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FREEWIRE®

January 27, 2021
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

Re: FreeWire Technologies Comments on the Draft 2020 Integrated Energy Policy Report Update Volume I: Blue Skies, Clean Transportation

On behalf of FreeWire Technologies, thank you for the opportunity to provide comments regarding the California Energy Commission's (CEC) Integrated Energy Policy Report (IEPR). FreeWire appreciates the CEC's dedication to advancing transportation electrification across the state. Our comments here, which are focused on the above-mentioned report, are intended to reflect recommendations focused on EV programs and policies in general and specifically, Chapters 4 and 6 of the IEPR.

FreeWire believes there is a great opportunity to accelerate the roll-out and lower the total costs of EVSE programs in California. Our recommendations are intended to address three critical areas of opportunity to improve current programs. California can optimize state and private resources to meet the electrification challenge by adopting policies which emphasize the following:

- **Accelerate deployment** of charging infrastructure
- **Attract investment in the charging market** by creating efficient, transparent funding for the most cost-effective charging projects over the project life
- **Promote innovative technologies** and charging approaches by removing bias from program design

FreeWire Technology Overview

FreeWire is dedicated to accelerating the deployment of EVSE by reducing the barriers to installation and the high energy cost of operating chargers. FreeWire accomplishes this by integrating battery storage technology into its Boost Charger, which reduces the need for make-ready infrastructure and reduces the grid impact of charging vehicles. Boost Charger provides a charge to the vehicle directly from the FreeWire battery using a low power input, as opposed to conventional chargers, which pull power directly from the grid at high power. The Boost Charger can deliver high power output to vehicles while dramatically lowering the energy costs of charging - a significant benefit to site hosts, grid operators, and ratepayers alike.

FreeWire, a California Small Business, manufactures in a DAC community and received a CEC Advanced Manufacturing grant in 2019.[1] Well known market players such as BP, ABB, Volvo cars have invested in FreeWire. Boost Chargers have been deployed in California, Tennessee, and Oklahoma and will soon be deployed in Nevada, Utah, and Massachusetts. The Boost Charger has undergone testing at EPRI that has verified the performance and cost reduction benefits of the technology.

Side view of the Boost Charger, 120kW Battery integrated fast charger

FreeWire's mission is not just to electrify but to create sustainable electrification. FreeWire and other innovative providers are addressing electrification holistically to reduce the overall costs of electrification, not just for vehicle owners but for businesses and the energy system. By siting batteries at the grid edge, and utilizing existing infrastructure to repower them, FreeWire's products can store solar and wind power and enable use of it off peak without the need for any smart charging or customer impacting charge reduction. In future iterations that same battery will be able to provide back-up power to critical facilities or grid services, providing customers a lower cost charger and reducing their electrical costs overall. In

[1] FreeWire was awarded funding from the CEC's Bringing Rapid Innovation Development to Green Energy (BRIDGE) grant program

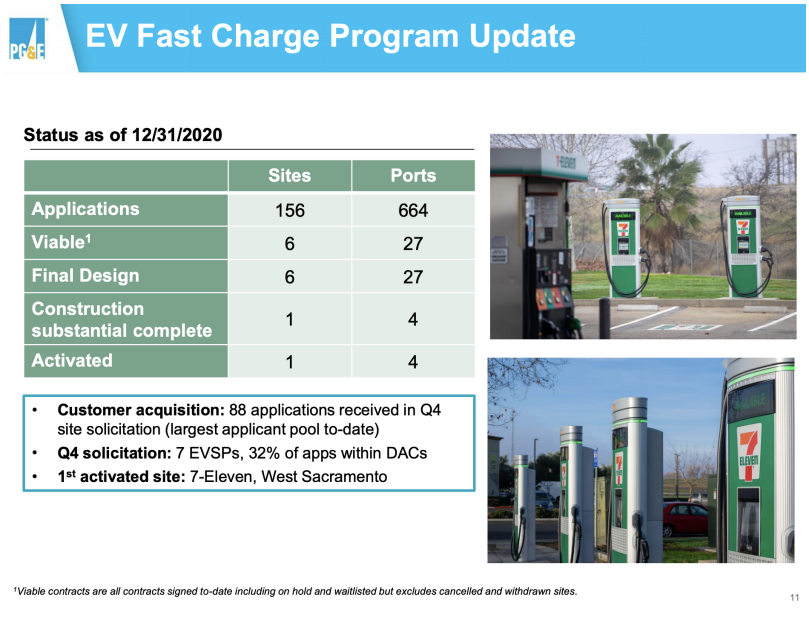
this way FreeWire is developing the next evolution of charging assets that are also grid resources, provide back-up power and can integrate renewable generation to harden the grid.

FreeWire Comments
Chapter 4: Charging Infrastructure: Key to Market Growth and an Opportunity for the Grid

FreeWire couldn't agree more with the first sentiment of Chapter 4: *California must stay ahead of charging demand*. Unfortunately, the current design of infrastructure programs doesn't recognize speed to market as a key attribute of program design. FreeWire filed comments on the CALeVIP program on December 23rd, 2020 on this exact issue. Non-CEC programs, such as utility make-ready fast charger programs, are incredibly time intensive, require overhead in analysis from the utility, and are designed for yesterday's technology.

Climate related events are occurring with increasing frequency. With less public subsidy, DCFC stations could be deployed immediately throughout the state in rural, congested urban, DAC, and low-income communities. Current programs and policies are burdened by delay, lowering the economic value of our public investment, and slowing deployment of chargers. California, as the leader of US electrification, must demonstrate and leverage its technology resources by creating opportunity, not reducing it, and by better qualifying public spending on outdated, slow-to-deploy, and expensive solutions.

The graphic below illustrates the difficulty of finding suitable sites for make-ready programs. In a recent Public Advisory Committee presentation, PG&E shows that less than 4% of applications to the EV Fast Charge Program resulted in viable sites (just 6 out of 156).



PG&E

EV Fast Charge Program Update

Status as of 12/31/2020

	Sites	Ports
Applications	156	664
Viable[1]	6	27
Final Design	6	27
Construction substantial complete	1	4
Activated	1	4

- **Customer acquisition:** 88 applications received in Q4 site solicitation (largest applicant pool to-date)
- **Q4 solicitation:** 7 EVSPs, 32% of apps within DACs
- **1st activated site:** 7-Eleven, West Sacramento

[1]*Viable contracts are all contracts signed to-date including on hold and waitlisted but excludes cancelled and withdrawn sites.*

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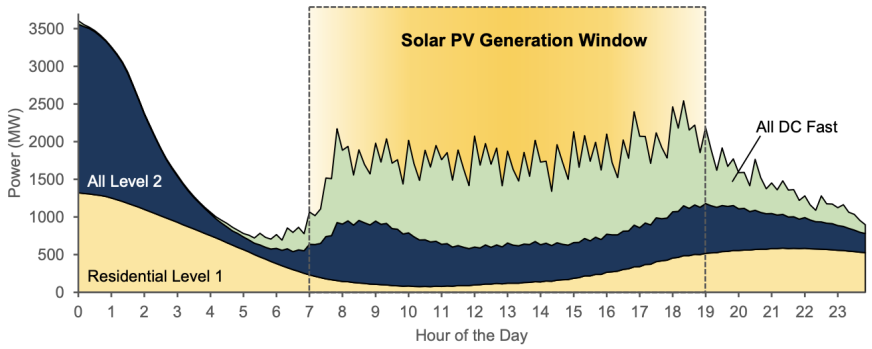
Source: PG&E

While FreeWire has had positive interaction with PG&E, who sees value in our technology as part of their program, getting into the program is arduous and time consuming. CPUC efforts to "future proof" the program has resulted in a very limited set of potential charging solutions. Including FreeWire's Boost Charger as eligible hardware could substantially increase the number of viable sites due to its use of low voltage input (240v or 208v 3 phase) while still outputting high power at up to 120kW for one vehicle or 60 kW for each of two vehicles charging simultaneously. This lower input power solution would accelerate deployment of public funds and open up more sites for fast charging. In PG&E's Q4 2020 Clean Transportation Program Advisory Council (PAC) Meeting, PG&E stakeholders acknowledged that future proofing requirements for their make-ready program prohibited the deployment of DCFC at desirable sites, such as MUDs and parking garages in urban areas where it is extremely costly to bring in 480v power.

Preparing for Charging Loads

One benefit of storage technologies is that they can easily and inherently enable charging across a variety of load profiles and optimize renewable energy generation resources. The CEC graph below shows the DCFC load and its relation to solar generation. Battery integrated charging hardware will flatten this curve and shifting variable generation and load - without any impact on the driver experience or need for sophisticated integration with the grid manager. Programs should reward this benefit specifically and help reduce the costs to the site host of battery integration.

Figure 27: Load Profile for a Typical Weekday for EVI-Pro 2 With 5 Million PEVs



Data Source: National Renewable Energy Laboratory

IEPR Page 82, Battery backed charging enables electricity created during PV Generation window to be provided to vehicles outside the window without any "SMART" software

Standardization and Interoperability

As noted by the CEC's infrastructure assessment, standardized connectors and communication protocols are essential to the widespread adoption of EV driving.

FreeWire is opposed to using public funds to support proprietary networks such as Tesla. Allowing Tesla connectors to receive CALeVIP funds potentially creates an unfair advantage for Tesla and is at odds with the CEC's efforts to increase standardization across the EV industry. In

addition to the lack of availability of the Tesla connector to third party EVSE manufacturers, there is a challenge in managing the Tesla chargers through software. To FreeWire's knowledge, Tesla has not adopted the Open Charge Point Protocol ("OCPP"), meaning that the integration of the Tesla hardware is only possible with Tesla software. FreeWire expects that if Tesla is going to receive public funds intended for public charging, that they would also have to integrate on OCPP. In Europe, Tesla added CCS plugs to certain models in order to comply with European regulations and standards. As referenced in the CEC's workshop titled "AB 2127 Charging Infrastructure: Needed Hardware & Software," held in August 2020, "Harmonized standards and regulations [will create:] Interoperable PEVs, EVSE, and communication networks" and "Predictable investment requirements [to achieve scale]."[2]

Soft Costs

FreeWire agrees soft costs are unnecessarily high in the sales and deployment assessment process for those exploring investing in charging. When analyzing the feasibility of a DCFC project, one must consider available electrical capacity, expected utilization, and property limitations, in addition to other site-specific factors that dictate the best available charging technology. Site hosts require significant education and business model analysis to accurately forecast the return on investment of deploying charging infrastructure - or even just the costs associated with it. An example is modeling new pilot programs that reduce demand charges based on certain utilization levels. This "assessment" complexity is exacerbated by having multiple programs with varying qualifications for the same project (e.g., utility make-ready, local rebates, LCFS credits, AQMD grants, etc.) Many of these programs have prohibitions on pre-spending or require lengthy review or are available on a first come first serve basis. In short, companies have high customer acquisition costs only to have the sale hang in the balance of securing multiple program approvals with little transparency into outcome timing. A program's assessment of the project typically doesn't include an avoided cost analysis and additional preference for speed to deployment. The result is a murky marketplace with significant delay for market entry.

Equity

Innovative technology can enable broader participation in EV charging and electrification generally. FreeWire's Boost Charger was developed specifically for gas stations[3], which seem to be disproportionately sited in DAC communities near major thoroughfares. Boost Chargers infrastructure-light approach should open up cost effective deployment in areas that are both congested, such as MUD locations, as well as grid constrained.

Maximizing Charger Benefits at the Lowest Cost Will Spur Private Investment FreeWire strongly supports the CEC's proposed Transportation Electrification Regulatory Policies ("TERPA") concept, where EVSE projects are evaluated on the basis of avoided cost. FreeWire believes TERPA's approach to a more holistic cost-benefit analysis will reward EVSE technologies that reduce the amount of public investment needed to support DCFC

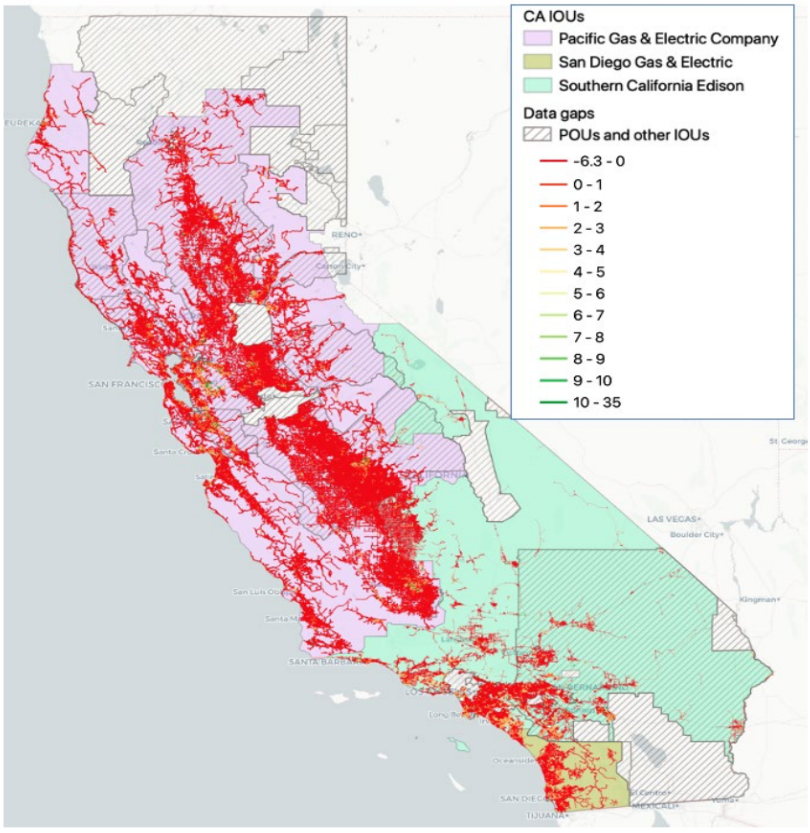
[2] Presentation - AB 2127 Charging Infrastructure Needed Hardware & Software

[3] There are approximately 10,000 gas stations in California

deployments, in addition to rewarding technologies that can be deployed quickly. FreeWire has submitted comments in support of TERPA, which are referenced below.[4]

The current policy approach has lacked imagination and has focused on traditional charging solutions such as make-ready programs. To address the high costs of operating chargers in low utilization scenarios, utilities and the CPUC have proposed and approved demand charge reduction programs that merely shift costs from one rate class to another, instead of focusing on technological solutions that reduce the overall cost. Unfortunately, these costs, while hidden from the owner, do not disappear. They are born by ratepayers, many of whom are low income, and add to the systemic costs of electrification reducing the very value of electrification.

The EDGE Capacity Analysis and Data Gaps chart below shows just how much make-ready is needed to accommodate new loads from EV charging. The red areas, showing significant capacity gaps, paint a staggering picture of the amount of make-ready infrastructure being contemplated.



Red lines indicate areas where the grid cannot accommodate additional load without any thermal or voltage violations. Grey hatched areas indicate regions where gaps in utility grid data exist (mostly in POU service areas). Colored lines, keyed in the legend, indicate the available circuit capacity in megawatts.

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[4] FreeWire TERPA Comments

[5] Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment (Staff Report), Page 47

If make-ready is implemented without regard to cost assessment, ratepayers may be burdened with high rates. In addition to high costs, improving the infrastructure will create lengthy delays in EV charging deployment. The market will receive an inaccurate signal where higher cost charging solutions will look more attractive to buyers and providers of EV charging due to the subsidies they receive. FreeWire supports the TERPA framework as it addresses many of these challenges and creates other benefits related to reductions in soft costs and facilitation of financing and private investment. At the very least FreeWire recommends creating a vehicle for funding alternative solutions similar to what has been proposed in Connecticut by United Illuminating.

> "A new generation of DCFC charger is being developed and deployed that has the potential to radically alter traditional views of DCFC infrastructure requirements. The next generation of DCFC integrates battery storage and all DCFC components into a single consolidated device. The primary benefit of this design is a significantly reduced load requirement that further reduces infrastructure requirements. This type of "hybrid" storage and DCFC unit reduces load requirements to those equivalent to a LII charger but delivers high power DC outputs of 120 kW.
>
> Hybrid storage/DCFC designs provide opportunities for siting in potentially capacity constrained areas without significant distribution system upgrades, but also reduce the possibility of creating new capacity constraints. Hybrid storage/DCFC is more expensive than the current generation of DCFC, however the infrastructure to support them would be significantly less. Since the infrastructure cost related to these units is comparable with LII but provide the benefit of DCFC, and due to the ability to these units to reduce strain on the distribution system, **the Company proposes to allow the battery components related to hybrid storage/DCFC units qualify as customer-side make ready and be eligible for DCFC make ready incentives."**[6]

VGI

VGI is a broad term with many potential applications. In the DCFC context, FreeWire believes drivers will be unwilling to stop at a DCFC in order to put power back into the grid. Also, it may be some time before the technology is ready. The CCS connector isn't expected to support bi-directional power flows until 2025. Battery-backed fast charging designs similar to the Boost Charger can simultaneously provide vehicle charging and grid services such as envisioned by VGI. FreeWire is developing a bi-directional DCFC product to accomplish this and expects it to be commercially available in 2022. This solution would feed power back to the grid from the charger battery--not from the vehicle.

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[6] United Illuminating comments in DOCKET NO. 17-12-03RE04, RESPONSE TO REQUEST FOR PROGRAM DESIGN OF THE UNITED ILLUMINATING COMPANY, page 23-24

Chapter 6 Zero-Emission Vehicles (ZEVs) Are a Source of Energy Resilience, but Careful Planning is Needed

A core requirement for transportation electrification is "grid down" charging (e.g., charging capability without grid input power). It is hard to imagine hitting the EV adoption targets of the CEC models, particularly for fleets, without readily available resilience solutions. By the end of the year FreeWire expects its battery integrated fast charger will be able to charge vehicles without grid input power, providing some measure of resiliency for PSPS and other grid events. Today, FreeWire's Mobi units can provide L2 power (11kW output) without a grid input until its 80kWh capacity is drained. These units are highly mobile and can be deployed in minutes, recharging when empty from either a standard 110 or 220 volt outlet.

FreeWire recommends creating public value for hardware that has grid down functionality in a recognition of the public benefit and higher costs to provide these features.

As noted in the IEPR, the state needs resilient charging options for PEVs but also for petroleum vehicles, as gas stations require electricity to operate fuel pumps. UC Davis, a FreeWire customer, purchased a Mobi to charge its hybrid fleet but also to provide back-up power for its gas pumps to fill ICE vehicles in the case of a grid outage. FreeWire's product development roadmap incorporates bi-directional charge units to support similar applications at gas stations and other critical facilities using its Boost Charger.

Conclusion

FreeWire recognizes the early policies and programs were necessary to drive the first phase of charging infrastructure deployment. These programs helped achieve a market tipping point wherein early buyers had the confidence to invest in EVs. However the program designs and policies initially used are unlikely to lead to sustainable electrification because they exacerbate soft costs, delay deployment and investment, and bias non-traditional approaches.[7] To quote the CEC's infrastructure report, "Generally, the best fit charging solution maximizes the electric miles enabled at the lowest overall cost while reflecting local needs and constraints."[8] Innovative technologies, such as FreeWire's Boost Charger, are penalized by these programs even though in most cases they reduce the total cost of public investment needed to deploy an EVSE solution.

The Boost Charger's design eliminates make-ready electric infrastructure costs and lowers the site host's operating costs by reducing punitive demand charges.[9] The economics of DCFC projects need to be analyzed using a total cost of ownership framework, where infrastructure, hardware, and operating costs are factored into the evaluation of a charging technology.

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[7] Page 61 of CEC Infrastructure Report

[8] Page 61 of CEC Infrastructure Report

[9] Page 4: FreeWire Comments on Strategies to Attract Private Investment in Zero Emission Vehicle Charging Infrastructure and Other Clean Transportation Projects

Battery integrated solutions require little, if any, make-ready, and yet have been disqualified from some programs because they don't require high voltage power to provide high power charging. From a customer perspective, a battery integrated charging solution costs more because the public is subsidizing traditional technology, irrespective of a lower total cost of ownership.

FreeWire appreciates the opportunity to comment on current and future program and policy designs and hopes its experience in the marketplace can inform policy recommendations as we collectively attempt to radically change our power infrastructure to achieve the fastest, most equitable and suitable infrastructure deployment.

Sincerely,

FreeWire Technologies