DOCKETED

Docket Number:	17-IEPR-07
Project Title:	Integrated Resource Planning
TN #:	217097
Document Title:	comments by eMotorWorks
Description:	N/A
Filer:	System
Organization:	eMotorWorks
Submitter Role:	Public
Submission Date:	4/17/2017 2:25:10 PM
Docketed Date:	4/17/2017

Comment Received From: Steve Taber
Submitted On: 4/17/2017
Docket Number: 17-IEPR-07

A Road Map to Attracting Private Capital into the Deployment of Residential Charging Infrastructure - comments by eMotorWerks

Additional submitted attachment is included below.

Charting a Course for EV Charging Infrastructure Deployment in California: One Million EVs by 2020

A Road Map to Attracting Private Capital into the Deployment of Residential Charging Infrastructure

comments by eMotorWerks
21 March 2017

Executive Summary. If judiciously applied, public funds and related policy initiatives can be used to attract private capital into the business of deploying EV charging infrastructure in the residential sector, at a ratio of as high as 5 to 1 (private capital/end user contribution to public funds). Thus, for example, with a deployment of $10m in public funds, at least 28,000 EVSEs and as many as 67,000 or more EVSEs can be deployed and as much as 3.9 TWh/yr of energy and ancillary services can be offered to the grid.

This is accomplished by capturing revenues from (1) selling ancillary services to the wholesale markets and (2) optimizing the exposure of load-serving entities to the real time market, then using a project financing model to front-load the stream of revenues, attracting private capital to help to pay for the charger deployment. The available public funds are inadequate by themselves to the task of deploying charging infrastructure, but public funds and policies can be used to attract private capital and, in combination, accomplish substantial deployment of grid-integrated charging infrastructure.

To enable the deployment activity to attract private capital at the lowest possible cost, we recommend consideration of several policy initiatives, discussed below.

An Example of How to Structure the Use of Public Funds to Attract Private Capital into the Deployment of Residential Charging infrastructure.

A grid-integrated residential EVSE is most useful for delivering wholesale commodities to the grid in the evening and/or overnight, depending EV state of charge at plug-in, battery capacity and customer rate plan. EVSEs operating during this period are particularly useful for avoiding local and regional coincident peak demand and balancing renewable generation fluctuations, particularly wind generation. A fleet of grid-integrated EVSEs can provide multiple services including:

- Receiving market awards for curtailment in the day-ahead or real-time market during higher priced intervals.
- Receiving market awards for consumption in the day-ahead or real-time market during negative priced intervals, subject to market participation model and CAISO rule development.
- Providing ancillary services.
- Mitigating real time energy procurement costs for a Load Serving Entity through a

bilateral arrangement.

For purposes of illustration, consider a JuiceBox Pro 40A, drawing 10 KW, on a ToU tariff such as PG&E's Electric Schedule EV tariff[1], connected to the EV during the hours of 11PM and 7AM, with a total session charge required of 12 KWh/day. This EVSE creates the following value, in addition to fulfilling its primary purpose of charging up the owner's vehicle:

- Sale of Ancillary Services in the CAISO Wholesale Markets. As detailed in Appendix A, and assuming market participation as a Non-Generating Resource within a Distributed Energy Resource Aggregation, this EVSE can generate up to 8.3 KW of regulation and 1.6 KW of spinning reserves, unconstrained by charge depth, during the period of HE24-HE7[2]. Based on the published prices for Regulation and Spinning Reserves during 2016[3], this EVSE will earn revenues of approximately $155/yr from the sale of Regulation and approximately $10/yr from the sale of Spinning Reserves during the 8-hour charging period, for a total of $165/yr.[4]

  If the off-peak period ToU period is changed to HE1-HE17, the potential revenues would increase to approximately $211/yr for Regulation and approximately $13/yr for Spinning Reserves during the 16-hour charging period, for a total of $224/yr.[5]

- Mitigation of Real Time Market Price Exposure for an LSE. LSEs are exposed to the Real Time Market (RTM) prices on the margin. That is, they schedule their load and contracted generation into the Day Ahead Market and settle any discrepancy between their scheduled load/supply and their actual load/supply in the RTM. Thus, any management of their load in real time will affect RTM procurement costs or revenues. A fleet of grid-integrated EVSEs can ramp charging up or down in response to RTM prices. Based on the published prices for RTM energy during 2016[6], an EVSE can reduce the RTM procurement costs by approximately $60 per year.[7]

Thus, our illustrative EVSE creates about $250 to $300/yr in value. As more distributed energy resource providers ("DERPs") enter the market, increased competition will tend to reduce prices for grid commodities. On the other hand, as renewable penetration increases, the demand for these commodities is likely to increase. Therefore, we have assumed steady state revenues, adjusted only for CPI.

1 http://www.pge.com/tariffs/tm2/pdf/ELEC_SCHEDS_EV.pdf
2 HE24 indicates the hour ending at 2400, namely, 11:00 PM to 12:00 midnight.
3 AS_CAISO_EXP market, http://oasis.caiso.com/mrioasis/logon.do.
4 For illustrative purposes, this analysis is based on a simple model for offering ancillary services, Reg Down during HE24-3, Reg Up and Spin during HE 4-7. A more sophisticated offering strategy would yield higher revenues.
5 If the EV is plugged in 24/7, the revenue produced would be approximately $300/yr. This calculation takes into account a typical load curve for a residential EVSE.
6 DLAP_PGAE_APND.
7 For illustrative purposes, this analysis is based on a simple linear model, known as "P1-P2", whereby charging is dispatched of the RTM price is below P1 and curtailed if the RTM price is above P2. A dynamic control strategy would yield better results.

This value, shared between the participants, can be used to attract private capital into the activity of deploying residential charging infrastructure. We offer the following two exemplary scenarios for accomplishing this:

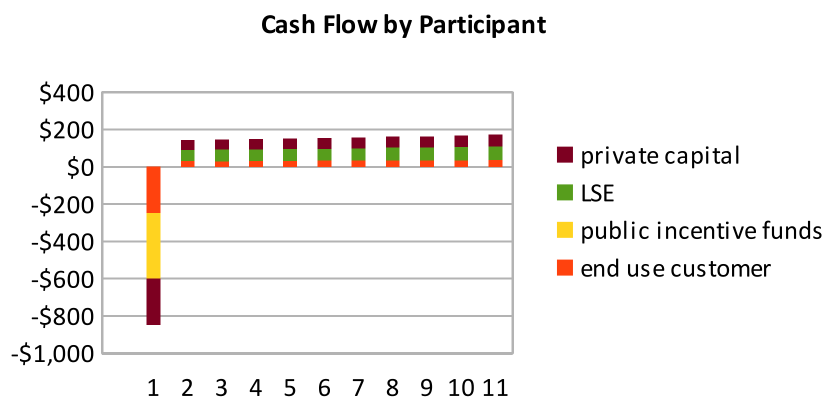
Scenario #1: Baseline: Venture Financing, No Changes in Policy, Market Design, or LSE participation. Scenario #1 is the easier approach to implement. Public funds will be used to provide rebates for EVSE deployment. To qualify for the rebate, an EVSE would need to meet the following criteria:

- be located in a CAISO-qualified DER resource[8]
- be connected and grid-integrated during the ToU off-peak period. The public subsidy would be scaled back for EVSEs that partially meet this criterion.

As discussed in Appendix B, this approach would subject the private investor to merchant risk, so it would need to offer a high return on investment ("RoI") to attract capital. (For purposes of this discussion, we make some educated guesses about what RoI the capital market will sustain. See Appendix B for further discussion.)

We estimate the following sources of funds and returns for this approach:

Sources of cash	Amount	% of total	RoI
customer	$250	29%	5%
public incentive funds	$350	41%	0%
LSE	$0		∞
private capital	$249	29%	18%



This approach results in a leverage of public funds of approximately 3 to 2 (private funds to public funds). As an example, an allocation of $10m in public funds to this approach will result in the deployment of 28,600 EVSEs.

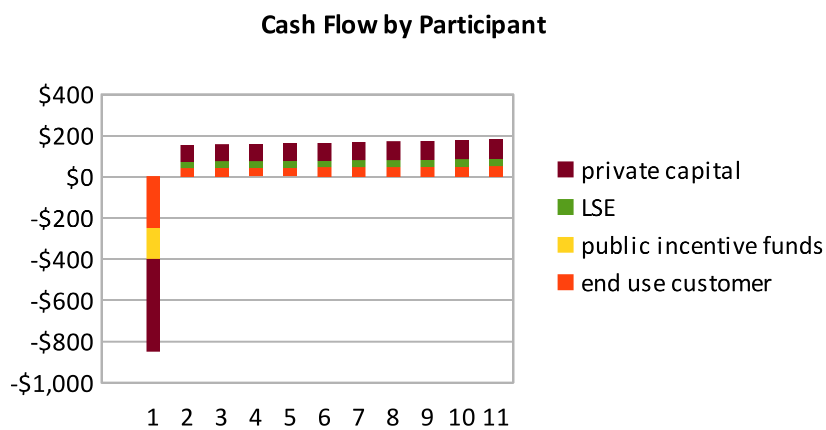
8 Generally speaking, such a resource must be offered to CAISO by a DERP, be part of a resource of at least 500 KW (about 100 residential EVSEs), be properly registered, and meet various technical and programmatic criteria. https://www.caiso.com/participate/Pages/DistributedEnergyResourceProvider/Default.aspx

A disadvantage of this approach is that it may be difficult to guarantee generation of market revenues at the time of EVSE purchase (and rebate issuance) and prior to achieving provision of energy products by the EVSE. In all likelihood, there would be a lag between provision of revenues from an EVSE and the preferred time of rebate funds distribution for equipment purchase and installation. Certainly, this approach would increase adoption of grid-integrated EVSE, but it may not be the optimal approach unless combined with policy initiatives to accelerate adoption, as discussed in Scenario #2.

Scenario #2: Project Financing, with Proposed Changes in Policy, Market Design, and LSE participation. As with Scenario #1, public funds in this approach will be used to provide rebates for EVSE deployment. This approach incorporates certain proposed changes in contracting, rules, and policy which are intended to make the program more attractive to private capital. This approach will mitigate the exposure of the private investor to merchant risk, so it will be able to attract more private sector capital in the form of project financing. Project financing will carry lower rates of return and larger infusions of private capital, resulting in greater leverage for the public funds.

We estimate the following sources of funds and returns for this approach:

Sources of cash	**Amount**	**% of total**	**RoI**
customer	$250	29%	12%
public incentive funds	$150	18%	0%
LSE	$0		∞
private capital	$450	53%	14%



This approach results in a leverage of public funds of approximately 5 to 1 (private funds:public funds). As an example, an allocation of $10m in public funds to this approach will result in the deployment of 67,000 EVSEs.

This approach incorporates the following proposals, which are intended to make the program more attractive to private capital. In essence, these proposals are intended to qualify the program for project financing, as opposed to venture financing. As discussed in Appendix B, project financing must be comprehensively risk-mitigated. Project financing is typically eligible for low-cost, long-term financing, increasing the deployment of charging infrastructure deployment and the leverage of public funds.

In addition, these proposals are intended to mitigate friction in the customer participation process and to fairly allocate the economic benefits of grid-integrated charging among the participants.

For this approach, we propose the following:

> ***Recommendation #1 to enhance financability****: Consider enabling Distributed Energy Resource Aggregations to enter into long-term, fixed price contracts for ancillary services, through a Standard Offer (SO) contract.*

Currently, ancillary services are procured through the CAISO wholesale markets, with prices set on a daily basis. This exposes the projected revenues from the program to merchant risk. Project financing is inherently incompatible with merchant risk. An SO contract will provide price certainty, qualifying the deployment of EVSEs for project financing.[9] This will attract lower cost private capital and in larger amounts, decreasing the need for public funds.

We note that, at the four agencies-VGI workshop held on 7 December 2016, an auto OEM representative stated that it would be necessary for the wholesale markets to offer substantially higher unit revenues than at present, in order to attract private capital into the deployment of charging infrastructure. We respectfully disagree; we believe that the CAISO wholesale markets are economically efficient and provide transparent, accurate price signals. We consider these revenues sufficient to attract project financing capital into the deployment of residential charging infrastructure. However, it is the transitory nature of the prices that presents an obstacle to qualifying a portfolio of EVSEs for low-cost project financing. In other words, increasing unit payment levels for services is one solution, but making payment levels more predictable is another, potentially superior, solution.

It is also very important to offer long-term, fixed price contracts through an SO process, not through an RFP. The RFP process is time-consuming and risky for DERPs, adding considerable friction to the process, reducing the number of capable DERPs participating, and slowing deployment. In addition, the interests of ratepayers are furthered by an SO offering, since the SO contracts will provide protection against spikes in market prices for ancillary services which could result from increasing renewable penetration on the CAISO grid.

If the offtakers are concerned that an SO might result in overpaying for

9 Revenue certainty can also be obtained by hedging the price of the commodities, as is done with project financing of merchant plants in wind and solar. However, hedges for ancillary services in CAISO are not currently available in the market.

ancillary services, an alternative approach could be for the offtakers to offer long-term, fixed price put options for ancillary services service-territory-wide, priced at a major fraction[10] of the expected prices for ancillary services on the wholesale markets. This would result in minimal exposure of the ratepayers to overpaying, while preserving a compromise with the private sector investor on merchant risk and still attracting project financing.

Recommendation #2 to enhance financability*: Consider allowing DERPs to provide ancillary services to the wholesale markets without the 500 KW per SubLAP-LSE minimum resource quantity prerequisite. This goal could also be accomplished by allowing DERPs to provide ancillary services on a DLAP basis, not constrained by SubLAP or LSE.*

Most residential EVSEs provide only single-digit KW of ancillary services or energy dispatch per device. Under current CAISO rules, this means that, for an EVSE to participate in the wholesale markets within a DERA, the customer must be part of an aggregation that comprises approximately 50 to 150 EVSEs in each SubLAP, aggregated by a single DERP and is served by a single LSE. Under the best circumstance, there is friction and delay built into the process of getting a customer/EVSE from program entry to revenue production, while the aggregation builds up to the minimum size. Under the worst circumstance, this means that customers that have EVSEs and want to participate may be stranded outside the program. This obstacle could be mitigated by allowing customers anywhere in a DLAP and served by any LSE to participate, or by allowing customers to participate as part of a DERA without a minimum size.

Recommendation #3 to enhance financeability*: Direct LSEs to share RTM savings.*

If an LSE shares RTM savings with DERP and Private Capital Providers, this will further incentivize EVSE deployment, enhance portfolio revenues, and prevent free-ridership by the LSE.

[10] For example, the strike price could be set at the reciprocal of a typical debt service coverage ratio for the project financing. Assuming a DSCR of 150%, the strike price for the put would be set at 2/3 of the market price. It may work best if the offtaker and the DERP/Private Capital/End Use Customer side of the put transaction share the delta between the share price and the market price; this would further justify the possible risk to the ratepayer of overpaying through an SO.

Additional Recommendations.

eMotorWerks offers the following additional recommendations for consideration to maximize the leverage that public funds achieve and to deploy the maximum amount of charging infrastructure possible:

> ***Recommendation #4. Residential Sector Set-Aside***: *From whatever funds are available, consider setting aside ½ or more for the residential sector. The residential sector is very attractive as a target for public funds and policy attention, given the bottoms up benefits of encouraging EV and L2 grid-integrated, market-revenue-producing EVSE adoption.*
>
> ***Recommendation #5. Spread the Public Incentive Funds as Widely as Possible***: *Consider setting the per-EVSE rebate low enough to encourage price competition and to maximize the overall impact of the program. In Scenario #2, $150 per EVSE is sufficient to attract private capital, while still keeping the end use customer's cost of entry low (primarily the cost of installation) and the customer's value proposition attractive.*
>
> ***Recommendation #6. Minimize friction in the customer enrollment process:*** *As discussed in the CPUC Click-Through Working Group and various CPUC proceedings, it is essential to greatly simplify the customer enrollment process.*

Appendix A

Quantification of Ancillary Services Resources from a Residential EVSE Fleet

Proprietary information is redacted from this Appendix for public distribution. It is available to public officials for review under confidential information restriction.

In summary, the amount of frequency regulation and spinning reserve available from an EVSE is calculated. Constrained by the following:

- Customer-applied constraints/requirements
- ToU off-peak tariff
- Rate of charge
- Depth of charge available
- Ramp rate required by the resource specification
- Probability of dispatch
- Full charge required by scheduled disconnect time.

Appendix B

Structuring DER to Attract Project Financing to EVSE Deployment

Project financing is a vehicle for providing low-cost capital to energy projects. The overall approach is to mitigate all investment risks, enabling the financing to attract conservative, "widows and orphans"-type investors. In general, this means that the investor must be protected by outsourcing to reliable providers all salient risks, including:

- Completion risk (if the financing closes pre-COD)
- CapEx overrun risk
- OpEx overrun risk
- Resource risk (i.e., will the project produce the projected quantities of energy commodities)
- Operating risk
- Offtake price risk

Project financing is designed to be applied to free-standing generation assets. In this structure, the lender takes a security interest in the generating asset itself and all the instruments which entitles the asset to operate (land lease, offtake agreement, interconnection agreement, etc. In the case of DERs, however, the project finance model needs to be adjusted to take into account the inherent differences between conventional generating assets and DERs, as discussed in this Appendix.

Proprietary information has been redacted from this Appendix for public distribution. It is available to public officials for review under confidential information restriction.

In summary, eMotorWerks has developed a path to mitigate all project financing risks except for the merchant risk, which is discussed in the main body of this paper.

Appendix C

About eMotorWerks

<u>About eMotorWerks</u>: eMotorWerks is revolutionizing the electric vehicle charging market with its JuiceNet™-enabled smart-grid EV chargers. These devices are manufactured by eMotorWerks (such as the JuiceBox™, the bestselling charger on Amazon), and by major OEMs or EVs and EVSEs, that use eMotorWerks' proprietary software embedded in their devices. JuiceNet-enabled devices maximize charging efficiency & speed while providing EV owners with intuitive control and visibility.

In addition to providing a best-in-class user experience, the JuiceNet platform enables eMotorWerks to control when and how fast chargers draw power from the grid. This enables eMotorWerks to help utilities and grid operators reduce costs, ease congestion, and absorb additional solar and wind power. eMotorWerks is paid by grid operators for these services and shares a portion of the proceeds to the EV drivers. For fleet owners and operators, the JuiceNet technology offers substantial operating cost savings, as well as substantial new revenue opportunities.

For more information on eMotorWerks, visit www.emotorwerks.com.