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EPIC 2025 concept proposals

The storage of surplus power in the form of electr. hydrogen in metal hydrides is proposed for large scale applications to power fuel cells rated at over 1 MW in data centers and power grid substations.
In addition, for the transfer of hydrogen to other sites from large solar projects we propose the biomethanation process (using biogas derived CO2 and green H2) to avoid liquid H2 transportation costs and associated energy losses.
The commercial scale green hydrogen generation at a 1 MW solar field is proposed and construction of a larger reactor for Power-to-X.

Additional submitted attachment is included below.

ELECTRIC PROGRAM INVESTMENT CHARGE 2021-2025 (EPIC 4)
RESEARCH CONCEPT PROPOSAL FORM

The CEC is currently soliciting research concept ideas and other stakeholder input for the EPIC 4 Investment Plan. For those who would like to submit an idea for consideration, we ask that you complete this form and submit it to the CEC by 5:00 p.m. on **July 2, 2021**.

To submit the form, please visit the e-commenting link, https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-EPIC-01, enter your contact information, and then use the "choose file" button at the bottom of the page to upload and submit the completed form. Thank you for your input.

1. Please provide the name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:

   Christian Tasser, P.E.
   e-mail: christian@technology-investments.org,
   phone 714 702 4943

2. Please provide the name of the contact person's organization or affiliation:

   Technology & Investment Solutions LLC

3. Please provide a brief description of the proposed concept you would like the CEC to consider as part of the EPIC 4 Investment Plan. What is the purpose of the concept, and what would it seek to do?

   The proposed concept for your consideration is to demonstrate hydrogen storage in 1) fuel cell power back-up solutions in data centers starting with a capacity of 1 to 2 MW. The storage of hydrogen gas is still not proven in this field because H2 gas storage requires large volumes and foot prints, liquid hydrogen is more energy intensive and finally the newest solution includes metal hydrides solid state hydrogen storage. 2) Use MH in the field of telecommunication towers (5 – 10 kW) to replace diesel generators, and 3) use MH in long duration H2 storage at power grid substations with low pressure metal hydrides at 40 bar fueling 1 MW turbines or fuel cells.

4. In accordance with Senate Bill 96, please describe how the proposed concept will **"lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals."** For example, what

technical and/or market barriers or customer pain points would the proposed concept address that would lead to increased adoption of clean energy technologies? Where possible, please provide specific cost and performance targets that need to be met for increased industry and consumer acceptance. For scientific analysis and tools, what data and information gaps would the proposed concept help fill, what specific stakeholders will use the results, and for what purpose(s)?

The cost targets to be met based on DOE goals are less than $4 per kg of hydrogen. To achieve lower costs we would use an existing 1 MW solar field with surplus power connected to electrolysis units. At this site the conversion of biogas derived CO2 with Hydrogen to methane is demonstrated in our CEC project ARV 18-24. We aim to increase the capacity of this demonstration project for commercial production of power-to-X and showcase the feasibility for the next commercial scale.

5. Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the technology at scale?

   The project outcome will demonstrate the benefits of combining hydrogen storage from electrolysis in metal hydrides for over 8 hours and then using a hybrid process which allows transmission of hydrogen after conversion to biomethane in existing NG pipelines using an existing digester at the green technology park in Phelan , CA. This process will use certified LCFS pathways to avoid the loss of carbon and LCFS credits if CO2 is vented from conventional biogas membranes or PSA upgrading systems. Biomethanation is a solution to upgrade the CH_4 content in biogas by injecting H_2 into an anaerobic digester. The process is using indigenous hydrogenotrophic methanogens for converting the injected H_2 and the CO_2 into CH_4. However, the injection of H_2 could cause process disturbances by impacting the microbial communities of the anaerobic digester and we address this with biofilm fixed media and physical separation of the hydrogenotrophic CH4 formers in the digester zone towards the top where CO2 is then captured. .

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

   The impact will be evaluated based on the cost of hydrogen $ per kg, the efficiency of the conversion of hydrogen to biomethane for pipeline injection, the reduction of the overall GHG emissions when reducing CO2 from 40% in biogas to less than 10 % using CO2 and H2 in hydrogenotrophic archaea.

7. Please provide references to any information provided in the form that support the research concept's merits. This can include references to cost targets, technical potential, market barriers, etc.

The biomethanation will grow by a factor 7 by 2030 and by a factor 27 by 2050 (Source: RNG Coalition and Internetional energy agency)

Biomethanation using hydrogen:
"Biomethanation is a promising solution to upgrade the CH_4 content in biogas. This process consists in the injection of H_2 into an anaerobic digester, using the capacity of indigenous hydrogenotrophic methanogens ...... Better understanding on how the indigenous microbial community can adapt to high H_2 partial pressures is therefore required".
Source:
https://biotechnologyforbiofuels.biomedcentral.com/articles/10.1186/s13068-020-01776-y