CALIFORNIA HYDROGEN BUSINESS COUNCIL

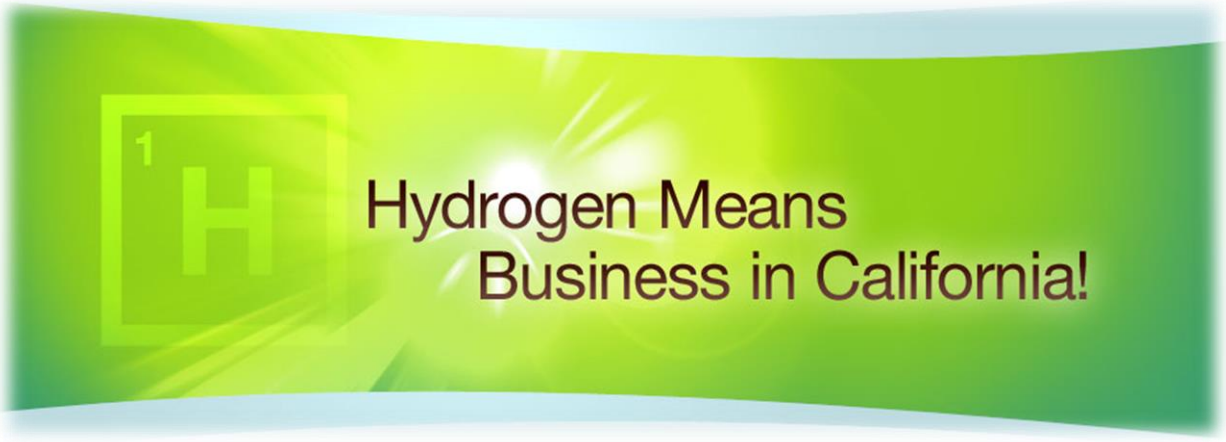
ANNUAL REPORT 2014

JULY 30, 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 technologies and services that are taking the hydrogen economy into the mainstream.



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EXECUTIVE SUMMARY

The 2014 Annual Report of the California Hydrogen Business Council (CHBC) is designed to inform members, potential members and other stakeholders about the organization's activities including advocacy, events and membership changes in 2014, progress in the organizational restructure as well as its plans for 2015.

Continuing under its new management and through collaborative work of the Board of Directors, members and staff, the CHBC made significant progress during the third year of a complete restructuring effort. The CHBC reached several important milestones, increasing its membership, continuing with the hydrogen energy storage program module, and improving its strength and presence in California by recruiting strong leaders in the industry as members and Directors. 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, two VIP Luncheons, submission of comments and position letters and three all-hands calls for membership engagement.

2013 – BREAKING NEW GROUND

2013 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: an extremely successful summit, unprecedented increase in membership, development of a first program "module", and successful committee work, among other improvements to the effectiveness of the organization.

The association management company Technology Transition Corporation (TTC) continued to manage and staff the growing depth and breadth of the CHBC's activities. TTC is a renowned 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 three decades of experience in clean energy, in hydrogen, solar and biomass sectors, serving as President of the National Hydrogen Association and the Hydrogen Education Foundation. As Managing Director he provides strategic guidance to CHBC.

Emanuel Wagner, TTC Program Coordinator for the Hydrogen Education Foundation and the Biomass Thermal Energy Council, 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.

GOALS FOR 2014

ADVOCACY

- Build support for infrastructure development in preparation for light duty vehicle rollout in 2015
- Advocate for policies that facilitate the expansion of telecom power, goods movement and power business for CHBC members in these sectors
- Strength 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 8 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

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.

ADVOCACY

The CHBC goals in Advocacy include regulatory advancement, incentive development and market research and analysis. The CHBC supports initiatives to increase the number of hydrogen fuel stations to advance the commercial release of hydrogen fuel cell vehicles. The CHBC also advocates for tax credits for hydrogen and fuel cell systems, the expansion of incentive programs like the Self-Generation Incentive Program (SGIP) and bills that provide funding or assistance to new projects or retrofitting projects of existing buildings and facilities.

A restructuring of the CHBC in early 2014 led to the closure of the Advocacy Committee. It was replaced by several Sector action Groups (SAGs) which focus on their respective sector of the hydrogen/fuel cell industry.

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.

Chaired by Bob Oesterreich, 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 2014, the Committee focused on increasing public awareness through the use of demonstration projects.

ALL HANDS CALLS

The CHBC held three "All Hands Calls," in July, November and December of 2014 in an effort to improve membership value and communication. The calls were designed as a novel, 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 2014 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 several calls in February, April, August, September, October, and November of 2014. The main activities of the HES Committee are outlined below.

ENERGY STORAGE ROADMAP FOR CALIFORNIA

In 2014, the Energy Storage Roadmap for California was introduced as a joint effort between the CPUC, CEC, and CAISO. The purpose of the roadmap was to facilitate the advancement of energy storage in support of California's energy and environmental policy goals by identifying actions to address challenges and barriers that have been identified by industry participants and other stakeholders. On November 10, 2014, Jeff Serfass, Managing Director, submitted comments on the Energy Storage Roadmap for California outlining how HES could be included in the roadmap. The CHBC commentary urged the agencies to look at HES as a viable way to increase efficiency and cleanliness of the current grid whilst meeting California's energy goals. The comments focused on the potential for HES to be reliable and cost effective by looking at contemporary examples of and studies done on HES. The comments also addressed the ability of HES to meet time-shift electrical loads with ease. The final

Energy Storage Roadmap for California did not provide any sort of preference to any one energy storage method, but provides a general view of how all of the energy storage options will be evaluated under the roadmap.

The final comments submitted are available in Appendix A.

WHITE PAPER

Members of the CHBC Hydrogen Energy Storage Committee have continued to develop a White Paper to outline the technology and the business-case of hydrogen energy storage. The completion of the White Paper is scheduled for early 2015.

DOE HES WORKSHOP - MAY 15-16, 2014

The DOE along with the CHBC hosted two HES workshops on May 15-16, 2014. The goal of the workshops was to provide feedback on what could be done in order to help promote HEs and help make it more commercially viable. The workshops were attended by ten CHBC member organizations.

NETWORKING EVENTS

As described in the subsequent sections, the CHBC held several successful events in 2014. The CHBC will continue to expand upon this success in 2015.

SPING SUMMIT AT ACT EXPO

The CHBC's Spring Summit, held May 5, 2014 at the Long Beach Convention Center in Long Beach, CA focused on the latest breakthroughs in utility intersections with hydrogen and fuel cells, including renewable energy and hydrogen energy storage; fuel cell power solutions; investment opportunities in hydrogen fueling; EV range extenders; and strategic visions of hydrogen infrastructure development in California.

Over 90 attendees participated in the Spring Summit.

Speakers at the Summit included:

- **Dr. Andreas Truckenbrodt**, former CEO and CTO for AFCC
- **Bob Oesterreich**, Director of the Hydrogen Energy, Air Liquide Industrial
- **Chris Callum** of SafCell
- **Chris McWhinney** of Millennium Reign Energy
- **Chris White**, Communications Director, CaFCP
- **Denis Obiang**, Head of Transmission Project Development at LA Dept. of Water and Power
- **Eric Denhoff**, Executive Director for the Canadian Hydrogen and Fuel Cell Association in Vancouver
- **Erik Hansen**, VP Sales and Hydrogen, Plug Power

- **Jeff Reed**, Director of Business Strategy and Development, Southern California Gas
- **Jeff Serfass**, Managing Director for the CHBC
- **Jerome Torresyap**, President & COO, Vision Motor Corp
- **Joseph Pratt**, Mechanical Engineer RD&D, Sandia National Labs
- **Mark Abramowitz**, President, CHBC
- **Pinakin Patel**, Director-Special Systems & Research, FuelCell Energy
- **Dr. Robert Shaw**, Managing Director, Arete Investment Management
- **Professor Scott Samuelson**, Director for National Fuel Cell Research Center
- **Dr. Shane Stephens-Romero**, President and Co-Founder, FirstElement Fuel, Inc.
- **Stephen Jones**, Managing Director, ITM Power
- **Steve Ellis**, Manager, Fuel Cell Vehicle Marketing, American Honda
- **Steve Szymanski**, Director - Government Business, Proton OnSite
- **Tyson Eckerle**, ZEV Infrastructure Project Manager, GoBIZ

This meeting owed its success to its sponsor, ITM Power, the hosting organization, the ACT Expo, the Long Beach Convention Center, the support of the CHBC members, attendees and the gracious help of volunteers from UC Irvine. The presentations for the Spring 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 October 15-16, 2014 at the California Environmental Protection Agency in Sacramento, CA. The event gathered over 200 representatives of companies in the hydrogen and fuel cell industry, government agencies and NGOs to celebrate progress in the hydrogen and fuel cell world and to discuss the ongoing rollout of first generation commercial fuel cell electric vehicles, spotlights on national and state developments such as H2First and H2USA, environmental benefits of our technology, biogas to hydrogen, clean ports, DOD activities, and energy storage and Power2Gas.
This Summit provided a balanced forum for businesses, academia, and government agencies to explore hydrogen and fuel cells through intelligent conversation, insightful presentations and thought provoking sessions. The Summit covered two full days with a special focus on envisioning new technology contrasted by the advances already made, using hard data from industry developments in the real world.

Presenters during the summit included:

- **Dr. Andreas Truckenbrodt**, Chairman, Canadian Fuel Cell and Hydrogen Association
- **Bonnie Holmes-Gen**, Senior Policy Director, American Lung Association of California
- **Brendan Shaffer**, Manager, Sustainable Energy/Sustainable Transportation, Advanced Power and Energy Program - UC Irvine
- **Buz McCain**, Platform Manager, Ballard Power Systems
- **Caio Mogyca**, Director of Biogas Clean Energy Solutions, Air Liquide
- **Captain James C. Goudreau**, Acting Deputy Assistant Secretary of the Navy for Energy, United States Navy
- **Catherine Dunwoody**, Chief, Fuel Cell Programs, California Air Resources Board (CARB)
- **Chris White**, Communications Director, California Fuel Cell Partnership

- **Christine Houston**, Manager of Sustainable Practices, Port of Long Beach
- **David Armijo**, General Manager, AC Transit
- **David Teichroeb**, Business Development, Alternative & Emerging Technology, Enbridge Inc.
- **Don Anair**, Research and Deputy Director of the Clean Vehicles Program, Union of Concerned Scientists
- **Geoff Budd**, Business Development Representative for North America, ITM Power
- **James Provenzano**, President, Clean Air Now!
- **James Zoellick**, Senior Research Engineer, Schatz Energy Research Center
- **Janea Scott**, Commissioner, California Energy Commission
- **Jeff Reed**, Director of Emerging Technology, Southern California Gas
- **Jeff Serfass**, Managing Director, CHBC
- **Jim Alkire**, Project Manager, Department of Energy
- **Joe Heinzmann**, Sales Engineer - Energy Storage Systems, General Electric
- **Dr. Joe Lyou**, Governing Board Member, South Coast Air Quality Management District
- **Joel Rinebold**, Connecticut Hydrogen Fuel Cell Coalition
- **Kevin Harrison**, Senior Engineer, National Renewable Energy Laboratory
- **Larry Stapleton**, Vice President of Sales, Ballard Power Systems
- **Lauren Skiver**, General Manager, Sunline Transit
- **Mark Abramowitz**, President, California Hydrogen Business Council
- **Mike O'Brien**, Vice President, Product and Corporate Planning, Hyundai Motor America
- **Nihar Patel**, Vice President, North America Business Strategies, Toyota Motor Sales (TMS), U.S.A.
- **Pinakin Patel**, Director of Research and Special Systems, FuelCell Energy
- **Pramod Kulkarni**, Senior Consultant, Customized Energy Solutions
- **Randall Winston**, Special Assistant to the Executive Secretary, Office of California Governor Brown
- **Rob Friedland**, President and CEO, Proton OnSite
- **Dr. Robert B. Weisenmiller**, Chair, CEC
- **Prof. Scott Samuelsen**, Co-Chair, California Stationary Fuel Cell Collaborative
- **Dr. Shane Stephens-Romero**, Chief Development Officer and Principal, First Element Fuel
- **Steve Ellis**, Manager and Board Chariman, Honda
- **Tyson Eckerle**, Zero Emissions Vehicle Infrastructure Project Manager, Governor's Office of Business and Economic Development
- **Vladimir Prerad**, CEO, United Hydrogen

This Summit would not have been successful without the support of its title sponsor, Toyota, its gold sponsor, Honda, its networking sponsors, Air Liquide and ITM Power, and its breakfast sponsor, Johnson-Matthey Fuel Cells.

VIP LUNCHEON WITH MIKE PEEVEY

On January 27, 2014, the CHBC held a VIP Luncheon with Mike Peevey, President of CPUC. Mr. Peevey worked on overarching utility needs. Organizational members were invited to participate in this event. Eight CHBC member organizations attended the event. The lunch allowed for CHBC members to have an informal discussion on how to close the electricity gap left behind by the closure of the San Onofre Nuclear generating Station (SONGS).

Mike Peevey

VIP LUNCHEON AND PORT OF LONG BEACH VIP TECHNOLOGY TOUR

On December 18, 2015, the CHBC held a VIP Luncheon with Jon Slangerup, CEO Port of Long Beach. Mr. Slangerup heads one of the world's premier seaports, a primary gateway for trans-Pacific trade and a trailblazer in innovative goods movement, safety and environmental stewardship. A major economic engine for the region, the Port handles trade valued at more than $180 billion each year and supports hundreds of thousands of Southern California jobs. As the chief executive officer, he leads the Port's Harbor Department staff of 490 people, with an annual budget of nearly $900 million. Organizational members were invited to participate. Seven CHBC members were represented. The lunch and tour allowed for CHBC members to have an informal discussion regarding the Port of Long Beach and possible sustainable measures that could be taken to lessen its environmental impact and to see the port in action.

Jon Slangerup

MEMBERSHIP

MEMBERSHIP COMMITTEE

The membership committee was led by Larry Stapleton of Ballard Power Systems.

2014 PLATINUM MEMBERS

South Coast AQMD

Bay Area Air Quality Management District

AC Transit

Ballard

FuelCell Energy
Ultra-Clean, Efficient, Reliable Power

Hydrogenics
SHIFT POWER | ENERGIZE YOUR WORLD

plug power

2014 GOLD MEMBERS

Clean Energy · HONDA The Power of Dreams · THE LINDE GROUP · PROTON ON SITE

NEW MEMBERS IN 2014

The CHBC attracted $11,900 in new membership revenue. New organizational members included:

- BMW of North America LLC
- Giner, Inc.
- Gladstein, Neandross & Associates
- HandyTube Corporation
- Hydrogen Frontier Inc
- Idaho National Laboratory
- Port of Long Beach - POLB
- SAFCell Inc
- Solar Hydrogen Inc.
- United Hydrogen Group Inc

New individual members are:

- Chris McWhinney
- David Polanco
- Jerome Torresyap
- Mike Cox
- Narendra Pal
- Ram Mohan
- Stan Heinemann

RESEARCH AND ANALYSIS

For 2014, 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.

INDUSTRY DATA PROJECT AD HOC COMMITTEE

The Ad Hoc Committee In 2014, 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. In addition to the intern, the CHBC hired 4th Energy Wave Ltd, the world's leading organization dedicated to working with all stakeholders in the fuel cell and hydrogen sector, to help gather industry data. The company identifies business opportunities, provides world class strategy as well as undertaking analytical work on the fuel cells sector. 4th Energy Wave is run by Dr. Kerry-Ann Adamson, with a number of active associates.

MANAGEMENT

The CHBC held three board meetings in 2014. The first meeting was held on May 6th, following the CHBC Spring Summit. This meeting mainly focused on the creation of new subcommittees called Sector Action Groups (SAGs) and the elimination of the Advocacy Committee. The Second meeting was held on September 24th and focused mainly on the goals for the subcommittees as well as possible goals for 2015. The third meeting was held on December 17th and focused mainly on 2014 in review, the 2015

program plan and budget and the election of Jeff Reed as the new Board Director. A list of 2014 Board of Directors is available in Appendix B.

PLANS FOR THE FUTURE

2015 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 2015.

GOALS FOR 2015

The sections below describe the main goals for Transportation, Clean Ports, Hydrogen Energy Storage, Business Expansion, Education and Outreach, and Events based on the current budget.

TRANSPORTATION

- Utilize a CHBC member Transportation Sector Action Group (SAG) to advise staff on Transportation Program goals and activities
- Support the continued build out of the 100 station hydrogen infrastructure with state cost-shared funding
- Assist in developing pathways and models for private funding of hydrogen stations beyond the 100 stations planned with state funding
- Develop market-supported pathways to renewable hydrogen production and assist in development of renewable hydrogen projects

CLEAN PORTS

The goal of the CHBC's Clean Ports program is to expand the role of hydrogen and fuel cell business solutions for making the ports of California models of high energy efficiency and low environmental impact goods movement centers. The Clean Ports Program can naturally embrace goods movement and other market sectors, including micro-grids and distributed generation, backup power, and truck refrigeration. The activities listed below allow the CHBC to begin significant engagement to create opportunities for members and to begin to address stakeholder goals for clean ports.

HYDROGEN ENERGY STORAGE

The goals of the Hydrogen Energy Storage Program are to:

- Continue development of the HES Committee to represent all CHBC interests in energy storage and power to gas, holding monthly meetings, and advising staff efforts in the HES Program
- Create the economic understanding for the roles that HES can play, with details that allow this technology solution to play at the industry energy storage table. This will be done through completion of the HES White Paper and using it to create a CHBC Fact Sheet on HES. Organize presentation of the results to DOE's Hydrogen Technology Advisory Council.
- Advocate the facts and economic opportunities before the PUC, Cal ISO, ARB and CEC.
- Convene a national invitation-only workshop in California with other stakeholders to develop projects to meet DOE, CEC, PUC and other stakeholder needs.
- Hold at least one VIP Luncheon for this program area

BUSINESS EXPANSION

The goals of the Business Expansion in California Program are to:

- Measure the economic and jobs impact of hydrogen and fuel cell business activities in California.
- Help CHBC members expand their business in California through reduced barriers and enhanced incentives and agency resources
- Assist members in development of specific projects where the voice and actions of the CHBC's broad industry group could make a difference
- Assist state agencies in tapping private industry interest and resources to achieve their objectives
- Attract new supply chain industry players to support expanding hydrogen and fuel cell markets

EDUCATION AND OUTREACH

The goals of the Education and Outreach Committee are to:

- Expand the Education and Outreach Committee to oversee and plan work in this program area.
- Plan and execute the CHBC Hydrogen and Fuel Cell Summit, September 30 – October 1 in Sacramento. Consider side events with collaborating organizations to increase the impact.
- Plan and execute the CHBC Spring Summit to be held in conjunction with a related national meeting being held in California (like ACT 2014 this last year), or a planned meeting of a California organization, like CESA.
- Publicize milestones of CHBC members, no matter where they occur. For California milestone events (e.g. station opening, new customer installation), send one or more CHBC representatives.
- Plan and conduct two Technology Tours of CHBC member products or installations.
- Continue outreach efforts designed for CHBC members and to non-CHBC members, including newsletters, all hands calls for members, website updating, and handling incoming calls from the press and from interested business and government stakeholders
- Website maintenance and expansion
- Identify with members and stakeholders activities that CHBC might undertake to educate AHJs and municipalities to ease the siting of hydrogen fueling infrastructure.
- Explore with CaFCP having a major hydrogen and fuel cell presence at the Super Bowl in Phoenix, AZ, on February 1, 2015

MEMBERSHIP DEVELOPMENT AND SERVICES

- A new focus on international companies wanting to do business in California will be added
- New focus will be added on companies who may not be positioning to do business in California, but want access to the leading industry and government activities taking place in our market because it affects their business
- Care will be taken to ensure that each membership market sector is supported by the CHBC as their interest warrants and grows.

EVENTS

The events goal of 2015 is to host the following:

- 1 Transportation Symposium
- 1 HES Workshop
- 1 RINs/Biogas event
- 1 Spring Summit
- 3 Supply Chain Workshops
- 1 CaHFC Summit
- 1 Silicon Valley Event
- 4 VIP Luncheons
- 1 Ports Event
- 2 Technology Tours

APPENDICIES

APPENDIX A

CALIFORNIA HYDROGEN BUSINESS COUNCIL

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November 10, 2014

The California Hydrogen Business Council (CHBC) applauds the multi-agency effort to establish a comprehensive Energy Storage Roadmap for California to facilitate wide-scale deployment of energy storage. As the roadmap process enters the finalization process, the CHBC would like to point out some issues related to Hydrogen Energy Storage (HES) that have not been fully addressed in the process to date. It is important that California policy and regulation address these issues in order to ensure that least-cost, best-fit storage solutions are available to meet the state's needs.

Barrier to Integrated Resource Planning – Optimizing Environmental Benefits Across Energy Uses

One of the real strengths of the approach being taken in developing the roadmap is that it is a joint effort among the CPUC, CEC and CAISO to define and develop action plans to overcome barriers to achieving policy goals in the area of energy storage. This process seems to have an imbedded assumption that the needed electric energy storage will follow the model of existing resources (battery, pumped hydro and compressed air) in which electric energy is both the input (stored) energy and the output (returned) energy. We would like to suggest that the paradigm be expanded in recognition of the many opportunities to store, and later use, surplus electrical energy in a variety of scenarios (use cases) that take advantage of the interrelationships that exist across the energy silos of electricity, gas and transportation. These cases may not fit the conventional use-case models envisioning storage and re-injection of electricity at one location.

Clearly and by definition, the source energy in this roadmap must be electricity. However, optimal "return" energy may take other forms. One example that has been recognized, at least in part, is thermal storage to time-shift electrical load. As we are witnessing in countries such as Germany (and others including Canada), substantial penetration of renewables will require not only short-term and locational energy storage but also true load-shifting capabilities on the scale of days, weeks and months. Hydrogen and methane, as storage media, provide that capability. They also create synergistic options for use of stored energy in the gas and transportation sectors which increase in many cases the overall environmental benefit of the energy storage round trip. Hydrogen energy storage allows conversion of surplus renewable electricity into renewable hydrogen fuel for FCEVs, renewable natural gas (hydrogen blend or renewable synthetic natural gas) in the natural gas system, or renewable hydrogen feedstock for use in the refining of conventional gasoline and diesel.

There is a comprehensive and growing set of policies, laws and regulations in California driving increased use of renewable resources for transportation and electric generation. When considered in combination with an evolving set of regulations and procurement requirements for electricity storage to support renewables integration, we see an opportunity for real synergy.

There is, as yet, no policy, regulation, incentive or procurement program which addresses the potential for conversion of renewable electricity into another energy form. This is a

major barrier to pursuing alternatives that may provide optimal strategies for energy storage in California. We encourage inclusion of this proven approach in the roadmap process and inclusion of related policy gaps as an important barrier to be addressed.

Hydrogen Energy Storage Use Case(s)

We believe that it is critically important to include Hydrogen Energy Storage (HES) in the process of testing use cases against the identified barriers and actions. The current draft matrix does not do so. Much research, analysis and demonstration work on Hydrogen Energy Storage (often referred to as "Power-to-Gas") has been completed over the past several years in Europe and to a lesser extent in Canada and the U.S. This work provides a foundation of knowledge on technologies, environmental impact, project economics, barriers and emerging business models that validates the important role that hydrogen energy storage could play in the energy mix. As you might expect, one of the more obvious potential use cases for hydrogen energy storage – creating hydrogen to be stored and then converted back to electricity via a fuel cell or other generation resource – is not the most cost-effective approach under many circumstances due to round-trip efficiencies of current technologies, although that use case is highly feasible from a technical perspective.

HES is similar in many respects to pumped hydro and compressed air on a map of storage functions but, unlike those technologies, can return energy in a number of forms. For example, use of surplus renewable electricity to produce hydrogen for later use as a vehicle fuel could provide significant support for the state's ambitious goals for fuel cell vehicle deployment. We believe that looking at use cases that would be synergistic with the projected growing demand for hydrogen fuel in California for vehicles is critical to ensuring that all technically feasible and potentially economic storage options are included in California's multi-agency electricity storage roadmap development.

Hydrogen energy storage is not yet main-stream in the storage community but the potential is real. This was recognized through the convening of a recent workshop sponsored by the DOE and Industry Canada. The report from that workshop, entitled *Hydrogen Energy Storage for Grid Services and Transportation,* is in draft review and soon to be released. Beyond this, the province of Ontario has already selected a Power-to-Gas solution in competitive storage procurement, and there are over 30 projects built or in development in Europe. This development activity clearly demonstrates that others see the value of HES. We support and urge the inclusion of Hydrogen Energy Storage use cases in the California Energy Storage roadmap.

Sincerely,

Jeff Serfass
Managing Director
California Hydrogen Business Council

APPENDIX B

CALIFORNIA HYDROGEN BUSINESS COUNCIL

CHBC Board of Directors Contact Information

Last Update: 06/12/2014

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