DOCKETED	
Docket Number:	20-EPIC-01
Project Title:	Development of the California Energy Commission Electric Program Investment Charge Investment Plans 2021-2025
TN #:	239015
Document Title:	LiCAP Technologies Inc. Comments - Research and Demonstration Opportunities for Energy Storage Technologies
Description:	N/A
Filer:	System
Organization:	LiCAP Technologies Inc.
Submitter Role:	Public
Submission Date:	7/27/2021 8:28:16 AM
Docketed Date:	7/27/2021

Comment Received From: LiCAP Technologies Inc.
Submitted On: 7/27/2021
Docket Number: 20-EPIC-01

Research and Demonstration Opportunities for Energy Storage Technologies

Additional submitted attachment is included below.

Research and Demonstration Opportunities for Energy Storage Technologies

LICAP Technologies, Inc.

7/26/2021

California is a world's leader in development and implementation of decarbonization goals and was among the first nations to adopt ambitious goals of reducing greenhouse gas emissions and plans to achieve a net-zero emissions no later than 2050. California will need to more than double the rate of decarbonization to ensure it is on track of meeting this target (CEC, Integrated Energy Resources Report, 2018).

The key to a shift towards a green economy is the deployment of renewable energy infrastructure and electric vehicles (EVs). To this end, California was the first state in the nation to implement a phase-out plan to end the sales of new gas-powered vehicles by 2035. To ensure the rapid adoption EVs in the state the technology must be affordable for all Californians and sustainable on the projected scale of deployment.

Several peer-reviewed life cycle assessment (LCA) studies investigated the materials and processes within a EV battery life cycle that are likely to pose the greatest impacts to both public health and the environment. LCA experts agree that the conventional "wet electrode" process, where the active battery materials (NMC, LFP, NCA, LNMO) are mixed with an extremely toxic solvent N-Methyl-2-pyrrolidone (NMP) drives the costs and energy consumption of battery manufacturing up and presents a significant risk to the environment and health.

State of the art manufacturing of electrodes for lithium battery cells starts with the preparation of a slurry consisting of active material, conductive agents, and binder materials dissolved in NMP, a highly toxic and expensive organic solvent. The wet slurry is coated on the current collectors and then dried in a large and energy-consuming ovens to vaporize the NMP. The drying process is responsible for most of the manufacturing footprint of the battery cell production and consumes up to 47% of the energy used in the battery cell making step.

The alternative, so called "dry electrode" process is significantly more energy-efficient and non-toxic. Sacramento-based LICAP Technologies, Inc. has advanced the electrode manufacturing and developed an "activated dry electrode" (ADE) process that would eliminate the use of the NMP in battery cell fabrication, decrease the energy intensity manufacturing costs of lithium battery manufacturing and provide a competitive advantage to the domestic battery manufacturers and OEMs. In addition, the activated dry electrode process allows production of very dense/thick electrodes, that have a higher energy density and reduce the cell stacking time and the amount of current collector foils (copper) used in the battery manufacturing. This makes the technology well suited not only for the application in EVs, but would also reduce costs and capacity of stationary storage applications.

We recommend the following research initiatives to the California Energy Commission:

1. **Research Suggestion #1:** LCA study that would investigate costs/energy/CO2 savings from the battery cell manufacturing using the conventional wet electrode method vs the dry electrode method.

2. **Research Suggestion #2:** Development of low-cost/high energy density lithium-ion battery systems for stationary storage applications and demonstrating the viability and advantages on a pilot scale.

3. **Research Suggestion #3:** Development and testing of prototype lithium-ion battery cells with the electrodes produced via "activated dry electrode method" and validation of the technology in collaboration with California-based OEMs.