CALIFORNIA HYDROGEN BUSINESS COUNCIL

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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