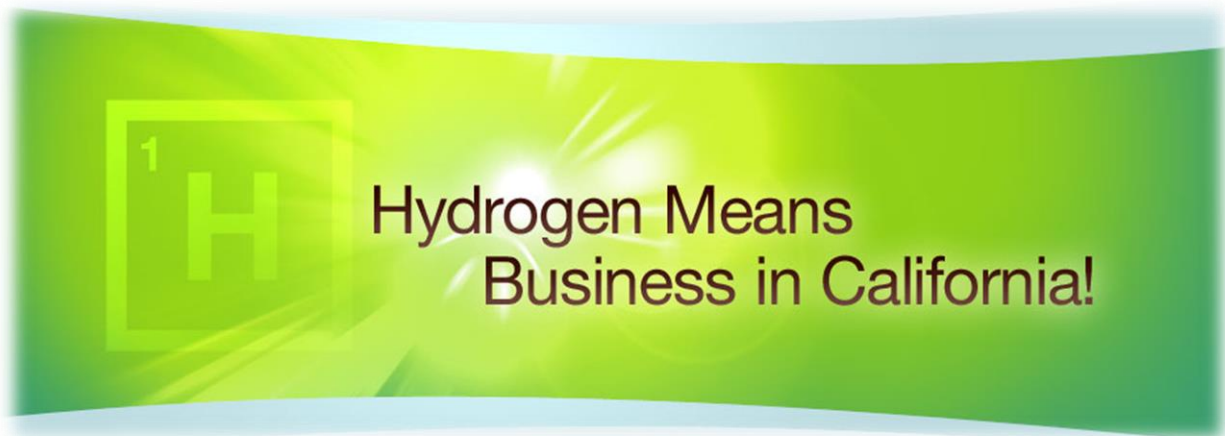

ANNUAL REPORT 2015

MARCH 11, 2015

ABOUT THE CHBC

The California Hydrogen Business Council connects hydrogen technology developers, businesses, energy leaders, government, and infrastructure providers with a common vision of energy and transportation fueled by zero-emission hydrogen.

Our members develop, adapt, and implement technology and services that are taking the hydrogen economy into the mainstream.



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EXECUTIVE SUMMARY

The 2015 Annual Report of the California Hydrogen Business Council (CHBC) is designed to inform members, potential members and stakeholders about the organization's activities including advocacy and events in 2015.

Under its management by Technology Transition Corporation and through collaborative work of the Board of Directors, members and staff, the CHBC made significant progress during the fourth year of a complete restructuring effort. The CHBC reached several important milestones, further increasing its membership, continuing with the hydrogen energy storage program and adding renewable hydrogen, public transit and transportation, clean ports and goods movement to its areas of engagement. The CHBC also promoted networking and advocacy in the hydrogen energy industry sector to expand business opportunities in hydrogen and fuel cells. The CHBC organized two successful summits, three board meetings, one technology tour, four VIP Luncheons, two workshops, released one white paper, submitted comments to the CPUC and held four all-hands calls for membership engagement.

2015 - COMPLETING THE TRANSITION

2015 was an exciting year for the CHBC. The CHBC continued its evolution to be an impactful industry advocate for the interest of its members, leading to significant achievements throughout the year: two highly successful summits, unprecedented increase in membership, and successful committee work, among other improvements to the effectiveness of the organization.

Technology Transition Corporation (www.ttcorp.com) continued to manage and staff the growing depth and breadth of the CHBC's activities. TTC is a known name in the hydrogen and fuel cell industry, having managed the National Hydrogen Association (NHA) from its founding in 1989 to the merger with the U.S. Fuel Cell Council to create the Fuel Cell and Hydrogen Energy Association (FCHEA) in 2010. TTC also continues to manage the Hydrogen Education Foundation (HEF) and its programs, the Hydrogen Student Design Contest (www.hydrogencontest.org) and H-Prize (www.hydrogenprize.org).

Jeff Serfass, President of TTC has over two decades of experience in clean energy, mainly in hydrogen sector, serving as President of the NHA and the HEF. In December, he was named Executive Director, and as such he provides strategic guidance to CHBC. Emanuel Wagner, TTC Program Manager, has 5 years experience in managing projects for the Hydrogen Education Foundation and 6 years experience of program management for the Biomass Thermal Energy Council. He serves the CHBC as Assistant Director, managing the day-to-day operations of the organization. James Provenzano, Executive Director of Clean Air Now!, was contracted by TTC to provide his experience and California relationships and connections to assist with on-the-ground support for special events like technology tours and meetings. This year, Cory Shumaker was hired to provide staff support in Los Angeles and lend his expertise on goods movement and transportation, having worked at Vision Motor Company until 2014.

2015 PROGRAM PLAN

The CHBC developed an array of goals for 2015 as part of the 2015 Program Plan and Budget, which was approved by the Board of Directors in December 2014. Those goals included:

Advocacy

- Build support for infrastructure development in preparation for light duty vehicle rollout in 2016
- Advocate for policies that facilitate the expansion of telecom power, goods movement and power business for CHBC members in these sectors

- Strengthen the Advocacy Committee by expanding representation from each of the market sectors to be able to both plan initiatives in each of the sectors and to respond to unexpected policy issues
- Augment federal and state agency relationships and develop relationships in areas of importance to the objective of growing markets (DOE, CEC, Cal/EPA)
- Amplify the policy messages of CaFCP and CSFCC in CHBC activities for stronger industry impact
- Supplemental: Conduct a policy briefing of Assembly in support of 2014 advocacy goals
- Supplemental: Produce and submit white papers and reports needed to communicate CHBC's views on key policy and regulatory developments and to advocate public policies on behalf of the industry to the California State Assembly and government agencies

Networking

- Produce high-quality in-person CHBC meetings in support of key topics to improve member benefits, build opportunities for business development; conduct workshops for potential customers; and support a potential national hydrogen and fuel cell business event in California.

Education and Outreach

- Maintain active communications, education and outreach program by generating interest for the technology; expand social media where effective with the goal to further elevate the CHBC as the voice of the industry in California.

Hydrogen Energy Storage

- Achieve awareness of the option of hydrogen for energy storage with California regulatory bodies, state agencies, legislators and other decision makers
- Build the analytical understanding of the role that hydrogen can play in managing increasing penetrations of renewable energy
- Build relationships with key California and national stakeholder groups that can help build awareness of the role of HES
- Enable the eligibility of hydrogen in existing funding vehicles and develop new mechanisms, where appropriate, for state support of HES in member driven projects and for expansion of CHBC HES capability, including SGIP and EPIC

Member Services and Development

- Increase CHBC membership, especially on the manufacturing side and sectors currently underrepresented, which increases membership revenue in support of CHBC activities
- Develop approach and value proposition to engage utilities in CHBC

Research and Analysis

- Produce a document that can be shared with agencies, legislators, the public, and prospective members to convey information about who the business council is and what the member companies contribute to the economy in California
- Supplemental: Secure funding for a project module to create an industry report for CHBC's advocacy positions and E&O.
- Supplemental: Develop work group-led stationary fuel cell program with focus on hydrogen energy storage to advance the analytical, technical, and policy support within the CHBC to improve energy security and build-out of renewable energy

COMPLETION OF 2015 PROGRAM GOALS

In the next sections, detailed information on the CHBC's activities in each program area will be provided. This includes Advocacy, Hydrogen Energy Storage, Education and Outreach, Events, and Membership. Additionally, goals and plans for the future will be reviewed at the end of the report. Supplementary information is provided in the Appendices.

EDUCATION AND OUTREACH

Formed in 2012, the Education and Outreach Committee was tasked with identifying low cost high value efforts to educate customers, policymakers, investors, media and other stakeholders on the facts related to hydrogen energy and fuel cells.

Currently chaired by Bob DeSautels, the committee works to develop or connect parties to information resources that advance the level of knowledge and interest in hydrogen and fuel cell technologies, products and markets.

Unlike the other CHBC committees, E&O Committee members are recruited from the entire membership. They help identify key stakeholders and key issues facing the industry that could be addressed through education and outreach. They assist in the development of materials and other educational resources and help develop strategies for reaching out to key stakeholders and decision makers on these issues. CHBC members can use these CHBC educational resources to help build market understanding for products and services.

The Education and Outreach Committee helps guide the organization's development of educational resources and outreach strategies and implements "all hands" calls for the entire membership, identifies materials and resources for website development, and provides input on hydrogen information materials. In 2015, the Committee focused on increasing public awareness through the use of demonstration projects.

In 2015, the CHBC developed a Member Engagement Survey in order to help highlight the various areas of activities of the CHBC to members. The survey received a 40% response rate and helped prioritize dues supported and additional sponsorship supported activities.

ALL HANDS CALLS

The CHBC held four "All Hands Calls," in March, May, November and December of 2015 in an effort to improve membership value and communication. The calls were designed as an interactive version of a newsletter and were open to all members of the CHBC. Each call had between ten and twenty attendees. The discussions included updates on the 2015 Program Plan, legislative developments and activities, industry news and upcoming events as well as updates from CHBC committees. Each of the calls ended with a section where all members had the opportunity to bring up issues, comments, questions, new projects, or industry updates of which all members should be aware. These calls served as an effective forum for discussion.

HYDROGEN ENERGY STORAGE

The Hydrogen Energy Storage (HES) Committee was created in 2013 to address the increasingly important role that energy storage will play in California's energy future. HES has the potential to become a significant business opportunity in California, as the state moves to an ever increasing use of renewable energy, currently set for 33% by 2020. Through the HES Committee, the CHBC can provide help to California's decision makers in assisting this market growth of renewable energy and address challenges caused by this build-out. Recognition for the unique role that hydrogen energy storage can play is the focus of that work, by helping to manage the intermittency of the dominant renewables, in addition to broader grid management. The actual uses of

hydrogen that can be produced off-peak by solar and wind facilities include augmenting natural gas delivered in pipelines by creating a renewable component of that gas, and its use as a transportation fuel. Hydrogen added to a natural gas pipeline could also be retrieved downstream, thus using the pipeline itself for storage. All of these uses of renewably produced hydrogen are potential components of a hydrogen energy storage strategy.

The HES Committee held monthly calls in June, July, August, September, October, and November of 2015. The main outcomes of the HES Committee for 2015 were the white paper and the HES workshop at the 2015 CHBC Summer Summit.

WHITE PAPER

On October 8, 2015 CHBC released its official White Paper “Power-to-Gas: The Case for Hydrogen”, outlining the feasibility and economics of energy storage solutions using hydrogen and methane as energy carriers. The White Paper is a project spearheaded by the HydrogenEnergy Storage Group in the CHBC and member companies.

To support the integration of ever-increasing amount of intermittent renewable generation, California is faced with a growing need to deploy utility-scale storage solutions. The White Paper is intended to provide policy makers and other interested parties with an overview of the concept and potential of hydrogen-based energy storage. It covers key aspects of this technology, including needs for grid scale energy storage, power-to-gas solutions, economic analysis, use cases and existing projects. It is available on the CHBC website at <https://californiahydrogen.org/sites/default/files/CHBC%20Hydrogen%20Energy%20Storage%20White%20Paper%20FINAL.pdf>

NETWORKING EVENTS

As described in the subsequent sections, the CHBC held several successful events in 2015. The CHBC will continue to expand upon this success in 2015.

TECHNOLOGY TOUR FOR DUTCH BOVAG AT AC TRANSIT

On January 21, 2015, the CHBC hosted a tour for the Dutch automotive dealer association BOVAG at AC Transit, featuring their pioneering Fuel Cell Bus program, followed by briefings from state officials at the Emeryville City Hall.

TECHNOLOGY TOUR AT WEST SACRAMENTO FUELING STATION

On September 29, 2015, the CHBC hosted a tour for members and non-member prior to the two-day Sacramento Summit. The 8 attendees learned from Nitin Natesan at Linde about the design and challenges of the station deployment as well as the standardized measurement for hydrogen dispensing applied there. The group benefited from a serendipitous refueling experience when a FCEV driver pulled up at the station.

SUMMER SUMMIT - DOWNEY, CA

The CHBC’s Summer Summit, held on July 29-30, 2015 at Southern California Gas Company’s Energy Resource Center in Downey, CA was composed of two interlocking workshops that are important to California and beyond, designed to produce actionable outcomes for renewable hydrogen and grid support: The Renewable Pathways to Hydrogen Workshop and the Hydrogen for Energy Storage and Grid Services Workshop. Over 90 attendees participated in the Summer Summit.

Topics included:

Renewable Pathways to Hydrogen Workshop includes sessions on:

- Keynotes from Industry and Government: Needs and Opportunities
- Generating Market Drivers for Renewable Hydrogen
- Aligning Views on Renewable Hydrogen from Government Agencies
- Modeling and Experiences from Real Projects Around the Globe
- Facilitated Discussion of Barriers to Adoption
- Workshop Conclusions - Next Steps to Project Development - Panel Discussion
- Workshop Results and Messages to Stakeholders

Hydrogen for Energy Storage and Grid Services Workshop includes sessions on:

- Keynotes from Industry and Government: Needs and Opportunities
- Energy Storage as a Grid Asset
- Practical Examples
- California Market Opportunities and Regulatory Issues
- Next Steps to Project Development
- Workshop Results and Messages to Stakeholders

Speakers at the Summit included:

- **Bill Elrick**, Executive Director, California Fuel Cell Partnership
- **Brent Koski**, COO, United Hydrogen
- **Brian Goldstein**, Executive Director, Energy Independence Now
- **Catherine Dunwoody**, Chief of Fuel Cell Program, California Air Resources Board
- **Craig Scott**, National Manager, Toyota Motor Corporation
- **Daniel Poppe**, Vice President, Hydrogen Frontier
- **Daryl Wilson**, President & CEO, Hydrogenics
- **Geoff Budd**, USA and Canada Representative, ITM-Power plc.

- **Henry Hogo**, Assistant Deputy Executive Officer, South Coast Air Quality Management District
- **Jack Brouwer**, Association Director, UC Irvine
- **James Provenzano**, President, Clean Air Now
- **Jay Keller**, President & CEO, Zero Carbon Energy Solutions, Inc.
- **Jeff Reed**, Director, Southern California Gas Company
- **Jeff Serfass**, Executive Director for the CHBC
- **Johannes Escudero**, Executive Director, Coalition for Renewable Natural Gas
- **Jonathan Palacios-Avila**, CEO, Stratos Fuels, LLC
- **Josh Eichman**, Research Analyst, National Renewable Energy Laboratory
- **Keith Ropchock**, Director, Golden State EPC
- **Kevin Harrison**, Senior Engineer, National Renewable Energy Laboratory
- **Mark Abramowitz**, President, CHBC
- **Matthew McClory**, Manager, Toyota Technical Center
- **Michael Beckman**, Vice President, Linde LLC
- **Michel Archambault**, Director, Hydrogenics
- **Mike Levin**, Director, FuelCell Energy, Inc.
- **Nico Bouwkamp**, Technology Analyst & Renewable Technology Strategic Advisor, California Fuel Cell Partnership
- **Prabhu Rao**, CEO North America, McPhy Energy
- **Rich Myhre**, Vice President, Bevilacqua Knight Inc.
- **Rob Friedland**, President & CEO, Proton-OnSite
- **Sam Wade**, Chief of Transportation Fuels Branch, California Air Resources Board
- **Stephen Jones**, Managing Director, ITM Power
- **Steve Szymanski**, Director - Government Business, Proton OnSite
- **Tyson Eckerle**, ZEV Infrastructure Project Manager, GoBIZ
- **Susan Schoenung**, President, Longitude 122 West, Inc
- **Valentino Tiangco**, Biomass Program Manager, Sacramento Municipal Utility District
- **Wouter Vanhoudt**, Director EMEA at HINCIO, CertifHy

This meeting owed its success to Southern California Gas Company, the hosting organization, Hydrogenics, gold sponsor, ITM Power and the California Fuel Cell Partnership, break sponsors, the support of the CHBC members, attendees and the gracious help of volunteers from UC Irvine. The presentations for the Summer Summit are available on the Members Only section of the CHBC website, www.californiahydrogen.org.



CALIFORNIA HYDROGEN AND FUEL CELL SUMMIT - SACRAMENTO, CA

The California Hydrogen and Fuel Cell Summit was held on September 30 & October 1, 2015 at the California EPA in Sacramento. The Summit featured national and international hydrogen and fuel cell energy industry experts and policy makers to create a forum for the exchange of information about both stationary and mobile fuel cells. The Summit helped the participants recognize the already important commercial markets for these technologies and new products and technologies about to enter the commercial marketplace.

Topics included:

- California Leadership in Sustainable Energy
- National Activity in Hydrogen and Fuel Cells
- Visions of Hydrogen and Fuel Cell Business Chief Executives
- Regional Environmental Action
- Spotlight on Clean Transportation - Stations, Vehicles, and Transit
 - Public Transit
 - Infrastructure
 - Fuel Cell Electric Vehicles
- Spotlight on Renewable Energy
- Renewable Energy, Energy Storage and Grid Management
- Utilities of the Future
- Perceptions of Hydrogen
- Visions of Business Chief Executives on Sustainable Goods Movement & Freight
- Innovative New Markets & Products

Presenters during the summit included:

- **Alberto Ayala**, Deputy Executive Officer, California Air Resources Board
- **Andy Marsh**, President and CEO, Plug Power
- **Arthur 'Chip' Bottone**, President and CEO, FuelCell Energy, Inc.
- **Brendan Shaffer**, Technology Manager, University of California, Irvine
- **Brian Goldstein**, Executive Director, Energy Independence Now
- **Catherine Dunwoody**, Chief of the Fuel Cell Program, California Air Resources Board
- **Cliff Rechtschaffen**, Senior Advisor, Office of Governor Edmund G. Brown Jr.

- **Damian Breen**, Strategic Innovations Section, Bay Area Air Quality Management District
- **Eddy Nupoort**, Project Director, H2 Logic Company
- **Gilbert Castillo**, Senior Group Manager of Advanced Vehicle Strategy, Hyundai Motor America
- **Graham Noyes**, Attorney, Keyes, Fox & Wiedman LLP
- **H. E. Christian Peeples**, At-Large Director, President
- **Jack Brouwer**, Associate Professor of Mechanical and Aerospace Engineering, UC Irvine
- **Jacquelyn Birdsall**, Engineer, Toyota
- **Janea Scott**, Commissioner, California Energy Commission
- **Jeff Serfass**, Managing Director, CHBC
- **Jeff Reed**, Director of Emerging Technology, Southern California Gas
- **Dr. Jerrold Hutton**, Director of Training and Codes & Standards, Millennium Reign Energy
- **Joel Ewanick**, Chairman and CEO, FirstElement Fuel, Inc.
- **Jonathan Leonard**, Senior Vice President, Gladstein, Neandross & Associates
- **Lauren Skiver**, CEO & General Manager, SunLine Transit Agency
- **Mark Abramowitz**, President, California Hydrogen Business Council
- **Mark Rawson**, Energy Research Technology Officer, Sacramento Municipal Utility District
- **Matt Miyasato**, Deputy Executive Officer, Science and Technology Advancement Office
- **Michael Dray**, Technical Operations Manager, Cal State LA Hydrogen Research & Fueling Facility and the College of Engineering
- **Mike Strizki**, President, Hydrogen House Project
- **Rob Del Core**, Director, Fuel Cell Power Systems
- **Rob Harvey**, Director, Hydrogenics
- **Steve Ellis**, Manager, Fuel Cell Vehicle Marketing at American Honda Motor Co.
- **Sunita Satyapal**, Director, Fuel Cell Technologies Office
- **Dr. Thomas Bialek**, Chief Engineer, San Diego Gas & Electric
- **Tom Joseph**, President, Bethlehem Hydrogen Inc.
- **Tyson Eckerle**, Project Manager, Governor's Office of Business and Economic Development

The presentations for this Summit are available on the Members Only section of the CHBC website, www.californiahydrogen.org. This Summit would not have been successful without the support of its Platinum Sponsor, Toyota, and its two break sponsors, Honda and Hydrogenics.



VIP LUNCHEON WITH ANGELINA GALITEVA

On December 2, 2015 the CHBC held a VIP Luncheon with Angelina Galiteva, ISO Board of Governors. Ms. Galiteva was appointed by Governor Jerry Brown on May 2, 2011 to the California Independent System Operator Corporation Board of Governors. The California Senate unanimously confirmed Ms. Galiteva on September 21, 2014 and on January 29, 2014, she was reappointed to a second term. Ms. Galiteva is also President for NEOptions, Inc., a renewable energy and new technology product design and project development firm. Her industry experience includes serving as Executive Director of the Los Angeles Department of Water and Power. As Executive Director, she was responsible for structuring and managing the Department's internationally acclaimed "Green LA" Environmental and Green Energy portfolio programs. Her career includes working with

the California ISO and Power Exchange on their initial launches and she also worked as a power analyst for the New York Power Authority.

VIP LUNCHEON WITH DAVID HOCHSCHILD

On December 8, 2015 the CHBC held a VIP Luncheon with David Hochschild, California Energy Commission Commissioner. Commissioner Hochschild was appointed by Governor Jerry Brown on February 11, 2013. He fills the environmental position on the five-member Commission. Commissioner Hochschild's career has spanned public service, environmental advocacy and the private sector. He first got involved in the solar energy field in 2001 in San Francisco as a Special Assistant to Mayor Willie Brown where he launched a citywide \$100 million initiative to put solar panels on public buildings. In 2007-2008, he served as a commissioner at the San Francisco Public Utilities Commission.



VIP LUNCHEON WITH MICHAEL PICKER

On December 9, 2015 the CHBC held a VIP Luncheon with Michael Picker, President of the California Public Utilities Commission. President Picker was named President of the California Public Utilities Commission (CPUC) on December 23, 2014, by Governor Jerry Brown Jr., who first appointed President Picker as a Commissioner on January 29, 2014. Prior to his appointment, President Picker was Senior Advisor for Renewable Energy in the Office of the Governor from 2009 to 2014. He was a principal at Lincoln Crow Strategic Communications from 2000 to 2009, Deputy Treasurer in the Office of the California State Treasurer from 1998 to 1999. He was a member of the Sacramento Municipal Utility District Board of Directors from 2012-2014.



MEMBERSHIP

The Membership Committee was led by Anca Faur of Johnson Matthey Fuel Cells. Initially meeting monthly, the committee reevaluated the value of regular meetings to report on progress and then decided to meet on an ad-hoc basis. Using membership engagement tools and marketing materials, its work provided considerable support to CHBC's continued membership growth. A full list of 2015 members is available in Appendix B.

RESEARCH AND ANALYSIS

For 2015, the CHBC identified the collection of industry data as an important item to educate legislators and companies interested in investing in the hydrogen and fuel cell market in California. These efforts were led by the industry data project subcommittee. In 2015, CHBC hired an intern from Humboldt State University to undertake a survey of CHBC members and the "Study to Quantify Hydrogen Based Industry in California" is available presents the results in a draft report. However, the results from the report were not yet published due to a concern in the lack of data for some of the sectors.

MANAGEMENT

The CHBC held three board meetings in 2015. The first meeting was held on July 28th, following the CHBC Spring Summit. This meeting mainly focused on the previous Summit and creating a term limit of three years for Directors. The Second meeting was held on September 29th and focused mainly on 2016 CHBC Strategic Program. The third meeting was held on December 3rd and focused mainly on 2015 in review and the election of Lauren Skiver and Jack Brouwer to the Board of Directors and reelection of Anca Faur as Treasurer and three

directors including Mike Beckman, Bob Oesterreich, and Daryl Wilson. A list of 2015 Board of Directors is available in Appendix C.

FINANCES

The CHBC's revenue in 2015 amounted to \$156,225 of which \$106,240 came from dues, with expenses amounting to \$178,589, leading to a \$22,362 net loss, which is due to late membership payments that are expected to be received in early 2016.

PLANS FOR THE FUTURE

2016 will be marked with the strengthening of the industry association by establishing a pattern of strong signature events, increased awareness and activities in market sectors, supportive appropriate state policies, and an increasingly broad and diverse Board of Directors and membership. Beyond leading discussions of hydrogen for energy storage and managing the intermittent renewables on the electric grid, new market sectors will be addressed that build on the experience of the module approach.

The CHBC will attempt to expand existing activities and develop new modules as necessary in support of goods movement, ports and airports, vehicle deployment and fueling, telecommunications power, biogas, and beyond. These new and expanded activities not only help the members in those sectors, but they also help the CHBC attract new members.

To maximize the CHBC's effectiveness, the staff and the Board will continue to increase collaboration and cooperation with other key organizations and events in the California and beyond. While the CHBC is having an impact in the state, it will increase its national visibility in 2016. The Program Plan and Budget for 2016 is available on the CHBC website.

APPENDICIES

APPENDIX A - COMMENTS OF CALIFORNIA HYDROGEN BUSINESS COUNCIL ON ELIGIBLE TECHNOLOGIES FOR THE WORKSHOP: ENERGY STORAGE TECHNOLOGY AND SAFETY FOR R.15-03-011

Pursuant to the California Public Utilities Commission's ("Commission") Rules of Practice and Procedure and the rulings of the Assigned Commissioner, the California Hydrogen Business Council (CHBC) submits its comments for the CPUC Workshop: "Energy Storage Technology and Safety" for R.15-03-011.

Considering the significant market opportunity for energy storage technology in California, the members of the CHBC are concerned that CPUC staff inadvertently limits the technology options for energy storage, thus reducing pathways for utilities and ratepayers to utilize some of the most cost-effective and versatile technology options currently commercially available, particularly with regard to bulk storage.

The CHBC requests CPUC acceptance of Power-to-Gas and Hydrogen Energy Storage as a viable energy storage technology under R.15-03-011 for the following reasons.

Countries around the world are investing heavily in renewable generation with wind and solar as the dominant technologies. Without large-scale storage of electrical energy, power grids cannot accommodate high levels of intermittent renewable resources because of mismatches in supply and demand, which can result in periods of significant excess generation and challenge the ability of the grid to respond to rapid changes in renewable

supply. This situation is predicted to become acute in California over the coming five years as solar production peaks near mid-day and declines rapidly just as demand peaks in the late afternoon and early evening creating a the need for rapid ramp up of replacement power. This need will become even more dramatic as California progresses toward its goal of 50% renewable power by 2030. A similar situation can exist with wind resources, which can show high production in pre-dawn hours when demand is low. In periods when supply exceeds demand, excess wind power must be curtailed, which wastes a renewable resource. In such periods of excess, which can span minutes, hours or even days, large amounts of renewable electricity can be lost simply (even though paid for) because the grid cannot accept the power.

Power-to-Gas (P2G) represents one potential tool for managing renewable power intermittency and over-generation. Simply described, P2G is the process of using electrolysis to split water into hydrogen and oxygen. Through this process, electrical energy is converted to chemical energy in the form of hydrogen. The hydrogen can then be stored for use in a fuel cell or engine or transported through the natural gas grid via blending, or used directly at the point of production. The stored chemical energy can be used to generate electricity, as a transportation fuel, or for any other purpose for which hydrogen or methane is used.

When considered as an energy storage system, hydrogen P2G is similar to pumped hydro, in that long duration storage is inexpensive. The “charge” and “discharge” components are independent of each other and the storage component, so that the system can be optimized to complement the profile of the grid with increasing renewables, even on a seasonal basis. Compared with other energy storage technologies, the cost of ownership is very attractive in this use case, even if the system efficiency is not as competitive.

Another important distinction between P2G and other forms of energy storage is that P2G allows conversion of energy amongst a variety of sectors and end-uses (e.g., electric grid, gas grid, transportation fuel) and takes advantage of the natural gas grid as an existing and inexpensive storage resource to augment, and in some instances replace, dedicated hydrogen storage infrastructure. Defining grid electricity storage to include conversion and later use in non-electrical forms of energy is critical to achieving emissions and climate goals in a least-cost, best-fit manner. In addition to the technology’s ability to support the growing need for grid stabilization the technology can offer within seconds demand response capabilities.

Respectfully submitted,

Dated: August 18, 2015

Jeffrey A. Serfass

California Hydrogen Business Council

APPENDIX B - LIST OF MEMBERS

PLATINUM MEMBERS

South Coast Air Quality Management District Bay Area Air Quality Management District AC Transit Ballard Power Systems FuelCell Energy Hydrogenics Corporation	Plug Power, Inc. Southern California Gas Company Toyota Motor Sales, USA, Inc.
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GOLD MEMBERS

American Honda Motor Co., Inc. IRD Fuel Cells LLC	Proton Onsite United Hydrogen Group LLC
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SILVER MEMBERS

Air Liquide Advanced Technologies U.S. LLC. BMW North America California Air Resources Board Cambridge LCF Group Center for Transportation and the Environment (CTE) Clean Energy Fuels Electro Power Systems General Motors Giner Gladstein, Neandross & Associates (GNA)	Golden State EPC H2 Logic H2Safe, LLC Humboldt State - Schatz Energy Research Center Hyundai Amercia Technical Center Idaho National Laboratory Intelligent Energy ITM Power Johnson Matthey Fuel Cells Linde Group McPhy	National Renewable Energy Laboratory - NREL Next Hydrogen Corporation Nuvera Fuel Cells Port of Long Beach Powertech Labs, Inc. Rio Hondo College Sacramento Municipal Utility District SunLine Transit Swagelok Total Transportation Services, Inc. US Hybrid
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SOLE PROPRIETORS AND EMERGING BUSINESSES

ACE Cogeneration Company Bethlehem Hydrogen Community Environmental Services E4 Strategic Solutions GTM Technologies Inc.	Hydrogen in Motion Hydrogenious Technologies HySa Systems Keyes, Fox & Wiedman LLP Longitude 122 West, Inc. Paramount Energy West LLC	PowerDisc Rose Communications SAFCell Inc Solar Hydrogen Zero Carbon Energy Solutions Ztek Corporation
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INDIVIDUAL MEMEBRS

Arturo Epstein Ben Mehta Bill Leighty Chris McWhinney Craig Hover Danesh Chandra Dave Savidge	Doug Weaver Eaden Saw Elias Greenbaum Hank Wedaa James Provenzano Mark Sheldon Michael Cox	Paul Scott Ram McCormack Richard Cromwell III William Ryan Ram P. Mohan Stan Heinemann
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AFFILIATES

Advanced Power and Energy Program - UC Irvine	California Fuel Cell Partnership CALSTART	Coalition for Clean Air Energy Independence Now (EIN)
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APPENDIX C - 2015 BOARD OF DIRECTORS

CHBC Board of Directors Contact Information

Last Update: 11/13/2015

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