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**Ample Comment on Widespread Infrastructure for Ride-Hailing EV Deployment (WIRED) modeling analysis**

*Additional submitted attachment is included below.*



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**-VIA ELECTRONIC FILING-**

**California Energy Commission  
Docket No. 19-AB-2127**

***Ample, Inc. Comment on CEC Widespread Infrastructure for Ride-Hailing EV Deployment (WIRED) modeling analysis***

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Thank you for this opportunity to provide input on the California Energy Commission's (CEC) Widespread Infrastructure for Ride-Hailing EV Deployment (WIRED) modeling analyses workshop held on November 9, 2022, pursuant to AB 2127. AB 2127 requires the CEC to take a broad view of the study of charging infrastructure needed to meet California's goal of reducing carbon emissions by 40% below 1990 levels by 2030:

(b) The assessment shall expand on the commission's electric vehicle infrastructure projections to consider all necessary charging infrastructure, including, but not limited to, the chargers, make-ready electrical equipment, and supporting hardware and software, all vehicle categories, road, highway, and offroad electrification, port and airport electrification, and other programs to accelerate the adoption of electric vehicles to meet the goals described in subdivision (a).

Cal. Pub. Res. Code § 25229 (emphasis added).

The CEC should consider all types of EVSE for rideshare deployment because AB 2127 requires a broad perspective, and because the current system of home charging supplemented by occasional DC fast charging will not be sufficient to meet California's electrification goals, especially for ridesharing fleets. This comment provides an update on the development of EV battery swapping in California and international markets, and encourages the CEC to include battery swapping in its assessment of EV infrastructure for ride-hailing EV deployment.

**Background**



Ample is a San Francisco-based startup that provides battery swapping services to California rideshare EV fleets — a repowering option that is faster than conventional DC fast-charging and more affordable than gasoline. Today, the high cost of electric vehicle supply equipment (EVSE) and lengthy charge times mean that neither rideshare drivers nor fleet companies can afford to use EVs in high-intensity applications that require on the go repowering.

Despite aggressive statutory goals for electrifying transportation and rideshare fleets, California EVs are mostly driven by individuals who can charge at home overnight. This is not an option for most rideshare drivers. But Ample’s modular battery swapping system provides a 100% charge in minutes at a price lower than gasoline, and does not require fleet owners to install costly charging equipment.

Battery swap stations can have much higher utilization rates than tethered charging stations, because the vehicle does not have to be parked at the station to charge. Swap-enabled EVs can be repowered quickly, while high use rates for a conventional charger would lead to queuing and long lines. Ample’s battery swap stations also have the potential to time battery charging when renewable energy is plentiful and send electricity back to the grid at times of peak energy demand.

Ample now has nine battery swap stations in the Bay Area, and is continuing to and improve its battery swapping network. Ample will begin deploying swapping stations in Madrid in 2023. Ample expects that the passage of the Inflation Reduction Act (IRA) will encourage development of additional battery swapping infrastructure in the US in the near future, because the IRA’s technology neutral credits for EVSE and qualified commercial clean vehicles will apply equally to conventional charging as well as swapping stations and swap-enabled EVs.

### **How can Ample accelerate deployment of EV charging infrastructure?**

In order to limit climate change to no more than 1.5C, emergency measures must be taken to reduce carbon emissions. In America, transportation is the largest contributor to energy-related GHG emissions, and globally emissions must fall by roughly 50% within a decade. Over the same period demand for mobility will grow by ~70% thanks to economic expansion in countries like China, India and regions like sub-saharan Africa. The world needs technologies and business models that serve customers far beyond America’s suburban two-car garages. Electrification must reach into cities with high-rise apartment buildings and densely packed street parking, rural communities, corridors for interstate travel and commerce, and mobility fleets -- which will account for a disproportionate share of vehicle miles traveled. Ample’s solution fills this gap.

This is because Ample outcompetes DC fast charging and gasoline for a number of important use cases. Mechanical swapping takes roughly the same amount of time as stopping at a gas station and energy cost is competitive with the most affordable modes of fast charging.



Speed of deployment is also a key differentiator. Most EV charging stations take many months if not years to site and build. Because Ample stations are designed to be assembled onsite and require no construction (trenching, pouring concrete pads, etc.), Ample stations can be deployed in days. Perhaps most importantly, Ample battery swap stations can store renewable energy when it is available and deliver clean energy to an EV quickly when it is needed. This energy storage capacity fills a huge gap in our energy supply system. Deploying an Ample pod costs less than deploying a DC fast charger, but fast swap times mean that Ample achieves much higher capacity factors -- thus offsetting demand charges and reducing the need for costly grid upgrades. On average, DC fast chargers operate less than 5% of the time. Battery swapping stations can charge batteries up to 100% of the time because batteries can charge while the vehicle is in use (a ~20X improvement).

**CEC should consider battery swapping and other EVSE innovations in its WIRED analysis because it is required by AB 2127 and international markets are adopting battery swapping**

As noted above, the CEC should consider battery swapping and other EVSE innovations in its WIRED analysis because AB 2127 requires consideration of all types of charging equipment, and because California cannot meet its electrification goals with current policies focused on home charging supplemented by occasional DC fast charging.

Historically, California has led development on policies for clean air and transportation electrification, but it has fallen behind the federal government and other countries. In China (which is the world's largest auto market and has over 80% of the world's public DC fast chargers) a major shift towards battery swapping is already underway, because China has learned through experience that public fast charging alone is not sufficient to expand EV use beyond early adopters. Most major OEMs in China now have battery swapping solutions for repowering electric vehicles. EV manufacturer Nio has over 2000 battery swapping stations in China and Europe and these stations likely deliver more electric miles than all the public fast chargers in the U.S. combined (because of the high capacity factor of their battery swapping stations). California should look towards these more developed EV markets for technological and market guideposts and learn from their experience.

By 2025, Nio claims it will have 4,000 battery swap stations in operation, while Chinese auto manufacturer Geely has set a goal of deploying 5,000 battery swapping stations by 2025.<sup>1</sup> In August of 2022, the Chinese battery swap station operator Aulton announced that it had completed its 30 millionth swap.<sup>2</sup> While California's battery swapping capacity is very small by

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<sup>1</sup> China's Geely to set up 5,000 battery swapping stations by 2025, Reuters, Sep. 26, 2022 <https://www.reuters.com/business/autos-transportation/chinas-geely-set-up-5000-battery-swapping-stations-by-2025-2021-09-26/> (accessed November 22, 2022).

<sup>2</sup> Aulton says it has achieved 30 million cumulative battery swap services, CNEVPost, August 12, 2022 <https://cnevpost.com/2022/08/12/aulton-says-it-has-achieved-30-million-cumulative-battery-swap-services/> (accessed November 22, 2022).



comparison, California policymakers should include battery swapping in its analysis of EVSE for rideshare vehicles, and develop technology neutral policies to promote transportation electrification that puts battery swapping on a level playing field with conventional EV charging.

### **The path forward**

EV charging will be part of the solution for refueling electric cars. However, the economics and speed at which vehicles charge and infrastructure can be deployed means that battery swapping must increasingly be viewed as an important mode of public EV refueling. This shift is already under way in more developed EV markets like China. Battery swapping also bridges the gap between sustainability and convenience by absorbing renewable energy when it is available, storing it and refueling electric vehicles within minutes. The CEC should acknowledge the reality of the evolving EVSE market internationally and ensure that battery swapping is included in all of its charging infrastructure studies and policies.