



From: Dr. Levi Tillemann
To: The California Air Resource Board
Re: Battery Swapping
Date: May 5, 2017

To Whom It May Concern:

I am writing concerning a proposal that the Air Resource Board eliminate certain incentives for battery swapping from its Renewable Fuel Standard. I am the managing partner of Valence Strategic LLC and author of *The Great Race: The Global Quest for the Car of the Future* (Simon and Schuster 2015) a hundred year history of innovation within the automotive industry. I am also the co-author of a forthcoming book with ARB member Dan Sperling and served as an advisor to the United States Energy Department during the Obama administration. I would strongly urge ARB to reconsider the proposal to eliminate battery swapping in its staff discussion paper entitled Electricity as a Fuel Staff Discussion Paper Electricity as a Transportation Fuel, dated November 23rd 2016.

The proposed reason for eliminating “battery switching” is that “no entities have opted into the LCFS under this category over the past 6 years.” Based on my extensive knowledge of the history of automotive innovation, I would observe that there have been many times when a technology has been left for dead, only to reemerge as a critical piece of the innovation puzzle. There is no more relevant example than the electric vehicle (EV) itself. Just as electric vehicles were nearing commerciality in the early 2000s, ARB backed away from its aggressive mandates. To be sure, there were technical challenges that needed to be overcome. There were also legal challenges and the original goals of the ZEV mandate were optimistic. However, ARB’s retrenchment was arguably too all encompassing and too soon. Luckily, the Tokyo Electric Power Company stepped into that void and developed an ecosystem that supported the development of the modern electric vehicle (EV). Based on TEPCO’s success, in the mid-2000s ARB renewed its focus on EVs.

I am aware of at least two companies that are developing credible and in one case a highly

innovative approach to battery swapping. (In the spirit of full disclosure, I will note that I have both worked extensively with and maintain a business relationship with one of these two companies.) Battery swapping could yet emerge as a critically important refueling option for EVs and renewable energy in the 21st century. It allows for fast refueling, and sidesteps many of the knotty economic and technical obstacles that bedevil fast charging. It would be a pity if ARB, which has done so much to promote the development of the EV industry (and is often unfairly maligned for its role in the EV's first demise in the early 2000s), decided to withdraw support from this potentially valuable approach to low carbon refueling.

Please feel free to contact me for additional information (720) 951-8373

Sincerely,

Levi Tillemann, Ph.D.