



Sustainable Real Estate Roundtable
Member Briefing

Electric Vehicle Charging Stations

QUESTION – HOW ARE COMPANIES DEPLOYING AND MANAGING ELECTRIC VEHICLE CHARGING STATIONS ACROSS THEIR REAL ESTATE PORTFOLIOS?

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Introduction

Leading companies such as SAP, Google, Advanced Micro Devices, and Marvell are installing electric vehicle charging stations (EVCS)¹ to attract and retain top talent, anticipate EV demand among employees, and integrate EVs into more sustainable buildings. While regulations for EVCS are still being developed, RE stakeholders are leveraging first mover advantage to create value for both their employees and their brands.

The purpose of this SRER Briefing is to provide decision support for RE leaders pondering ECVS installation for employee use, by providing:

- Information about the rapidly evolving market, policy, and regulatory contexts;
- Insight into installation considerations; and,
- Guidance on overcoming management challenges.

RE leaders are aware that, with the introduction of over 20 Electric Vehicle (EV) production models into the US market by 2012—including both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs)—and with range anxiety still a predominant concern, the EVCS market is poised for major growth. Non-residential EV charging equipment sales are expected to increase from 25,000 in 2011 to 110,000 in 2015.² The market is expected to reach \$1.13 billion by 2013.³ Public and private sector stakeholders in some major US markets, such as Los Angeles, the San Francisco Bay Area, New York, and Austin, are more aggressively installing charging infrastructure to accommodate small but growing EV fleets.⁴

Industry analysts foresee the growth of two EVCS markets⁵ for companies: employee vehicles and EV company fleets. Company-owned EV fleets can be a highly effective way to save on fuel and vehicle maintenance costs. But the scope and challenges of installing EVCS for company EV fleets are distinct from those for installing a limited number of EVCS for employees, since EV fleets often require more infrastructure and different hardware (such as DC 3 fast chargers), than vehicles owned by employees. In response to multiple inquiries from SRER Members, this briefing will focus on EVCS for employee vehicles.⁶

While it is assumed most charging will be done at home, predictions are that some EV owners, especially those who live in multi-dwelling units, may choose their workplace as their primary charging point.⁷ A recent Consumer Reports poll shows that 63% of consumers would be more likely to purchase an elec-

¹ Throughout this document, EVCS is used to describe the charging equipment itself, and not the station space.

² Electric Vehicles: 10 Predictions for 2011. Pike Research, 2010. <https://www.pikeresearch.com/wordpress/wp-content/uploads/2010/12/EVP-10-Pike-Research.pdf>

³ <http://earthfriendlyenergy.blogspot.com/2011/02/ge-siemens-set-challenge-to-car-charger.html>

⁴ See Appendix for a graph of which cities are most prepared for EVs.

⁵ The term 'EV' will be used throughout this briefing to refer to automobiles; other electric vehicles, such as bicycles and scooters, will be mentioned explicitly.

⁶ With the near-term growth of these fleets expected among Members, SR Inc will assess Member interest and plan research accordingly.

⁷ http://www.bc3sfbay.org/uploads/5/3/3/9/5339154/electrify_your_business.pdf

tric car if their workplace had charging stations. This highlights the importance major employers can have on promoting wider EV adoption.⁸ Most companies will not generate a profit from EVCS, but anticipate indirect monetary benefits through recruiting and retaining top talent, socially responsible branding, earning LEED® or BREEAM points, and attracting customers, vendors, and strategic partners.⁹ Furthermore, EVCS installation can help companies reduce their scope 3 GHG emissions related to employee commuting.¹⁰ RE leaders can expect a number of benefits from providing EV charging infrastructure as illustrated in Table 1 below.

Table 1. The benefits of EVCS to stakeholders.

Source: http://www.bc3sfbay.org/uploads/5/3/3/9/5339154/electrify_your_business.pdf.

	Company exec.	Property mgmt./ owner	H R	Retail GM	sustainability / CSR leader	Individual or Fleet Driver	Marketing and PR	Fleet Operator
Direct Monetary:								
Decreases operational costs	•			•	•	•		
Fed and State Tax Credits	•	•				•		
Government Grants	•	•						
Future carbon credits	•	•		•	•			
Possible increased profits							•	
Reduced fuel costs								•
Employee Satisfaction								
Decreased employee turnover	•		•					
Attract and retain talent	•		•					
Unique company benefit	•		•					
Enriched driving experience						•		•
Branding Values								
Sustainability initiative	•				•			
Improved, cool image	•		•	•	•	•	•	•
Possible increased profits	•			•	•		•	
LEED points	•	•			•			
Advertising opportunities						•	•	•
Other advantages								
HOV lanes-less commute time	•		•			•		•
GHG emissions reduction	•	•	•	•	•	•	•	•
Public health benefits	•	•	•	•	•	•	•	•
Energy independence	•	•	•	•	•	•	•	•

⁸ <http://news.consumerreports.org/cars/2010/03/consumer-reports-electric-car-buying-survey.html>

⁹ <http://chargedsv.org/wp-content/uploads/2011/06/Calise-Main-Pres-for-SVLG-Jun-2.pdf>

¹⁰ Note: EV chargers themselves do not reduce CO2 emissions. The vehicles they charge do when compared to the gasoline powered vehicles they replace. Some EVCS systems include GHG calculations in their data reporting software.

EVCS Policy & Standards in the United States

The US regulatory landscape for EVCS remains murky and largely undeveloped. As of 2010, no city in the US has implemented a comprehensive building or zoning ordinance addressing EV infrastructure; rather, “the rollout of enabling EV infrastructure (EVI) regulation at the local government level is at a very early stage of development”.¹¹ The development of processes, ordinances, and regulation for siting, permitting, and installing EVCS is still in its infancy and limited to EV-friendly markets such as the San Francisco Bay Area and Seattle.

Some EVCS technical standards, including those for vehicle connectors, have emerged for Level 1 and 2 chargers (see the Installation section below for description of charger types). Industry stakeholders are confident that the J1772 vehicle connector (which meets the specifications in the Society of Automotive Engineers (SAE) standard J1772) will be the industry standard for Level 1 and Level 2 charger connectors. California now requires new EVs and PHEVs to be equipped with the J1772. A final connector standard for DC fast charging is still being developed and is expected to be published in 2012.¹²

Other standards and specifications for EVCS are emerging as well - see the recent Monterey Bay Area Governments EV RFP for trends regarding EVCS product specifications, operating environment standards, physical specifications, internal technologies, network management, product safety and data collection capabilities.¹³

Government EVCS Policy

Currently, the installation and management of EVCS is predominantly regulated at a municipal level and, to a lesser extent, at the state level. The full list of EV infrastructure regulations and incentives at the federal and state level is available on the US DOE’s Alternative Fuels and Advanced Vehicles Data Center website.¹⁴ The federal government has yet to establish national EVCS policies or guidelines, with the exception of EVCS purchase rebates (described below in section on EVCS Costs).

Municipal & State Policy

Today, the installation of EVCS is optional for companies. However, this may change. In Hawaii, by the end of 2011, all public, private, and government parking facilities with at least 100 parking spaces must designate 1% of spaces specifically for EVs. One of these spaces “must be located near the building entrance and must be equipped with an EV charging unit that meets recognized

¹¹ http://www.psrc.org/assets/4325/EVI_full_report.pdf

¹² “Ready, Set Charge, California! A Guide to EV-Ready Communities.” Draft. Association of Bay Area Governments, EV Communities Alliance, Bay Area Climate Collaborative, LightMoves Consulting, and Clean Fuel Connection. May 2011. http://chargedsv.org/wp-content/uploads/2011/05/EV_Ready_Communities_Document-FULL-V3_5.27.11.pdf

¹³ http://www.ambag.org/rfp_jobs/public_charging_station_rfp.pdf

¹⁴ <http://www.afdc.energy.gov/afdc/laws/>

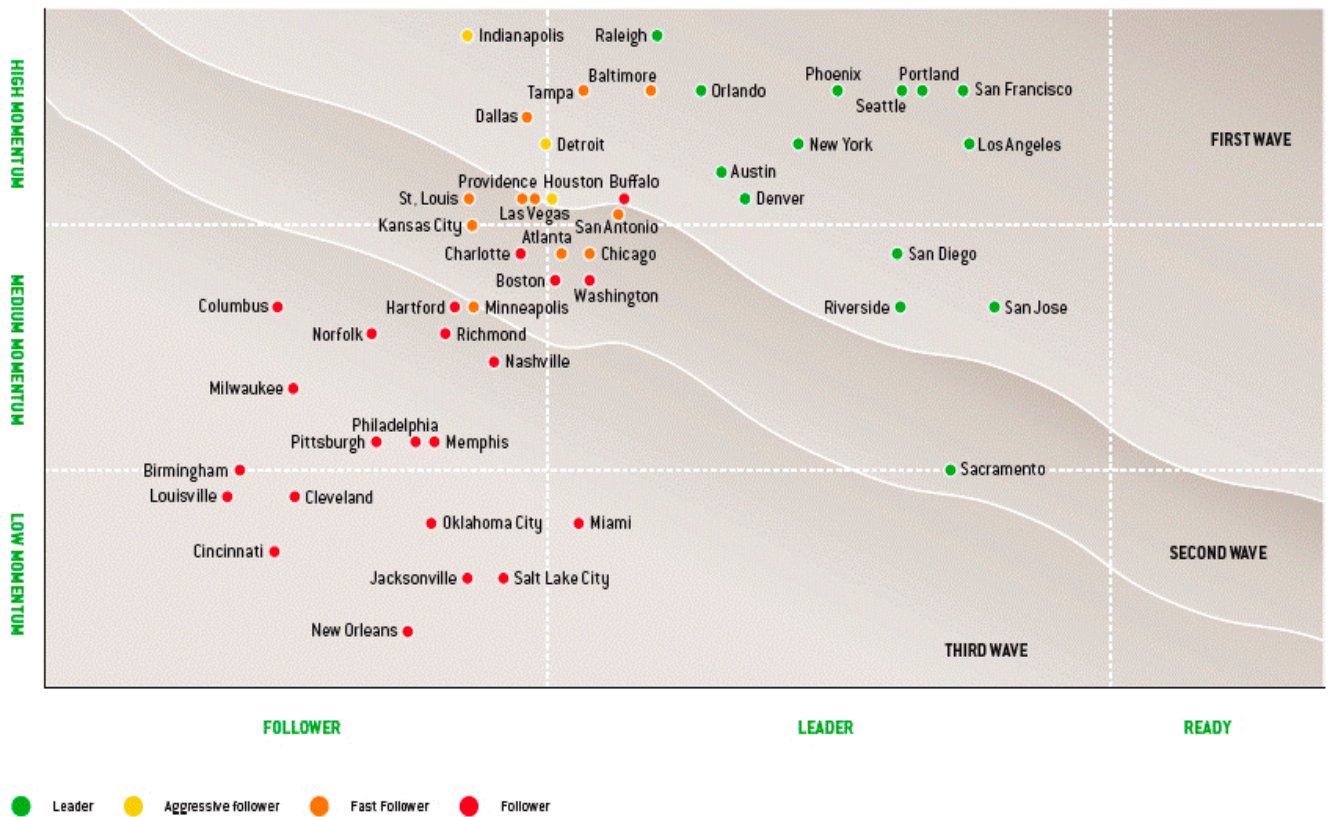
standards...the spaces designated for EVs will continue to increase by 1% for each additional 5,000 registered EVs (in the state) until the percentage reaches 10%.”¹⁵

Hawaii is currently the only state with such standards, though California is currently considering a similar measure. In 2010, the California Green Building Standards included EV charging as a voluntary measure, suggesting 10% of spaces be wired with a 120 volt circuit and a 208 or 240 volt grounded AC outlet, or a conduit and panel capacity installed for future outlets. The state is currently reviewing these requirements to determine if these should be made mandatory.¹⁶

Permitting for EVCS installation is also in its infancy. Santa Clara-based Marvell, for example, received the town’s first commercial EVCS permits in early 2011.¹⁷ Los Angeles and the San Francisco Bay area have also recently adopted guidelines for commercial electric vehicle service equipment (EVSE) permits, and other areas will likely see these policies rolled out in the near future. As shown in Figure 1 below, some cities are more prepared than others for EV rollouts.

Figure 1. The EV preparedness of America’s largest 50 metro areas.

Source: <http://projectgetready.com/resources/electric-vehicles-in-america>.



¹⁵ <http://www.afdc.energy.gov/afdc/laws/law/HI/6566>
¹⁶ "Ready, Set Charge, California! A Guide to EV-Ready Communities." Draft. Association of Bay Area Governments, EV Communities Alliance, Bay Area Climate Collaborative, LightMoves Consulting, and Clean Fuel Connection. May 2011. http://chargedsv.org/wp-content/uploads/2011/05/EV_Ready_Communities_Document-FULL-V3_5.27.11.pdf
¹⁷ See case study below. Marvell also points out they were able to work closely with city administrators to help craft a personalized permitting solution.

ADA Requirements

Under the Americans with Disabilities Act (ADA), an accessible EVCS is one where the battery charging station equipment is approachable and usable by persons with disabilities in compliance with codes that apply to commercial buildings (for example, Title 24 of the California Code of Regulations).¹⁸ Unfortunately, uncertainty remains as to how ADA regulations apply specifically to EVCS, as there are currently no consistent design standards or guidelines for EVCS siting in the ADA or California Title 24.¹⁹ While ADA requirements for EVCS siting will likely be clarified at some point, there is great uncertainty as to what the final revisions to the Act will look like. Due to the uncertain interpretation of and constant changes to these regulations, RE executives should be cautious when installing stations that may not meet the ADA requirements.

Green Building Certification

A commercial building over four stories that has one or more chargers installed qualifies for up to 3 points under LEED for New Construction (LEED NC) and between 3-15 points under LEED for Existing Building Operations & Maintenance (LEED EBOM).²⁰ In the UK and some other European countries, EV charging stations installed at office and commercial locations can earn building owners 3 credits under BREEAM.²¹

Installation

Google has received positive press coverage about the recent installation of 70 EV chargers on its Silicon Valley campus, and has plans to install an additional 200. Most SRER Members, however, are presently considering a more modest EVCS installation of between 1-3 chargers per site. Before installing EVCS, RE executives should determine whether:

- The community has, or is in the process of developing, an EVCS siting plan
- The project meets the long-term needs of the employee user base
- Sufficient electricity can be supplied to the EVCS²²

¹⁸ "Ready, Set Charge, California! A Guide to EV-Ready Communities." Draft. Association of Bay Area Governments, EV Communities Alliance, Bay Area Climate Collaborative, LightMoves Consulting, and Clean Fuel Connection. May 2011. http://chargedsv.org/wp-content/uploads/2011/05/EV_Ready_Communities_Document-FULL-V3_5.27.11.pdf

¹⁹ http://chargedsv.org/wp-content/uploads/2011/06/Accessible_Electric_Vehicle_Charging_Station-EV_Symposium_5.31.rg6-1final.pdf

²⁰ <http://evsolutions.avinc.com/yourbusiness/developers/LEED1>. "Newly constructed buildings and major building renovations may earn up to three points under LEED NC Sustainable Sites (Credit #4.3, Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles) for installing one or more EV chargers. Existing buildings may earn between three and fifteen points under LEED EB Sustainable Sites (Credit #4.0, Alternative Commuting Transportation), depending on how many 'conventional commuting trips' can be demonstrated to have been replaced by electric, hybrid, or other alternative fuel vehicles."

²¹ http://www.breeam.org/filelibrary/BREEAM%20Communities/BREEAM_Communities_Stage_2_Version_1_280211v1.pdf, pg 372

²² "Ready, Set Charge, California! A Guide to EV-Ready Communities." Draft. Association of Bay Area Governments, EV Communities Alliance, Bay Area Climate Collaborative, LightMoves Consulting, and Clean Fuel Connection. May 2011. http://chargedsv.org/wp-content/uploads/2011/05/EV_Ready_Communities_Document-FULL-V3_5.27.11.pdf

Companies should consider designs for both initial installation and future expansion. If they expect to increase the number of EVCS, initial installation work should include basic infrastructure (i.e. conduit, trenching, available circuit breaker location in supply panel) for future charger installations, as the first costs of this infrastructure will be lower overall if completed as one project.²³ Real estate executives should also be aware that battery capacities will likely increase, and heavy duty chargers and corresponding electricity load demand will become more common.

Due to the evolving nature of EVCS regulations, still modest EV use, and dynamic hardware and software markets, many companies may be reluctant to invest in a large scale EVCS roll out until at least 2012.

Charge Types

Electric vehicle chargers are currently available in three levels of power output – Level 1, Level 2, and DC fast charge (see Tables 2 and 3 below), as well as dual Level 1 and 2. Level 1 charging can be used for electric cars as well as electric scooters and motorcycles. Level 2 charging, with twice the output of Level 1, is generally for charging EVs. DC fast charging, while offering the lowest charge times, requires expensive equipment and infrastructure upgrades. Furthermore, there are concerns about the effect of fast charging on battery life. Some of the charging times listed in Tables 2 and 3 might be understated for some existing Nissan Leaf and Chevrolet Volt EVs due to the on-board charging units installed on these models.²⁴

Table 2. Level 1, 2, and DC fast charging details.

Source: <http://chargedsv.org/wp-content/uploads/2011/06/Calise-Main-Pres-for-SVLG-Jun-2.pdf>.

AC Level 1: "basic", "slow", or "trickle" charging	110V (volts)-120V alternating current (AC), single phase, 15A (amps) continuous. This charging level is identical to plugging into a typical household electrical socket. It is most appropriate for smaller battery sizes such as in PHEVs. It takes from 10 to 20 hours to fully charge a BEV depending on battery size. Many EV charging stations have a Level 1 charger included in the Level 2 charger equipment.
AC Level 2: "fast" or "quick" charging	208V -240V alternating current (AC), single phase, typically 220V/30A continuous but up to 80A specified. This charging level is identical to plugging into a typical household electric clothes dryer socket. This is the most common public charging level and excellent to top off the battery in 1.5-3.0 hours or between 4-8 hours to fully charge a BEV.
DC Fast Charge	Converts three phase alternating current (AC) to direct current (DC) for ~80% to fully charge a BEV in 20-30 minutes. This charging level requires significant electrical infrastructure such as panel and service upgrades and is conducive for fast turnaround time locations and fleet vehicle charging depots. This is the most expensive to implement, most stressful to the grid, and the US connection standards are still being developed. Fast charging replenishes batteries faster, but it may shorten the life of the battery if this method is used regularly.

²³ "Ready, Set Charge, California! A Guide to EV-Ready Communities." Draft. Association of Bay Area Governments, EV Communities Alliance, Bay Area Climate Collaborative, LightMoves Consulting, and Clean Fuel Connection. May 2011. http://chargedsv.org/wp-content/uploads/2011/05/EV_Ready_Communities_Document-FULL-V3_5.27.11.pdf

²⁴ According to Pike research, many current Volt and Leaf models are equipped with on board charging equipment that provides a maximum of 3.3 kW to the batteries. In the case of a Leaf, a full charge that could have been completed in less than 4 hours takes 8 hours.

Table 3. Charger types, times and costs.

Source: http://chargedsv.org/wp-content/uploads/2011/05/EV_Ready_Communities_Document-FULL-V3_5.27.11.pdf.

Charger Type	Charge	Time to Charge Vehicles at Various States of Charge			Charger Hardware Costs ³⁹	Installation Costs ⁴⁰	Typical Range of Total Costs	Average Total Costs
		Volt 16 kWh	Leaf 24 kWh	Tesla 53 kWh				
Level 1 1.4 kW 110 volts	Half	6 hrs	8.5 hrs	19 hrs	\$300 - \$500	\$300 - \$500	\$600 - \$1000	\$900
	Full	11 hrs	17 hrs	38 hrs				
Level 2 7.5 kW 240 volts	Half	1 hrs	1.5 hrs	3.5 hrs	\$500 - \$1500 home \$2000 - \$6000 commercial	\$500 - \$2500/home \$3,000 - 5,000 commercial	\$1500 - \$4,000/home \$4,000 - \$11,000 commercial	\$2200/home \$8000/commercial
	Full	2 hrs	3 hrs	7 hrs				
DC Fast 50 kW 480 volts	Half	10 min	15 min	35 min	\$25,000	\$15,000 - \$30,000* ⁴¹	\$40,000	\$65,000
	Full	20 min	30 min	70 min				
DC Fast 150 kW 480 volts	Half	5 min	8 min	17 min	\$55,000	\$15,000 - \$30,000* ⁴¹	\$40,000	\$65,000
	Full	10 min	16 min	35 min				

EVCS Providers

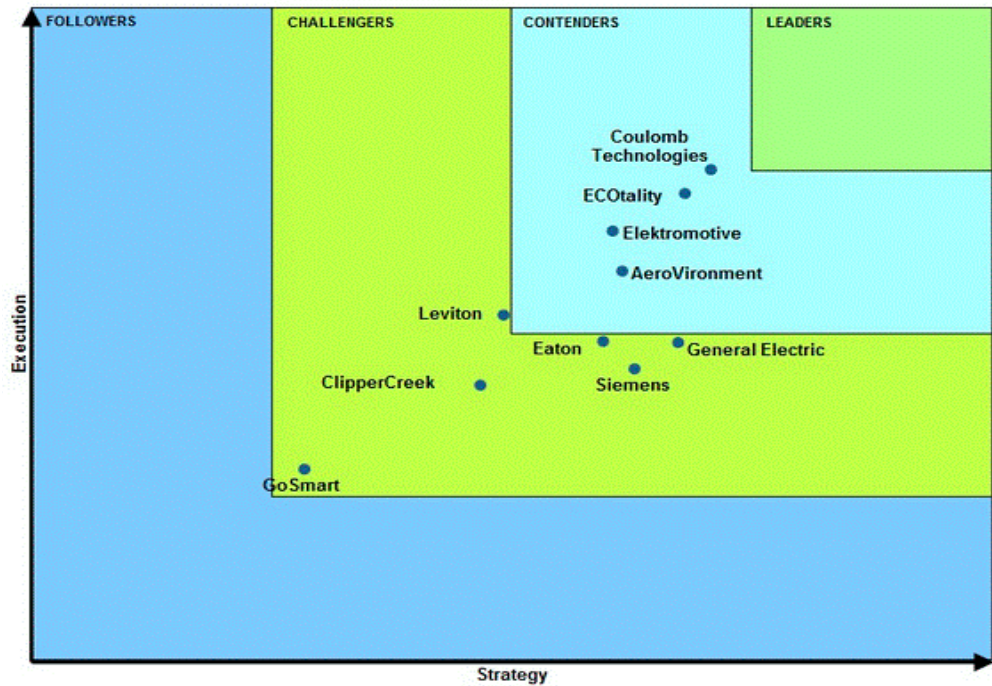
Until recently, the EV charging market was dominated largely by startup companies such as Coulomb Technologies, ECotality, Elektromotive, and AeroVironment, which have capitalized on federal rebates and strategic partnerships with local governments and the DOE. Already in 2011, three major multinational companies entered the market – GE, Siemens, and Eaton. Some of these companies are leveraging their extensive experience in electrical technologies and partnering with smaller software companies to develop network-based energy management systems. GE, for example, is partnering with Juice Technologies, whose Plug Smart intelligent charging system complements GE smart meters for advanced energy management performance.²⁵ Analysts believe that 2011 will see more consolidation in the EVCS market, which will bring more standardization to the industry, in addition to lower charger costs for consumers.²⁶ Pike Research has analyzed the players currently in the field and ranked them according to a variety of metrics (see Figure 2 below). From this analysis, Coulomb and ECotality appear to be the leaders in the EVCS market.

²⁵ <http://gigaom.com/cleantech/the-details-behind-ge-wattstation-electric-car-charger/>

²⁶ <https://www.pikeresearch.com/wp-content/uploads/2010/12/EVP-10-Pike-Research.pdf>

Figure 2. Assessment of strategy and execution for 10 leading EV supply equipment vendors.

Source: Pike Research <http://www.pikeresearch.com/research/pike-pulse-report-electric-vehicle-charging-equipment>.



EVCS Software

EVCS commercial software packages feature advanced controls, reporting capabilities, reservation systems, text messaging alerts, and advanced payment systems. Due to the emerging nature of the EVCS software market, compatibility between EVCS and software platforms is also a key consideration for RE executives, who partner with their IT departments to ensure that potential problems are identified early. Experts are also expecting this market to consolidate in the next couple years, which will result in technology and systems homogenization.

RE executives should work together with IT staff to evaluate software options and consider purchasing software with the following system management capabilities in order to maximize EVCS service:

- Ability to manage employee reservations
- Diagnostic reporting
- Charging status and charging time
- Software upgrades
- Ability to manage advertisements
- Ability to monitor usage²⁷

²⁷ <http://www.pepstations.com/Portals/0/PDF/Brochure.pdf>

Siting

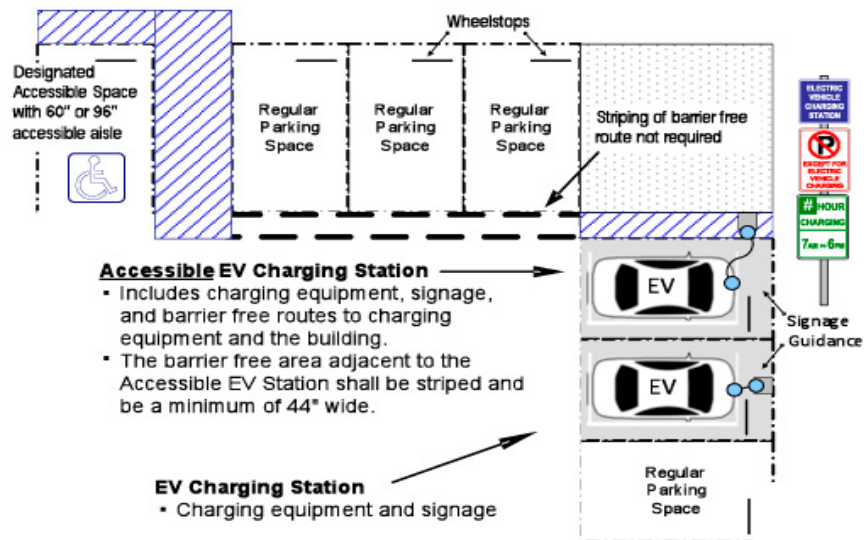
Siting regulations for private EVCS on commercial properties are currently under development in most US municipalities. Therefore, project planners are combining their knowledge of existing regulations with what they anticipate will be regulated in the future to design ideal placement of chargers in commercial facilities.

RE executives should consider the following when locating their charging stations:

- Adjacency to accessible parking spaces
- Accessible route to building elevator
- Electrical service supply (voltage, amperage, distance, etc.)
- Access to single or multiple building entry points
- Availability of lighting near the EVCS
- Shelter considerations for EVCS users
- Directional and charging space signage
- Days and hours of operation and enforceability²⁸

Under current interpretation of the ADA, the first two charging stations at each parking site must be accessible, though a charging station that can simultaneously charge two or more EVs would qualify to meet this requirement.²⁹ See Figures 3 and 4 below for layout examples.

Figure 3. Off-street accessible EV charging station – Option 1.
Source: <http://psrc.org/transportation/ev/model-guidance>.



²⁸ http://www.psrc.org/assets/4325/EVL_full_report.pdf

²⁹ "Ready, Set Charge, California! A Guide to EV-Ready Communities." Draft. Association of Bay Area Governments, EV Communities Alliance, Bay Area Climate Collaborative, LightMoves Consulting, and Clean Fuel Connection. May 2011. http://chargedsv.org/wp-content/uploads/2011/05/EV_Ready_Communities_Document-FULL-V3_5.27.11.pdf

Table 4. Breakdown costs of installation per charger.

Source: http://www.bc3sfbay.org/uploads/5/3/3/9/5339154/electrify_your_business.pdf.

	Labor	Materials	Permit	Tax	Freight	Total
Average Cost per Charger	\$2,243	\$1,096	\$ 64	\$242	\$46	\$3691
1 charger installation	\$3,191	\$1,613	\$119	\$314	\$56	\$5293
3-5 charger installation (per charger)	\$1,395	\$701	\$74	\$184	\$42	\$2396

Government Incentives

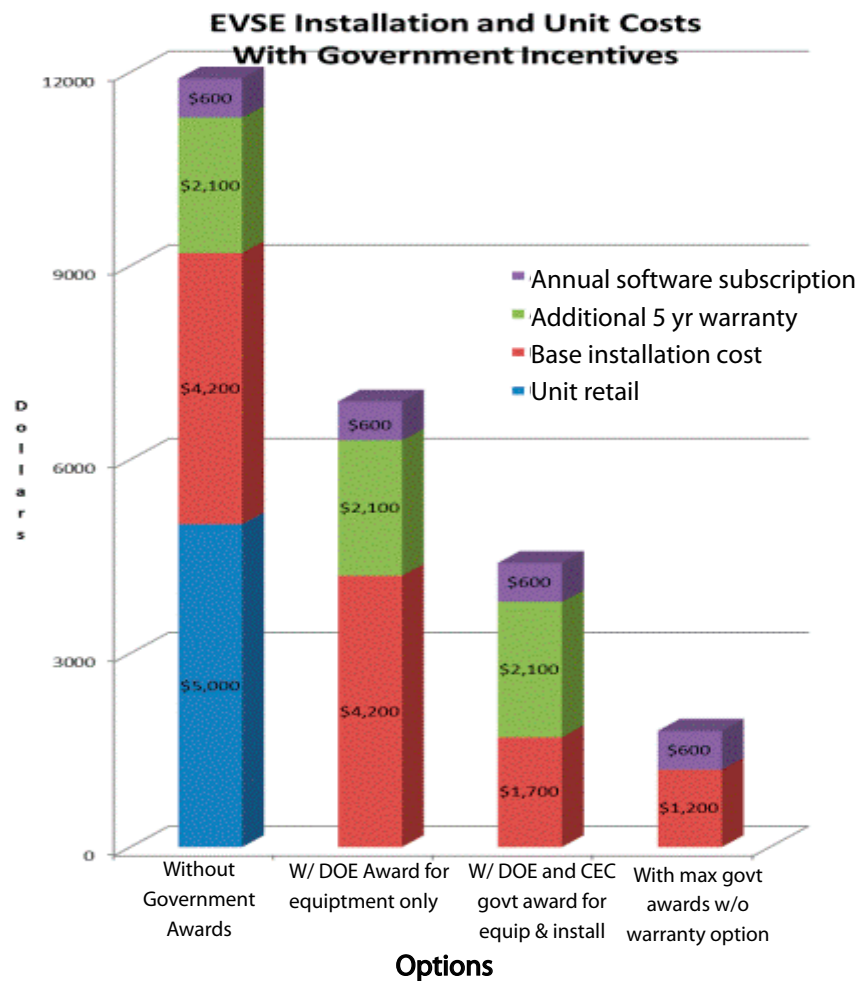
The most important federal incentive is a tax credit on 30% of the cost of EVCS equipment, not to exceed \$30,000 for charging equipment placed into service by December 31, 2011 under the Alternative Fuel Infrastructure Tax Credit.³² This tax credit is for each address, meaning that companies with multiple sites can leverage the incentive for *each* address. This is a reduction from the 50% of the cost of EVCS equipment up to \$50,000 tax credit that was in place from 2009-2010. While EV industry organizations are actively lobbying to extend this credit, it faces opposition in Congress and cannot be counted on. State and local incentives for EV charger installation that are available are listed on the US DOE AFAVDC site.³³ These incentives can significantly decrease the cost of EVCS for companies (see Figure 5 below). Some SRER Members find the application process for government and utility-sponsored incentives cumbersome and not worth the time and resources, while others have relied on these incentives to lower costs enough to gain corporate approval of the project.

³² <http://www.afdc.energy.gov/afdc/laws/law/US/351>

³³ http://www.afdc.energy.gov/afdc/laws/state_summary/CA. For example, California's California Energy Commission has awarded grants for a number of EVCS projects, including matching federal funding, replacement of existing obsolete charging infrastructure and creation new networks of charging infrastructure.

Figure 5. EVCS installation and unit costs with government incentives.

Source: http://www.bc3sfbay.org/uploads/5/3/3/9/5339154/electrify_your_business.pdf.



Signage

Companies must provide adequate signage for EVCS. To ensure the effective utilization of EVCS, they need to incorporate signs that show time limits, vehicle removal provisions, parking restrictions, hours and days of operation, and towing contact information. Signs should comply with the Manual on Uniform Traffic Control Devices (MUTCD).³⁴

Electricity Use

Some commercial EVCS customers take advantage of utility programs that help manage time of use rates and demand charges. Many chargers are equipped with communications equipment that enable the charger to ramp down or halt the charging rate in response to signals from the utility or from energy management systems software deployed at the site.³⁵ When companies already use sophisticated building energy management systems (see the 2010 SR Inc Report *Advanced Energy Management Systems*), compatible EVCS systems can enable project managers to balance a variety of loads within the building and

³⁴ See <http://projectgetready.com/wp-content/uploads/2010/08/Washington-EVSE-Guide.pdf>

³⁵ "Ready, Set Charge, California! A Guide to EV-Ready Communities." Draft. Association of Bay Area Governments, EV Communities Alliance, Bay Area Climate Collaborative, LightMoves Consulting, and Clean Fuel Connection. May 2011. http://chargedsv.org/wp-content/uploads/2011/05/EV_Ready_Communities_Document-FULL-V3_5.27.11.pdf

parking lot.³⁶ A few industry leaders such as Google directly supply their EVCS with on-site renewable energy, such as solar PV or microturbines, though for most companies this is not yet a priority.³⁷

Smart Grid: V2G

EVCS systems can also supply electricity for other uses, which means that EV batteries can serve as storage devices for the grid as a whole or for an individual site. Some pilot projects are currently testing this technology. As smart grid technologies continue to develop alongside demand side management and more sophisticated energy management software, vehicle to grid (V2G) proponents argue that the thousands of EV batteries hooked up to charging stations could also store energy for the grid or to the commercial real estate space, thereby serving as a source for helping companies to help reduce their peak grid load. Some current EVCS systems are already outfitted with this technology. While V2G has interesting implications for companies planning on installing EVCS, there is still a host of technical issues to work to resolve, including the effect of a higher charging and depletion rates on costly lithium ion batteries.

Managing EVCS Use

Reservations and Enforcement

RE leaders are concerned about managing their EVCS to provide a service for employees, and insist that EVCS be reserved for company personnel. At the same time, managers are concerned that employees will not carefully monitor their reservations, or they may be too busy at work to return to the parking lot and remove their car from the EVCS when charging is complete, undermining the effectiveness of the reservation system. Companies can reduce this risk by leveraging notification software (via email, Outlook, SMS and applications which allow users to track progress of the charge) present in many current EVCS systems. Offenders can be ticketed or even towed, but managers are hesitant to impose these sanctions since they might reduce the value of EVCS as an employee service. SRER Members have not yet encountered such difficulties (or at least not at any magnitude), due to low current EVCS use. Most are working on company policies to address potential issues before usage increases.

Some vendors are currently working with SRER members to develop alternative EVCS management strategies. Genentech, for example, is working with WIN Partners on a model in which WIN will manage Genentech's EVCS system (including insurance, maintenance and service, in addition to providing em-

³⁶ "Ready, Set Charge, California! A Guide to EV-Ready Communities." Draft. Association of Bay Area Governments, EV Communities Alliance, Bay Area Climate Collaborative, LightMoves Consulting, and Clean Fuel Connection. May 2011. http://chargedsv.org/wp-content/uploads/2011/05/EV_Ready_Communities_Document-FULL-V3_5.27.11.pdf

³⁷ <http://www.cleanfleetreport.com/electric-vehicles/charging-electric-vehicles/google-70-charge-stations/>

ployees with cards and smart phone applications for reservations) under or an EVCS purchase or lease structure. Today, however, most companies are opting to manage the EVCS themselves.

Employee Charges

Regulations in most states are still unclear as to whether companies can charge employees for electricity used in EVCS. If employees are charged for electricity, the employer may be treated as a utility and thus, subject to a range of regulations.³⁸ Some companies are therefore opting to charge employees a flat fee (for example, \$2/charging session) for using the charger. A national standard for this issue has yet to be established. But the issue was recently settled in California when state regulators unanimously voted that as long as a company acts as a not-for-profit and does not inflate electricity prices in providing a benefit to employees, the company will not be considered a utility. However, in this case, such benefits are subject to taxation.³⁹ For those companies that opt to charge employees by the kWh, the EVCS vendor can usually assist with the development of a fee collection plan.^{40 41}

Ancillary Service

Ancillary services offered by some EVCS vendors, such as roadside charging assistance and remote maintenance, are of interest to companies. However, some utility programs for residential customers already include such services, and employees may not value a redundant service from their employer's vendor.⁴² But companies that have installed EVCS, such as SAP (see case study below), have cited ancillary services as a major selling point from certain vendors.

Privacy Concerns

Some companies have expressed concern about some aspects of EVCS data acquisition, especially regarding the personal banking information of employees. Others dismiss these concerns, since most employees are accustomed to providing 3rd parties with financial information (for example, swiping a credit card to buy gasoline). Regulations have yet to clarify privacy standards for information gathered from EVCS. A recent RFP by the Monterey Bay Area Governments (MBAG) is an early indication of what could be an emerging data collection standard. The MBAG calls for the EVCS to manage over 20 data points,

³⁸ In Washington State, it was decided that "the potential impact of the regulatory of [utilities] has broad authority to regulate the rate, services, and practices of companies providing electricity service...private companies that charge customers for electricity provided at EV charging stations could be subject to UTC's jurisdiction..." http://www.psrc.org/assets/4325/EVI_full_report.pdf

³⁹ Coulomb, ECOtality, and Better Place all actively lobbied for this ruling. <http://gigaom.com/cleantech/cali-makes-it-official-electric-car-charging-wont-fall-under-utility-rules/>

⁴⁰ Options for fee collection can include credit and debit card readers, pay-to-park kiosks, radio-frequency identification cards linked to a subscription service, and standard parking meters. http://www.psrc.org/assets/4325/EVI_full_report.pdf

⁴¹ For companies that prefer to charge users, via either a time of use or flat fee, refer to this paper for a model on how to charge http://www.bc3sfbay.org/uploads/5/3/3/9/5339154/electrify_your_business.pdf

⁴² <http://texasishotblog.org/?p=1197>

including the vehicle identification number of the EV being charged, the charge before and after each charging session, the current stored energy load in the battery, and the charging data (subscriber, location, kWh used, and start and stop times) for each charging session.⁴³

Additional Concerns

Some members have expressed concern that providing EVCS service to electric vehicles could be perceived as biased against other forms of alternatively fueled vehicles, such as electric scooters and biodiesel automobiles. These concerns are rare but are already being addressed by leading companies. As described in the case studies below, leading companies are installing at least one EVCS with Level 1 charging capabilities, which allows for the charging of electric bicycles, scooters, and motorcycles. Providing other types of fuel services for employees, such as biodiesel, generates a host of additional regulatory, infrastructure, and cost concerns, and is therefore not a component to any company's EVCS strategy at this time.

Case Studies **SAP Case Study**



In anticipation of a large-scale international Electric Vehicle Charge Stations (EVCS) rollout, global software firm SAP is in the process of installing 12 Level 2 chargers at its Palo Alto Campus. Larry Morgan, Head of Operations for SAP's Global Facilities Management (Americas), shared his expertise on how best to sell EVCS projects to corporate decision makers, as well as the importance of pre-installation planning and preparation.

Key Takeaways

RE Executives should:

- Formulate a comprehensive EV strategy, including EVCS, for key company stakeholders, which should include financial (CFO), corporate sustainability (applicable executive), and employee attraction and retention (HR) motivations.
- Conduct a feasibility study which looks at both employee EVCS demand and current electrical support infrastructure and potential costs for upgrades.
- Consider hardware, software, and ancillary services when purchasing EVCS.

⁴³ http://www.ambag.org/rfp_jobs/public_charging_station_rfp.pdf

Overview

- SAP embraces emerging technology in its operations as well as its product line, and the company is currently a major player in the EV management software solutions market
- Since EVs will play an important role in the future, the company wants to get ahead of the curve and take a leading early-adopter position by providing EVCS infrastructure.
- Employee attraction and retention is very important in the competitive Silicon Valley market, and more employees than before are either requesting or are interested in EVCS.
- SAP in the US does not manage a fleet, but the company does have a fleet in Germany. By being an early adopter in Palo Alto, SAP can learn how the EVCS process works before embarking on an EV fleet deployment in Germany.
- As sustainability becomes a core business consideration, EVCS will become increasingly important. SAP uses 100% renewable energy for its facilities, so the ability to supply EVCS with clean energy offsets scope 3 emissions from employee commuting and is a welcome additional GHG footprint reduction. See Figures X and X for GHG reduction and fuel savings from SAP's EVCS.

Planning

- SAP Real Estate leaders questioned the real motivations and value behind the EVCS project. Why do the project? What is a holistic approach to EVCS? What is the philosophy behind putting in EVCS, and why not just provide extension cords to charge EVs?
- SAP project developers defined their selling strategy carefully before taking the project to the C-Suite. They developed an argument based on the company's corporate sustainability strategy along with cost-effectiveness and employee attraction and retention.
- SAP stressed that project developers should understand the rules of corporate engagement-i.e. finance value business cases go to the CFO, employee attraction and retention business case go to HR-in making the case.
- They focused their buy-in strategy by drawing a pie chart of the decision makers, deciding which key stakeholders fit in the pie, how much time should be spent on each decision maker, and who had veto power.
- Once the team secured buy-in from executives, they engaged in a feasibility study, including contracting an engineer to conduct a system audit.

- The company's Palo Alto campus equipped with EVCS is owned by the company, but some remote offices operate under long term leases structures, and in these cases factors like corporate user and owner relationship, lease and renewal structure, holding period and asset ownership should be factored into feasibility study.
- SAP surveyed employees to gauge interest in EVs and the likelihood of EV purchase or lease in the next 1-2 years in order to better plan for future EVCS installation.

Regulations

- After presenting the business case and conducting a feasibility study, SAP obtained EVCS permits from the City of Palo Alto. The process is slow, since utilities are still developing regulations. Some municipalities work faster than others, but in general the permitting process was straightforward. The fact that EVCS do not generate hazardous waste streamlines permitting.
- By engaging in the permit process, which not all companies are undertaking, SAP gained valuable insight into future ADA regulations.
- SAP did not need to change parking layouts to install the EVCS, as these are located in existing outside lots.
- While recognizing that there are many rebates and incentives available for EVCS, the process for obtaining any one is very bureaucratic. In light of the administrative costs, SAP is not convinced that EVCS rebates are worth the effort. If the application process were to become more streamlined, SAP would reconsider.

Technology and Installation

- SAP purchased twelve Coulomb Technology charging stations because they are easy to use and reasonably priced compared to other solutions. Also, Coulomb seemed to have a good sense of the future of charging, which bodes well for scalability. SAP opted for a 2-level charger (Level 1 and 2), since many employees have long commutes, and Level 2 is necessary to provide a stronger, quicker charge so commuters do not run out of fuel.
- SAP considered purchasing EVCS from larger companies, but at the time GE and Siemens units were still in early production. The Coulomb units were ready to ship and had desirable technology features as well as ancillary services such as roadside charging assistance and remote maintenance.

- SAP asserts that it is best to put conduit and wiring in early, so when upgraded technology enters the market, companies can install it. Putting in most of the infrastructure at once takes advantage of economies of scale (see Installation price comparisons). The feasibility study and a 5-10 year facility plan can help project managers figure out the infrastructure needed.

Management

- After a free trial period, SAP will set a cost per kWh used to charge their EVs and the users will have their credit card direct billed. Coulomb provides a portal interface to oversee all of the EVCS SAP manages, allowing SAP to monitor GHG savings and utilization.
- Since the EVCS system is set up as a not-for-profit employee benefit structure, SAP is not considered a utility. However, questions remain as to the taxable status of this employee benefit. SAP believes that resolution of this issue could be important for selling these types of projects to HR.
- SAP is pursuing an aggressive global strategy for EVs, which includes a fleet of 40 EVs in Bangalore, India, and 32 in SAP's Future Fleet in Germany. While there are currently only a handful of EVs at SAP's Palo Alto campus, the company is trying to stay ahead of the curve and anticipate an influx of employee EVs. SAP is developing a vehicle ID sticker as a way to identify EV owners, so that anyone can contact them if the EVCS is needed. The Coulomb portal provides updates on charging status to users via text message or email. Additional real-time charging status updates are in development. Coulomb also allows for reservations to be created so employees can ensure they have an opportunity to charge their vehicle. SAP prefers to use notification technologies to avoid administrative burdens and sanctions. As they craft an EVCS management policy, SAP is considering the "employee behavior and common courtesy element" and expects that most employees will know to move their car with fair warning and notifications, rendering a sanction mechanism largely unnecessary.
- Unlike some other SRER Members, SAP has not been concerned with the privacy issues related to an EVCS payment system, since the information received by the 3rd party EVCS vendor is generally limited to credit card account information, which employees are already accustomed to sharing to make purchases.

Figure 6. Fuel savings (gallons of gasoline) from SAP's EVCS (as of 8/2/11).

Source: Adapted from SAP interview.

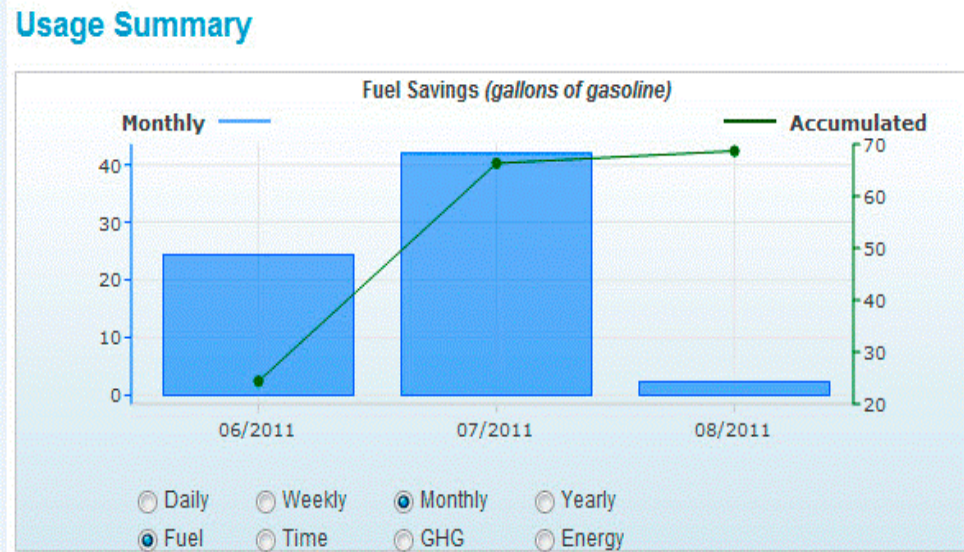


Figure 7. GHG savings (kg) from SAP's EVCS (as of 8/2/11).

Source: Adapted from SAP interview.

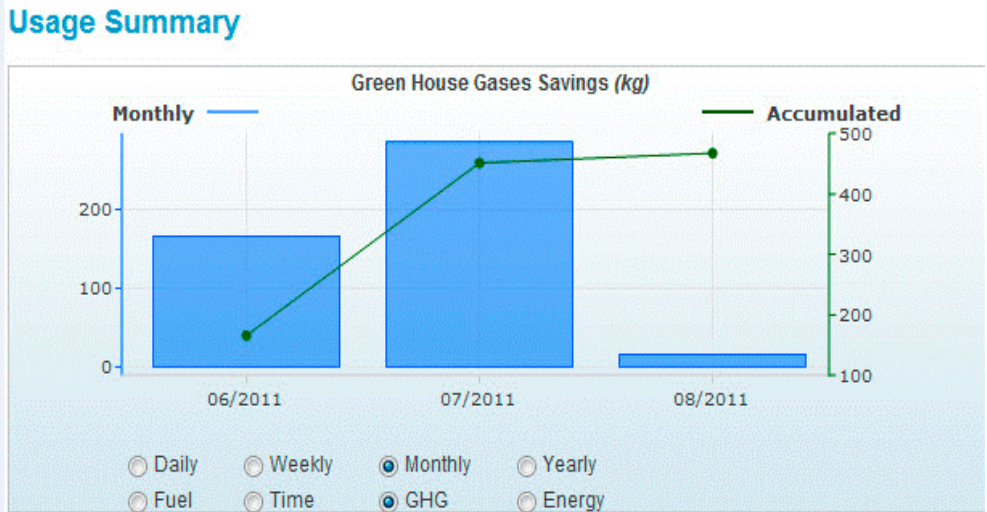
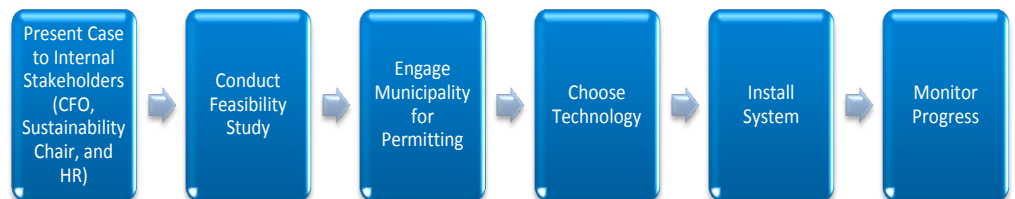


Figure 8. The SAP 6-step framework for integrating EVCS in facilities.

Source: Adapted from SAP interview.





Marvell Case Study

In May of 2011, Marvell installed 3 ECOtality Blink chargers at its Santa Clara, California headquarters. Thomas Irpan, Director at Marvell, shared his insights into how the competitive Silicon Valley environment is driving installation of EVCS, and how being a first mover can prove advantageous.

Key Takeaways

RE Executives should:

- Conduct employee polls and surveys to help guide company EVCS policy. This can optimize the benefits gained from these services while reducing employee security and privacy concerns.
- Engage with the municipality early to obtain EVCS permits, and leverage the early adopter position to assist municipalities in crafting EVCS permit policy.

Overview

- Marvell is a company that sees value in providing services for the community as well as employees.
- Many Marvell employees are conscious of their energy use, and several employees already have EVs.
- Marvell operates in a very competitive environment for talent acquisition and retention. There are many technology companies in the Bay Area that compete for talent, and thus Marvell wants to provide a great workplace and benefits to attract and retain the best employees.

Planning

- Marvell owns its Santa Clara property, which has EVCS installations, and leases other more remote sites. Marvell believes that landlords will choose to install EVCS in response to requests from tenants, and in order to keep their properties competitive.
- Because Marvell applied for the federal EVCS rebate, the EVCS project will need to be capitalized on its balance sheet.
- Marvell evaluates EVCS projects based on two main criteria:
 - Do employees want this service, and will they increasingly call for it in the future? The need for quality employees was the main driver for selling EVCS to the C-suite.
 - What are competing companies doing in the area? Marvell believes that market pressure in a very competitive environment means that if a company does not install EVCS, sooner or later it will become a

problem for them. Marvell prefers to anticipate this need and be a first mover. While Marvell's EVCS installations are not on the scale of Google's, establishing an EVCS presence has been a company priority.

Regulations

- Marvell was the first commercial campus in Santa Clara to go through the EVCS permitting process. Marvell worked with Santa Clara to develop a permit that covered technology, electrical and ADA issues, a process that took about three weeks.
- Marvell concluded that engaging with the city on such issues is a good hedge against future regulatory risk, and also helps the company better align with industry trends.

Technology and Installation

- Marvell installed 3 ECOtality Blink systems. These were the first to be implemented on a corporate campus.
- Marvell has yet to aggregate and analyze usage data, since the system has been in operation for only a short time. While the demand from each Level 2 charger is high, of the order of 7.5 kW, existing electrical panels normally have sufficient extra capacity to accommodate this. Marvell did not need to upgrade its electrical infrastructure, since the first three EVCS were connected to panels with spare capacity.
- Additional EVCS on the Santa Clara campus will likely require additional transformers and panels. Marvell is waiting until the next round of energy projects on its campus (EVCS or otherwise) to upgrade this infrastructure and capacity.
- Marvell assessed three criteria to determine EVCS siting:
 - Proximity to electrical panel. The further away an EVCS is from the panel, the more it costs to install.
 - Highly visible areas are ideal.
 - Though ADA requirements have yet to be finalized, Marvell sited their EVCS with ample space to ensure compliance with any future changes to ADA.

Management

- Marvell will initially provide EVCS service free of charge since most competitors in Silicon Valley do the same. In the future, if the competitive environment changes, Marvell will re-evaluate EVCS alongside other employee benefits.

- Currently, employees swipe a card to activate the charger. When the vehicle is charged, the employee receives an SMS or email. Marvell plans to send a notice or warning for employees who do not move their cars when they are charged, though Marvell has not yet decided on any penalties.
- Since the parking lot currently houses more chargers than EVs, there has not been a need of a reservation system. However, Marvell is anticipating that a reservation management system will be necessary in future.
- Marvell's EVCS do not currently process sensitive employee information, such as credit card data. While the system connected to the EVCS is on a secure server, there are still some concerns regarding the security of the cloud containing the payment and vehicle information, which might surface if Marvell decides to charge employees in the future. Marvell plans to poll employees on both willingness to pay for EVCS and on privacy concerns regarding the service.
- Marvell employees seem happy with the EVCS service so far, and the company will soon conduct surveys to better comprehend both successes and concerns with the system.



AMD Case Study

Advanced Micro Devices (AMD) has recently installed three dual electric vehicle charging stations (EVCSs) at its Austin, Texas campus, and an additional three stations at its Sunnyvale, California campus. Justin Murrill, Global Sustainability Manager for AMD, spoke to SR Inc on how EVCSs were successfully installed under different facility ownership structures, the importance of EVCS software networks, and how a company's sustainability values can help drive EVCS project development.

Key Takeaways

RE Executives should:

- Consider the values contained in the EVCS proposal, and link these to the company values in order to promote the project to senior executives.
- Actively promote EVCS to encourage electric vehicle (EV) adoption within the company to help achieve a more sustainable campus and engaged employee-base.
- Plan on remaining on a site for 3-5 years or more (if leasing a property) to amortize infrastructure costs for EVCS.
- Address potential EVCS security and privacy issues with the company's legal, facility, and security teams before proceeding with a project.

Overview

- Employees expressed interest in company-provided EVCS, and many were waiting for these before purchasing an EV.
- AMD's two main US campuses are in locations with federally-supported EVCS infrastructure and EV availability. Thus, the expectation is that AMD's EVCS infrastructure will be complemented by additional local public infrastructure, enhancing the appeal of EVs to employees.
- The company is confident of EV market growth, and EVCS installation is an opportunity to stay "ahead of the curve".⁴⁴

Planning

- The EVCS project fit well into AMD's corporate responsibility values and existing sustainability programs, including the internationally-recognized "Go Green" commuter program.
- AMD is a technology company that relies on the attraction and retention of top talent, and the existence of EVCS is perceived as attractive to current and new employees.
- AMD's facilities team decided to proceed with the EVCS project, partly owing to the availability of a 50% EVCS federal tax credit in 2010 (since reduced to 30% in 2011), which helped reduce the project cost. In addition to enhancing the business case, the temporary nature of the federal tax credit incentivized AMD to move forward quickly.
- AMD owns its Austin campus, and thus owner and lessee issues were not raised with EVCS installation.
- For its Sunnyvale facility, where AMD holds a long-term lease, EVCS development and installation costs were well under the threshold requiring landlord approval.
- If AMD relocates from a leased site, the company can also move any EVCS hardware, although the associated electrical infrastructure would remain with the landowner.
- Due to significant installation costs, AMD recommends lessees are committed to a minimum 3-5 year lease in order to amortize the significant infrastructure costs.
- One of AMD's focus areas for sustainability is "scope 3" greenhouse gas emissions (which includes those created through internal combustion-related commuting). Creating incentives for employees to drive EVs helps reduce these emissions.

⁴⁴ Pike Research recently announced the San Jose-Sunnyvale-Santa Clara metro area would see the highest PEV penetration rates relative to population in the country. <http://www.pikeresearch.com/newsroom/california-and-new-york-cities-to-be-the-largest-markets-for-electric-vehicles>

Regulations

- AMD recognizes the regulatory forecast for EVCSs is unclear at this time. In Austin, Coulomb Technologies' service providers assisted AMD with EVCS siting, ADA considerations, and other issues. In Sunnyvale, the installer and the city were involved in addressing regulatory considerations.

Technology/Installation

- AMD purchased six Coulomb dual Level 1 / 2 chargers for its Austin and Sunnyvale campuses. The charging stations have dual outputs that deliver energy simultaneously: a 7.2 kW output delivering Level II (208/240 VAC @ 30 A) and a 2 kW output delivering Level I (120 VAC @ 16 A) charging.
- The Level 1 charge is beneficial, despite the lower wattage, since employees will likely be parked in each charging space the entire day. Also, some employees drive electric scooters and will thus use Level 1 charging. When AMD made the purchase decision for its Austin project, Coulomb was the largest and most well established company close to the AMD locations.
- The ChargePoint Network is a joint Coulomb/US DOE project. ChargePoint allows EV drivers to locate charging stations in the network and detect charging station availability from a smart phone or Google Maps. The network also facilitates EV trip mapping, driver billing, 24/7 driver assistance, and GHG and energy savings calculations.⁴⁵
- The Austin facility has several parking garages, so AMD installed one station per garage, with the option to add additional stations next to existing ones. The Sunnyvale facility installed one EVCS in the south lot and two in the north lot.

Management

- AMD will track performance using reporting features from the ChargePoint Network, which includes usage data, kWh rate, occupancy rates, and electricity.
- Full use of the EVCSs is expected to represent less than 1% of electricity consumption at each campus, and thus do not significantly affect AMD's electricity use and "scope 2" greenhouse gas emissions. Because AMD purchases 100% renewable energy for the Austin Lone Star campus, the scope 2 emissions are further reduced.
- AMD does not currently charge employees for EVCS use. Like most companies, AMD limits EVCS units to employee use only.
- AMD thoroughly discussed EVCS security measures and privacy issues with the legal team and aligned on all the procedures before proceeding with the project.

⁴⁵ <http://finance.yahoo.com/news/AMD-and-Coulomb-Technologies-iw-3005599620.html?x=0&.v=2>

- Since EVCS stations have yet to be widely utilized, AMD has not developed a reservation system. AMD's goal is to avoid having to manage use or sanction misuse. When EVCS begin to reach full utilization, AMD will evaluate adding additional stations by polling employees and estimating demand and costs. EVCS have generated lots of positive interest within AMD, especially among the company's engineers.
- AMD holds EV demo days to display EVs and supporting infrastructure. AMD's efforts have prompted several employees to consider EV purchases.

Recommendations

RE leaders are increasingly aware of the benefits of installing EVCS. SR Inc provides the following recommendations to guide executives in EVCS deployment. Companies should:

- Establish the connection between EVCS benefits and company values when making the business case.
- Actively seek relevant EVCS financial incentives, some of which expire at the end of 2011, to support implementation.
- Plan for a limited initial deployment of between one and three EVCS units per site, since employee EV use is unlikely to be high, but incorporate infrastructure for future expansion.
- Install EVCS primarily as an employee benefit and take precautions to avoid negative employee experiences with the service, such as data security issues or inadequate reservation systems.
- Get employee input both before and after project installation to gauge EVCS demand and identify best practices.
- Work proactively with municipalities where opportunities exist to help craft permitting policies and contribute best practices.
- Identify and track the evolution of relevant laws and regulations affecting data privacy, construction permitting, the ADA, and tax status of employee benefits.
- Engage local EV alliances such as SoCal EV⁴⁶, the Bay Area Climate Collaborative⁴⁷, and Austin EV⁴⁸, as these can be excellent resources for information about local EV regulations, policy, financial incentives, RFPs, and other enabling information and tools.

⁴⁶ <http://www.socalev.org/>

⁴⁷ <http://baclimate.org/>

⁴⁸ <http://www.austinev.org/>

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Members should contact SR Inc with any questions or comments. Members who have EVCS deployment best practices that they wish to share with others are encouraged to do so for inclusion in future updates of this briefing.