DOCKETED	
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Project Title:	Medium- and Heavy-Duty Zero-Emission Vehicles and Infrastructure
TN #:	242310
Document Title:	Cal State LA Hydrogen Research and Fueling Facility Comments - Broader Hydrogen Station Concepts for Educational Institutions
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Comment Received From: Cal State LA Hydrogen Research and Fueling Facility
Submitted On: 3/14/2022
Docket Number: 19-TRAN-02

Broader Hydrogen Station Concepts for Educational Institutions

Additional submitted attachment is included below.

CALIFORNIA STATE UNIVERSITY, LOS ANGELES

COLLEGE OF ENGINEERING, COMPUTER SCIENCE AND TECHNOLOGY

Department of Technology

March 14, 2022
California Energy Commission Dockets Office,
MS-4 1516 Ninth Street
Sacramento, CA 95814-5512

Subject: Comments on the Hydrogen Refueling Concept, Docket # 19-TRAN-02, February 28, 2022 CEC Workshop

Cal State LA Hydrogen Research and Fueling Facility (HRFF) appreciates the opportunity to comment on the California Energy Commission (CEC) Hydrogen Refueling Concept introduced during the February 28, 2022 CEC Workshop (Docket # 19-TRAN-02). HRFF strongly supports the development of Hydrogen Refueling Infrastructure as an important tool to sprout alternatives to large business market domination in hydrogen technologies. To potentially expand the scope of the Hydrogen Refueling program, HRFF would like to offer the following comments for consideration.

--The current hydrogen network has faults due to reliability on delivery of compressed and liquid hydrogen, the future system wide resilience will benefit from introducing alternatives like electrolysis or on-site reformation so that some hydrogen can be provided during system faults.

--Encourage integration of hydrogen fueling network at college/university campuses so that research and workforce training for the hydrogen industry can be accelerated. Thus, exclusions should be made from larger stations to smaller size capacity suitable to campus operations.

--In case of the Cal State LA HRFF, the facility is more than 10 years old and needs to be upgraded to new standards from older T20 fueling protocols (chillers and dispenser). It will also benefit from stanchion, increased storage, gas panel, electrolyzer refurbishments, etc. This could be $2-2.5 M project including most costs. Funding equipment and engineering costs by CEC would be truly appreciated.

--Heavy Duty protocol can be optional for smaller or experimental hydrogen stations as described above.

Thank you very much for your consideration of these comments. We look forward to the release of the solicitations and seeing the hydrogen infrastructure growth that would be supported by this funding. Please don't hesitate to reach out with any questions or clarifications at (323) 343-4569 or blekhman@calstatela.edu.

Sincerely,

David Blekhman

David Blekhman, Professor of Technology
Technical Director, Hydrogen Research and Fueling Facility
2019-2020 Fulbright Distinguished Chair

California Energy Commission

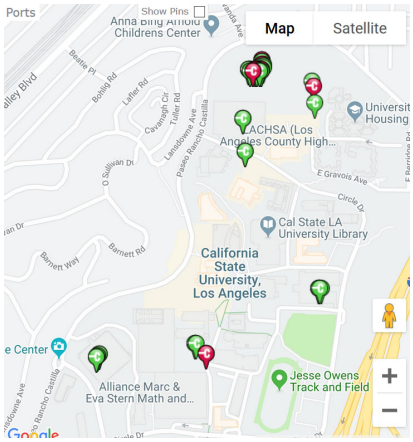
Hydrogen and Clean Transportation Research and Workforce Training

Dr. David Blekhman
California State University, Los Angeles
March, 2022

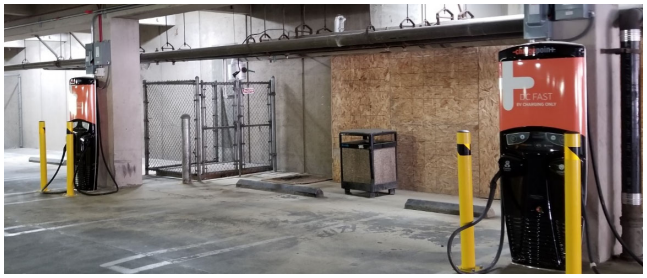
Sustainable Energy and Transportation Lecture-Lab

- **TECH 1000 Introduction to Automotive Mechanisms**
- **TECH 3700 Sustainable Energy and Transportation**
- **TECH 4700 Electric and Hybrid Vehicles**
- **TECH 4710 Engine Design and Performance**
- **TECH 4720 Photovoltaics Applications**
- **TECH 4740 Fuel Cell Applications**
- **TECH 4760 Measurement, Instrumentation and Control**
- **TECH 4880 Fluid Power**
- **TECH 5720 Autonomous Vehicles and Smart Infrastructure**

59 Level 2 and 6 FCDC Charge Point



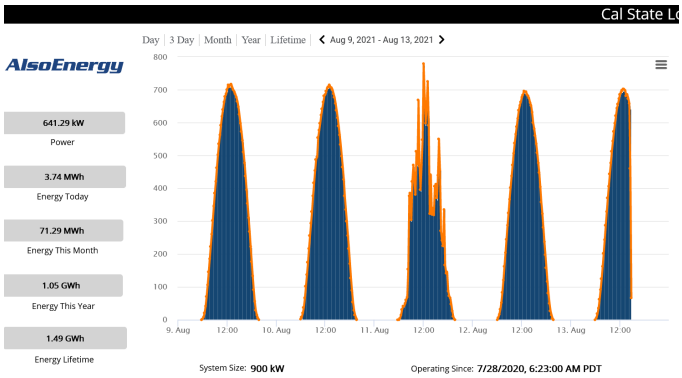
Dept. of Technology (Dr. Blekhman) collaborated with its industry partner Green Commuter and the university offices of Planning and Construction and Parking and Transportation to expand the campus alternative fuels infrastructure with 6 new FCDC by Charge Point. Value ~$300, 000 funded by California Energy Commission.



3 Charge Point FCDC in parking structure B, B level

3 Charge Point FCDC in new parking structure E, 1st level

1 MW Solar on Campus



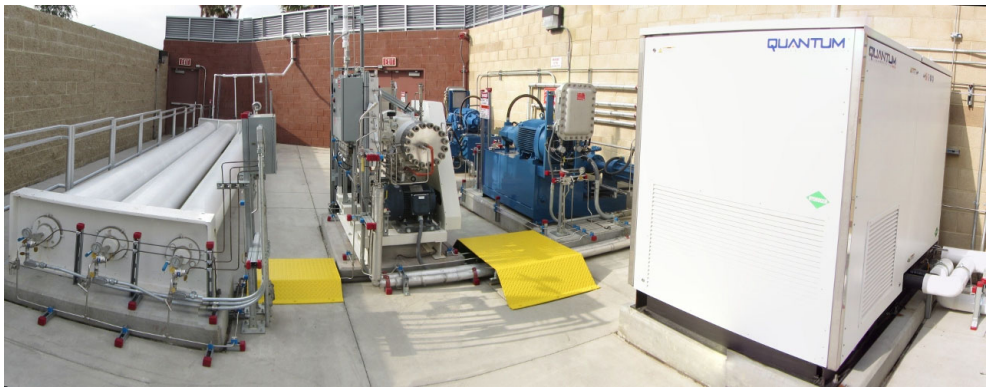
Cal State LA Hydrogen Fueling Facility

Grand Opening:
May 7, 2014

Sponsors:
CARB $2,700,000
DOE $475,750
SCAQMD
MSRC
Ahmanson Foundation
AAA

CSULA Hydrogen Station Specs

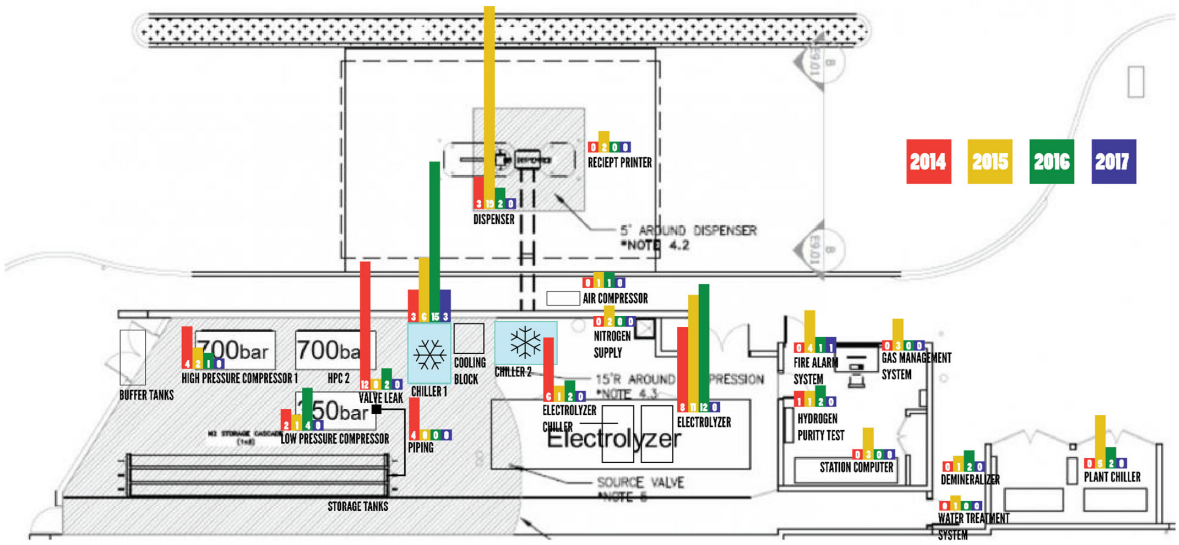
Production: 60 kg/day
Storage: 60 kg
Pressure: 350 and 700 bar
Capacity: 15-20 fuel cell vehicles per day



CSULA Hydrogen Station Map

Failure by Component

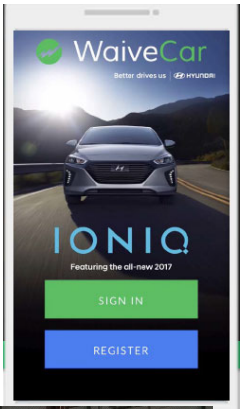
2014-2017



Component	valve leak	electrolyze chiller	piping	gas management system	station computer	demineralizer	booster/ hydropac compressor	PDC compressor (low pressure)	plant chillers	fire alarm system	receipt printer	air compressor	hydrogen purity test	water treatment system	electrolyzer fault	dispenser	nitrogen supply	H2 chiller
2014	12	6	4	0	1	0	4	2	0	0	0	0	1	0	8	3	0	3
2015	0	1	0	3	2	1	2	1	5	4	2	1	1	1	11	19	2	6
2016	2	2	0	0	2	2	1	4	2	1	0	1	2	0	12	2	0	15
2017	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	3
Total	14	9	4	3	6	3	7	7	7	6	2	2	4	1	31	24	2	27

Campus Fleet and Publications

World's first H2 zero emission, zero cost car-sharing program.



Waive

"Empirically Verified Model for a Dual Cooling System Performance in a Hydrogen Station," Piraino Francesco, D. Blekhman, M. Dray, and P Fragiacomo, Renewable Energy (*journal pre-proof, available online 14 October 2020*)

"Hydrogen Losses in Fueling Station Operation," Genovese Matteo, D. Blekhman, M. Dray, and P. Fragiacomo, J of Cleaner Production, *Vol 248*, March 2020.

Dispensing Meter Type Approval, First in the World

CSULA is the first in U.S. to receive seal of approval for sale of hydrogen on per kg basis as of January 2015. Testing was conducted in collaboration with the California Department of Weights and Measures, CAFCP and CARB.

Testing equipment at CSULA Station

Two Firsts for the Cal State LA Station!

First dispenser type approval in the World

First commercial H2 sale by the kg in the World

HySTEP Device Testing

Developed by Sandia and the National Renewable Energy Laboratory (NREL), the Hydrogen Station Equipment Performance device, or HyStEP, could reduce the time to commission new stations from months to just one week.

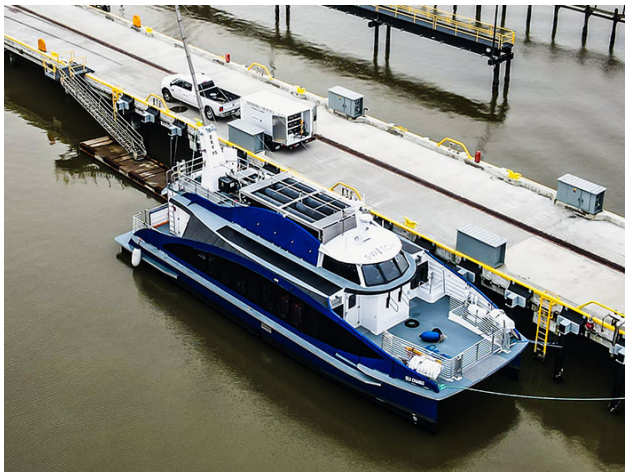
Collaborations: Ebus Development and more German Vehicles

The station is medium and heavy duty vehicle capable, E-bus fueling.
Right, Audi demonstrates new fuel cell vehicles during 2014 LA Auto Show

Collaborations: Enabling Special Activities

Mobile lighting system. University Commuter Service vehicles
Right, mobile refueler for remote hydrogen-fuel cell installations.

Sea Change For NorCal



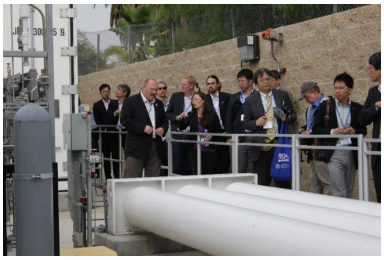
Hydrogen is from Cal State LA

"SWITCH Maritime reports that its hydrogen fuel cell powered ferry *Sea Change* successfully completed a world first-of-its kind hydrogen fueling on November 18 at the Bellingham, Wash., All American Marine shipyard. The vessel is now beginning its final sea trials before delivery."

https://www.marinelog.com/passenger/ferries/sea-change-ferry-completes-landmark-hydrogen-fueling/

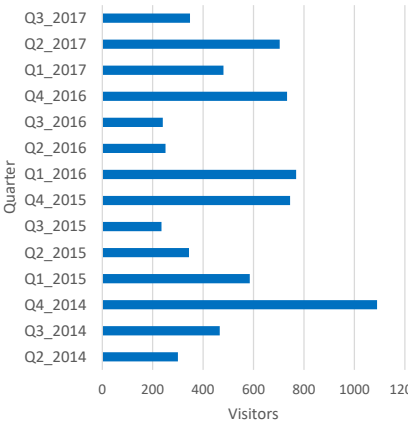
"The vessel is equipped with a hydrogen fuel cell power package …, comprised of 360 kW of Cummins fuel cells and Hexagon hydrogen storage tanks with a capacity of 246 kg. This system is integrated with 100 kWh of a lithium-ion battery provided by XALT and a 2x 300 kW electric propulsion system provided by BAE Systems. … the construction supervision and management are led by Hornblower Group." https://www.allamericanmarine.com/hydrogen-vessel-launch/

Outreach



Fuel Cell Seminar

Jaime Cromwell, actor—first man to achieve warp drive, Star Trek universe



Number of visitors to CSULA hydrogen station

PS Science Camp, Santa Monica

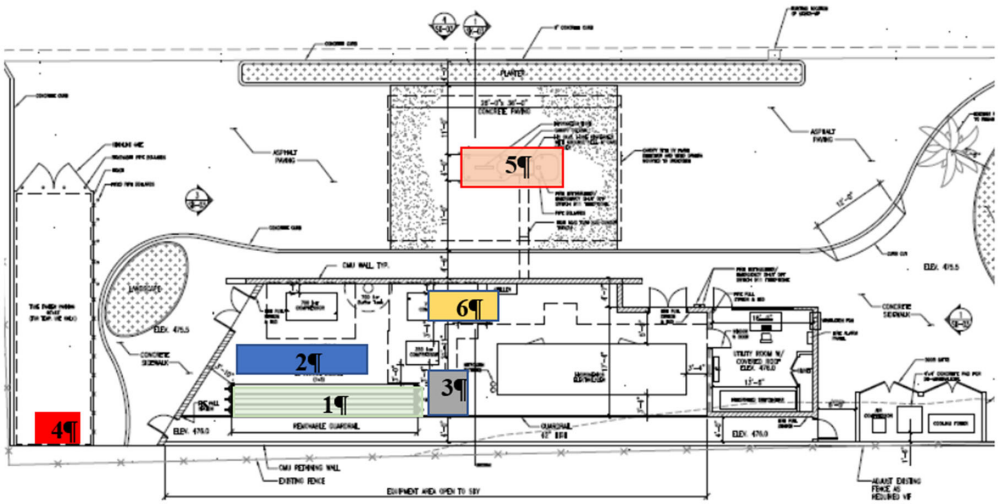
Hydrogen Purity Testing

- MRI: Acquisition of a Multifunctional Hydrogen Gas Analyzer for the Center for Energy and Sustainability
  - NSF, $512,000

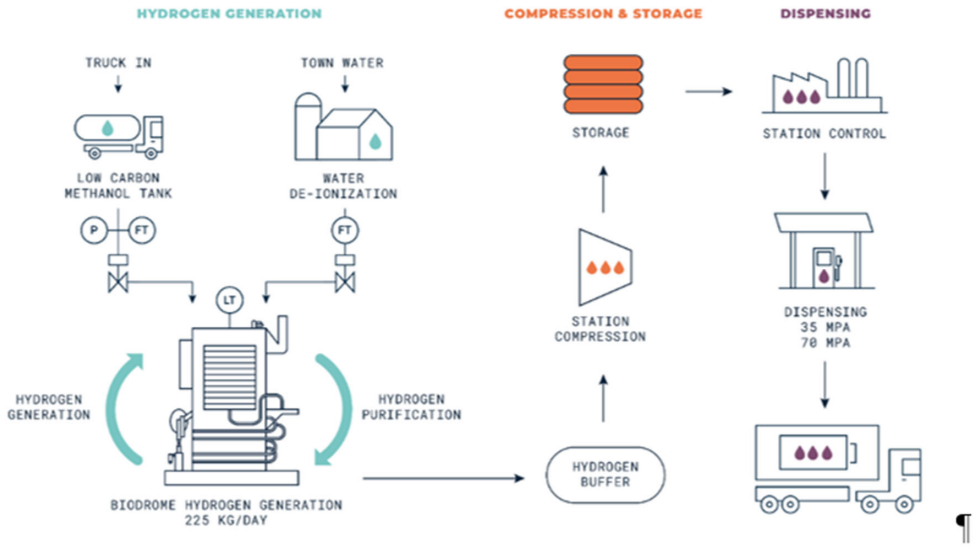
Cal State LA Future Work

- Hydrogen Station Upgrade—Research and Modern Standards, Capacity--$2.5M
- Hydrogen Infrastructure Workforce Training--$500K, training curriculum and internships
- Alternative fuels onsite generation-Azolla Hydrogen
- Rocketruck-MORBUGS, hydrogen infrastructure resilience with mobile backup power through CEC and DOE
- Autonomous vehicles research for Olympic Games--1M/year.

Station Upgrade Plan



Azolla Hydrogen



Rocketruck Backup Power For Hydrogen Resilience, CEC-DOE

- **Goal:**
- Engineer and design a system that will provide resilience operation to Cal State LA hydrogen research and fueling facility.
- Develop partnerships and collaborations necessary for the implementation of the project
- Identify funding sources and cost shares, prepare a core narrative for a potential proposal
- Design, equipment, “what if modeling.”