DOCKETED	
Docket Number:	21-ALT-01
Project Title:	2021-2022 Investment Plan Update for the Clean Transportation Program
TN #:	239899
Document Title:	Ample Response to California Energy Commission’s Clean Transportation Program Investment Plan
Description:	N/A
Filer:	System
Organization:	AMPLE
Submitter Role:	Public
Submission Date:	9/30/2021 3:28:54 PM
Docketed Date:	9/30/2021

Comment Received From: Levi Tillemann
Submitted On: 9/30/2021
Docket Number: 21-ALT-01

Ample Response to California Energy Commissionâ€™s Clean Transportation Program Investment Plan

Additional submitted attachment is included below.

Levi Tillemann
Vice President, Policy and International Outreach
AMPLE, Inc. 100 Hooper St.
Suite 25
San Francisco, CA 94107
ltillemann@ample.com

September 30, 2021

-VIA EMAIL FILING-

CALIFORNIA ENERGY COMMISSION
1516 Ninth Street Sacramento, California 95814
E-mail: docket@energy.ca.gov
Subject Line: CEC Clean Transportation Program Investment Plan

Response to California Energy Commission's Clean Transportation Program Investment Plan

---

AMPLE, Inc. appreciates the opportunity to provide comments to the California Energy Commission (CEC) regarding the Clean Transportation Program Investment Plan. The CEC's investment plan builds on a formidable body of knowledge, integrating policy analysis, industry data and modeling projections on future requirements for ZEV charging infrastructure in the State of California. However, two key variables that will ultimately determine whether electric vehicles are in fact able to serve the needs of a vast majority of Californians are largely omitted from the Commission's analysis: time and cost premiums associated with public charging as compared to gasoline. Much of the relevant data on these variables is closely held by EV charging companies, and as a result remains opaque and confusing to consumers, policymakers and researchers. But what is overwhelmingly clear is that public charging is significantly more expensive than gasoline and that the time required for public charging is prohibitive for many use cases – especially use cases relevant for low income and working Californians. While the EV activist and policy community's intense focus on delivering environmental justice is laudable, the fact that current plans for meeting public EV repowering needs are yoked to EV charging networks that are both slow and expensive is worrisome. Telling low-income MUD dwellers, street parkers and TNC drivers that they ought to rely on slow, expensive public charging rather than fast and comparatively cheap gasoline is rather like telling a citizenry starved for bread that they should instead eat cake. It's feasible in concept, but impractical and likely to provoke an intensely negative response.

Simply put, CEC's current plan underestimates the infrastructure challenges of electrifying the state's mobility system. At the same time, it does not fully account for important and powerful technological solutions to the challenges that bedevil today's EV system. In more developed EV markets such as China technologies not covered by the Clean Transportation Program Investment Plan are already solving for the obvious shortcomings of public charging as a primary repowering solution for EVs. One prominent example is battery swapping.

Ample, Inc. is a San Francisco-based company that is in the process of deploying battery swap-based energy delivery service for electric vehicles. It is Ample's intention to install and maintain a significant network of battery swap stations within the state of California, throughout the United States and internationally. Ample's

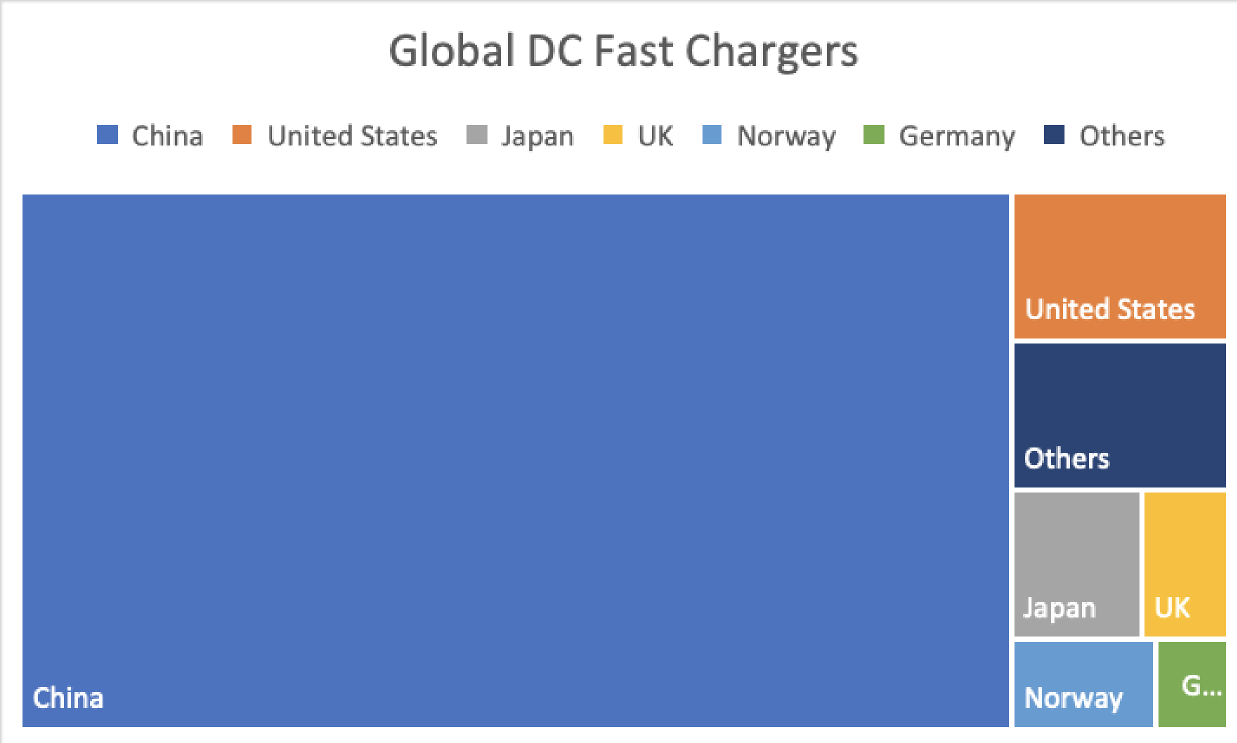

Figure 1: Despite the fact that China hosts over 80% of the world's DC fast chargers, the country has moved aggressively to promote battery swapping.

modular battery swapping is a cost-effective means of transitioning drivers without access to overnight EV charging to electric vehicles.

Embracing technology-neutral approaches to EV infrastructure would allow for transformative technologies like Ample's modular battery swapping to fill significant gaps in CEC's Clean Transportation Program Investment Plan going forward.

Public charging is a solution for distressed drivers with dedicated overnight charging, but battery swapping works better as a primary method of repowering EVs.

More than half of American vehicles lack access to an overnight charging point,[1] and CEC significantly overestimates the ability of DC fast charging and public L2 charging to support drivers without access to home charging. The inadequacy of public charging as a solution is demonstrated vividly by the experience of China –the world's largest EV market. Today, China accounts for over 80% of DC fast charging stations installed globally.[2] Yet despite this robust charging network, over the last 18 months China has undergone a major policy shift to prioritize the deployment of battery swap enabled electric vehicles and battery swap stations. Publicly announced additions for battery swapping facilities in China will be capable of repowering over 80 million vehicles a week by the year 2025.

Despite this, it appears that CEC has largely disregarded battery swapping and the various ways in which swapping can enable greenhouse gas reductions, air quality improvements, sustainable business models for repowering EVs, and promote equality of access in low-income and disadvantaged communities.

This is particularly true with respect to providing charging services to multi-unit dwellings (MUDs), rural communities and street parkers. For these constituencies battery swapping allows for many of the same

---

[1] Credible estimate range from 53% from ICCT to 78% from researchers at Carnegie Melon.

[2] IEA (2021), *Global EV Outlook 2021*, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2021

operational benefits as hydrogen but at a lower cost of infrastructure and with better interoperability with traditional EV charging infrastructure.

At 59 cents a kilowatt hour (a standard price for public EV charging in California) the cost of refueling a Nissan Leaf is equivalent to a Prius driver paying about $8.40 a gallon. In some cases, EVSE pricing is also done on an hourly basis. However, the costs are generally roughly equivalent. For instance, a September 26th charge on a L2 ChargePoint charger in Pacifica, CA cost $4.84 for a little less than 9kwh of electricity (27 miles of range for an all-wheel drive Ford Mach-E) dispensed over the course of an hour and thirty-eight minutes. Using a Toyota RAV4 as a point of comparison, this would equate to over $7/gal equivalent. Using a Prius as the point of comparison, it is equivalent to well over $9/gal. A full charge at this particular station would have taken well over 16 hours. These exorbitant costs and charge times are not sustainable or equitable for Californians that lack access to at-home charging.

Battery swapping is a solution for high-intensity duty cycles
The aforementioned points are doubly true with respect to high-intensity drivers. This is why Ample is currently the only company renting EVs to Uber drivers in the Bay Area. (Soon Sally will also rent EVs to Uber drivers, but Sally's EVs will similarly use Ample's modular battery swapping to repower their vehicles.) Again, the reason that there is currently no active market for renting EVs to Uber drivers outside of the Ample ecosystem is relatively straightforward: high cost and lengthy charge times mean that neither drivers nor fleet companies can afford to use EVs in high-intensity applications. Assuming one hour a day of EV charging (which is, in fact, a very generous assumption) an Uber driver would sacrifice roughly $5000 of income annually simply due to charging time. With per mile equivalent cost of $8.40/gal – or roughly twice the retail price of gasoline in California. Conservatively estimated, the time plus energy cost[3] penalty for drivers who transition from gasoline to public charging infrastructure would be around $9,000 annually.

In contrast, Ample drivers save roughly 15% annually on energy costs as compared to gasoline while sacrificing negligible amounts of time. The current fleet of Uber drivers utilizing Ample-enabled vehicles all lack access to at-home charging and come from economically disadvantaged communities. Every single one of them has switched over to an EV from a high-utilization internal combustion engine vehicle.

Battery swapping as a solution to reducing systemic costs of electrifying mobility
Battery swapping is also a cost-effective means of building out the storage capacity required to decarbonize the grid. Conversely, the costs of integrating electric vehicle charging systems into the U.S. grid without battery swapping are astonishing. The Boston Consulting Group (BCG) pegs the cost of upgrading the grid for electric vehicles through 2030 at between $1,700-$5,800 per car.[4] Assuming annual auto sales of 1.7 million units in the California, a 100% EV sales scenario would equate to between $2.9 billion to almost $10 billion in grid system upgrades annually. An additional point of concern is that BCG's analysis shows that higher numbers of EV sales will result in higher (not lower) per vehicle grid integration costs.

A significant portion of this cost can be offset by grid storage assets in the form of battery swap stations. By separating the process of charging from the action of transferring energy into an electric vehicle, battery swap stations allow for better managed, more constant and more efficient utilization of existing grid assets as compared to charging. The potential for improving the integration of renewable energy is particularly important. Significant static storage capacity combined with battery swapping allows the electrical system to capture the energy from intermittent low carbon energy sources (e.g. wind and solar) when available and to dispense that energy quickly when it is needed.

---

[3] At 59 cents a kilowatt hour (a normal price for public EV charging in California) and utilizing EV drivetrain efficiency estimates from the U.S. Department of Energy's eGallon methodology (a little better than 3 miles per kwh), public charging rates are equivalent to a Prius (a popular TNC vehicle) driver paying $9.60 a gallon.
GFO-21-601

[4] Sahoo, Anshuman, et al. "The Costs of Revving Up the Grid for Electric Vehicles." United States - EN, United States - EN, 8 Jan. 2021, www.bcg.com/en-us/publications/2019/costs-revving-up-the-grid-for-electric-vehicles.

Conclusion
California has been a global leader in EV policy. However, California's policy is no longer setting the pace for innovation in the global EV market and state regulations, programs and policies are even failing to keep pace with deployed technologies in the world's leading EV markets. More worrisome, many of California's current and planned policies that are disconnected from the scale of the electrification challenge ahead and overlook significant shortcomings of the existing EV system to fulfill the needs of future EV drivers.

Today, a tiny percentage of California's vehicle miles traveled (VMT) are electric. And it is unwise to assume that the business models and technologies that got us to 2% electric VMT (probably about where California is today) will be the same technologies and business models that get us to 10%, 40% or 95% electric VMT.

In light of this, we strongly urge CEC to pursue technology neutral, performance-based programs that are open to innovation. Technology neutrality will be a critical variable dictating whether California is successful in achieving the state's electrification and decarbonization goals and accomplish maximum decarbonization at the lowest possible cost. In general, CEC should avoid restrictive, prescriptive, and technologically deterministic incentives and policies. No government agency and no single corporation, NGO or individual possesses the capacity to foresee the exact convergence of ideas and technologies that must emerge in order to address the climate crisis. Accordingly, well-designed CEC policies will avoid command and control-style technology requirements in favor of performance-based requirements and technology-neutral criteria. Efforts to promote particular technology standards or approaches are unlikely to solve the climate crisis or to age gracefully.

On the other hand, aggressive policy that incentivizes performance and penalizes environmental externalities has the very real prospect of dramatically accelerating the critical transition to a zero-carbon clean energy economy.