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-VIA ELECTRONIC FILING-

California Air Resources Board
1001 I St #2828, Sacramento, CA 95814
Re: sp22-kickoff-ws

***Ample Inc. Comments on the California Air Resources Board Scoping Plan
Update to Achieve Carbon Neutrality by 2045***

AMPLE, Inc. appreciates the opportunity to provide comments to the California Air Resource Board (CARB) regarding the state's Scoping Plan Update to Achieve Carbon Neutrality by 2045. We applaud the ambitious scope of CARB's plan, but we also believe that it underestimates the infrastructure challenges of electrifying the state's mobility system, and at the same time does not fully account for technological solutions to these challenges that are already operational in more developed EV markets such as China. Specifically, the Air Resource Board overestimates the utility of DC fast charging in reaching full electrification and overlooks the role battery swapping can play in filling this gap. Today, China accounts for over 80% of DC fast charging stations installed globally. 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. We strongly urge the Air Resource Board to more fully account for this market trend 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. We also urge the Board to recognize that battery swapping allows for many of the same operational benefits as hydrogen in light-duty applications but at a lower cost of infrastructure and with better interoperability with traditional EV charging infrastructure.

Ample, is a San Francisco-based company that has pioneered modular battery swap and solved the challenge of how to deliver energy to electric vehicles in under 10-minutes without straining the grid, while accounting for renewable energy intermittency and reducing the cumulative need for large carbon-intensive EV batteries. Modular battery swapping represents a new generation of battery swap infrastructure that is economically self-sustaining, operationally flexible and has already been integrated into a dozen distinct vehicle models from five different OEMs. Not only is Ample's refueling fast and

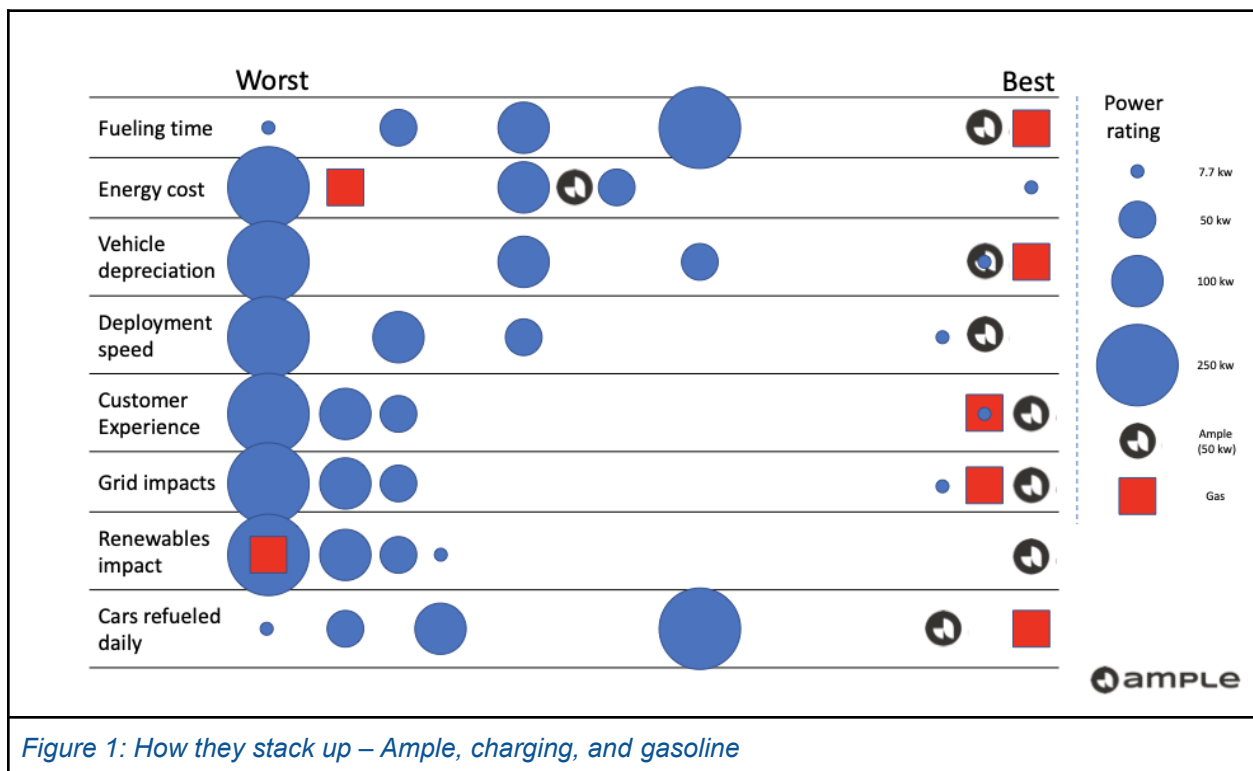


affordable, installation of swap stations is too. It is Ample's intention to install and maintain a significant network of battery swap stations within the state of California, throughout the United States, and internationally.

We believe that the battery swapping (and Ample's modular approach to battery swapping in particular) answers a number of key questions confronting the Board with respect to its 2045 scoping plan. These questions include:

How can California 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 California, transportation is the largest contributor to energy-related GHG emissions (~50% of total emissions¹), 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.² The world needs technologies and business models that serve customers far beyond suburban America's two-car garages. Electrification must reach into cities with high-rise apartment buildings and densely packed street parking, low-income neighborhoods, 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.



¹ Ramalingam, Jordan, "CARB Scoping Plan Presentation Day 3: Transportation," *California Air Resource Board*, June 10, 2021 <https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/scoping-plan-meetings-workshops>

² World Economic Forum 2020. Raising Ambitions: A New Roadmap for the Automotive Circular Economy [L Tillemann, W. Machur, et al]. World Economic Forum, Geneva Switzerland.



Because Ample is designed to be assembled onsite and requires no construction (trenching, pouring concrete pads, etc.), Ample stations can deploy in days. Perhaps most importantly, Ample can slowly charge batteries with renewable energy when it is available and deliver charged batteries to an EV quickly when energy is needed. This energy storage capacity fills a critical gap in our energy supply system. Deploying an Ample pod costs less than deploying a DC fast charger, but fast swap times and integrated storage mean that Ample achieves much higher capacity factors – without high demand charges or costly grid upgrades. On average, DC fast chargers operate less than 5% of the time. Ample can charge batteries up to 100% of the time because batteries can charge while the vehicle is in use. This means that Ample can deliver a roughly 10X utilization improvement over today's fast chargers (25+ vehicles/day for an Ample pod with a 50kw connection). Ample enables a step change in California's ability to meet EV charging needs by means of public charging and reduces the cost of installing infrastructure for EVs (see Figure 1).

Because of the speed and efficiency with which Ample can swap batteries, the system's throughput is the equivalent to a gas or hydrogen station and unlike charging modular battery swapping is economically profitable.

How can California provide disadvantaged populations access to clean, affordable mobility?

Ample's modular battery swapping is a cost-effective means of transitioning drivers without access to overnight EV charging to electric vehicles. Currently, we are supporting a fleet of high-mileage Uber drivers in the Bay Area. All of these drivers have transitioned to Ample's zero emission EV platform from internal combustion engine vehicles. Without Ample's quick refueling these drivers would not be able to rely on electric cars and would be significant sources of GHG and criteria emissions. The drivers utilizing Ample's platform come from low-income communities that have not been prioritized by many EV-incentives to date and their shift toward electrification translates directly into improved environmental, noise and air quality outcomes in affected communities. This deployment demonstrates the viability of utilizing battery swap to decarbonize miles driven by multi-unit dwelling (MUD) residents, in communities where street parking is the norm and by fleets.

How can California reduce the systemic costs of electrifying mobility?

The built-in storage capacity of swapping systems will dramatically reduce the systemic cost of decarbonization. The Boston Consulting Group (BCG) estimates that the cost of upgrading the grid for electric vehicles will be between \$1,700 and \$5,800 per car.³ Assuming annual auto sales of 1.7 million in the state, 100% EV sales would equate to between \$2.9 billion and almost \$10 billion in grid system upgrades annually. According to BCG's analysis, the bigger EV market gets, the more expensive these upgrade costs will be on a per vehicle basis. By separating the process of charging from the action of transferring energy into an electric vehicle, battery swap turns EV batteries into a storage asset.

How to manage the impact of a clean energy transition on the automotive and energy workforce?

The California Office of Planning and Research (OPR) has stated that "efforts to reduce greenhouse gas emissions have been complemented by efforts to increase the creation of high quality jobs and greater access to them for disadvantaged populations." However, in addition to catering to high-income Californians with dedicated parking, the current paradigm of EV charging also threatens to destroy jobs at

³ 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.



gas stations and associated convenience stores. Unlike charging, Ample's battery swap technology can support a workforce that is both qualitatively and numerically similar to employment in the gas station industry. The poor economics and low-throughput of charging are not well suited to supporting a similar workforce. Ample's high throughput means it can provide good clean energy jobs for mechanics, technicians and convenience store attendants.

Ample expects to directly support a significant workforce in three relevant areas:

- Installing swap stations that will service fleets and private individuals
- Maintaining and operating swap stations
- Manufacturing and installing Ample's modular battery packs

Our expectation is that each battery swap station will require local labor to install and roughly one-half full-time employee to maintain. If half of California's 15 million vehicles were to run off of Ample's battery swap-enabled electric cars, we predict that would result in 50,000 associated maintenance jobs, and thousands of jobs in onsite assembly, manufacturing, and potentially associated retail.

The path forward

EV charging and hydrogen will be part of the solution for refueling electric cars. However, the speed at which vehicles charge, economics of EV infrastructure, interoperability and deployment challenges for both hydrogen and fast charging mean that battery swapping should also be viewed as a primary mode of public EV refueling. This shift is already under way in more developed EV markets like China, where government policy is now preferentially incentivizing swap-enabled EVs. Major Chinese EV manufacturers have already announced capacity for battery swap stations capable of servicing 40+ million vehicles by 2025. In Europe, Nio is importing battery swap infrastructure to Norway and Renault CEO Mateo de Luca has publicly stated that the company is revisiting battery swapping for EVs. California cannot afford to ignore this powerful trend.

Ample's modular battery swapping system allows electric vehicles to refuel in minutes and pay for energy on a per-mile basis -- just like gasoline. It can also work with virtually any electric vehicle. The Ample system bridges the gap between sustainability and convenience by absorbing renewable energy when it is available, storing it and refueling electric vehicles within minutes.

Today's pace of electrification is not nearly fast enough to achieve critically important climate goals and the economics do not pencil out absent massive and sustained government subsidies for charging. Battery swapping will be necessary to dramatically accelerate this process. As Ample deploys its modular battery swapping system at scale in 2021 and beyond, we urge the California Energy Commission to find ways to support this effort and integrate swap into future planning and funding efforts. California needs to support a new generation of battery swap, because the critical work of decarbonizing mobility needs to accelerate in order to achieve the state's goals for a sustainable mobility future.