August 3, 2020

Mary Nichols
California Air Resources Board (CARB)
1001 I Street, 6th floor
Sacramento, CA 95814

RE: The Path to Deep Decarbonization

Dear Chair Nichols:

Mitsubishi Hitachi Power Systems, and Magnum Development are pleased to provide comments for consideration as CARB implements the state's decarbonization benchmarks. Our companies are leaders facilitating change in the energy sector, developing and commercializing technologies that produce and utilize non-fossil, zero carbon energy resources – including green electrolytic hydrogen, and highly efficient turbines capable of converting existing power plants into those utilizing 100 percent green hydrogen. Meeting the goals in SB 100 requires solutions that can rise in the marketplace rapidly. We look forward to helping the state meet its short-lived climate pollutant reduction goals and supporting and accelerating its transition to 100 percent clean energy – not just in the power sector but in all sectors that will require rapid transition.

About Us

Mitsubishi Hitachi Power Systems Americas, Inc. (MHPS) leads the industry in power generation and energy storage solutions, and is at the forefront of deploying green hydrogen and battery energy storage systems. Our mission is to provide power generation and storage solutions that enable our customers to combat climate change and advance human prosperity. MHPS was recently awarded a contract by the Intermountain Power Agency for turbines to support transitioning the Intermountain Power Plant from coal today to a blend of 70 percent natural gas and 30 percent green hydrogen by 2025, and then 100 percent green hydrogen by no later than 2045. The project, which is operated by the Los Angeles Department of Water and Power, will immediately reduce emissions from the plant by 75 percent in 2025, and is a critical element to the utility's climate goals and SB 100 compliance plans.

Magnum Development owns and controls the only known "Gulf Coast" style domal-quality salt formation in the western United States. The site is strategically located adjacent to the Intermountain Power Project and positioned to integrate seamlessly with the western U.S. power grid utilizing existing infrastructure. In May 2019, MHPS partnered with Magnum Development to announce plans to develop the Advanced Clean Energy Storage (ACES) project at the site. The ACES project will use renewable power to produce hydrogen through electrolysis, which will be stored in the salt domes, using technology that has been in operation for the past 30 years in the Gulf Coast. The stored, renewable green electrolytic hydrogen can serve to make intermittent wind and solar power a firm, dispatchable, 24/7 renewable resource. It can also provide seasonal energy storage to shift excess renewable generation from sunny spring and summer months to cold and cloudy winter weeks, when renewable generation may be lowest.

Mitsubishi Hitachi Power Systems Americas, Inc.
400 Colonial Center Parkway, Suite 400
Lake Mary, FL 32746, USA
Tel: 407.688.6100 Fax: 407.688.6480

Decarbonization 1.0 - Retiring Coal and Replacing with Natural Gas and Renewables

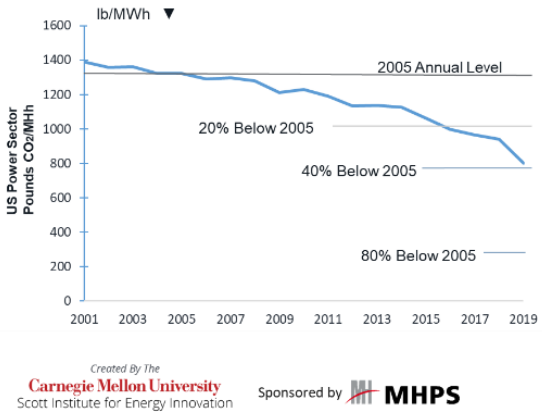

Figure 1. Carnegie Mellon University's "Power Sector Carbon Index." https://emissionsindex.org/

The deployment of natural gas and renewable resources in place of retiring coal-fired power plants has resulted in substantial reductions in carbon emissions throughout the United States. This transformation is quantified in Carnegie Mellon University's (CMU) Power Sector Carbon Intensity Index, which presents publicly available emissions data from the EPA and DOE. Updated quarterly, the CMU index illustrates a decline of carbon intensity on the US power grid by 38.5% since 2005 (see Figure 1). CMU determined that this reduction was due to the retirement of coal and its replacement by natural gas, the improved efficiency of new natural gas plants and deployment of renewables.

As part of industry Decarbonization 1.0, we have been able to achieve 40% or greater reductions in CO_2 emissions through the combination of natural gas and renewables displacing coal and other carbon-intensive units.

Decarbonization 2.0 – Tackle Long-Term Intermittency of Renewables – Currently Managed by Natural Gas – with Energy Storage

The next phase of decarbonizing the electric grid involves reducing or replacing natural gas with renewables. This next phase also requires energy storage to solve the issue of renewable intermittency which is currently managed by natural gas. One way to cost effectively aid this transition is by leveraging natural gas power generation infrastructure to support the large-scale integration of renewables through hydrogen energy storage.

Large scale, affordable green hydrogen storage has been a barrier to using hydrogen gas in the power industry. However, key technologies to create seasonal utility-scale green hydrogen storage are a reality today. These technologies will enable a blend of hydrogen with natural gas to fuel currently available gas turbines and reduce carbon dioxide emissions in the process. Eventually green hydrogen will enable next generation gas turbines that are in development to be fueled with 100% hydrogen gas for a 100% renewables future.

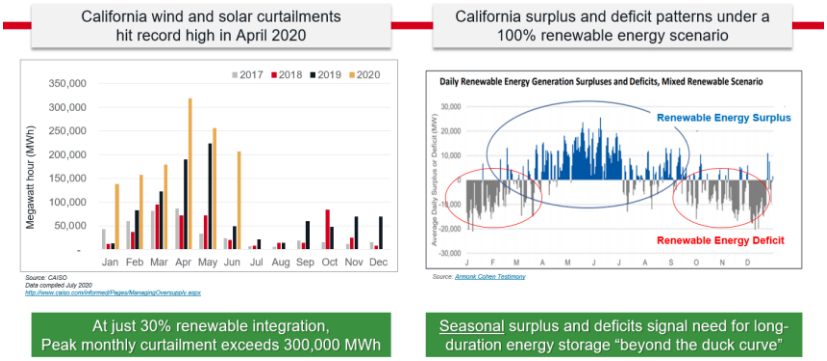

Figure 2. Renewable Energy Surplus and Deficits Signal the Need for More Storage Options.

As grids move toward larger penetrations of renewables, so does our need to move toward securing long duration energy storage to absorb the increasing percentage of daily, weekly, and seasonal surplus renewable energy and to shift it to periods of time when the grid faces sustained shortages. While battery storage has become increasingly affordable, it is only effective for short durations of a few hours and low percentages of renewable energy. A large-scale solution using

electrolysis, a proven technology to convert renewable energy into hydrogen, and storage is now available and increasingly needed as our power grids move towards greater dependencies on renewable energy (see Figure 2).

Green hydrogen can be produced using electrolysis powered by excess electricity from solar, wind and other renewable energy sources. Electrolysis splits water into hydrogen and oxygen to create green hydrogen gas which can then be stored as potential energy. This process can yield GWh's worth of clean energy which can be stored for days, weeks, or months. Commercial, safe and cost-effective hydrogen storage has been in use for decades in various industries including petrochemicals, power, and transportation and across various storage mediums including salt domes and above-ground tanks.

In fact, this form of bulk scale, long duration energy storage with green hydrogen is happening today. Los Angeles Department of Water and Power (LADWP) has recently announced its intent to repower the Intermountain Power Plant (IPP) in Utah with green hydrogen. The 840 MW hydrogen gas turbine project will have a commercial operation date of 2025. It will enter operation with the ability to utilize a blend of natural gas and up to 30% green hydrogen, and eventually will convert to 100% green hydrogen over time. Marty Adams, General Manager and Chief Engineer of LADWP, was recently quoted saying, "If you look at reality, there is no way to get to 100% renewable energy without hydrogen in the mix."[1]

As California seeks to meet the state's climate target goals, we want to make you aware that today we offer our advanced class gas turbines that can generate carbon-free energy from stored green hydrogen – effectively acting as a utility scale, long duration "battery" (see Figure 3). Every gas turbine we sell going forward will have the ability to utilize hydrogen. Ultimately the use of hydrogen in our gas turbines will support the integration of massive amounts of variable renewable energy. These turbines can initially operate on 100% natural gas or a blend of hydrogen/natural gas and ultimately over time shift towards 100% operation on green hydrogen as the grid demands storing larger amounts of renewable energy in the form of this fuel.

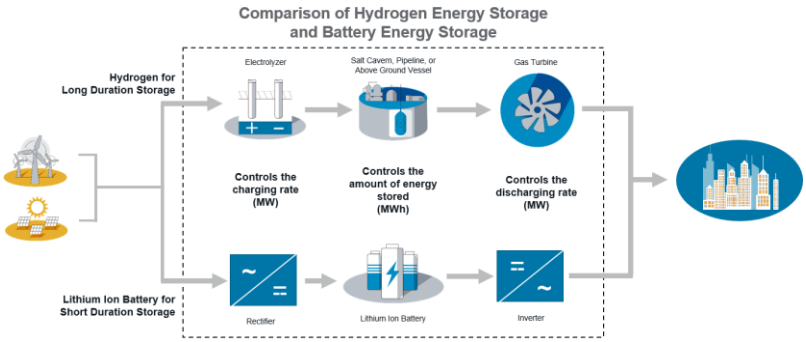

Figure 3. Visual of Hydrogen Energy Storage Ecosystem with Lithium Ion Battery Storage System Benchmark for Comparison.

[1] https://www.publicpower.org/periodical/article/ladwp-embarks-hydrogen-generation-project

As part of your revised Scoping Plan, we propose development of a strategic plan that incorporates green electrolytic hydrogen and energy storage into the efforts to reduce carbon emissions across industries. Additionally, we recommend CARB, CEC and CPUC take the following steps to support the necessary role green hydrogen will play in achieving deep decarbonization in California:

1. Define Green Hydrogen Energy Storage as the conversion of renewable energy into hydrogen via electrolysis technology; the temporary storage of hydrogen in a vessel or geologic formation; and the conversion of hydrogen back to electricity via a power generation source such as a gas turbine or fuel cell technology.
2. Pursuant to SB 1369, recognize green electrolytic hydrogen as an energy storage technology and identify through existing and potential new energy and climate planning processes the importance it plays in supporting a 100% carbon-free grid.
3. In developing alternate scenarios pursuant to SB 100, include those that achieve zero or near-zero greenhouse gas emissions and utilize green electrolytic hydrogen as long duration energy storage and zero-carbon, dispatchable power.
4. Create programs and incentives to support the deployment of green electrolytic hydrogen, such as pilot projects, EPIC grants, tax credits or infrastructure public-private investment.
5. Incorporate green hydrogen into the state's stimulus and economic recovery plans, similar to approaches in Europe and elsewhere.
6. Create a procurement program to support deployment of green electrolytic hydrogen in line with the state's climate goals.
7. Provide tax incentives for shovel ready projects.

California's leadership in decarbonization and commitment to combating climate change are a testament to what can be accomplished when policy makers come together with solutions. We applaud your efforts and work to recognize the importance of green hydrogen and energy storage as a solution to achievement of deep decarbonization.

Sincerely,

Michael Ducker
Vice President, Renewable Fuels
Mitsubishi Hitachi Power Systems

Robert Webster
Chief Strategy Officer
Magnum Development