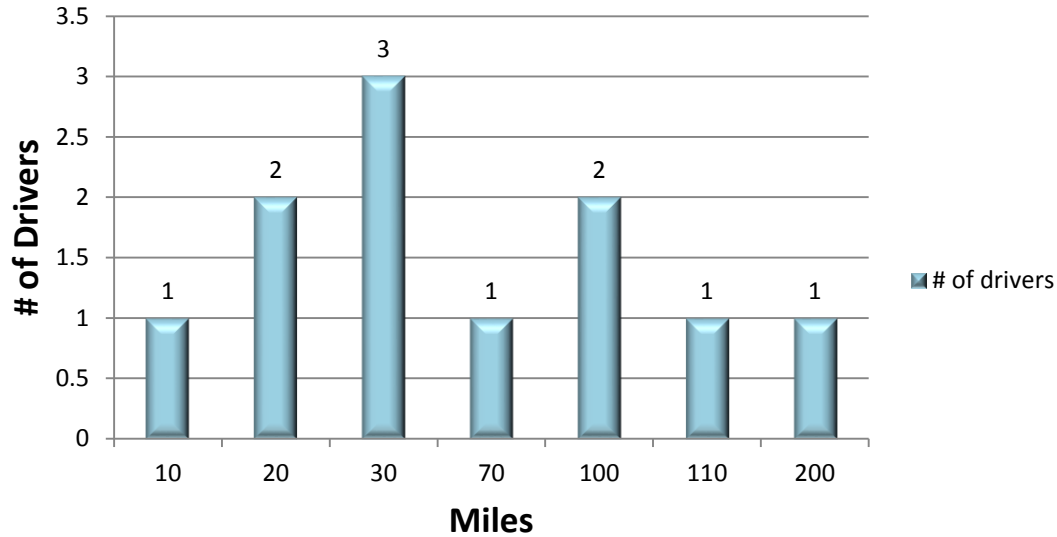
Weekend Use



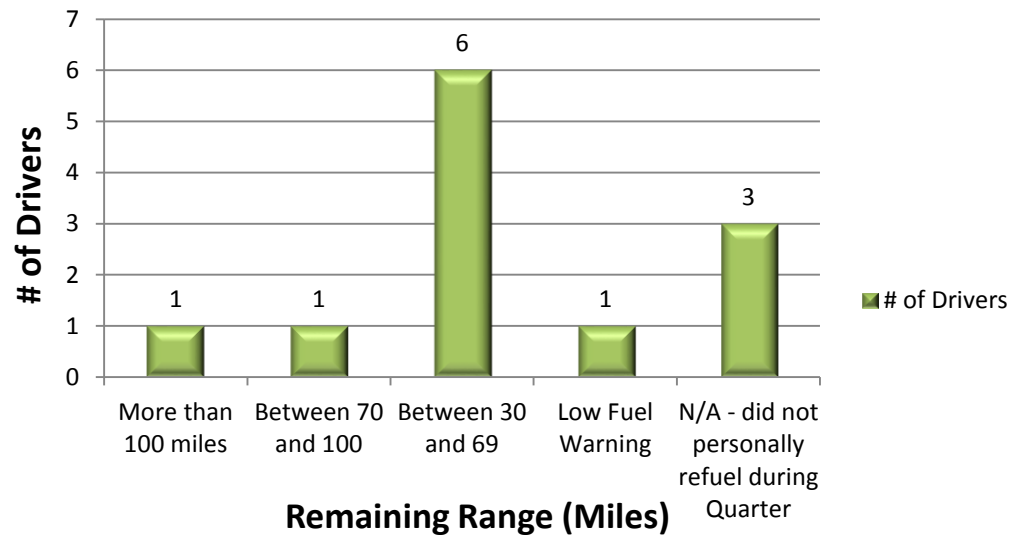
Driver Survey Data

(4th Quarter of 2013)

Miles Driven per Weekday

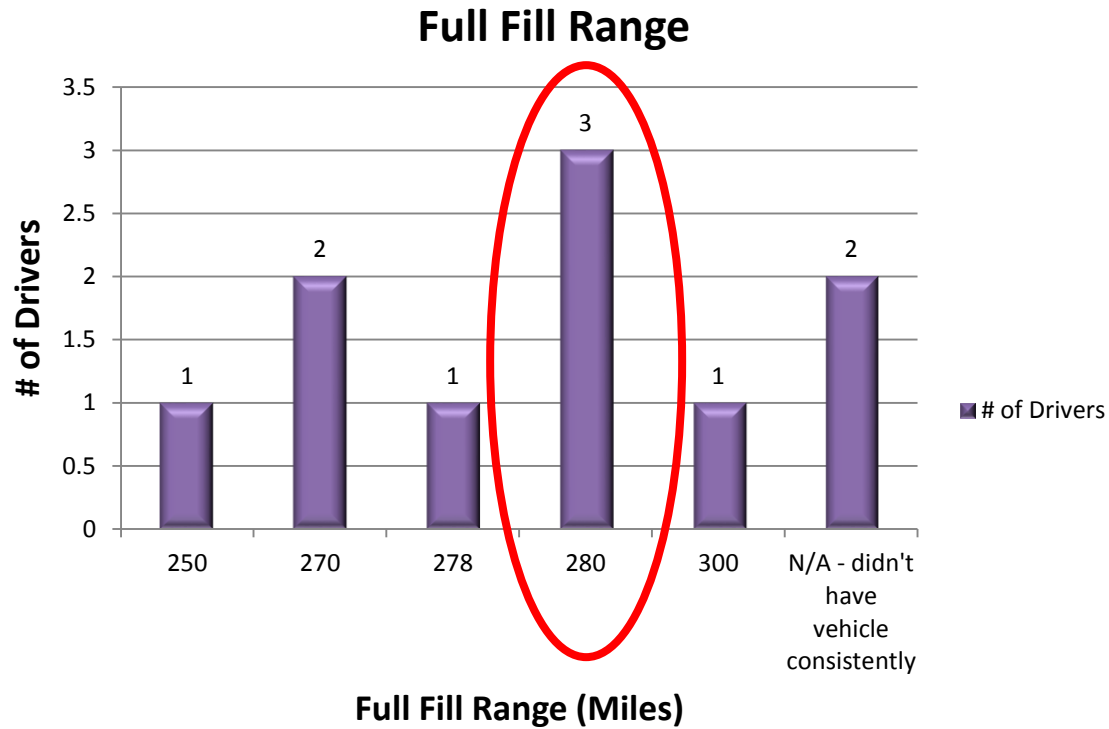


Decision to Refuel



Driver Survey Data

(4th Quarter of 2013)



Driver Survey Data: *Performance*

(4th Quarter of 2013)

City

11/12

Excellent

1/12

Neutral

Hills

4/12

Excellent



2/12

Fair

1/12

Neutral

5/12

N/A



Freeway

10/12

Excellent

1/12

Fair

1/12

N/A

Zero "Poor" or "Somewhat Poor" Reviews 😊

*Were our drivers asked about the cars in public? **Yes!***

Is it 70 MPG?
(Confusion about 70
MPa)

What type of
Fuel?

Cost of Fuel?

Where can I refuel?
(infrastructure)

Is hydrogen
dangerous?

Cost of the car?
(cost of lease?)

How do I get a car?
(Or how did you become
a part of the program?)

Range?

Why Michigan license plates?





Cars



Stations

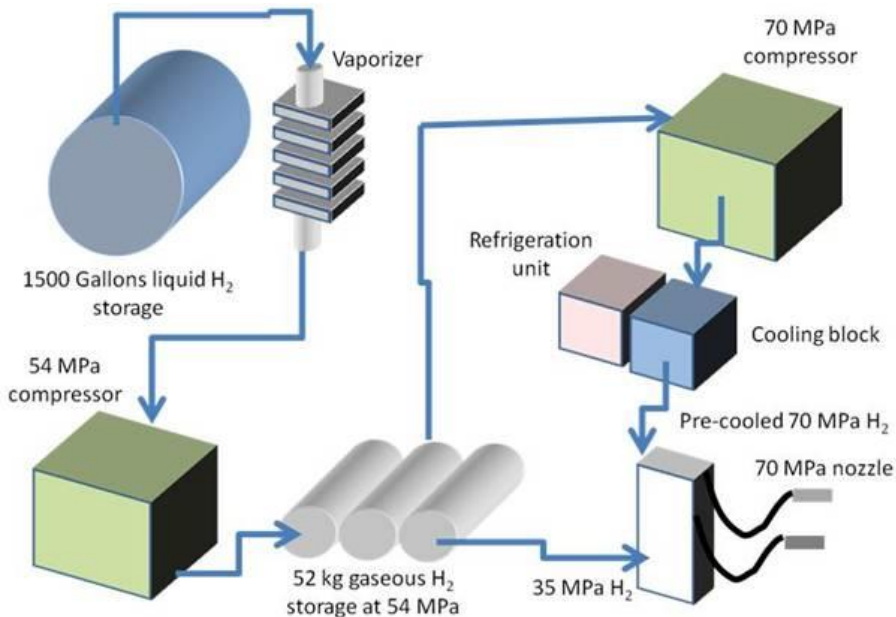


Roadmap:
Infrastructure
Plan

UC Irvine H₂ Refueling Station

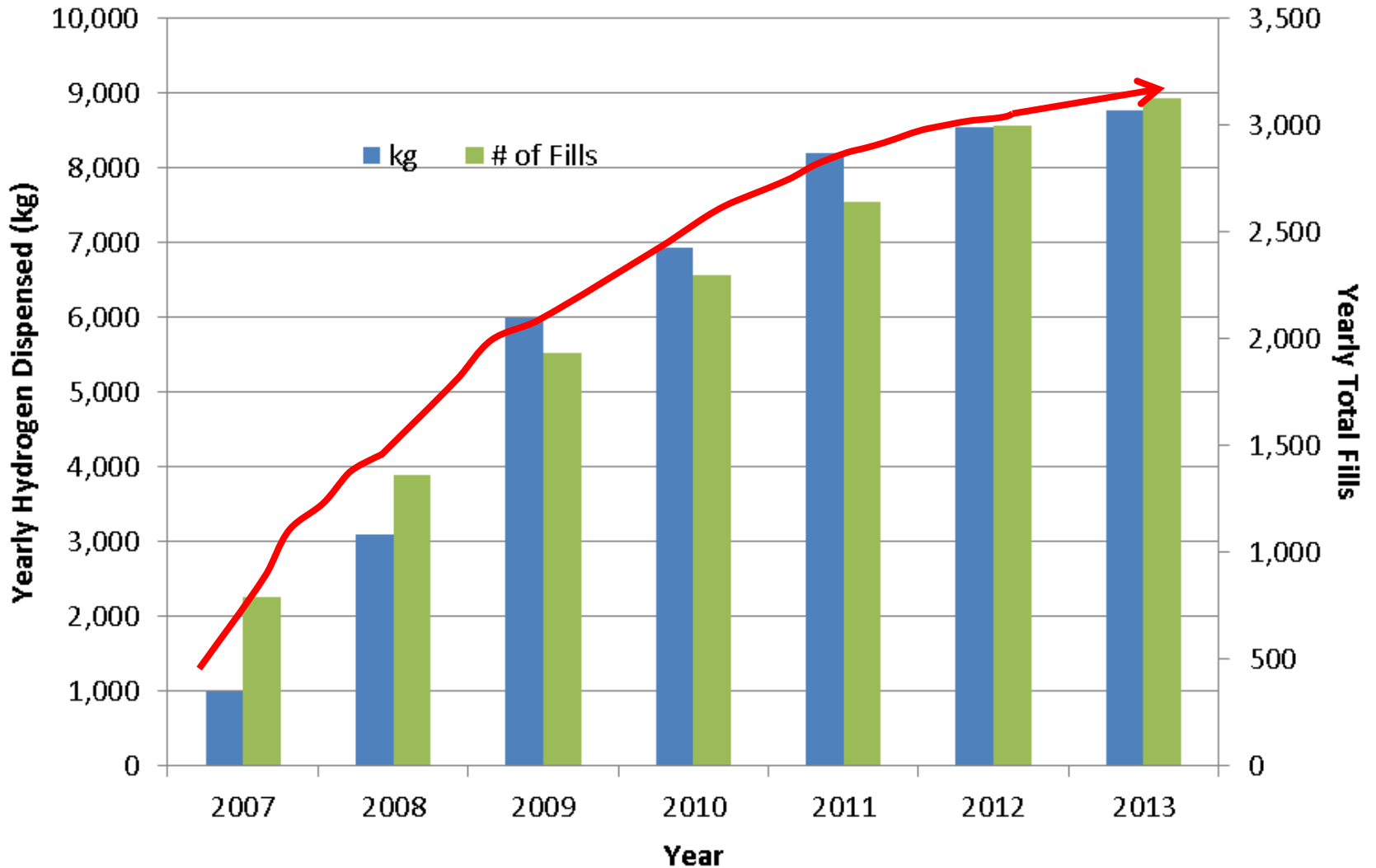
Station characteristics:

- Liquid hydrogen tank
- Hydrogen vaporizer
- Compressor
- Storage vessels
- Dual Dispensing Capability
- Retail-like design
- 24-hour access and operation
- Publicly accessible

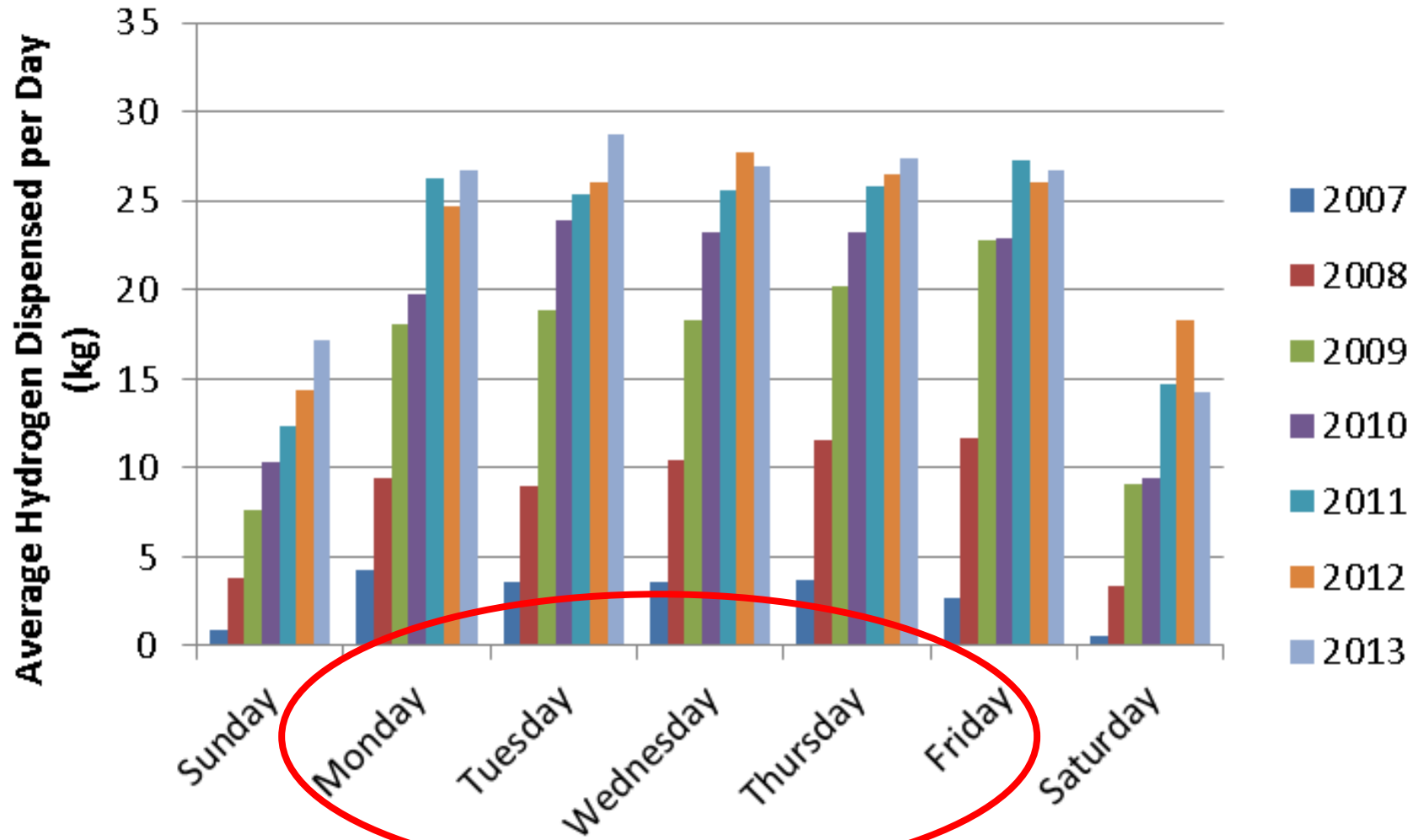


Corner of Campus Drive & Jamboree Rd
Irvine, CA

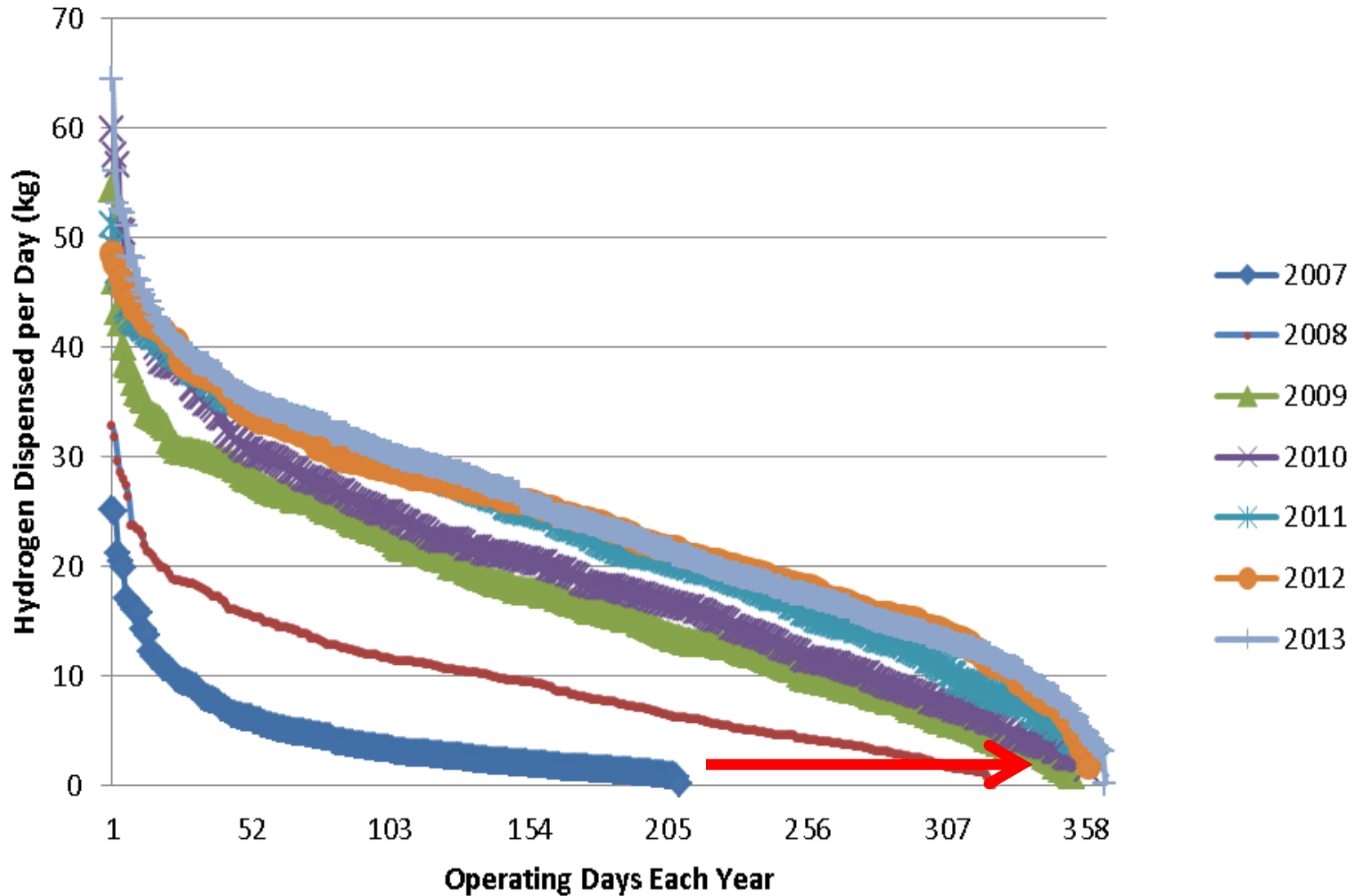
Hydrogen Dispensed



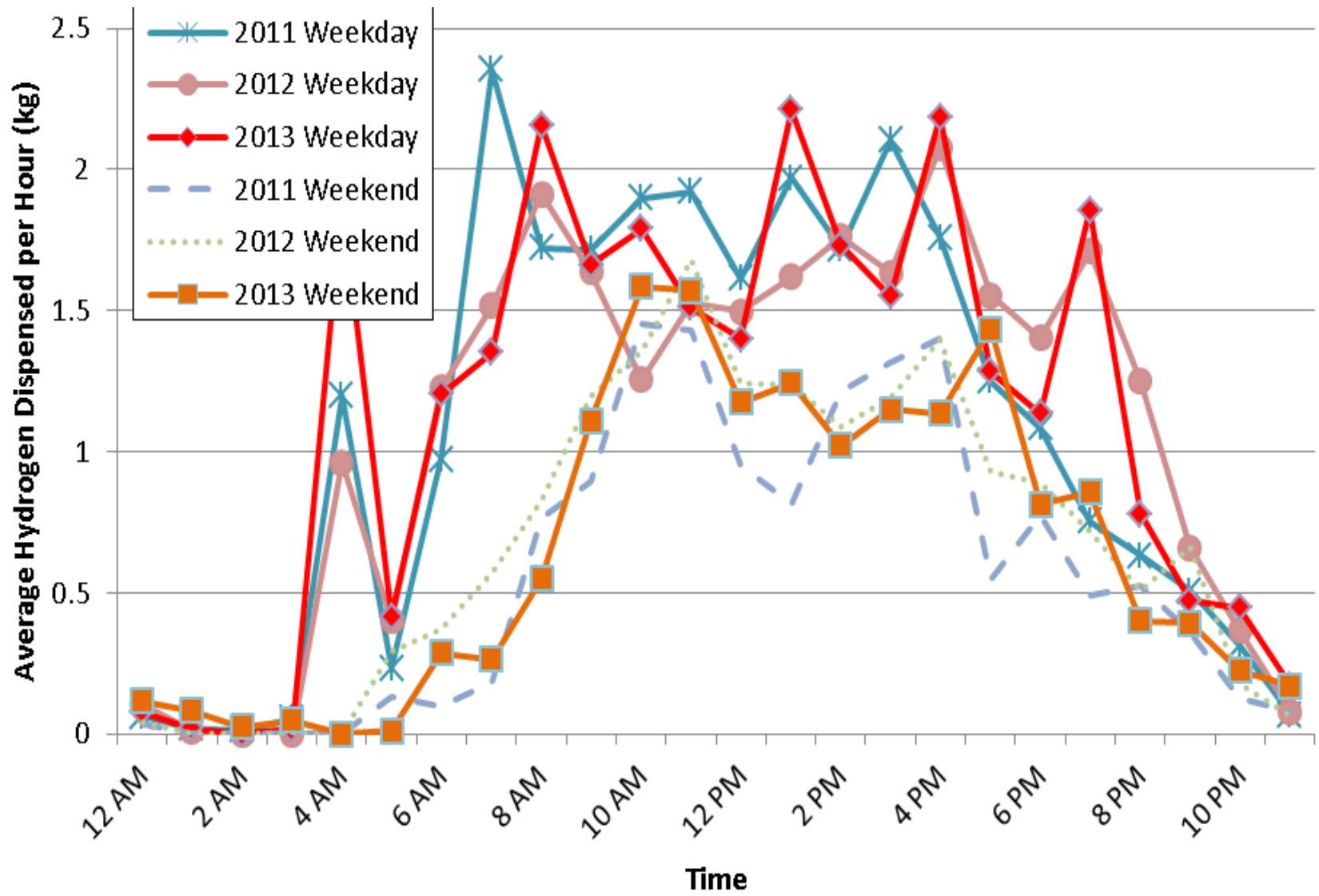
Refueling Days



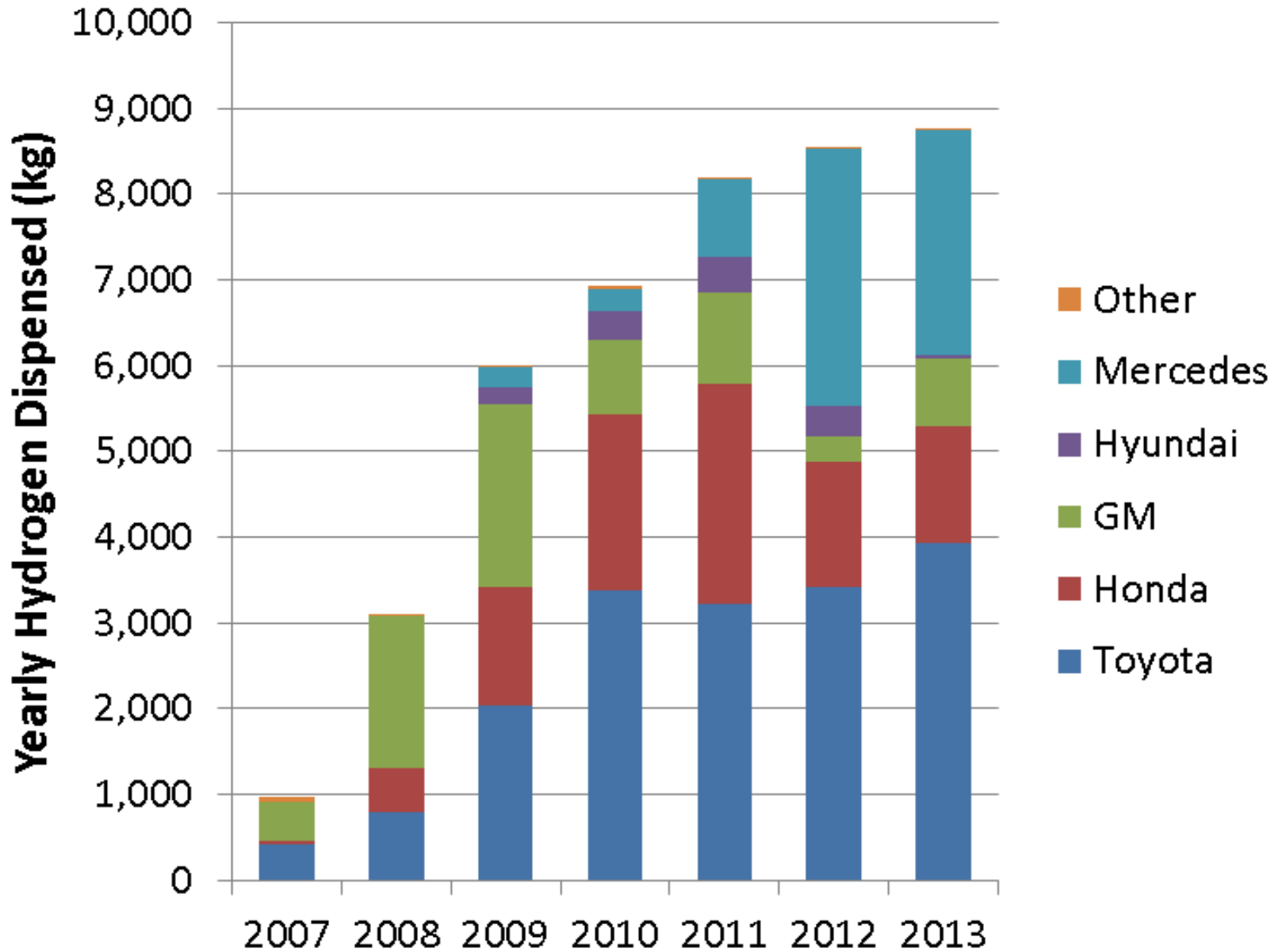
Operation & Reliability



When People Refuel?



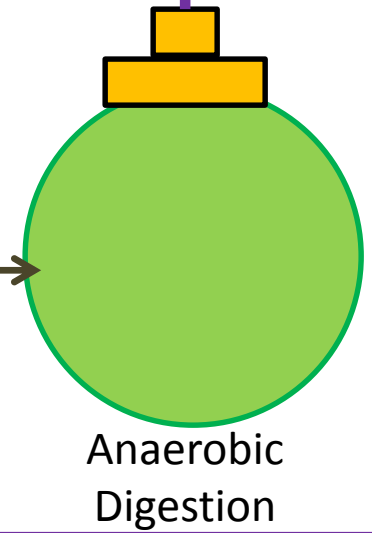
Automaker Usage



Orange County Sanitation District Tri-Generation Fuel Cell System & H₂ Refueling Station



Wastewater
Treatment
Plant
(Aerobic
Digestion)



High Quality Waste Heat

Electricity

Hydrogen



iMessages

Search

Mom 4:15 PM

Can you buy me a fuel cell car?

Mom

Did you remember to thank people during your presentation?

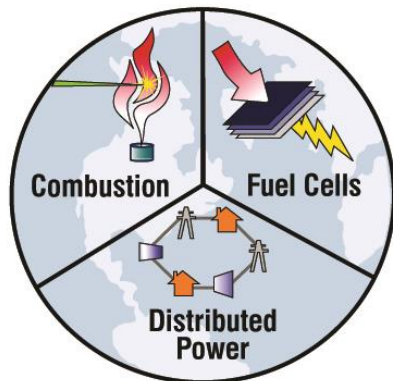
Thanks Mom :/

- Staff and Students at the Advanced Power and Energy Program
 - Prof. Scott Samuelson
 - Jean M. Grigg
 - Brendan P. Shaffer
- CEC
- Toyota
- Automakers
- UC Irvine
- Audience
- OCSD
- Fuel Cell Energy
- Air Products

Where there any questions? 😊

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