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On Executive Order B-48-18 - Proposal

Additional submitted attachment is included below.

From:	ceo@electrictrees.com
Sent:	Tuesday, August 28, 2018 10:13 AM
To:	Energy - Docket Optical System
Cc:	Crisostomo, Noel@Energy
Subject:	Docket 18-HYD-01 and Executive Order B-48-18- Proposal for Cost Effective, at Scale, EV Charging deployment in Multi-Family residential properties
Attachments:	Proposal for CEC MUD Site Acquisition Program.pdf

Hello,

Please find attached a proposal for achieving a successful deployment of EV infrastructure for the 42% of Californians, and the growing majority of urban residents, who are not single family home owners and who are currently denied access to the savings, credits, HOV access and the performance of electric vehicles, yet are contributing to the subsidies for those who can have access.

If enabled, this population can double the rate of sale of EVs in California and include the population as participants and beneficiaries of the health and economic benefits of EVs.

This proposal, as presented to the assigned Commissioner and Staff, presents a scale solution to address the Multi-Unit Dwelling Charger gaps and financing and deployments in a manner at least 6x more cost effective than current attempts and reaching at least 75,000 apartments to prove and demonstrate the performance of EV Charging services for Renters and residents of Multi-Family properties while achieving this at a negative cost per ton of GHG avoided in under 10 years.

Please feel to contact me with any questions about the contents.

Thank you,

Stacey Reineccius
CEO
Powertree Services Inc.

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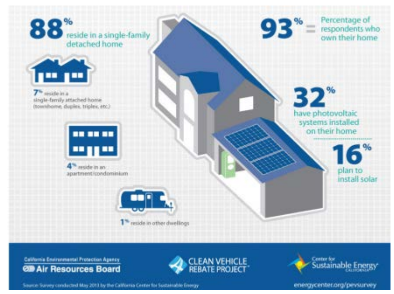
Proposal for California Energy Commission Funding of
Large-Scale PEV Accessibility via *Shared Use Charging Access*
for Residents of Multi-Unit Residential Properties
to fulfill Executive Order B-48-18

Submitted by Powertree Services Inc.
in collaboration with EV Alliance and Clean Fuel Connection

Purpose: This proposal to the CEC is designed to demonstrate the financial viability *and statewide scalability* of Multi Unit Dwelling (MUD) residential PEV charging by:



- Targeting AT SCALE 75,000 or more apartments to be enabled in tranches of at least 7,000 apartments per project
- Identifying key technical solutions, business models, and stakeholder alliances necessary for successful MUD EV deployment
- Testing proposed solutions at a sufficiently large scale to encourage substantial private investment and demonstrate statewide replicability
- Collecting and reporting on before and after effects of MUD infrastructure on area EV registrations, eVMT, and driver experiences.

The Lack of Scaled MUD Penetration is Undermining Transport Electrification: Multi-unit residential properties are a critical area of ZEV infrastructure need to achieve the GHG and gasoline reduction goals set forth by the State of California and to improve economic and environmental conditions for California residents. Today almost all (93%+) of plug in vehicles (both BEV & PHEV) have been sold to drivers wealthy enough to own a home in California -- while only 4% have been sold to either condominium or apartment residents (per CVRP data). Yet the US Census notes that 42% of Californians reside in rental apartments with high majorities of the population being renters in key urban markets such as San Francisco, Los Angeles, and their surrounding cities. Thus, the advantages of EV ownership have been inaccessible to nearly the entire population of California renters. This fact was recently used to defeat AB 1745 by demonstrating the differential hardships imposed on renters by rate-basing of transportation electrification given historic deployment patterns that favor wealthier single family home owners. The recent AB 1745 opposition featured renters and tenants who were experiencing substantial difficulties adopting an EV due to the lack of accessible charging at or near their homes.[1] To move beyond the unsatisfactory 4% of PEVs being sold to renters to date in California, it is critical to balance the scales and provide substantial investment for MUD charging. Moreover, a recent report from CARB indicates that GHG emissions from transport are increasing by approximately 2% per year currently. *This underscores the urgency of the need for more drivers, including MUD residents, to have access to PEVs*.

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[1] See https://careaboutenergy.org/ab-1745/?utm_source=stack&utm_medium=cpv&utm_campaign=ice_ban_02&utm_content=Barbara_30

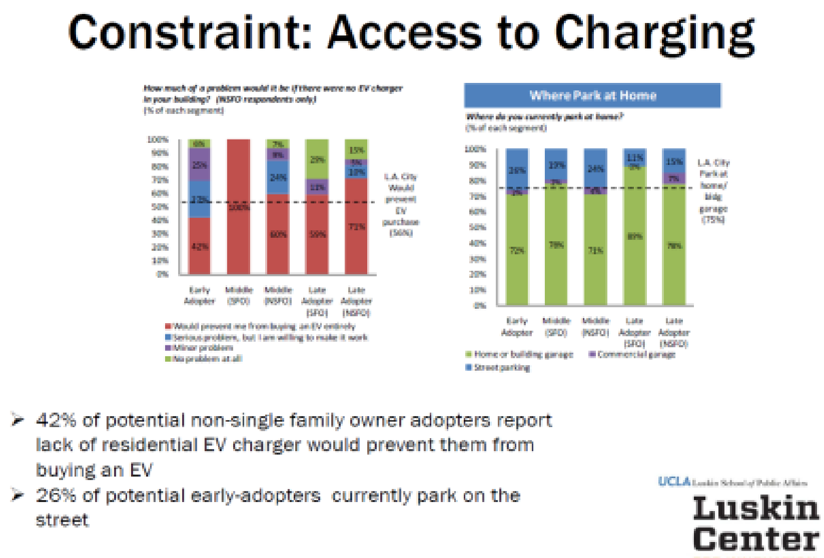
Increase in California Transportation Emissions: 2011-2016

	2011	2012	2013	2014	2015	2016
Transportation	**161.51**	**161.22**	**160.90**	**162.28**	**166.14**	**169.38**
On Road	***148.03***	***147.71***	***147.07***	***148.04***	***151.52***	***154.64***
Passenger Vehicles	111.37	111.77	111.52	112.20	116.33	119.03

Millions of tonnes of GHG emitted in Calfrornia by on-road transportation per year.
SOURCE: www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_sum_2000-16.pdf

The EV Access Gap: In the state's larger cities, where EVs are (potentially) best suited to meet driver needs, the prospects for EV ownership among renters have been particularly bleak. When surveyed by the UCLA Luskin Center, 65% of prospective early EV adopters were MUD residents. The same surveys indicate that up to 81% of MUD residents believe that the current lack of at home or near home charging will prevent or be a serious impediment to the purchase of a plug-in vehicle.

An Opportunity to Triple EV Ownership: By overlaying this data with income data on renters in the EV purchase demographic, one can reasonably infer that if a viable MUD infrastructure strategy had been in place from the beginning of EV deployment in the state, there would now be as much as *triple the current deployment of EVs in California*). The Bay Area EV MUD access study funded by the CEC and conducted by the EV Alliance demonstrates that several hundred thousand EV owners in the San Francisco Bay Area are in the prime EV purchase demographic but had no access to EV charging solutions.



New Business Models are Needed to Open the EVSE Market: Fortunately, there is now a renewed focus on the importance of the MUD market and useful experience from which to craft scaled EVSE deployment strategies. Also, the emergence of a robust market for used EVs has lowered the potential purchase price for EVs and thus broadened the addressable market substantially. (For example, relatively low-mileage Leafs are available for under $10K and Volts for under $20K in the Los Angeles market.) While MUDs face well-known and unique challenges, new business models are being purpose-built to address the hot-button issues of key decision-makers in the MUD context – especially property owners and managers. These solutions range from load sharing systems and full turnkey operations, to make-ready financing and business model innovations that combine charging with other onsite energy upgrades, incentives, and revenue streams.

To drive meaningful MUD market acceleration, the most critical need is to address the two greatest MUD challenges: 1) The need for business models that motivate widespread adoption by building owners; and, 2) the development of affordable approaches that enable electric mobility for MUD residents at low cost. As described in more detail below, one model (developed by Powertree) that can address both challenges is to combine shared use of EVSE with solar and energy storage to provide multiple revenue streams to building owners, while dramatically lowering the cost of EVSE *per apartment enabled for EV ownership and use.*

Shared Use Enhances MUD Charging Efficiency and Accessibility: A MUD charger with shared access for all building residents and nearby neighbors can enable substantially more cost-efficient EVSE access per apartment or vehicle compared to other residential approaches, while delivering a faster charging experience. For example, a typical MUD property in San Francisco has approximately 25 apartments with an average of 1.4 vehicles per apartment. Under current laws (AB 2565) a single installation can cost $375 for permits, $1500 for electrical work, and $700 to $3500 per single-port EVSE – ***<u>at a total cost of ~$3,600 to $6600+ to enable charging for a single vehicle if no upgrades are required</u>***. This does NOT count the full costs of parking space rental, electricity, insurance required to be paid by the EV owner, or potential cost of a utility electrical upgrade.

By comparison, the same MUD property equipped for <u>shared use</u> will enable <u>any</u> of the residents in the building to purchase an EV with known EVSE accessibility. In our example, this approach spreads the initial costs to the residents of 16 apartments resulting in a cost of under ***<u>$375 per apartment enabled for EV adoption</u>*** at the higher end of potential costs ($6000/16 = $375). [See related filings Docket 18-HYD-01 and Executive Order B-48-18 Workshops -- EV infrastructure and business model success for Multi-Unit Dwellings for a more detailed discussion of this cost effectiveness metric.]

While this approach is not always as convenient for EV drivers as a dedicated charger per space, in many urban environments, *<u>there simply has been no demonstrated history of viable business models for retrofitting chargers to a dedicated space given the churn in tenancy</u>*. Further, both tenants and owners/managers of properties are extremely reluctant to “start from scratch” on a new installation with each new EV buyer in the property -- and are often prevented by local rent ordinances from re-assigning parking spaces across different units. In effect, the single charger per dedicated space model is acting as a powerful <u>barrier</u> to initial EV purchases, whereas the shared use approach (managed by a responsible EVSP) resolves the problem of EV access for the entire building with a comprehensive and scalable approach. In addition, both battery sizes and charging rates are increasing at a significant rate, such that home charging sessions – while still essential for most owners -- will become both less frequent and faster over time, reducing the inconvenience of shuttling vehicles in and out of the electrified spaces.

By contrast with the many unknowns and stranded asset risk accompanying a new charger install in a pre-dedicated space, the shared use approach *<u>establishes an up-front protocol for expanding the number of charging ports within the building as demand increases</u>*. The shared use approach also involves installation of the requisite equipment and capacity to facilitate cost-efficient capacity growth through managed charging and integration of other distributed energy assets as appropriate to the use case, such as solar PV and stationary battery energy storage.

Once the comprehensive shared use agreement is in place, the MUD-focused EVSP will also be empowered to deploy newly emerging technologies – such as wireless charging and new load management strategies – to enable even greater convenience and ubiquity of charging as technologies evolve and costs decline. The key to this highly cost-efficient shared access strategy is that a long-term agreement (up to 20 years) is established with the owner to build out <u>all</u> the infrastructure needed to serve *<u>as many residents as choose to adopt EVs over time – from 1% to 100% of the building’s tenants – **and to include neighboring EV owners** as capacity permits!</u>*

Current Utility Programs are not showing traction in MUD and are very costly per vehicle: The following table shows the reported success of different MUD focused efforts in California as reported by SCE and PG&E to the CPUC in their most recent quarterly filings and Powertree's *actual* deployments in construction from its Powertree San Francisco One project, which was supported by a combination of $9.4 million in investor funding and a $500,000 CEC grant developed with EV Alliance.

MUD Project Costs Comparison			
	PG&E	SCE	Powertree
Vehicles Served	1	1	10
Shared Y/N	N	N	Y
Operating Costs Covered for Host?	N	N	Y
Cost per Apartment Enabled	$ 13,500	$ 13,731	$ 690
Cost per vehicle at 17% EV penetration (5 MM Evs)	***$ 13,500***	***$ 13,731***	***$ 2,058***
Ratio to Powertree	6 : 1	6 : 1	1 : 1
17% chosen as 5 million/28 million residential vehicles EV penetration to CA car fleet			
Apartments Supported in Pilots	**-**	**35**	**14,487**

See footnote [2] below.

As commented in other filings, Utility programs, while well funded, have been poorly received by MUD owners due to flaws in program design These include a focus on charge port deployment counts based on a 1:1 model of chargers to EVs, which leaves MUD owners and drivers vulnerable to stranded asset problems due to the well-documented churn in occupancy. Further, utility programs have been significantly non-responsive to property owner business concerns (e.g. need for significant revenue and/or increases in building equity value.) Key benefits of this proposal to the property owner are: 1) to significantly enhance the owner value proposition via revenue sharing and equity value enhancement; 2) reach far more households by focusing on electrification of entire buildings (via the shared model) rather than individual deeded spaces subject to churn, and; 3) to provide valid MUD operational data AT SCALE that can be used to improve MUD deployment programs and enable private financing of further projects without the need for State support.

Shared Use is Economically Essential in Most MUD Properties: Even after installation in a MUD property, a charger can quickly become a stranded asset if attached to just one specific dwelling unit, due to high turnover among residents. As shown in the following table, based on industry data from Marcus & Millichap commercial brokerage (specializing in MUDs), *a fixed assignment of an EVSE to a single apartment carries a 96% risk of being stranded in as little as 3 to 5 years*. By contrast, an urban shared used system that is accessible to all residents of a larger MUD building – and to "next-door neighbors" within a one-block radius – would achieve 100%+ utilization (i.e., definite certainty of use) as EVs are increasingly adopted by residents with guaranteed access to secure and convenient home charging.

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[2] Data for costs of SCE and PG&E programs taken from quarterly program reports filed by respective Utilities with CPUC under the AFV Program A.15-02-009 and SCE A1806XXX . NOTE – Utility costs do NOT include additional capital or operational costs borne by the site host or EVSP. Further, the utility figures do not include program administration costs (over $12M for PG&E) which are excluded from their construction cost reporting, but would likely boost per port reported costs by well over 50% if included. Also, utility service upgrades are provided at low cost for utility-sponsored installations, but at very high cost for non-utility EVSPs. Powertree costs (as in the case of other non-utility EVSPs) reflect higher per port costs due to paying "full retail" electrical capacity upgrade costs which are up to 10X higher than internal utility cost allocation for ratepayer funded internal EVSE program fulfillment. In addition, Powertree per port costs include costs of solar and storage as resilience and revenue producing features. However, inclusion of solar and storage enables more rapid deployment and more cost-efficient operations and supports larger-scale capacity expansion, thus enabling (with the shared approach) a more cost-efficient overall program when considered on a "per EV-enabled apartment" basis.

The projected 17% rate of EV penetration in MUDs is based on statewide achievement of the 2030 goal of 5 million EVs, given a 28 million total residential vehicle fleet in CA. Powertree costs are based on a "per EV enabled apartment" in San Francisco with vehicle populations adjusted per US Census projections and the 17% penetration for enabled apartments. Example: $690/enabled-apartment * 11 apartments enabled within 1 block radius * (5 million vehicle target / 28 million residential fleet) * 1.595 vehicles registered per apartment (DMV) = $2058 per enabled vehicle. Note that the Powertree model includes PV-powered resiliency, building access management, and energy storage support.

Likely Churn by Category of MUD			Utilization Probability of dedicated EVSE at Initial Location				
		Churn	% Initial Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Single Family Standalone		8% (12 years)	100.0%	91.7%	84.0%	77.0%	70.6%
	Adjusted for CARB EV penetration		**100.0%**	**91.8%**	**84.2%**	**77.2%**	**70.8%**
	Condominium	14% (7 years)	100.0%	85.7%	73.5%	63.0%	54.0%
	Adjusted for CARB EV penetration		**100.0%**	**85.9%**	**73.7%**	**63.2%**	**54.3%**
	Small House (2-4)	20% (5 years)	100.0%	80.0%	64.0%	51.2%	41.0%
	Adjusted for CARB EV penetration		**100.0%**	**80.2%**	**64.3%**	**51.6%**	**41.4%**
	Medium (10-20 units)	35% (3 years)	100.0%	65.0%	42.3%	27.5%	17.9%
	Adjusted for CARB EV penetration		**100.0%**	**65.4%**	**42.8%**	**28.1%**	**18.7%**
	Large (50+)	60% (2 years)	100.0%	40.0%	16.0%	6.4%	2.6%
	Adjusted for CARB EV penetration		**100.0%**	**40.7%**	**16.9%**	**7.5%**	**3.9%**

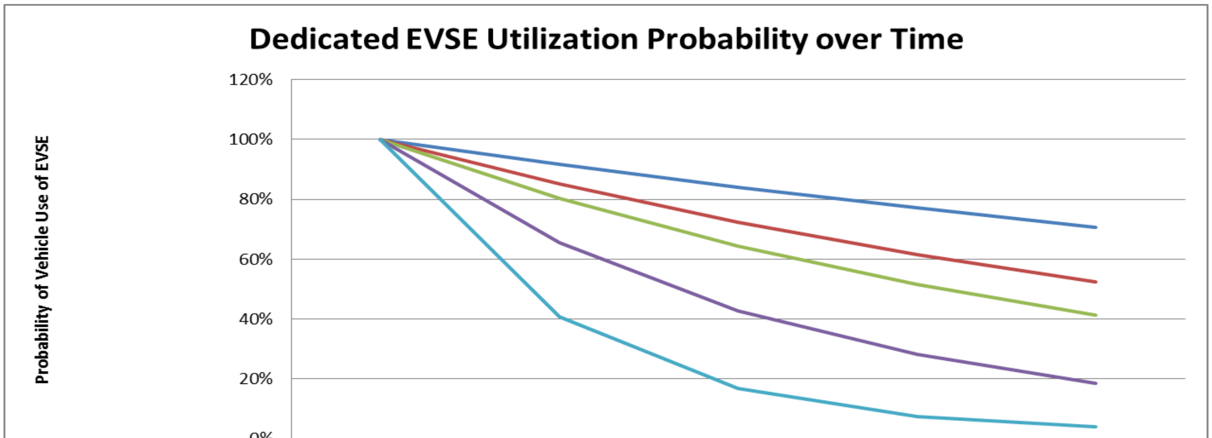
Churn is based on average duration tenants residing at given class of property. Utilization % figures are adjusted from baseline 2017. The CARB minimum % of new vehicle sales is adjusted to cumulative full California light duty vehicle fleet %. I.e., probability of new tenant having a Plugin Vehicle. Churn % from Commercial real estate trade data for MUD. [Marcus & Millichap]

Shared Use Utilization probability			(> 100% indicates multiple use/need for multiple chargers)				
		Density Factor (per census)	% Initial Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
	Rural	26	3%	3%	4%	5%	6%
	take rate	10%					
	Suburban	70	14%	17%	21%	26%	32%
	take rate	20%					
	Urban	1,078	582%	716%	881%	1083%	1332%
	take rate	54%					

Density Factor is Population per 1 Block radius Block (appx 1/16 square mile)
http://en.wikipedia.org/wiki/List_of_United_States_cities_by_population_density#Population_densities
https://www.census.gov/prod/cen2000/phc3-us-pt1.pdf#page=44

Take rate is % of location that utilizes shared service. (% in MUD as proxy)
100% = Certain Usage
< 100% less certain to be used
> 100% demand in excess of single use

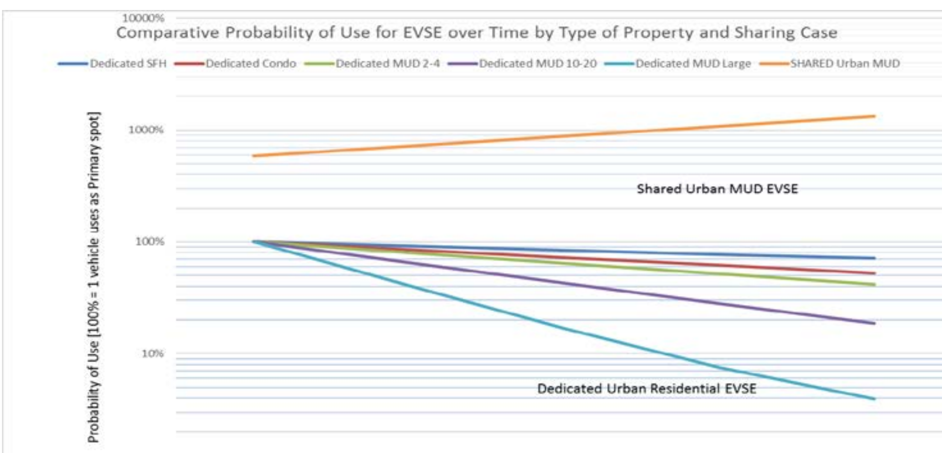
Shared use enlarges available customer pool and increases probability of regular utilization as it is not restricted to the single apartment in building but can draw on the general population in its location.



	% Initial Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Single Family Standalone	100%	92%	84%	77%	71%
Condominium	100%	85%	72%	62%	53%
Small House (2-4)	100%	80%	64%	52%	41%
Medium (10-20 units)	100%	65%	43%	28%	19%
Large (50+)	100%	41%	17%	8%	4%

Chart shows % probability of utilization for a MUD placed EV Charger if the stall and EVSE are dedicated to a single apartment and NOT shared. The dedicated model has been used by past and current MUD EVSE programs for Utilities and EvGo, etc.

Impact of EVSE Sharing in Diverse Market Segments: The table below shows the impact of sharing in different market segments. The property size churn constraint is eliminated as EV adoption increases. Figures above 100% show expected level of multiple vehicles per multi-family residential charging location, e.g., 582% = 5.82 vehicles using a single EVSE as their home base for charging.



	1	2	3	4	5
Dedicated SFH	100%	92%	84%	77%	71%
Dedicated Condo	100%	85%	72%	62%	53%
Dedicated MUD 2-4	100%	80%	64%	52%	41%
Dedicated MUD 10-20	100%	65%	43%	28%	19%
Dedicated MUD Large	100%	41%	17%	8%	4%
SHARED Urban MUD	582%	716%	881%	1083%	1332%

This chart shows impact of sharing in different market segments. Property size churn constraint is eliminated as full area market factors take control. Figures above 100% show expected level of multiple "primary" vehicles per charging location. I.e., 582% = 5.82 vehicles using single location as primary base for charging.

It is clear that over time properties with high churn and a low number of total drivers with plug in vehicles, *will very quickly be faced with stranded assets if the EVSE are dedicated to a single driver*. <u>By sharing the EVSE both within the building and with nearby neighbors – and by automating stall access and operation -- this churn factor can be managed</u>.

Leveraging Private Infrastructure Funding Requires Operating History of Comparable Projects and Technology: Recent announcements on MUD charging from EvGO, Chargepoint, and Powertree/Panasonic, amongst others, have promised attractive financing programs available ONCE a property owner is ready to commit and site control has been established. Each of these programs has demonstrated some owner interest -- but also faced difficulty in obtaining follow on finance. Financiers **require validated operational history of revenue and customer activity AT SCALE to bring large-scale funding to the MUD charging segment**. To demonstrate this history, it is critical to acquire site control and an operational history at a large enough scale to ensure a truly sustainable business model. That business model must provide:

1. ***EV charging accessibility*** **at a low cost per MUD resident**
2. ***EV charger utilization*** **at a low cost per EV driver**
3. ***EV charging program revenues*** **at a rate sufficient to sustain property owner participation and sustain the EVSP business operations.**
4. ***Clear impact on EV adoption by affected tenants***

All four conditions must be met to create a sustainable EV charging business model that will attract significant private funding.

Funding Design to Encourage and Assess Shared Charging in MUD Settings: A key barrier for rapidly scaling MUD access, even in the case of grant supported projects, is that funding has historically been available from the CEC only after individual properties have been fully vetted and enrolled. However, gaining full property owner commitments in larger properties with complex ownership structures (REITs, etc.) for an emerging market is very time-consuming and costly, as is the site survey process to establish accurate costs and timelines for EVSE deployment and electrical upgrades at scale. By contrast, once site control has been established, multiple pathways to funding for construction are available beyond CEC funding, such as private Energy Performance Contract (EPC) funding IF a proven revenue and performance history is available.

The one-time cost of site host identification, site qualification, engineering, permitting, and initial on-site promotion of the EV ownership opportunity is substantial. However, these steps are essential prior to the actual purchase, installation, and commissioning of the Charging Station. Taken together, this process can cost between $4000 and $8000 per charge port not including the equipment depending on the property, quantity, and region. It is essential that these costs be included in any funding program designed to achieve to large-scale MUD EV adoption.
Currently both MUD-located EVSE and revenues from EV Service Provider business models are new to the finance community -- resulting in a “Catch-22” or “chasm” for scaled deployment.

Proposed CEC Funding Program Design: To achieve truly broad-scale charging access for MUD residents, we propose that the CEC focus its resources on addressing the front-end financing problem with resources scaled to the challenge. A large-scale state investment that enables affordable and attractive charging business models will in turn unlock and leverage even larger private finance -- once we close the ***large-scale MUD site acquisition and performance history gap,*** and EV ownership by MUD residents becomes more ubiquitous.

Specifically, we propose that the CEC:

1) **Provide finance on a milestone basis for 75,000 apartments "enabled for EV."[3]** This could be comprised of projects with at least 1000+ apartments in-building with shared EVSE. It is recommended that the EVSE have at least 70 amps of deliverable AC capacity with shared access serving the host building and associated nearby apartments. The nearby apartments should optimally represent at least a 6X increment above the base host building for in-building and "near-neighbor" charging. Thus, a complex with 1000 apartments would optimally be configured to serve an additional 6000 nearby apartments – enabling a total of ~7,000+ apartments per project minimum enabling appx. 246 new EV purchases per year[4]. Initial milestone funding would be associated with completed MUD site agreements[5] and relevant engineering, followed by construction and operational milestones.
2) **Finance for EVSE construction, commissioning, and operations** will follow success in development of site agreements and surveys[6]. Support will be provided until appropriate performance history is collected on a "per apartment enabled" basis. The provision of operational support for MUD-focused EV charging networks is consistent with existing CEC practice in the hydrogen fueling space and reflects a serious response to the very real market failure in MUD charging -- experienced by both the IOUs and virtually all incumbent EV Service Providers to date.[7]
3) **Focus on Scale and Business Model Innovation:** The projects would be evaluated on the basis of business model innovation and scalability to reach large numbers of potential EV drivers in key metro-area markets.
4) **Minimum Project Size:** To ensure large-scale market impact, we recommend that each funded project be required to enable for charging a minimum of at least ~1000 apartments "in-building" -- with a building cap per project of perhaps 1000 host buildings to prevent any one applicant from controlling all the funding.

To ensure quality projects with a high likelihood of success, we propose the following funding parameters, and cost- and operational effectiveness metrics. This model also adapts the precedents used in the Hydrogen Fueling programs. See Appendix 2 for a Sample budget as described below.

<u>Project Target Size:</u> Given the share of market and current size of support for Single Family projects via State and CPUC approved Utility programs, the MUD program needs to be at significant scale and duration to effectively leverage private finance over the long term. We recommend these targets:

i. **Apartment Enabled Target:** Not less than 75,000 apartments be enabled in total -- comprised of multiple projects in target regions.

ii. **Project Minimum Size:** The total should be achieved in projects capable of creating a network effect in their region to attract and encourage new PEV adoption growth as the projects come online. A total CEC program size is recommended that would enable

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[3] Apartment-enabled = an apartment now having access to an EVSE charger in the same building or within a ~1 block radius

[4] At 1.4 vehicles per enabled apartment (CA DMV minimum) x 16 apts /building avg * 11 total buildings enabled = 246 vehicles. Assuming an average of 1.85 Chargers per multi-unit building (given the small average size of California MUDs).

[5] MUD Site Agreement is a long term (10+ year) agreement with the property owner sufficient to provide ongoing access and control of parking stalls, placement of EVSE and associated equipment, and signage, easements, rights and liability provisions sufficient to ensure operations and liability control for the parties involved.

[6] Survey is a physical count of living units (apartments, etc) in and within a 1 block radius of the EVSE Host address listing type of building (#units), host site and type of property, etc.

[7] In the case of Fuel Cell Vehicle infrastructure, persistent market barriers and "chicken and egg" problems with fueling infrastructure are being surmounted by <u>comprehensive</u> state funding – with private sector partners taking on the full burden of infrastructure development and operation only as the requisite scale economies are achieved.

approximately 10-12 Projects to reach the overall target of 75,000 apartments enabled for EV charging (including in-building apartments and near-neighbors.)

			Apartments Enabled (minimum)		
			In Building	Adjacent	Total Enabled
	# buildings	426	6,818	68,182	75,000
Per Project Minimum		40	636	6,364	7,000

Funding Parameters

- Recommended program parameters are as follows:
- **Up to $12,000 per building address in site acquisition costs**
- **$400 per enabled apartment for construction**
- **$300 per month in operating costs per building address for up to 24 months** (based on a single site address of at least 8 apartment units or more.) This operating funding would provide a bridge for project operators to continue providing charging services while the requisite PEV ownership and corresponding EVSE utilization rates are ramping up.
- ***Site Control Agreements*** -- meeting the size parameters above would be required with at least a 20-year contract term with the building owner guaranteeing EV Charging service access for all building residents and neighboring drivers during that period. Note that longer contract terms are crucial for securing private financing and developing a sustaining business model for the EVSP. Reimbursements would be paid as follows:
    - **Site Acquisition at up to $12,000 per contracted building:**
        - (a) 25% on grant award and the balance provided per (b) below:
        - (b) upon achievement of necessary number of Site Agreements meeting the program criteria and individual grant agreement terms and conditions. Payable in group of at least 10 buildings contracted.
    - **Site Construction Cost contribution per enabled apartment**:
        - (a) 25% upon delivery of area survey confirming the number of apartments in-building and within a 1 block radius of contracted properties
        - (b) 40% upon presentation of permits and plans (if required by local AHJ) and ordering of material required within 30 days.
        - (c) 25% upon completion of construction and final permit signoff by local AHJ
        - (d) 10% after commencement of operations

        The Per Apartment budget is recommended as the following table:

Cost Coverage per apartment for construction	Share of Buildings
$ 400	100%

    - **Site Operation Support at $300 per month per Stall for up to 24 months:**
        - Paid starting the first month following the completion of Site Construction for the site.
        - Reduced by 20% of the gross revenue generated at the site from EV charging payment or subscriptions in each month. (allowing for payment of costs of energy and equipment and a variety of business models)

Based on field experience in current efforts we project the following support schedule for budgetary purposes the per building budget for support can be calculated assuming from prior experience that there are 1.85 stalls average per building and that the support is reduced by 20% of gross charging revenues until no further support is required.:

Capacity of Bldg	Net Monthly Support per Building	Months at Capacity	Per Building Cost
0%	$ 555	3	$ 1,665
10%	$ 500	4	$ 1,998
25%	$ 416	5	$ 2,081
50%	$ 278	10	$ 2,775
100%	$ -	2	$ -
		24	$ 8,519
Average Stalls per Building:		1.85	
Note: Capacity is % of building's EV charging capacity being used regularly.			
Example: 10 vehicle/stall support would be at 50% with 5 vehicles as primary users.			
Ramp between 50% to 100% tbd but budgeted at 50% level for buffer.			

- **Eligible costs to include**
  - Site host outreach and sales costs
  - Legal fees, study fees, permit fees, certification costs (if required) and contract development
  - Site survey and preliminary engineering -- including any data collection, analysis, and electrical/construction estimates
  - Reservation and finance security costs (letters of credit, rebate reservation deposits, credit checks, etc. – as differentiated from the actual construction financing itself)
  - Relevant administrative overhead (accounting, rent, staff, travel, lodging, etc.)
  - Equipment, Labor and materials including resiliency renewable energy generation and control equipment
  - Construction Management Costs
  - Local permit and Utility charges
  - Real Estate rental charges, insurance, management and maintenance

- **Minimum project impact of at least 7000 apartments being enabled**. Note that this is not the same as 7000 chargers. Rather, this represents both a *Site Host Agreement* and a *charging infrastructure deployment plan* that enables a substantial proportion of the building's residents to access EV charging in a convenient location (either in the building or within a 1 block radius). (The minimum number of EVSE deployed in this scenario would be 79 chargers. Initially, assuming the statewide rate of appoximately 0.01% penetration of EVs in MUDs[8]**,** this number of chargers would serve vehicles in a nearly 1:10 ratio of EV to EVSE. However, as the vehicle population grows, the same set of chargers could ultimately serve as many as 790 EVs, based on the practical feasibility of one charger serving up to ten vehicles. Most importantly, however, as soon as the first tranche of chargers is installed, the full 7000 apartments in this example would be enabled to buy an EV, as the core infrastructure and *operating agreements* would be in place to rapidly expand charging to meet growing EV utilization. Of course, the exact number of actual EV drivers will fall along a curve until full EV adoption and full EVSE utilization is achieved.

[88] Per CVRP Rebates data showing 75% to 80% of CVRP purchases have single family home and total of CVRP rebates as % of 28 million California personal vehicles fleet. https://cleanvehiclerebate.org/sites/default/files/attachments/2017-10-19-CSE-EV-Rebate-Impacts.pdf

- **Expansion.** It is also important to note that expansion needs beyond the first tranche of chargers needed to “EV-enable” all the apartments in a given project (in this case, 79 chargers) would be the EV Service Provider’s responsibility to add as expanded operations beyond the first tranche of EV infrastructure are expected to be profitable. Finally, the operating agreements as well as the charging infrastructure design, would be required to demonstrate scalability sufficient to meet the needs for EV charging at high levels of EV penetration within the building (based on the term of the agreement) -- at least matching the CARB statewide deployment goals for new EV sales. (http://www.arb.ca.gov/msprog/zevprog/zevregs/1962.2_Clean.pdf)
- **At least one project needs to be in a Disadvantaged Community with at least 50% of its impacted apartments in that community.**
- **Demonstrate a viable shared use/ anti-stranding strategy.** Proposers must articulate a viable strategy for addressing tenant turnover and to mitigate or eliminate asset stranding.
- **Optimized EV charging technology strategy.** Proposers must demonstrate that charging equipment will serve diverse vehicle types and enable higher-rate AC charging to match both 100% of vehicles on the road and to accommodate the larger battery sizes and faster rates of charge expected in new vehicles. Design should be consistent with existing requirements such as those set by Cal E-VIP but also allow for innovation to accommodate MUD operations including unique vehicle identification via EVSE to Vehicle communication and identification.
- **Assure resilient operation in case of loss of communications or grid power for limited durations.** Recent and expected disaster conditions from recurring intense fires, earthquakes, floods, etc. highlight the need for accessible electrical fuel especially as drivers rely on their electric vehicles for personal safety in these emergency conditions.
- **Demonstrate value creation for property hosts and savings for renters and drivers.** Proposer must show clear path on how value is provided to each key stakeholder in the project effort, including prospective and existing EV drivers, other tenants, the building owner and manager, immediate neighbors, and the community at large.
- **Geographic density**. Sites should be close enough to one another (e.g., ~1 – 5 miles) to achieve a "cluster effect" wherein the relatively high visibility of new EV deployments and personal interactions and referrals will magnify EV awareness and grow EV sales and electric VMT.
- **Clean energy sourcing**. Applicants should identify the carbon intensity and renewable content of the energy delivered to the vehicles. Lower carbon intensity should be weighted more favorably.
- **Outreach plan for boosting EV adoption**. Applicants should develop a local outreach and marketing plan to boost EV purchases and charger utilization once the project is built.
- **Timeframe**. Given the scale proposed, a 24-month period for site acquisition is suggested, with construction and commissioning to be completed within an additional 18 months for installation and construction (dependent on the local utility’s ability to deliver required upgrades and permits with utility delays being accepted as an extension of this time) followed by up to 24 months of operation.
- **Cost effectiveness**. Projects should be assessed against cost effectiveness criteria and match level (among other attributes). The application of available incentives should be encouraged to enhance cost effectiveness for the CEC and the total value proposition for property owners and EV drivers.

Cost Effectiveness Metrics

- **Cost per EV opportunity enabled**: Calculate the number of annual vehicle purchases that can now consider an EV. For example: At 1.1 vehicles/apartment (per US Census) and a 6 year vehicle turnover (Motor industry average), 1000 apartments enabled will demonstrate an EV purchase opportunity of 1000 * 1.4 / 6 = 233 vehicles per year.
- **Cost per Apartment Enabled:** Calculate the final cost upon commencement of operation of the apartments enabled by the project. Sum total allowable costs and associated overhead to point of operation and divide by the count of previously surveyed apartments within the 1 block operational radius of the project buildings where EVSE has been installed. Note buildings hosting EVSE without shared access should not count for this apartment count.
- **Minimum Cost Effectiveness Score**: Projects can be scored according to relevant criteria for cost effectiveness and should have a high score (at least 5.0 or higher) to be able to participate. See Appendix for this calculation.
- **GHG Reduction potential**. Calculate the GHG reduction potential based on a cross of the CARB minimum vehicle sales as ZEV vs population of the apartments enabled and Vehicle Miles Travelled for the location of the project. (CEC should provide a reference table by region or zip code).

Operational Effectiveness Metrics

- **Number of buildings in Site Agreements**.
- **Number of buildings in which EVSE are actually installed** (reimbursement rates would be adjusted based on installation levels if building owners drop out of their agreements).
- **Number of charge ports & charge rate capacity in KW**
- **Operational data** on usage over time in # sessions, KWH delivered, hours of charging and time of day of charging
- **EV adoption.** CEC and awardees should baseline the number of registered plug-in vehicles in project zip codes and track on 1 year, 2 year and 3 year timelines as a measure of potential impact. Perform a survey of these registered owners to determine if the MUD infrastructure was influential in their purchase.
- **Local economic impact estimation**. CEC in collaboration with awardees should estimate the sales tax value, avoided fuel costs, and GHG impacts from newly registered EVs.
- **Correlation to incentives and program approaches**. CEC should report on the above metrics in comparison to the various project approaches and with reference to incentive programs utilized (e.g., vehicle purchase rebates, infrastructure rebate, utility infrastructure support, tax credits, etc.).

Summary

It is urgent that California achieve scale in EV adoption to keep pace with state goals for GHG and petroleum reduction, air quality improvement, and equitable economic development and access to clean vehicles.

A MUD-focused EV charging pilot program of the type described above will address key barriers to large-scale enablement of EV charging in urban areas -- <u>and do so for a fraction of the cost per new driver enabled of prior programs</u>.

Upon full program deployment, the high level program budget would be as follows:

Summary Budget	
Phase 1 - Site Acquisition	$ 5,113,636
Phase 2 - Construction	$ 30,000,000
Phase 3 - Operational Support	$ 3,630,362
Grand Total	$ 38,743,999
Payback period to State from new Sales tax revenues from EV fuel shift to Electricity:	9 years
[Payback period = Total Budget / Sales Tax generated per year]	
Effective $/tonne of GHG avoided (10 year basis):	**$ (0.91)**
Levelized Cost per Apartment:	**$ 516.59**
Cost Effectiveness Score:	**18.50**
Comparison Score for Cost Effectiveness:	
Single Family	1.00
DCFC Charger (dual format and assuming Tesla adapters)	2.10

The State of California will enjoy a net positive fiscal impact from shifting transportation fuel procurement from gasoline to electricity. The effective Sales tax revenue boost related to the EV shift amounts to approximately $495 per vehicle per year (per Strategen Consulting and Powertree Services analysis[9]).

***GHG:** Further at a pace of 36,816 tonnes/yr of GHG reduction this proposal achieves not only payback to the State in 9 years from new Sales Tax generation, but a cost per tonne of GHG reduction that is a NEGATIVE cost per tonne by year 10.*

Such a program is essential to further refine and demonstrate innovative business models that will make EV adoption a viable possibility for the 42% of Californians who reside in multi-unit dwellings and the $20 Billion+ in new annual economic activity for California that can be unlocked from this segment.

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<u>References</u>

Powertree Services Inc.	www.electrictrees.com www.electrictrees.com/locations
EV Alliance	http://www.zneallliance.org/
Clean Fuel Connection	https://www.cleanfuelconnection.com/

[9] "Impact Analysis: Governor Brown's 2030 Energy Goals", Strategen Consulting LLC [https://www.dropbox.com/s/disn2wvxfrvv1kw/Strategen_2030_Governor_Goals.pdf?dl=0]

Appendix 1: Cost Effectiveness Metric

Currently the industry and policy are all measuring "ports" as in charge cords. However, that is a misleading measure and ultimately can lead to wasteful investments.

Measuring ports alone assumes a one car to one charger linkage, which does not reflect the real potential for sharing of scarce charging resources.

One port, if managed correctly, can serve multiple vehicles. A DC fast charger for example is inherently shared, a Powertree MUD station is inherently shared, a workplace public charger is inherently shared, etc.

This can have an impact on the anticipated costs and related infrastructure budget needed.

A better metric to target is "Vehicles Enabled" – which is based on the number of vehicles that could use a single port as their PRIMARY charging location (for 75% of their charging or more). This would be adjusted by the % of the general fleet that can be supported by a given charger.

This assessment approach would make for a smarter investment allocation as the State and environmental goals are defined as more electric VMT (at lower carbon intensity per mile) and thus reduced emissions overall. Providing charging more cost effectively gets better results in both cost efficiency and emissions reduction.

For example: A single family "port" supporting a single car would have a Cost Effectiveness of 1:1

A single DC Fast Charger with CHAdeMO only might service 20 vehicles as their primary point of charging and with an adjustment for vehicle fleet coverage as follows:

DC	Mkt Share of DC**
1 - CCS	7.13%
2- TSLA	20.9%
3- CHAdeMO	2.4%
TOTAL DC MKT SHARE	30.36%

**Data here is based on CA EV population market share of vehicle capabilities per manufacturer monthly sales reports cumulative since 2011.

The CHAdeMO DCF would thus be 20 vehicles * 2.4% market share = 0.48 cost effectiveness score.

A dual format DCF (CCS + CHAdeMO) would be 20 vehicles * (7.13% +2.4%) market shares = 1.906 cost effectiveness score.

As AC is present on EVERY vehicle this would have a market share adjustment of 100% adjusted by rate of charge.

A Shared access AC charger serving 6 vehicles would look like: 6 * 100% = 6.0 cost effectiveness rating. This could be enhanced by the speed rating of the vehicles capable of being served. An example being this table from current market data:

KW	Mkt Share KW AC**
under 3.4	33%
6.6 to 11.5	46%
Over 11.5	21%
	100.00%

For example, a 3.4 KW would be a factor of 33%. A 9.6KW would be (46%+33%) = 79% and a over 11.5KW would be 100%.

So we see a ranking as follows assuming max 19.2KW for AC with 6 vehicles per stall and a single stall:

Category	Cost effectiveness Ranking (higher is better)
DC CHAdeMO	0.47
Single Family/Non-Shared MUD	1.00
DC CH+CCS	1.90
DC TSLA SC	4.17
MUD Shared	6.00

The formula for cost effectiveness is:

Number of Vehicles per Stall x Number of Stalls x (market share of DC charger type or rate of charge adjusted AC market share) = Cost Effectiveness Score

Investments should be guided toward locations that yield the *most vehicles enabled* *instead of just the most ports* – thereby achieving greater cost-effectiveness in terms of enabling EV utilization and eVMT.

** Data is gathered from cross tabulation of Vehicle model manufacturer specifications and manufacturer reported vehicle sales data across all PHEV, FCEV and BEVs since 2011 through July 2018.

Appendix 2: Sample Budget at 75,000 Apartments Enabled

					Apartments Enabled (minimum)		
Apartments Enabled Target					In Building	Adjacent	Total Enabled
75,000			# buildings	426	6,818	68,182	75,000
Min Project Size (apartments)	# Reqd Projects						
7,000	10.7		Per Project Minimum	40	636	6,364	7,000
			Minimum Chargers per Project:	74			

Phase 1 - Site Acquisition		Budget		
		Per Building	Per Min Group	**TOTAL**
On Award	25%	$ 3,000	$ 30,000	$ 1,278,409
On Group Milestone	75%	$ 9,000	$ 90,000	$ 3,835,227
				$ 5,113,636

Phase 2 - Construction		Per Building							
		1st 100%	2nd 0%	3rd 0%		1st 100%	2nd 0%	3rd 0%	**TOTAL**
Survey Complete	25%	$ 17,600	$ -	$ -		$ 7,500,000	$ -	$ -	$ 7,500,000
Approved Plans & Permits	40%	$ 28,160	$ -	$ -		$ 12,000,000	$ -	$ -	$ 12,000,000
Construction Complete and AHJ approved	25%	$ 17,600	$ -	$ -		$ 7,500,000	$ -	$ -	$ 7,500,000
Operations Commencement	10%	$ 7,040	$ -	$ -		$ 3,000,000	$ -	$ -	$ 3,000,000
		$ 70,400	$ -	$ -		$ 30,000,000	$ -	$ -	$ 30,000,000
Apartments Enabled		176				75,000	-	-	
Cost per Apartment Enabled		$ 400	$ -	$ -	cumulative	75,000	75,000	**75,000**	
eVMt enabled (1st yr)		266,400				113,522,727	-	-	
					eVMT per year	113,522,727	113,522,727	**113,522,727**	
					Sales Tax Generated per year from new ZEV from project	$ 3,907,862	$ 3,907,862	**$ 3,907,862**	
					CO2 Reductions Tonnes/year	***36,816***	***36,816***	***36,816***	

Phase 3 - Operational Support

Capacity of Bldg	Net Monthly Support per Building	Months at Capacity	Per Building Cost	**TOTAL**
0%	**$ 555**	3	**$ 1,665**	$ 709,517
10%	**$ 500**	4	**$ 1,998**	$ 851,420
25%	**$ 416**	5	**$ 2,081**	$ 886,896
50%	**$ 278**	10	**$ 2,775**	$ 1,182,528
100%	$ -	2	$ -	$ -
		24	**$ 8,519**	$ 3,630,362

Average Stalls per Building: 1.85

Note: Capacity is % of building's EV charging capacity being used regularly.

Example: 10 vehicle/stall support would be at 50% with 5 vehicles as primary users.

Ramp between 50% to 100% tbd but budgeted at 50% level for buffer.

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