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Ample Comments on Light Duty Electric Vehicle Block Grant Design Changes Workshop

Additional submitted attachment is included below.

From: **Matthew McGovern (Policy Counsel, Ample, Inc.)**

To: **California Energy Commission**

Date: **January 19, 2024**

Re: **Light Duty Electric Vehicle Block Grant Design Changes Workshop**

Introduction

Ample supports the California Energy Commission's goal of funding electric vehicle infrastructure to help California meet state climate goals. The purpose of this memo is to provide context on emerging opportunities associated with battery swapping and batteries-as-a-service (BaaS) business models. Both are burgeoning trends within the international EV industry and both will become increasingly salient for California as EV penetration rates climb over the coming years. Battery swapping is particularly relevant to the challenge of fleet electrification. Battery swapping is much faster than conventional charging and results in lower up-front costs for fleet purchasers.

The organization of this memo is as follows:

1. Policy and regulatory background on battery swapping.
2. Background on Ample and modular battery swapping.
3. Recommendation that CEC revise CALeVIP criteria to make battery swapping equipment eligible and for CEC to adopt technology-neutral language in its EV programs.

Policy and regulatory background on battery swapping in electric vehicles

The consumer EV industry is little more than a decade old. At its inception, a debate on optimal EV architecture for charging contemplated two separate technology pathways: tethered charging (represented by Tesla and Nissan) and battery swapping (represented by Renault and Better Place). Early EV policy included frameworks supporting both of these pathways and many policymakers considered each pathway to be equally likely. However, over the late 2000s and early 2010s a number of policy and market developments nudged the industry toward a tethered charging model for early EV deployment. The first of these was the bankruptcy of the battery swapping company Better Place. This was paired with the success of Tesla – which was saved from bankruptcy by a large Department of Energy Advanced Technology Vehicle Manufacturing loan. But there were additional factors. For instance, in the 2010s EV purchases were concentrated among affluent early adopters. These individuals tended to place a premium on performance (e.g. 0-60 times) and, conveniently, most had access to home charging. As a

Image 1: Ample swapping stations are designed to accommodate a wide range of vehicles.

result, almost all EVs sold in the United States relied on tethered charging (e.g. plugging in an electrical charging cable in order to transfer electrons). Slow charge times and high EV costs meant that EVs were primarily accessible to high-income individuals who could charge at home. Today in America, EVs still represent a relatively small proportion of automotive sales and they are primarily owned and operated by affluent individuals. Owners can, therefore, rely on home charging for about 90% of energy needs – utilizing public charging periodically.

Today, battery swapping is making a comeback in the world's largest EV markets. America accounts for only about 10% of global EV sales,[1] whereas China accounts for 57% of global EV sales and the EU claims 27%. China and Europe have already pushed past the market for early adopters. (In China more than a third of new vehicle sales are electric.) Because of this, China and Europe have begun deploying a variety of next generation EV charging technologies. One of the most important is battery swapping, which allows drivers to change out an empty battery for a fully charged one in minutes. This approach is fast, low-friction and reduces strain on the grid compared to fast charging. In the world's largest EV market, China, the sales of battery swapping electric vehicles are growing quickly. China already has over 2000 battery swapping stations for light duty electric vehicles and many more for heavy duty electric vehicles. In China there are more than half a million battery swap-enabled EVs on the road today. Battery swapping stations, like gas stations, can fully charge many dozens or even hundreds of EVs a day, whereas today's charging stations are generally limited to the single digits.

As America's EV market reaches a level of maturity similar to China and Europe, its reliance on battery swapping will increase – especially for fleet vehicles and EV drivers without access to overnight charging. There are some unique business model and technology considerations that California must consider so as not to inhibit growth of the EV market.

[1] Canalysis, Global EV sales up 63% in H1 2022, with 57% of vehicles sold in Mainland China (August 11, 2022) https://www.canalys.com/newsroom/global-ev-sales-h1-2022

Background on Ample

Ample provides modular battery swapping services to fleet customers. The company manufactures all of the major components used in its battery swapping system in our five research and manufacturing facilities in the Bay Area. Ample's Brisbane, CA battery module manufacturing plant is supported by a $14.7 million grant from the California Energy Commission, awarded on May 10, 2023. In December of 2023, Stellantis (the parent company of Chrysler, Jeep, Fiat and several other brands) announced that it would partner with Ample to sell swappable versions of its EVs, beginning with the Fiat 500e. This followed the 2023 announcement of Ample's partnership with Mitsubishi Fuso, a division of Daimler Trucks, which will bring a swappable version of its eCanter medium-duty truck to market.

Ample's swapping system repowers EVs faster than conventional DC fast charging at a price lower than gasoline. It was first demonstrated by a fleet of swap-enabled Nissan Leafs and Kia Niro EVs in the San Francisco Bay Area and deployed in partnership with Uber and the rideshare rental car company Sally. Ample is currently adding more swapping stations and swap-enabled EVs in the Bay Area, and is expanding into additional US, European and Asian markets soon (notably Spain and Japan).

Like many providers of battery swapping services worldwide, Ample does not sell its EV batteries. It provides EV repowering services on a "pay-as-you-go" basis (sometimes referred to as Batteries-as-a-Service or BaaS). Drivers pay a monthly fee to use the swapping service and Ample's batteries, plus a per-mile charge. Because drivers do not buy the battery, the up front cost of buying an EV is reduced by approximately the cost of the battery. Drivers can also right-size their EV battery for a specific duty cycle (increasing or decreasing the range as desired) which leads to more efficient utilization of scarce battery stocks. Because fast swapping reduces the charging anxiety associated with running out of energy, fleets can opt for smaller, shorter-range batteries. Currently, Ample's major customers are rideshare and last mile delivery fleets.

Ample's modular battery swapping service is an ideal solution for fleets as it resolves two critical obstacles: 1) lengthy recharging times and 2) costly infrastructure. Ample's BaaS system can repower an EV much faster than conventional DC fast charging, it works for a wide variety of OEMs and models, and is ideal for fleet drivers who do not have a place to charge an EV overnight.

The mechanics of Ample modular EV battery swap technology

Ample's platform consists of four major components (swapping stations; vehicle plates; vehicle trays; and battery modules) that form the basis of a drop-in replacement for OEM EV battery packs and enable faster, more affordable repowering than DC fast charging.

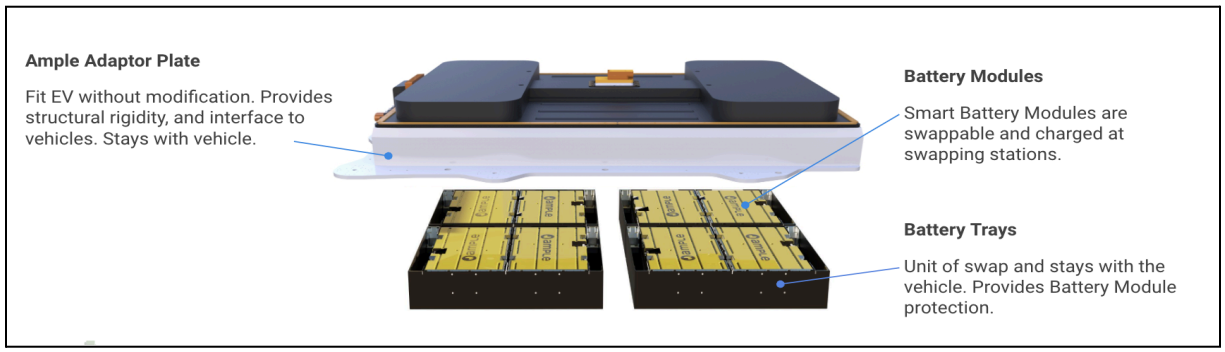

Image 2: Ample's vehicle integration kit has three major components: adaptor plate, battery trays and battery modules.

Battery Module: Battery modules contain EV battery cells connected serially or in parallel. Ample's battery modules can be stacked and arranged into various form factors (shapes) in order to fit into different vehicle chassis. This is accomplished by arranging battery modules into a holding tray. The tray serves two functions: 1) It secures the batteries and 2) provides a latching mechanism which allows the tray to fasten securely into the vehicle via an adaptor plate.

Adaptor Plate: Ample's adaptor plate is the same size and shape as the OEM battery pack, with the same mechanical, electrical, and data interfaces. A plate typically holds four trays, but this can be adjusted depending on the size of the vehicle and the geometry of the undercarriage and OEM battery pack. Each Ample-enabled vehicle will have one plate installed where a fixed battery pack would otherwise be located.

Swapping Station: The battery swap station utilizes an array of interconnected robots and electronics to safely and efficiently remove discharged modular battery packs from a vehicle, replace them with fully charged modular battery packs, and recharge the discharged battery packs.

The Swapping Process: The process of swapping is initiated by raising the vehicle via a lift embedded in the floor of the Ample swapping station. After the vehicle is raised, Ample's swapping robot positions itself underneath a tray and sends an electronic handshake to the vehicle instructing it to release the adjacent tray. The tray is unlocked by means of latching mechanisms that are internal to the tray (and thus protected from debris, inclement weather and under-vehicle impacts). The robot then delivers that tray to a swapping bay where a robot removes discharged batteries and replaces them with charged batteries. Discharged battery modules are racked for charging and subsequent swapping. This process is repeated until every tray within a vehicle has been swapped delivering a full charge to the vehicle.

Many key assumptions underlying California regulations, which explicitly assume tethered charging, do not apply to battery swapping electric vehicles. It will be important for California to

pursue technology neutral rules that do not needlessly bias fleet electrification against battery swapping. Some key considerations that should impact the development of California's ZEV Market Development Strategy are enumerated below.

CEC should allow battery swapping providers to apply for CALeVIP funds. CEC should ensure that all EV infrastructure funding opportunities are technology and business model neutral, and do not (explicitly or implicitly) disadvantage battery swapping

We urge CEC to adopt rules and criteria for funding opportunities that are technology-neutral and put battery swapping on a level playing field with conventional EV charging. This is not a fringe position. Just last week, Sen. Ron Wyden (D-OR), who chairs the Senate Finance Committee and authored the groundbreaking tax credits for decarbonization in the Inflation Reduction Act, opened a recent hearing on federal EV incentives by reflecting on the importance of technology neutrality:

> "Technological neutrality …ensured the competitiveness of our energy system while at the same time giving everybody the chance to be inventive and creative."[2]

Standards that are important for conventional tethered EV charging, such as a charging connector type, are not relevant to battery swapping because the vehicle can be repowered without plugging it in.

The criteria for CALeVIP funding is well-intentioned but overly prescriptive and should be amended because it stymies innovation in EV charging. EV infrastructure grants that are limited to certain types of charging connectors or require certain power levels have the practical impact of excluding battery swapping. For example, EVSE funded by CALeVIP must be either Level 2 or Level 3, and include a CCS connector for Level 3 chargers.[3] These requirements would exclude battery swapping or wireless EV charging, because neither has a CCS connector. If payment is required, the chargers funded by CALeVIP must have a credit card reader.[4] Even though battery swapping costs less than gasoline or Level 3 charging, a credit card reader requirement would exclude Ample's battery swapping stations. Ample's customers pay for battery swapping seamlessly through an online subscription, not at the swapping station.

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[2] Sen. Ron Wyden, Senate Committee on Energy and Natural Resources, Full Committee Hearing to Examine Federal Electric Vehicle Incentives Including the Federal Government's Role in Fostering Reliable and Resilient Electric Vehicle Supply Chain, January 11, 2024 https://www.energy.senate.gov/hearings/2024/1/full-committee-hearing-to-examine-federal-electric-vehicle-incentives-including-the-federal-government-s-role-in-fostering-reliable-and-resilient-electric-vehicle-supply-chains (accessed January 19, 2024).

[3] CALeVIP Eligibility Requirements page, https://calevip.org/general-eligibility-requirements (accessed January 10, 2024).

[4] CALeVIP Eligibility Requirements page, https://calevip.org/general-eligibility-requirements (accessed January 10, 2024).

While CEC has issued some technology-neutral GFO's, these are for competitive grant application programs, which are more competitive than CALeVIP grant applications. As such, these overly-prescriptive funding requirements penalize new technologies that may improve upon and compete with incumbent technologies.

Ample welcomes competition from all types of clean vehicle repowering technologies. Battery swapping works very well for fleets and other customers who do not have time for conventional charging. A program that excludes battery swapping, however, amounts to an unfair subsidy for incumbent providers of a mature technology and privileges affluent drivers with home charging available.

Conclusion

Conservatively, it is safe to assume that fewer than 1% of vehicle miles traveled in the U.S. are currently electrified. California leads the nation in electrification policies and EV market share. But as California looks toward the future of electrification, it is imperative that the state consider market trends in China and other countries that are further along in the transition to zero emissions.

Well-designed policies will avoid command and control-style technology requirements in favor of performance-based requirements and technology-neutral criteria. California has a proud history of driving innovation in the auto industry through its strong clean air policies. But in order to complete the transition to zero emission vehicles, the State must continue to innovate. Fully decarbonizing California's mobility ecosystem will require a diverse range of technologies and business models.