California Energy Commission
San Joaquin Valley Air Pollution Control District

San Joaquin Valley Plug-In Electric Vehicle Coordinating Council

Date: Thursday, August 1, 2013
Time: 1:30 p.m. – 3:30 p.m.
Location: SJVAPCD Fresno Office
1990 E. Gettysburg Ave.
Fresno, CA 93726

Teleconference information: Call-in: 646-364-1285 Access Code: 6619701

Video Teleconferencing at the following locations:

Modesto	Bakersfield
4800 Enterprise Way	34946 Flyover Court
Modesto, CA 95356	Bakersfield, CA 93308

August 1, 2013 Meeting Agenda (+ next to an item indicates an attachment)

1. Welcome and Introductions (Nhia Vu, SJVAPCD)

2. Announcements and Public Comments (All)

+3. Summary of August 1, 2013 Meeting (Jessica Jinn, CCSE)
   A. Plans to Attract PEV Manufacturing, Production, Infrastructure, and Services of PEV Development in the Region
   B. Public Agency EVSE Installation
   C. Regional Planning for public EVSE siting

+4. Regional Planning for Public EVSE Siting (SJVPEVCC members and Tyler Petersen, CCSE)
- UC Irvine's model for siting PEV infrastructure (Dr. Tim Brown, UCI)
- SJV PEVCC member feedback and discussion

+5. Promotion of PEVs in Fleets (SJVPEVCC members and Tyler Petersen, CCSE)
- Electric Vehicles International, an electric vehicle manufacturer based in Stockton, California (Ricky Hanna, CEO of EVI)
- SJV PEVCC member feedback and discussion

+6. Renewable energy and PEV charging (SJVPEVCC members and Tyler Petersen, CCSE)
- Solar panel adoption and PEV adoption
- Case studies
- Renewable Energy Portfolio

7. Training and education for car dealerships (SJVPEVCC members and Tyler Petersen, CCSE)
- SJV PEVCC member feedback and discussion

8. Project Next Steps (SJVPEVCC members and Tyler Petersen, CCSE)
- Draft Plan
- Public Workshop

July 11, 2013 MEETING SUMMARY

ATTENDEES:

Video Teleconference (VTC): Fresno (Central), Modesto (North), and Bakersfield (South)

July Meeting – Notes

Central Office Attendees:			
CCSE	**CCSE**	**City of Clovis**	**San Joaquin Valley Clean Energy Organization**
Tyler Petersen	Jessica Jinn	Kendall Cook	Courtney Kalashian
Fresno COG	**Fresno County**	**Merced County**	**PG&E**
Lauren Dawson	Patrick Starkey	Jeff Fugelsang	Bob Riding
SJVAPCD	**SJVAPCD**	**SJVAPCD**	**SJVAPCD**
Nhia Vu	Colette Kincaid	Juan Cano	Lisa Van de Water

North Office Attendees:
City of Stockton
David Stagnaro

South Office Attendees:
SJV Clean Cities/Kern COG
Linda Urata

Conference Call Attendees:		
UPS	**City of Lodi Electric Utility**	**Turlock Irrigation District**
Michael Britt	Rob Lechner	Chris Poley

Agenda Notes:

ITEM #1: WELCOME AND INTRODUCTIONS

Nhia Vu, San Joaquin Valley Air Pollution Control District (SJVAPCD), welcomed the group to the fifth San Joaquin Valley Plug-in Electric Vehicle Coordinating Council (SJVPEVCC) meeting. Ms. Vu opened up the meeting for introductions for all attendees on the phone, as well as those at the Fresno, Modesto and Bakersfield District offices.

ITEM #2: ANNOUNCEMENTS AND PUBLIC COMMENTS

There were no announcements or public comments.

ITEM #3: SUMMARY OF MAY 2, 2013 MEETING

Jessica Jinn, California Center for Sustainable Energy (CCSE), stated that there have been no changes made in the presentation from the June 10, 2013 meeting summary and a copy of the presentation can be found online at www.energycenter.org/pluginready.

A. Electric Vehicle Supply Equipment (EVSE) 101

It was concluded that PEV owners are very knowledgeable about their vehicles and, thus, about the technology that comes with it. The next step is to educate consumers about charging infrastructure and cost savings.

Types of Electric Vehicle Supply Equipment (EVSE) installed at public sites generally do not concern the public, but what matters are PEV-designated spots being taken by non-PEVs. The group had decided that there needs to be a penalty (or enforcement) designed to discourage this action.

To facilitate the expansion of PEV adoption, it is necessary that there be a universal card system in place so consumers can easily charge at different charging stations.

B. EVSE at Multi-unit Dwelling (MUDs)

The group decided that there is no need formally define a multi-unit dwelling (MUD) in terms of PEV readiness. The issue that arises when discussing EVSE in MUDs is the large amount of parking spaces MUDs have. It is recommended that property managers be well-informed about EVSE installations and usage. Further, when considering a public use charger at an MUD, implementing a pay-per-use method (such as that of a laundry machine) is a plausible option.

C. EVSE Installation and Inspection Guidelines

It was largely agreed that in the preliminary steps of the EVSE installation process (no matter if it is a public agency, private company, or resident), speaking with the EVSE providers is a necessary task along with contacting the utility and finding funding (as in the case for public or workplace installations).

The agriculture sector in the San Joaquin Valley was noted as being very diverse and therefore solutions are not transferrable throughout industries within agriculture. It is important to make distinctions between different industries and vehicle fleet types in the agriculture sector.

When considering whether or not the agriculture sector will be willing to convert to an electric fleet, it was noted that they have been able to pick up quickly on new technology in the past, but a clear benefit should be apparent to incentivize new technology adoption. Therefore, it is recommended that Valley-based incentives be developed for the electrification of agricultural equipment and transportation.

ITEM #4: PLANS TO ATTRACT PEV MANUFACTURING, PRODUCTION, INFRASTRUCTURE, AND SERVICES OF PEV DEVELOPMENT IN THE REGION

Tyler Petersen, California Center for Sustainable Energy (CCSE), introduced Mike Britt, UPS.

Mr. Britt introduced UPS and its history with sustainability and electric fleets. Notably, UPS delivered 26 million packages on Christmas Day and is the 9th largest airline in the United States. Through the years, the company has been recognized by several environmental groups for successfully deploying new technology.

The company was described as being "energy agnostic". There is not one overarching fuel type that the company uses; CNG, hydraulic hybrids, propane, and electricity are all utilized by the UPS fleet. Mr. Britt further added that the company has approximately 2,500 alternative fuel vehicles, which is the largest number in the industry.

Alongside Electric Vehicle International (EVI), UPS was able to conduct the largest major deployment of EVs in the industry. With the help of the California Energy Commission (CEC) and the San Joaquin Valley Air Pollution Control District (SJVAPCD) funding, 100 EVs delivery trucks have been added to the California fleet.

Mr. Britt provided the following comments about the EV deployment.

- At first there were some stumbling blocks because the equipment needed fine tuning;
- Different testing environments were needed to ensure vehicles performed well;
- Currently, the delivery trucks are performing very well. The electric trucks are averaging over one mile per kilowatt hour, which exceeded normal expectations;
- Training drivers is a very important facet of maximizing vehicle range;
- There was a big learning curve to make sure drivers don't waste energy and plug in on time;
- Overall, the facilities have successfully deployed their electric fleets;
- All safety processes have been implemented among drivers and facilities.
- The drivers enjoy the new electric trucks and are happy to give back to the environment.

The floor opened for questions and comments.

- Lisa Van de Water, SJVAPCD, asked where UPS is testing their hybrid hydraulic vehicles.
- Mr. Britt replied that they are being tested in Laguna with the help of a CalStart CEC grant.
- Ms. Van de Water asked if the company has a formalized feedback process from drivers about the trucks.
- Mr. Britt responded that drivers receive training with the new technology, then staff goes on ride-along with drivers, from which drivers receive immediate feedback. There are periodic check-ins and feedback daily that UPS requires of their drivers regarding vehicle performance. Each truck has a form of telemetry installed and performance is gauged from truck to truck.
- Mr. Petersen asked if Mr. Britt could share some feedback processes.

- Mr. Britt responded that local depots retain the driver feedback, but he could share feedback from the drivers.
- Jeff Fugelsang, Merced County, asked how long it took for administration to support this idea of an electric fleet.
- Mr. Britt responded that the project began in 2009, first as a contact with EVI. In the following couple of years, the technology needed to be validated and built into a delivery platform. Then, a test vehicle needed to be created. After validation on the test vehicle is when management committee needed to be informed and involved. The South Coast Air Quality Management District, SJVAPCD, and CEC offered funding programs for UPS to pursue this project further.
- Mr. Petersen asked if Mr. Britt could expand on the charging infrastructure and deployment efforts.
- Mr. Britt said that the company had EVSE custom built, "dumb" chargers with no communication capabilities. Now UPS is in the process of working with Clipper Creek to build smart chargers. Smart chargers will be able to collect data on the delivery truck and determine how long it will take to charge the vehicle to be ready for the next delivery day.
- Mr. Britt provided a smart charging example in which Truck 1 were plugged in and needed six hours of charging, the computer will see that the truck is scheduled for the next morning, and will subsequently choose the best period of time in which to charge the vehicle. A payment system was not installed. Further, if a truck completed its deliveries for the day and still had 50% of its battery left, the residual energy will be provided back to the grid. In essence, they will "sell back" any energy that is left.
- Mr. Petersen asked what type of chargers UPS has (Level 1, Level 2, or DC Fast Charger).
- Mr. Britt said that they are all Level 2 chargers. Commercial batteries are not allowed to be charged with a DC Fast Charger. It breaks the warranty of the battery. Further, there is no reason for Level 1 chargers since the facilities have a Level 2 set-up.
- Nhia Vu, SJVAPCD, asked what challenges were faced in deployment.
- Mr. Britt answered that having ample power is an issue. When delivery trucks come back to the facilities at night, power is still needed for sorting packages. It is important for UPS to supply its own power and maintain dedicated servers. Mr. Britt further mentioned that trenching for EVSE wiring has been an expensive under-taking.
- Mr. Britt added that each EVSE has a loaded platform, which enables safe movement of the EVSEs around the facility. Safety measures have been fully implemented in the facilities and among employee training.
- Bob Riding, Pacific Gas & Electric (PG&E), commented that PG&E had worked with UPS prior, supporting them with natural gas for their fleet vehicles. Mr. Riding asked what UPS plans to do with natural gas being cheaper these days.
- Mr. Britt responded that they want the natural gas fleet to continue and expand in California. The only difficult thing is building infrastructure. Because of the high cost for new natural gas stations, it is hard to justify constructing a new station. UPS will still maintain its current natural gas fleet and bring in new Class 8 CNG vehicles.
- Mr. Petersen asked if Mr. Britt could provide the group with best practices or lessons learned.

- Mr. Britt responded that the average electric vehicle that travels 10-12 miles a day maybe displaces a gallon of gas. However, with UPS electric trucks, about 100 miles a day displaces a noticeable amount of fuel and electric adoption becomes worth it.
- Mr. Britt commented that with the adoption of EVs, the maintenance issues and waste stream from gas trucks were eliminated. With that, there are significant cost savings. Further, there can be a 30-35% improvement in fuel efficiency for internal combustion engines depending on driver performance. Therefore it is important that drivers know how to properly use the electric technology so they can get back to facilities at the end of the day. Knowing the cost benefit of the switch from gas to electric is vital.
- Mr. Petersen thanked Mr. Britt for his participation.

Mr. Petersen moved Agenda Topic 5 with Mr. Lechner to follow Mr. Britt's presentation.

ITEM #5: CITY OF LODI PUBLIC EVSE INSTALLATIONS

Rob Lechner presented information about the City of Lodi's experience installing EVSE. Mr. Lechner described that the process began ten years ago when Lodi had two entry-level EV chargers installed at city hall and four installed at their municipal service center.

Early in 2012, EVSE vendor Clipper Creek contacted the City of Lodi and was promoting a CEC grant in which they were serving as contractor to provide replacement charging heads for old Level 2 Legacy chargers. The company would provide the upgrade at no cost for the municipality.

At the time, the City of Lodi was developing their Climate Action Plan (CAP). Mr. Lechner added that a good way to complement their plan would be to install more stations around town. Therefore, the city contacted Clipper Creek and was able to have five more stations installed for free. The new stations were installed at the city library, finance office, parking garage (transit center), community center, and animal shelter.

Currently, everyone in Lodi can charge for free. Later this summer, Clipper Creek has plans to add a card-swipe device to these chargers. The chargers will have a credit or debit capability and then people will pay to use these charging stations. Further, there is an ordinance that allows towing of vehicles that are parked in EV-designated parking spaces.

PEVCC members provided the following comments:

- Ms. Kincaid asked when installing a card swipe on them, can drivers use any credit card?
- Mr. Lechner answered that any credit or debit card will work. By October, the charging stations will be retrofitted and the Finance department is already set-up to receive revenue from use of the chargers.
- Mr. Riding asked whether or not these public stations were subject to Time-of-Use (TOU) rates.
- Mr. Lechner responded that PEV drivers cannot charge for more than four hours at any given time. Clipper Creek will have a shut-off device installed for that purpose. Mr. Lechner expects charging to cost somewhere between one to two dollars.

- Mr. Riding asked if he knows how much revenue Clipper Creek will receive from the charging.
- Mr. Lechner responded that he does not know, but he's been informed that it is a "nominal" amount.
- Mr. Riding asked if the city has any planned EV rates.
- Mr. Lechner responded that residential TOU rates began July 1. It is a flat rate of 14.2 cents for charging between 8pm and 2am. Any time after that is 33 cents per kilowatt hour. PEV owners are not required to adopt the TOU rate.
- Linda Urata, SJV Clean Cities/Kern Council of Governments, asked if the payment for public charging is just to recover electric rates.
- Mr. Lechner affirmed.
- Mr. Petersen reaffirmed whether or not the city has a parking ordinance.
- Mr. Lechner replied that the ordinance goes to council next week. But since there's no card-swipe device installed yet, it isn't a priority. The ordinance will become official in the first week of August 2013.

Electric Vehicle International

Mr. Petersen provided the group with a brief overview of the company Electric Vehicle International (EVI). The company is a manufacturer of EVs and alternative fuel vehicles. They assemble EV delivery trucks and have been working with the SJPAPCD for years. Ricky Hanna, Chief Executive Officer or EVI, will present next month about their operations.

No comments from the floor.

RFP Template for Public Agencies Interested in EVSE Installations

Mr. Petersen presented a template for a request for proposal (RFP) for public agencies interested in EVSE installations. An RFP is another method public agencies may utilize when all EVSE subsidies expire and jurisdictions are searching for methods to reach their CAP goals. A turn-key solution is promoted in the RFP. This means jurisdictions can sign a lease agreement with an EVSE vendor while the vendor still owns, operates, maintains and retains the revenue from the EVSE.

PEVCC members provided the following comments:

- Mr. Riding commented that local governments need relationships with these vendors.
- Mr. Petersen said that another option is that when an RFP is issued by a regional agency or jurisdiction, there is standard legal information added. Mr. Petersen asked if anyone has information that they are willing to share.
- Ms. Kincaid responded that in an RFP there are always pages and pages of requirements that federal or state governments like to add. Most of this is standard information, which can be included in the document.
- Mr. Riding said that he thinks the City of Fresno may have a great deal to contribute to this topic.

- Ms. Urata said that there are language requirements listing all vocabulary that is necessary for federal or state requirements. Ms. Urata said that she will send over as an attachment necessary language for RFPs.
- Ms. Urata then asked whether or not it is an RFP for services. If so, that language doesn't necessarily apply.
- Mr. Petersen stated that this RFP example had language adopted from the City of Long Beach and Chula Vista and will review the original RFPs.
- Ms. Van de Water asked if there a statement of liabilities that is assumed and if it comes at the RFP level or with the contracting.
- Mr. Petersen responded it's likely at the discretion of the jurisdiction. Many jurisdictions would include their general liability contracting language at the RFP level. Mr. Petersen stated that at the very least, once the city selects a vendor, additional documents such as the contracting agreements will come forth.
- Ms. Kalashian said that she is not sure if listing liabilities is necessary in the RFP process. Some cities will take some liabilities, but some will not at all. So it is probably important for these cities to note all possibilities.
- Mr. Riding said that each utility has a different process. Each vendor might not know each process unless they've worked with them before. Additionally, the costs are unknown until the actual job is complete.
- Mr. Petersen stated that another point that has been brought up is the issue of term/leasing agreements. Vendors seem to be attracted to longer term agreements. Mr. Petersen asked if any group member has ever been subject to service agreements such as this and what the general length of time the contract agreement.
- Kendall Cook, City of Clovis, said that they have several different agreements. It usually starts with a couple of years and that can be extended or reinitiated before they solicit other bids. They don't experience many long-term projects or contracts because of their low budget. This varies from city to city.
- Ms. Urata asked if Section 3 "Scope of Project" is for EVSE in public places.
- Mr. Petersen confirmed.
- Ms. Urata said that the text "if we comply with all building code, ADA, and global requirements" should be added, with particular emphasis on the ADA requirements. It is a possibility to have vendors send cities their ten most recent projects, for example, to act as a qualifier. Additionally, she said that in Kern County there are few cities with multi-year leases or contracts.
- Mr. Riding said that local governments own public and private areas. There may be private sites that are publicly accessible, which need to be differentiated from public sites for private use.
- Ms. Kincaid added that it would be necessary to ask for the vendor's employer/ID number and DUNS number for safety.
- Mr. Petersen added that included in the packet is also an evaluation proposal template and a criteria used for evaluating proposal.

TASK #6: REGIONAL PLANNING FOR EVSE SITING

Mr. Petersen presented the preliminary outline of an EVSE siting model developed by the Institute of Transportation Studies at the University of California, Irvine. This siting model will be implemented into the final plan and presented at the next meeting. Mr. Petersen asked the group for their input.

PEVCC members provided the following comments:

- Mr. Poley would like cooperation with local municipalities incorporated into the EV siting model.
- Mr. Petersen responded that that is a very realistic approach. This siting model was developed to find out the optimal locations for charging stations.
- Mr. Riding commented that interacting with local utility should be considered.
- Mr. Petersen moved on to the next slide of the siting analysis and asked if there are any specific preferences where Level 1 is more realistic as opposed to Level 2 or DC Fast Charging (DC FC)
- Ms. Kincaid said that there was a comment earlier about the DC FC and how commercial vehicles can't use it at all. She said that if very few people can use DC FC or if they use it when they shouldn't, there might be issues that arise.
- Ms. Van de Water asked why commercial vehicles can't use DC FC.
- Mr. Cook responded that there are structural issues in the battery that makes fast charging stressful on the battery.
- Mr. Petersen asked if information like this would be useful for the regional Councils of Governments for planning purposes
- Ms. Dawson replied that her colleagues would benefit. Member agencies would have to tweak the UC-Irvine model.
- Mr. Riding said that it is an assumption that most public charging would be Level 2 charging.
- Ms. Dawson asked if DC FCs would be installed at major corridors and interstates.
- Mr. Petersen said that that is a reasonable assumption.
- Mr. Riding said that DC FCs can help people get from community to community, and then Level 2s can help you move around within the community.
- Mr. Petersen stated that there are differences between plug-in hybrid vehicles (PHEVs) and battery electric vehicles (BEVs) and their charging activities. For instance, drivers for the PHEV Chevy Volt will try to maximize their charging experiences outside of home because they want to maximize their electric miles. The Volt driver, their cost comparison is gasoline. Whereas, BEVs will charge predominately at home, usually overnight. BEV drivers will compare their public charging rates to the much cheaper TOU rates they receive at home.
- Mr. Fugelsang asked if Level 1 charging can used at home for longer periods, whereas Level 2 is likely to be available in public places for shorter durations, 3-4 hours, then DC FC is for quick charges.
- Mr. Petersen confirmed. He also stated that Level 2 residential chargers are common, while Level 1 charging is a cheap option for workplace charging, where people tend to park their car 8-9 hours.
- Ms. Urata asked what "SOC" stands for.

- Mr. Riding and Mr. Petersen both respond that it means State of Charge.
- Ms. Urata commented that she will also take this siting model to the modeling group at COG ask for their comments.
- Mr. Riding said to link utility to electricity and the location. They are most interested in new business, cost, and location.

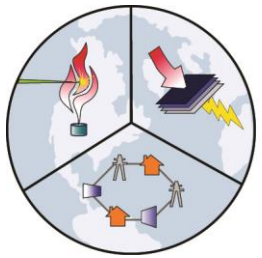
ADDITIONAL COMMENTS

PEVCC members provided the following comments:

- Mr. Riding commented that one reason why fewer people are coming to the meetings is because it's not on group members' outlook calendars. Mr. Riding suggested if it can be an Outlook calendar invite in the future.
- Mr. Petersen said that he wants as many people participating as possible and will send out an invite. The goal is to have the plan developed by the end of the year to be presented to the air district board by December or January; therefore the next two-three months will be critical.
- Ms. Kincaid said that it is great to have people attend in person or in the webcasts because it really encouraged discussion. Feedback is very important.
- Ms. Kalashian said that her organization is receiving calls from Blood Banks and offices of education to move forward in such a way. But these people are meeting some barriers from local governments. She asks whether or not these people should be included in the conversation.
- Mr. Petersen commented that the goal of the group is to have every local jurisdiction come together and learn more.
- Ms. Urata commented that the group needs to reach out to local governments to ask them if they need help. It is important to give tools to local governments and get people to advocate for their local communities. Even just directing them to CCSE's website is helpful.
- Mr. Petersen said that this is a good reminder to mention that the CCSE will be revamped soon.
- Ms. Dawson asked if there are any reactions to the public outreach template she had shared last time.
- Mr. Petersen used the presentation and presented to a group of city planners in Visalia last month.

PEV Infrastructure Planning

Dr. Tim Brown
Technology Manager Sustainable
Transportation and Energy



ADVANCED POWER
& ENERGY PROGRAM
UNIVERSITY of CALIFORNIA · IRVINE

Plug-In Electric Vehicles

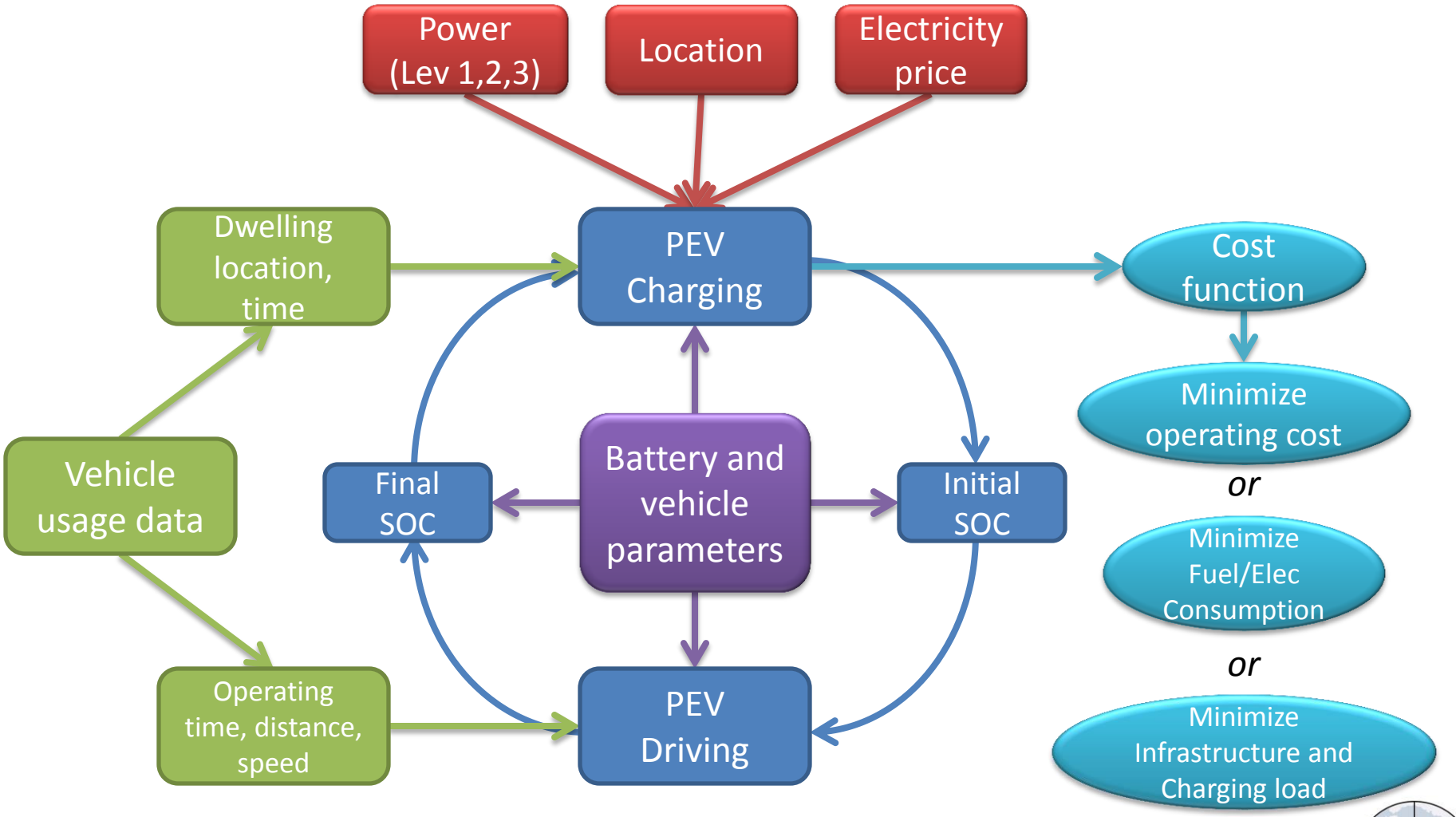
15 miles

40 miles

75 miles

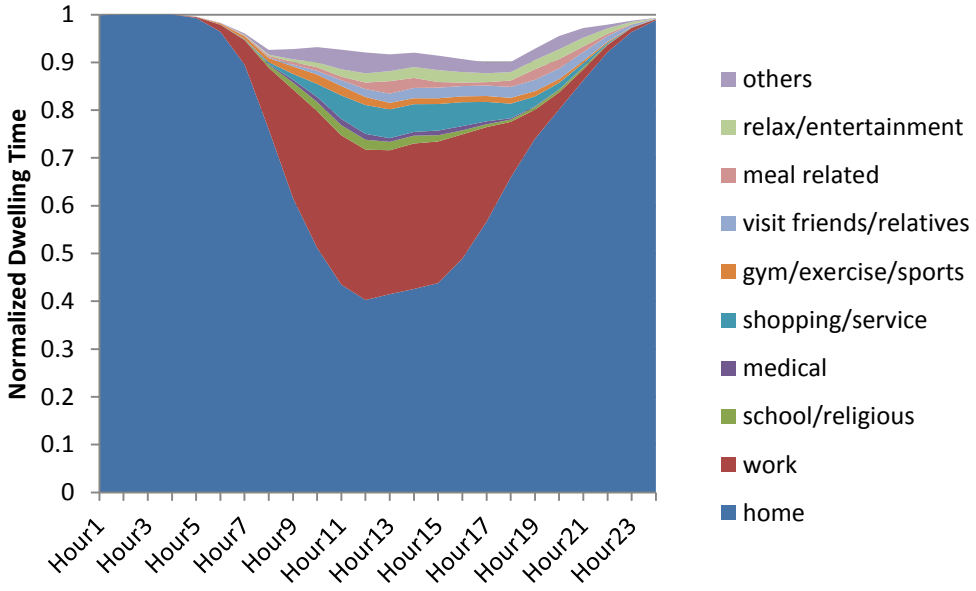
265 miles

Modeling Approach for PEV Infrastructure

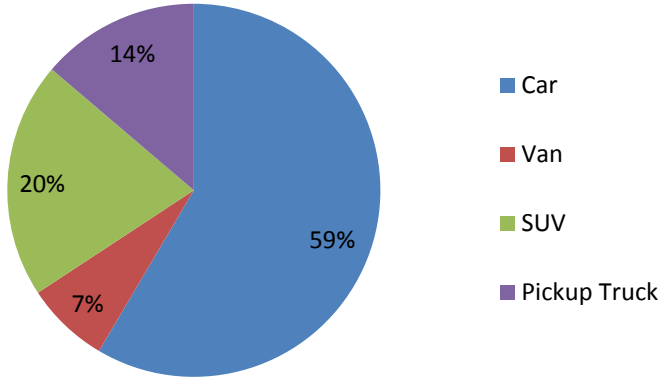


Vehicle Usage Patterns

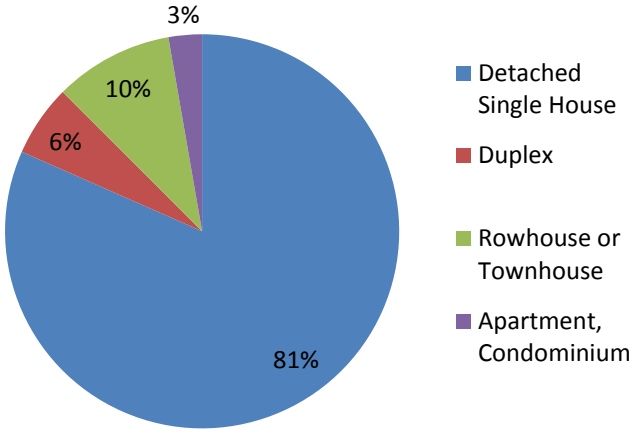
- 59% cars
- 81% detached house with garage
- Long dwelling time at home



VMT Distribution (vehicle types)



VMT Distribution (home types)



PEV Charging Infrastructure (EVSE)

- Charging infrastructure includes all of the hardware and software that ensures energy is transferred from the electric grid to the vehicle.
  - Location: home, work, other locations
  - Power level: industry standard
  - Time strategy: various control strategies

	Current	Converter	Connector	Power Limit	Time Strategy
Level 1	AC	On board (3.3 kW)	SAE J1772	1.44 kW (120V)	Y
Level 2	AC	On board (3.3 kW)	SAE J1772	Up to 19.2 kW	Y
Level 3 (BEV only)	DC	Off board	CHAdeMO J1772 Combo	Up to 50 kW	N/A
TESLA	AC/DC	2*10kW	TESLA (or adapter)		

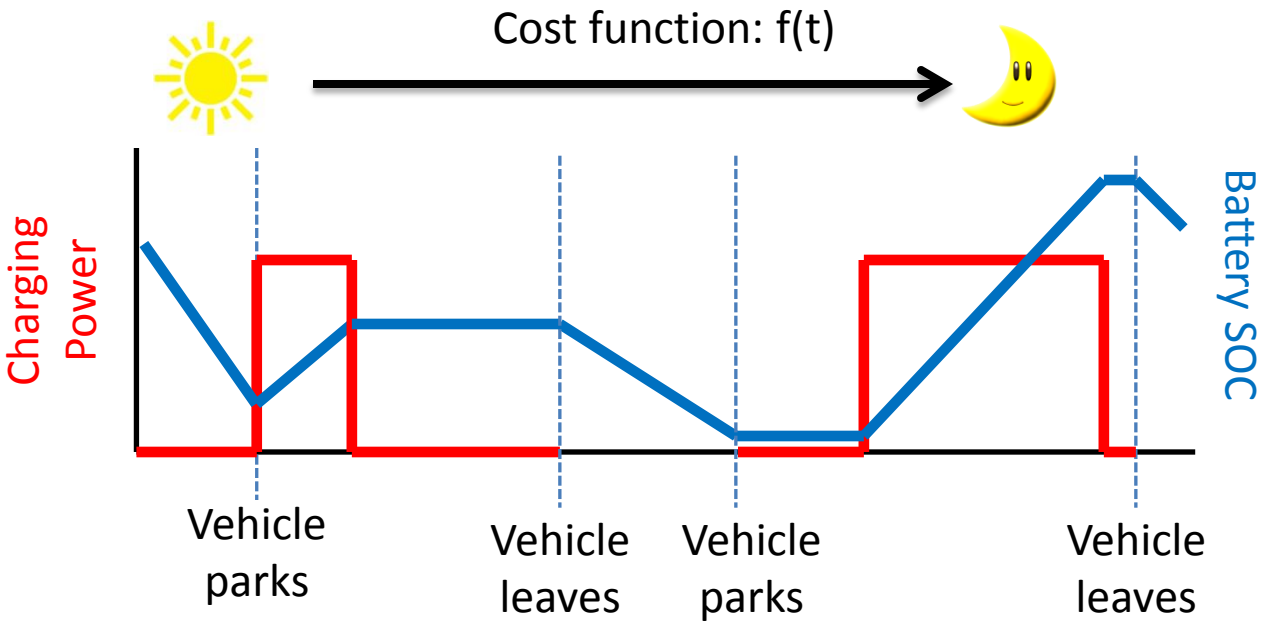
SAE J1772

CHAdeMO

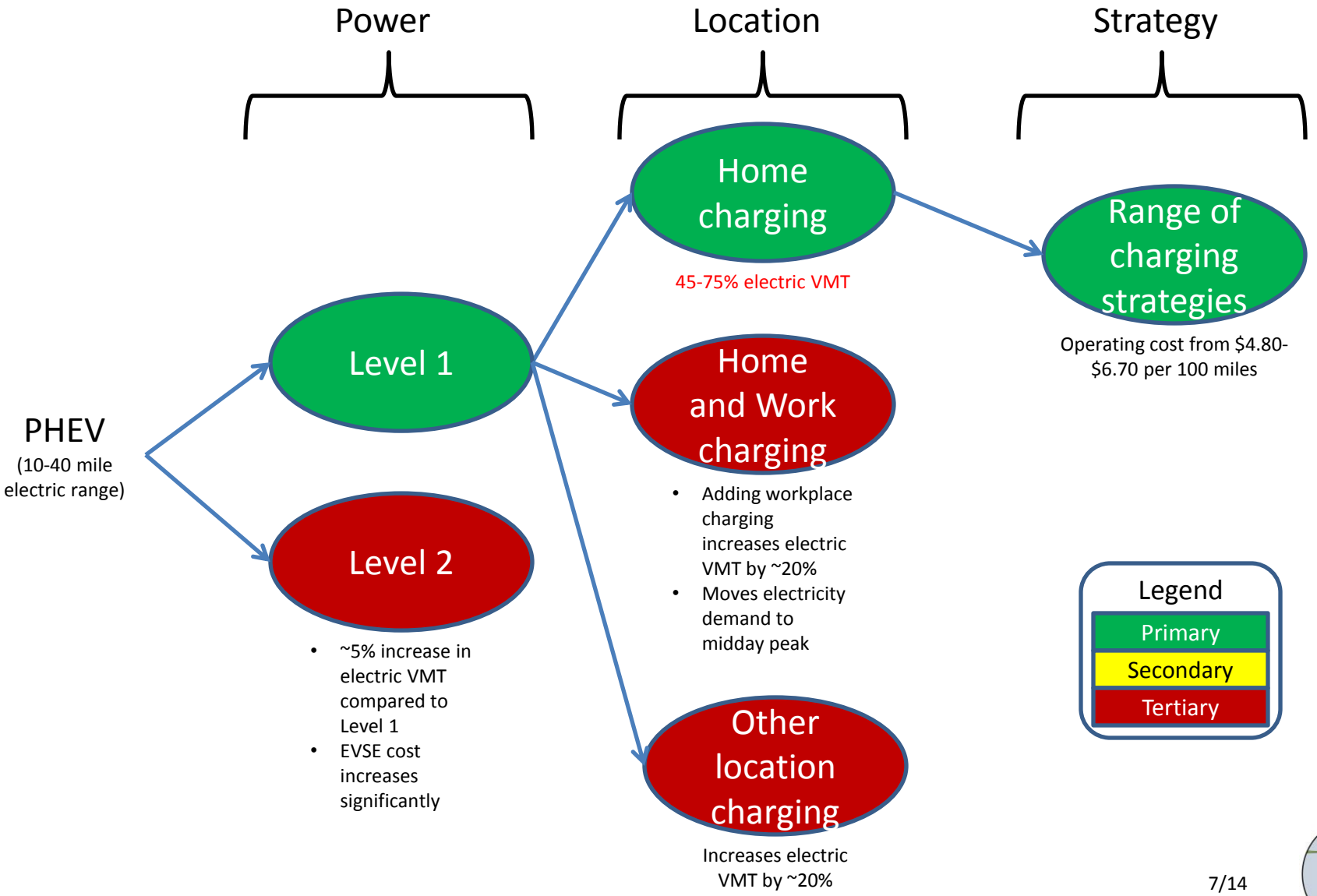
J1772 combo

PEV Charging Infrastructure (EVSE)

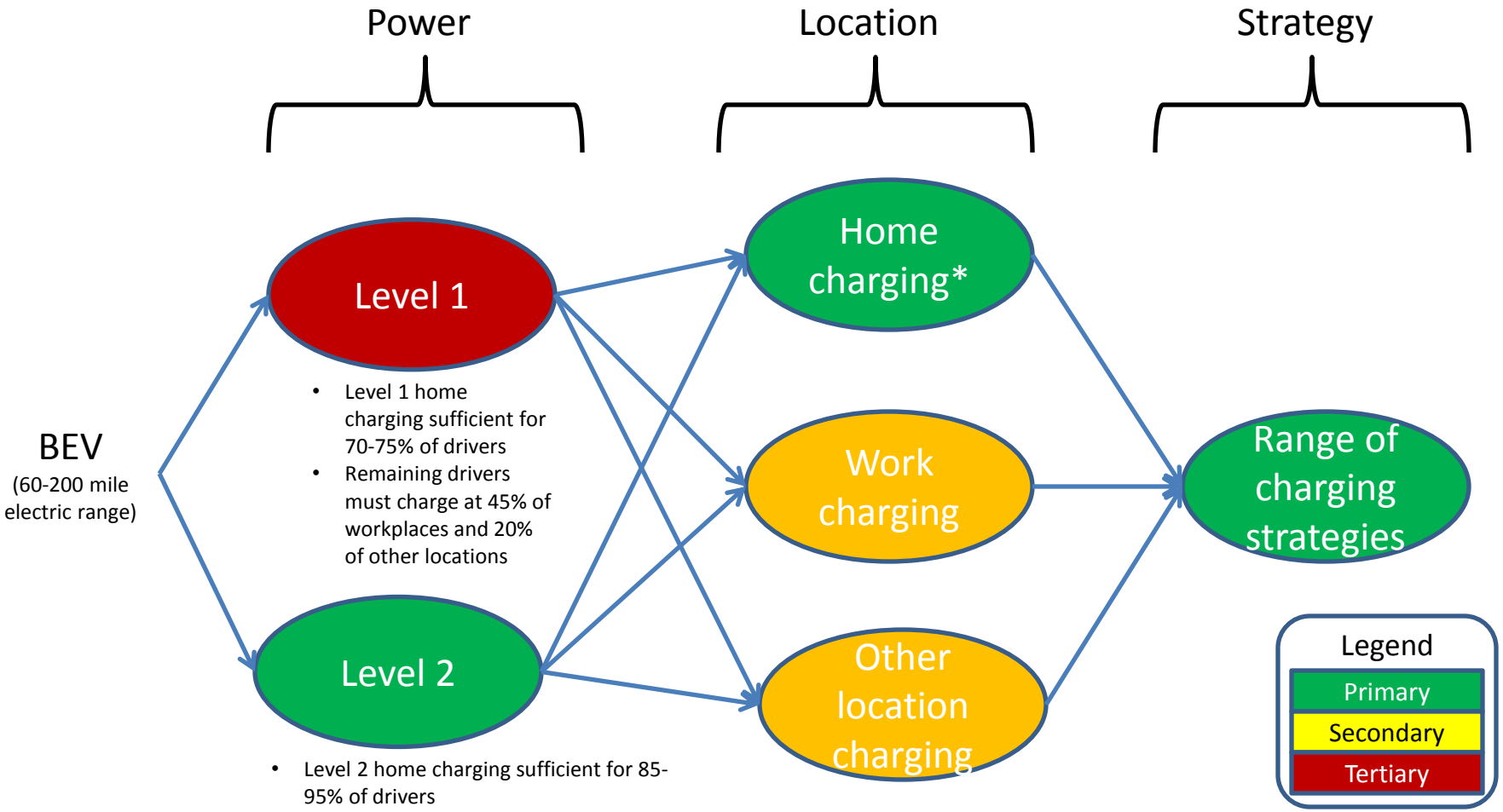
- Time strategy (Level 1 and Level 2)
  - Immediate
  - Delayed
  - Average
  - Smart
  - Optimal



Key Findings: PHEV



Key Findings: BEV



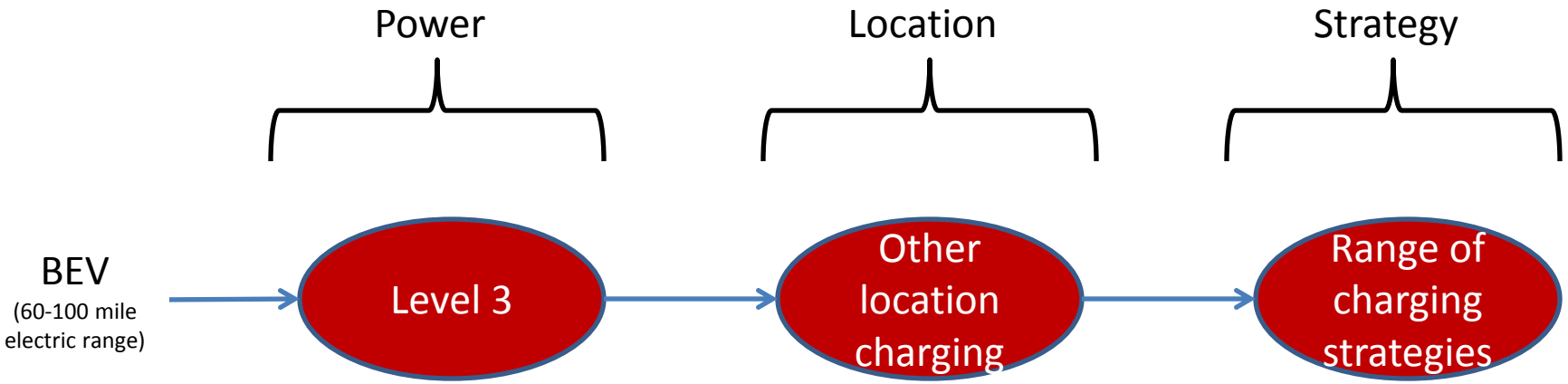
- Level 1 home charging sufficient for 70-75% of drivers
- Remaining drivers must charge at 45% of workplaces and 20% of other locations

- Level 2 home charging sufficient for 85-95% of drivers
- Level 2 home charging also reduces operating costs by 10%
- Remaining drivers must charge at 20% of workplaces and 6% of other locations

* Home charging can be challenging for 20% of VMT associated with multi-unit dwellings

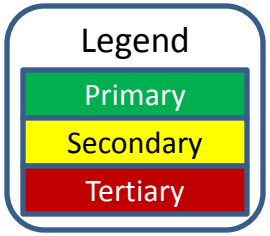
Key Findings: Lev 3 BEV

Level 3 charging can provide a PEV "safety net" and be relied on for longer distance travel, but because of both the infrastructure costs and high daytime electricity prices, Level 3 should not be considered a primary charging solution.



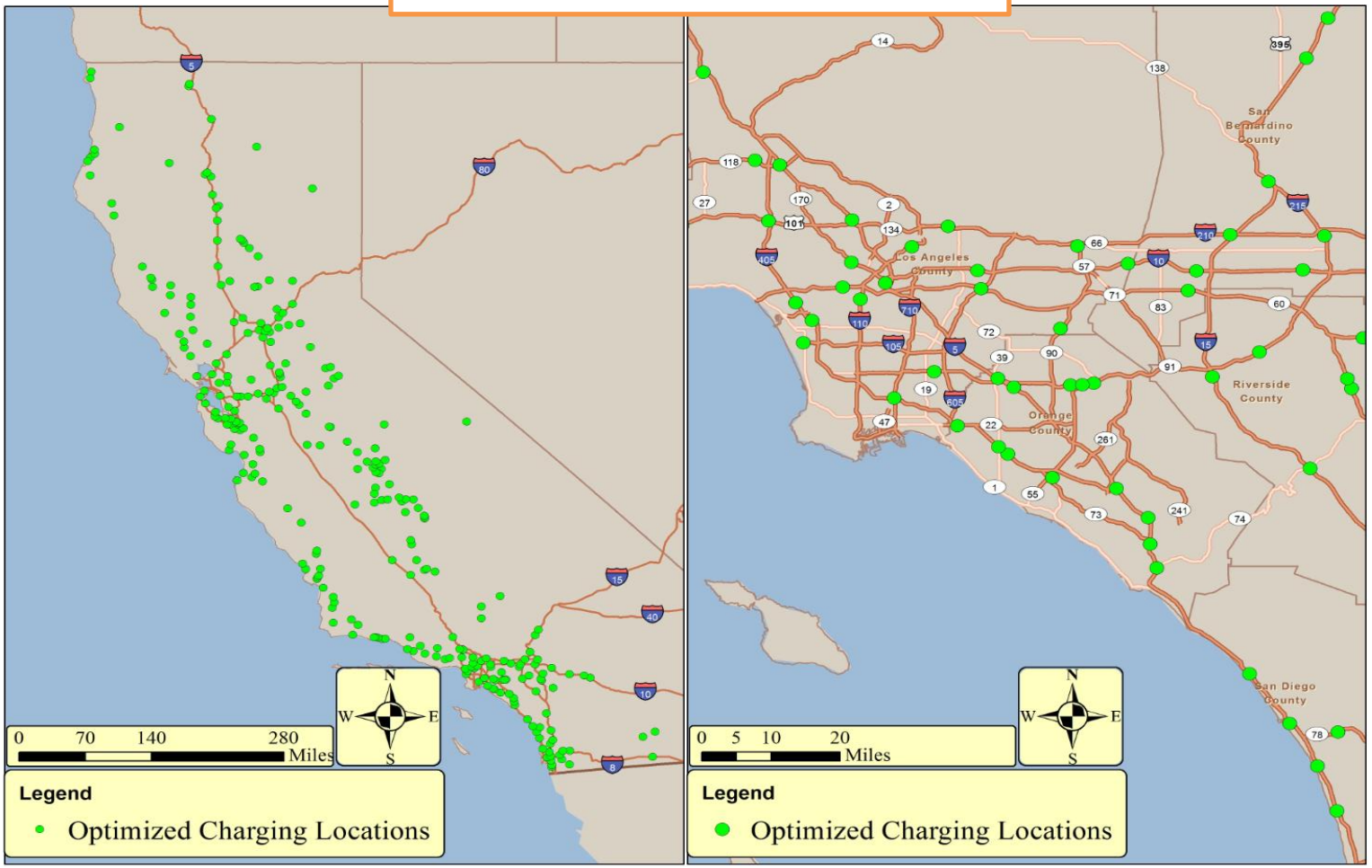
- Level 2 home charging not sufficient for 15% of drivers (long distance travel)
- Optimized Level 3 network could satisfy 98% of drivers

- A Level 3 reservation system can reduce charging costs by 30%
- A Level 3 reservation system could reduce wait times by 70%



Level 3 Station Distribution

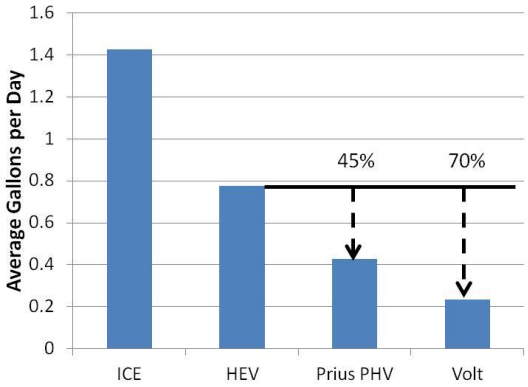
290 Stations in CA



Summary for PEV Infrastructure

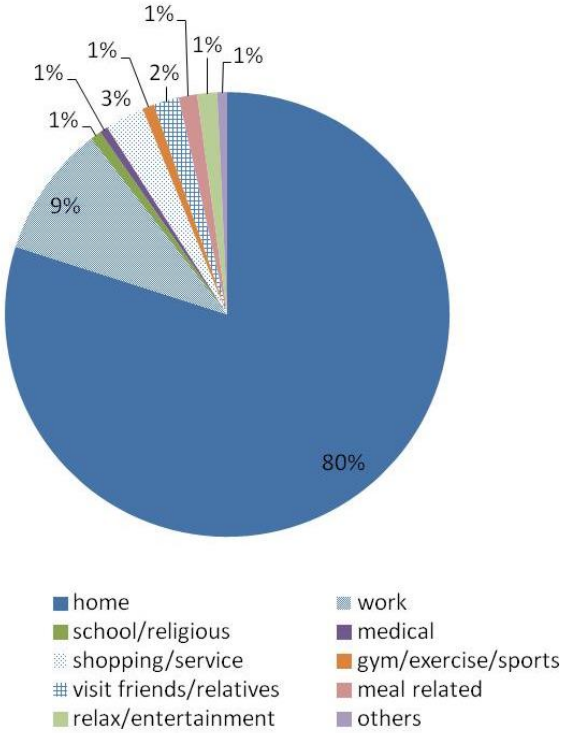
Level 1

- At home Level 1 is all that is needed for PHEVs
- E.g. Chevy Volt can achieve 70% reduction in gasoline consumption (compared to HEV) with only Level 1 at home



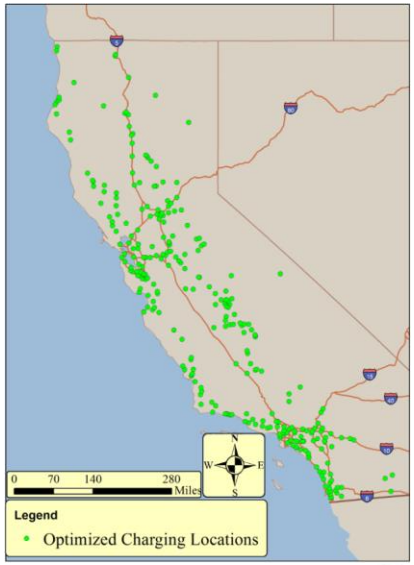
Level 2

- At-home Level 2 is critical to enable BEVs
- E.g. 8-1-1 is ideal Level 2 EVSE distribution



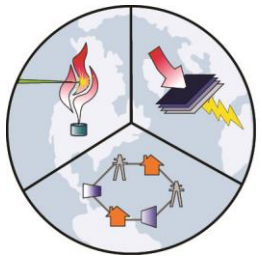
Level 3

- Level 3 provides "safety net" for BEV drivers
- E.g. 290 Level 3 locations in CA (plus home charging) can enable 98% of drivers to use BEVs



PEV Infrastructure Planning

Dr. Tim Brown
Technology Manager Sustainable
Transportation and Energy



ADVANCED POWER
& ENERGY PROGRAM
UNIVERSITY of CALIFORNIA · IRVINE

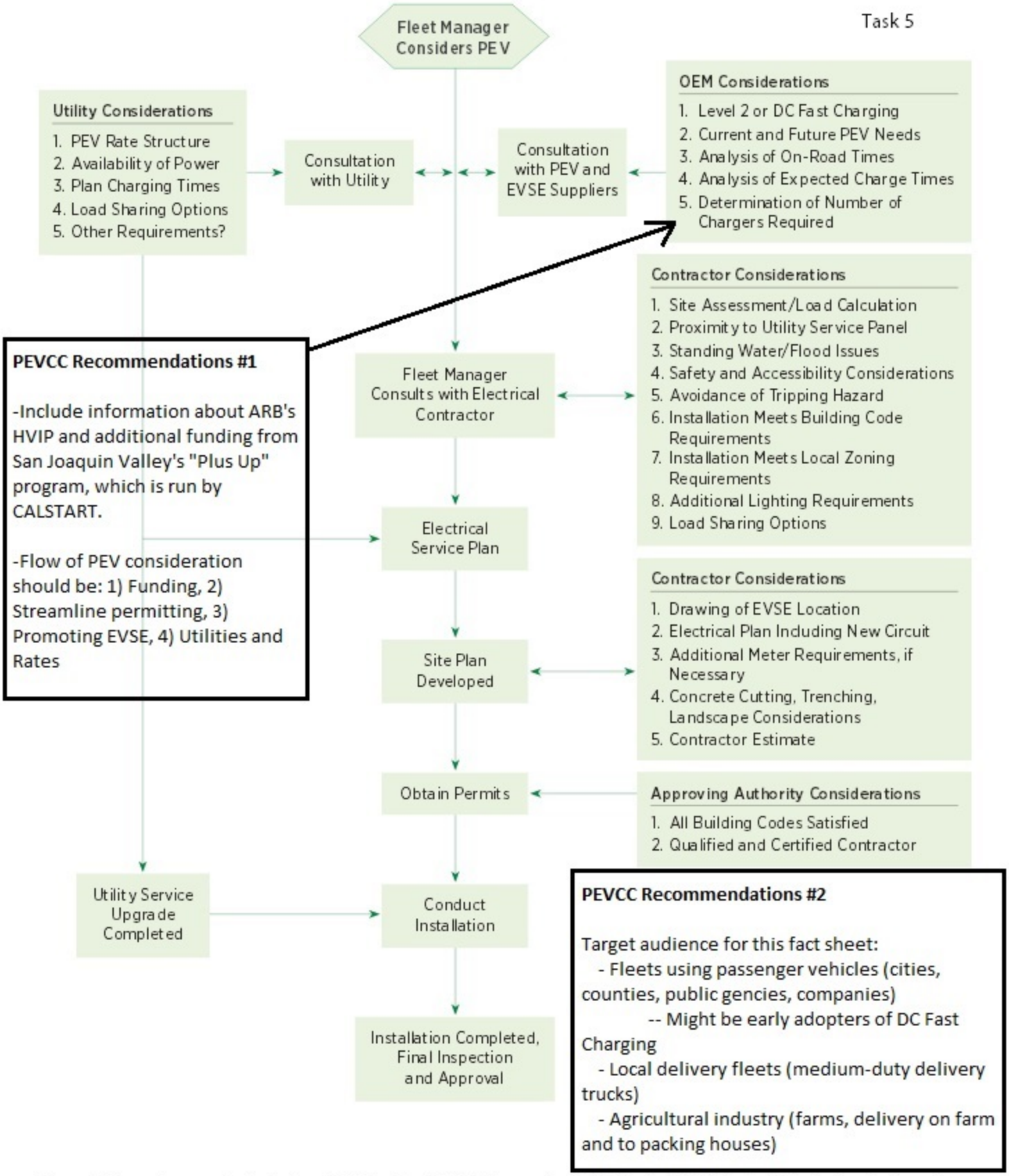


Figure 8. General process for installing EVSE at a fleet facility. *Source: eTec (2010), Electric Vehicle Charging Infrastructure Deployment Guidelines for the Oregon I-5 Metro Areas of Portland, Salem, Corvallis and Eugene. EV Project publication (www.theevproject.com/documents.php).*

Renewable Energy and PEV Charging

Table 1 shows residential solar panel rebate applications, with counties ranked according to the number of applications for the California Solar Initiative (CSI).

Table 1: Solar Panel Applications Residential (by County)

Number	County	% All Apps (res)	% SJV Apps (res)	% Residents
5479	Fresno	5.51%	34.04%	0.58%
4135	Kern	4.16%	25.69%	0.49%
2154	Tulare	2.17%	13.38%	0.48%
1814	San Joaquin	1.82%	11.27%	0.26%
812	Madera	0.82%	5.05%	0.53%
661	Merced	0.66%	4.11%	0.25%
653	Kings	0.66%	4.06%	0.42%
387	Stanislaus	0.39%	2.40%	0.07%

Table 2: Solar Panel Applications Non-Residential (by County)

Number	County	% All Apps (non-res)	%SJV Apps (non-res)
5219	Fresno	61.87%	40.85%
3445	Kern	40.84%	26.96%
1812	San Joaquin	21.48%	14.18%
788	Madera	9.34%	6.17%
650	Merced	7.71%	5.09%
387	Stanislaus	4.59%	3.03%
349	Kings	4.14%	2.73%
126	Tulare	1.49%	0.99%

Table 2 shows non-residential solar panel rebate applications, with counties ranked according to the number of applications for CSI.

Table 3: CVRP Rebates Residential (by County)

Number	County	% All Apps (res)	% SJV Apps (res)	% Residents
118	Fresno	0.44%	28.57%	0.01%
109	Kern	0.41%	26.39%	0.01%
107	San Joaquin	0.40%	25.91%	0.02%
44	Stanislaus	0.16%	10.65%	0.01%
31	Tulare	0.12%	7.51%	0.01%
16	Merced	0.06%	3.87%	0.01%
16	Madera	0.06%	3.87%	0.01%
3	Kings	0.01%	0.73%	0.00%

Table 4: CVRP Rebates Non-Residential (by County)

Number	County
5	San Joaquin
4	Tulare
4	Fresno
2	Stanislaus
1	Kern

Table 3 shows residential plug-in electric vehicle rebates, with counties ranked according to the number of applications for the Clean Vehicle Rebate Project (CVRP). It also provides the percentage of residents who have gotten rebates in each county.

Table 4 shows non-residential PEV rebates, with counties ranked according to the number of applications for CVRP.

Table 5: Solar Panel Applications			
Residential (by zipcode)			% Residents (in zipcode)
zipcode	number	city	percent
93619	784	Clovis	2.71%
93312	746	Bakersfield	1.31%
93611	675	Clovis	1.48%
93314	609	Bakersfield	2.72%
93720	462	Fresno	1.02%
93711	451	Fresno	1.23%
93311	404	Bakersfield	0.99%
93722	367	Fresno	0.48%
93727	328	Fresno	0.46%
93230	318	Hanford	0.49%

Table 6: CVRP Rebates			
Residential (by zipcode)			% Residents (in zipcode)
zipcode	number	city	percent
93619	21	Clovis	0.073%
93311	17	Bakersfield	0.042%
93306	14	Bakersfield	0.022%
93314	14	Bakersfield	0.063%
93611	14	Clovis	0.031%
93312	13	Bakersfield	0.023%
93720	12	Fresno	0.027%
95376	11	Tracy	0.022%
95391	11	Tracy	0.110%
93711	10	Fresno	0.027%

Table 5 shows the number of solar panel applications by zip code, ranked according to number of applications.

Table 6 shows the number of CVRP rebates by zip code, ranked according to number of rebates.

Tables 5 and 6 also present the application percentage within the zip code.

Table 7: Overlap Zipcodes (both solar and EV)			
zipcode	city	% solar	% EV (in zip)
93619	Clovis	2.72%	0.073%
93312	Bakersfield	1.31%	0.023%
93611	Clovis	1.48%	0.031%
93314	Bakersfield	1.31%	0.063%
93720	Fresno	1.02%	0.027%
93711	Fresno	1.23%	0.027%
93311	Bakersfield	1.0%	0.042%

Table 8: Top Cities (both solar and EV)

Top Cities	% city w/ solar	%city w/ EV
Bakersfield	0.51%	0.017%
Clovis	1.53%	0.037%
Fresno	0.33%	0.004%

Table 7 presents the zip codes that had both the highest PEV and solar rebates and applications.

Table 8 presents the top cities that had both the highest PEV and solar rebates and applications.

2010 U.S. Census data was used for all population analysis. The CVRP data was taken from the latest CVRP dataset from the week of July 15, 2013. The CSI data was from the California Solar Initiative website, but only provides information from applications administered by California Center for Sustainable Energy, Southern California Edison, and Pacific Gas and Electric.

Case Study: Lyons High School Micro-grid Island Project

Project Summary and Goals:

Transportation demands of rural schools present an exciting market opportunity for large-scale electric vehicle (EV) deployment and have the potential to realize significant environmental benefits. EV charter buses have the potential to reduce the associated emissions and fuel costs from the longer commuter distances required by students in rural communities. Utilizing clean renewable energy to power the buses will reduce emissions further and will make schools into self reliant systems—a benefit to both the school and the community. However, financing the steep upfront capital costs of such projects remains a problem. Grant funding, the primary mechanism for a project like this, is usually limited and highly competitive to obtain.

The Lyons High School (HS) Micro-grid Island project takes an innovative and holistic approach to sustainable financing and environmental goals. The proposed project is an integrated system comprised of electric transportation, electric generation, and multi-use storage capacity. By generating localized power for transportation and building use, providing an emergency storage opportunity, and incorporating this into a teachable situation for students, the Lyons HS project has the potential to be a replicable and sustainable model for other rural communities.

The goal of the project is to gather data to develop an energy performance contract (EPC)-type funding mechanism. The EPC financing mechanism is a sustainable and well-established tool for commercial buildings that has yet to be applied to the transportation field. The potential payoff of energy and fuel savings is an attractive venture for third-party investors and will have significant emissions reductions in a rural community like Lyons. Third party investors pay for the upfront capital costs of the entire project and capture various revenue sources as a return on investment (ROI). The revenue sources include tax credits, power purchased by the utility provider, and the school's energy bill savings.

This project will take place after the Project FEVER grant timeline. Lyons HS is in the process of changing utility providers, the outcome of which is critical in negotiating a power purchasing agreement (PPA). The details of the project however are outlined to convey best practices with others interested in exploring a holistic approach to EPC and electric transit.

The proposed system utilizes the following components and corresponds to Figure (1):

- *Solar PV Generation*
  Rooftop generation from a 100 kW system provides DC power directly to the battery. The battery, with a 1 mWh capacity storage, in turn, powers the school. The storage capacity also allows for a variety of power delivery scenarios: For example, it could deliver 100kW over 10 hours or 500kW over 2 hours. The PV system incorporates interactive displays for hands-on learning for the students and compliments existing energy curriculum for use in the classroom.

- *BYD Electric Charging Bus*
  An electric charter bus transports students between Longmont and Lyons. The bus will be set up to charge from the battery through a charging station, but also will be capable of vehicle-to-building power in case of an emergency. Charged from the micro-grid, the bus will be extremely low in emissions relative to both traditionally fueled transit vehicles and other electric vehicles charged from the utility grid. Replacing the current multiple personal vehicles used to transport magnet students to the school with an electrified transit system increases the emissions reductions.

- *Natural Gas Micro-Turbine*
  The existing emergency diesel generator will be replaced by a natural gas micro-turbine. As a backup to the solar/battery combination, the micro-turbine can provide base load generation and emergency power when demand exceeds the capacity of the solar/battery system.

- *Local Utility*
  The local utility can purchase power from the school during peak hours from the Town of Lyons. This power is a local source and can supplant the need to purchase higher cost power on the wholesale market. In addition, the utility can use the battery storage unit as well as natural gas micro-turbine as emergency power in the event their charging substation goes down.
- *Emergency Shelter*
  The school is the community's designated emergency shelter. Since the school would be set up as a micro-grid, it could be operated independently from the utility grid. With the transportation component, it can also serve as an emergency transportation facility.

Project Benefits:

One of the major benefits of having an electric bus centered project is emissions reduction. Lyons HS is a magnet school for the area and has more than 134 students commuting each day into Lyons from an average of 8 miles away. By providing an electric bus service for those students, both congestion and emissions are drastically reduced by 119 metric tons per year Renewable, clean energy powers the bus as well as the school creating a net-zero emissions environment. In addition, the components proposed in this islanded system avoid the need for diesel generators that are highly polluting, expensive, and go largely unused.

The high school will be capable of delivering power to the Lyons municipal system, but will primarily operate as an individual unit. When the school does not require much energy (e.g. in the hot summer months when the load is high in the municipality and the school is largely vacant) the utility provider can access a local distributed energy source, forgoing the need to purchase power on a wholesale market, located outside of the state. This local power can also be accessed during peak hours throughout the school months.

The micro-grid island generates power that is clean, localized, self-sufficient and has emergency power benefits for the larger community. Lyons HS is already a designated community emergency shelter, so the capability to operate separate from the utility grid increases its value. The power source is local and on the utility side of the closest sub-station located five miles from town.

Many schools in rural areas across the nation are similar to Lyons HS and could employ the system design and financing mechanism. For example, communities like Lyons that project increases in load with high transmissions costs could benefit from a local school becoming a micro-grid island. Areas of the country too remote for transmission construction or that need to tie in to the existing utility infrastructure could also benefit. Furthermore, every community has a designated emergency shelter and, in many instances, that designated facility is a local school.

Projected Costs:

Project Components	Cost	Financing sources
Solar PV (installation and capital)	$500,000	Reduced energy bills
3 EV charter busses (and connectivity)	$950,000	Solar tax credits and rebates

Continued on next page

Continued from previous page

Projected Costs:

Project Components	Cost	Financing sources
Storage (installation and capital)	$900,000	REC payment by utility @ $0.15/kWh
Metering	$200,000	
TOTAL	**$3,100,000**	

Partners:

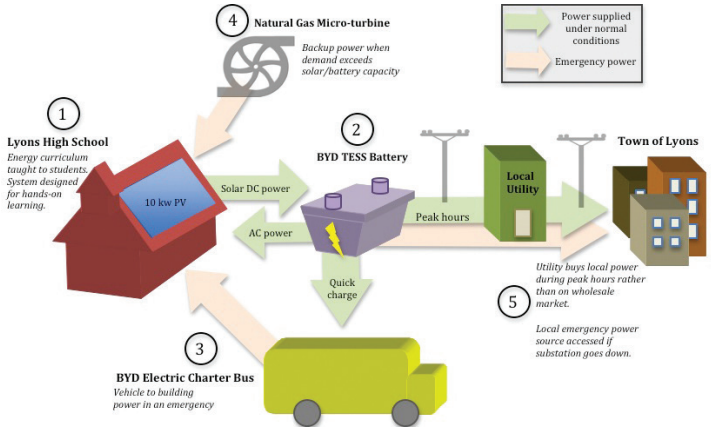
Based on the initial investigatory work, the following types of partners have been identified as critical in moving such a project forward:

- *Municipality – An advocate on city council is needed to champion a project and gain town support.*
- *Energy Service Company – This company will be responsible for designing and entering into the EPC with the school and a PPA with the local utility. Critical qualities include a willingness for innovation and an appetite for a certain amount of risk in uncharted territory.*
- *Electric Bus Manufacturer – Must be cost competitive in order to make the EPC viable. Ideally, the manufacturer can be vertically integrated in order to provide other system components to bring down overall project costs.*
- *Utility Provider– This partner is a clear project lynchpin. The ideal provider must be willing to purchase the power and link to the system for emergency situations.*
- *School – The school should be willing to integrate energy curriculum and have staff trained on system operation and maintenance.*

Potential Project Barriers:

The main barrier that needs to be resolved is thoughtfully engineering the system. Since this is a fairly complex system, many hours of engineering will be required. Requirements for purchasing from American providers are also a factor that will need to be addressed if federal funding is sought.

Figure (1): Lyons High School Transportation and Energy System



Despite the high up-front costs, EVSE providers or owners can generate revenue and reap other reputational benefits. As of August of 2012, EVSE providers can sell electricity to PEV drivers without being regulated as a public utility, as per Colorado House Bill 12-1258 (codified at C.R.S § 40-1-103.3). This policy opens a new revenue source for EVSE providers. Other revenue sources include charging more for EVSE parking spaces, increasing parking garage entry fees, or selling advertising space on EVSEs. Many retail stores, such as Walgreens, also project increased sales revenues from PEV drivers shopping longer while charging.[73] Others provide discounts on charging if consumers make a purchase in the store.

Consider a scenario where an EVSE provider installs a public charging station in a well-located site and only generates revenue through the resale of electricity. When gasoline costs $3.58, PEV drivers would be willing to pay between $0.28 and $0.95 per kWh to charge their vehicle at a desirable location. If a Level 1 and Level 2 EVSE supplier charges $0.30 per kWh, they can realize payback periods of less than 6 years.[74] If a DC fast charger provider charges $0.60 kwh, they can realize the same payback period of less than 6 years. These prices are within the consumer willingness to pay.[75]

Considering these financial and non-financial opportunities, government agencies, private companies, and property owners have developed several business models to effectively install and manage public charging stations, three of which are described here:

- One party ownership and management: One entity (either public or private) installs and operates the EVSE on owned property. For example, the City of Boulder installed and now operates a charging station at their South Boulder Recreation Center. This model allows governments to invest in infrastructure that may not be immediately available in the private sector and can provide a high-profile location for the promotion of PEVs. Kum and Go provides a private sector example of installing and operating EVSE alongside gasoline pumps.
- 3rd party ownership and management: A third-party company installs, operates and manages EVSE at a property owned by a host entity. The host entity seeks to increase revenue with the increased number of customers spending more time in their store, and may also receive a share of revenue generated from charging events. The third party would realize profits from the sale of charging events or selling advertising space on the EVSE. The CarCharging Group and NRG's EVGO network provide this third party service to commercial businesses and multi-residence units.
- Split ownership and management: An entity would purchase and install an EVSE, but turn over the management and operation to a third party. The City of Boulder intends switch to this model in the future, releasing management of current EVSE to a third party.

While the public charging deployment is somewhat complex, the opportunity for returns and profit may motivate a variety of investors to participate in the market, creating a robust level of public charging access that will make consumers more confident.

The success of this deployment plan hinges on continued stakeholder engagement, education, and action in the next few years. The status report and recommendations throughout the remainder of this report will be crucial to ensuring the EVSE infrastructure is deployed in an efficient, cost-effective, and consumer-friendly manner.

---

[73] "Plug In or Power Down? Retailers jockeying for position in evolving electric-vehicle charging race." CSP Daily News. CSP Business Media LLC, 17 October 2011. Web. 2012. <http://www.cspnet.com/news/technology/articles/plug-or-power-down>.

[74] Based on a Level 2 station with $6,000 installation costs, $300 annual O&M and an average usage of 3.5 hours per day (less in the first 3 years). Appendix 9: Public Willingness to Pay for EVSE.

[75] Appendix 9: Public Willingness to Pay for EVSE.

Tesla's Supercharger Network

San Joaquin Valley (and nearby) Locations:

Harris Ranch
I-5 Exit 334
Harris Ranch Inn and Restaurant
24505 W. Dorris Ave
Coalinga, CA 93210

Tejon Ranch
I-5 Exit 219B
Petro Shopping Center
5602 Dennis McCarthy Dr
Lebec, CA 93243

Gilroy, CA
101 at Leavesley Road
Gilroy Premium Outlets
Gilroy, CA 95020

Find out more on the Tesla Supercharger website: http://www.teslamotors.com/supercharger
(Photo via Tesla website, www.teslamotors.com)