Plugging In: A Stakeholder Investment Guide for Public Electric-Vehicle Charging Infrastructure

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Table of Contents

Plugging In: A Stakeholder Investment Guide for Public Electric Vehicle Charging Infrastructure is a Rocky Mountain Institute Initiative: move.rmi.org

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Executive Summary: A Look at Charging Station Investment

Transportation accounts for a quarter of green house gas emissions, one third of household spending, and a third of the fossil fuel consumption in the US. Major changes to the transportation sector are overdue and could have positive impacts on our economy, security, health, and natural environment if we make the right choices. Vehicle electrification is one way to reduce petroleum use and has gained significant momentum as of late. With support from federal and local incentives as well as huge investments from automakers, plug-in electric vehicles are a near term reality. The successful penetration of plug-in vehicles depends greatly on the thorough build-out of both residential and public charging infrastructure.[1] Certain local businesses, municipalities, and other local players can benefit from the prudent investment in charging infrastructure. This paper describes key benefits of constructing charging infrastructure, situations in which such construction proves a prudent investment, and situations in which it does not.

Plugging In: A Stakeholder Investment Guide for Public Electric-Vehicle Charging Infrastructure is designed to inform potential investors about the costs, revenues, and benefits of charging infrastructure. It presents some overarching conclusions while the accompanying model allows investors to examine the likely costs, revenues, and benefits for their specific investment scenario. While we applaud groups who install charging stations out of good will, this guide is for those stakeholders who want to understand the business case for infrastructure build-out. This report puts forward a business analysis and pathway to profitability for plug-in vehicle charging station investment. For more information on the environmental and community-based benefits that vehicle electrification offers, please see see RMI's Project Get Ready work at http://projectgetready.com, which specifically helps communities prepare for vehicle electrification.

To estimate the return on investment stakeholders can expect when investing in charging station infrastructure, RMI created a user-friendly investment tool. Individuals can enter unique stakeholder information, and the tool will then estimate future cash flows. This paper discusses and analyzes the results generated by this investment tool for general scenarios. Interested stakeholders can use the tool to explore the results of various investments for their personalized scenarios.

The tool allows the users to determine which key inputs drive charging infrastructure profitability. A few factors stand out as particularly critical to a successful investment. Stakeholders should investigate thoroughly hardware installation costs, as these can vary considerably depending on the chosen installation site. Installations costs and time vary greatly depending on existing infrastructure and available conduit. For example, a hardware installation with adequate existing conduit should be relatively inexpensive as opposed to a job that includes upgrades to the electrical system, destruction of sidewalks or walls, and large distances to existing conduit. For this reason, investors may decide to include charging infrastructure build-out in planned construction or retrofit projects. Hardware choice is also critical, especially if the investor hopes to track users and charge a fee to help offset initial capital costs. Federal, state, and local incentives, sometimes offsetting half of the hardware costs, reduce the burden of initial capital costs, and may also lower operating costs (for example, some incentives provide discounted electricity rates). These factors alone can affect costs by thousands of dollars, making the different between a loss and profitable investment.

The profitability of charging station investment will be heavily dependent upon the penetration of electric vehicles within the next decade. However, this penetration remains an unknown variable. Automotive companies are lining up to introduce 2010 and 2011 model year plug-in electric vehicles (PEVs) to the U.S.. The success of these vehicles will depend on a multitude of interdependent factors such as the strength of the economy, the price of gasoline, the continuation of federal and state subsidies, consumer education, the possible emergence of breakthroughs in internal

[1] "Federal Energy and Fleet Management," GAO Report to Congressional Requesters, June 2009.

combustion engine technology and platform efficiency, and the existence of public and residential charging infrastructure. Every major automaker is planning to release a PEV in the next few years and the current administration established a goal of one million plug-in vehicles on the road by 2015. However, neither this nor building charging infrastructure guarantee widespread consumer adoption, but they will help relieve range anxiety and build interest in plug-in electric vehicles.

List of Terms and Definitions

Alternative Fuel Vehicle (AFV): Alternative fuel vehicles may run on compressed natural gas (CNG), liquified natural gas (LNG), liquified petroleum gas (LPG), propane, methanol, ethanol, or electricity. Vehicles running on other fuels that meet or exceed federal clean air standards may also be classified as AFVs.

Charging Station: Charging stations are any installed physical infrastructure that can charge electric vehicles. They may or may not include communications capabilities and can supply various charging levels.

Electric Vehicle (EV): An electric vehicle operates only on battery-stored power; there is no internal combustion engine drive or hybrid mode possible (e.g., Tesla Roadster). Electric motors are more efficient that internal combustion engines - helping them to create fewer greenhouse gases than an ICE-powered vehicle, even when a plug-in vehicle is charged from fossil-fuel based electricity.

Hybrid-Electric Vehicle (HEV): A vehicle whose wheels are driven by either an electric motor with ICE (or fuel cell) backup to charge the battery (series design) or by either an electric motor or an ICE directly (parallel design) (e.g., Chevy Volt).

Internal Combustion Engine (ICE): Internal combustion engines are conventionally powered by gasoline or diesel fuel, but can also run on blends of biofuels, such as corn-based ethanol or biodiesel.

Leadership in Energy and Environmental Design Certification (LEED): LEED is a green building rating system developed by the U.S. Green Building Council (USGBC) to provide a suite of standards for environmentally sustainable construction and operation.

Level (for charging): Levels refer to the electrical charging connection. The average household outlet is called Level I and provides 120 volts (V). PHEVs require overnight charging and a full BEV will take over twelve hours to recharge. Level II charging is equivalent to an appliance plug that many households already have (as for a clothes washer) and provides 240 V. At this level PHEVs will charge in about 3 hours and BEVs with large batteries can easily charge overnight. Level III chargers allow for very fast charging, but require more extensive infrastructure and have additional impacts on the electric power grid.

Neighborhood Electric Vehicle (NEV): This U.S. Department of Transportation classification refers to speed-limited (or "low-speed") and street-legal battery electric vehicles. These vehicles must have a gross weight of less than 3,000 lbs and a top speed of 25 miles per hour. Due to their low speeds, they are not subject to crash-test requirements.

Plug-in Hybrid Electric Vehicle (PHEV): A HEV whose batteries can be charged through external infrastructure, i.e., by "plugging" them in.

Plug-in vehicle (PEV): Any vehicle which can recharge its batteries via an external electricity source, including PHEVs and EVs.

Range Anxiety: Concern of limited driving distance on one charge of battery electric vehicles.

Stakeholder: Any party interested in potentially investing in electric vehicle charging infrastructure.

Vehicle-Miles Travelled (VMT): A commonly used indication of how much motorists are using their cars. VMT is typically presented as the average number of miles travelled per registered vehicle.

Guiding Stakeholder Investment in Public Electric Charging Infrastructure

The Promise of Electrified Vehicles

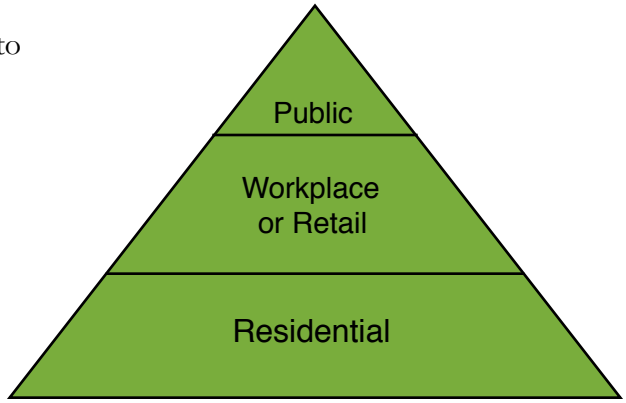
In the near future we could see a world that has beaten its addiction to fossil fuels, whose carbon emissions created by the transportation and electricity sectors are decreasing in absolute terms, and where vehicles run on quiet electric- and hybrid-drive systems powered by clean energy. This is the promise of plug-in vehicles, a keystone to transitioning to a greener economy. These vehicles can be new or converted conventional hybrid vehicles, and they run wholly or partially on electricity. They have the potential to reduce operating costs, air pollutant and greenhouse gas emissions, and dependence on fossil fuels. Drivers need never pump gas again. In fact, their cars refuel while they sleep. In this future, electric vehicles can help enable renewable energy generation and actually become cleaner as they age.[2]

Early models are already hitting roads in the U.S., including both factory-made and converted vehicles. Tens of thousands of factory-made plug-ins are expected to be available in the U.S. in the next few years. Public charging infrastructure will play an important role in encouraging plug-in vehicle adoption.

Which Comes First: the Electric Vehicle or the Electric Charging Station?

Stakeholders are understandably hesitant to build charging stations before it is clear that there will be strong demand for plug-in vehicles. Of course, demand for plug-in vehicles depends in large part on available charging infrastructure being in place *before* the vehicles are purchased. Research on driving habits indicates that most plug-in vehicle owners will do the bulk of their electric charging at home, perhaps overnight.[3] However, widespread public charging infrastructure (including infrastructure in workplace or retail parking spaces) will help facilitate the penetration of plug-in vehicles and help address consumer "range anxiety." Strategically placed charging infrastructure will help build electric vehicle demand by:

1. Allowing plug-in drivers to operate reduced-range electric vehicles, which require smaller battery packs, thus decreasing the weight and costs of vehicles and increasing their efficiency,
2. Increasing the visibility of PEVs, making them more appealing to a general public concerned about finding a convenient place to charge, while decreasing range-anxiety,
3. Supporting plug-in vehicle ownership for those who may not have a dedicated parking space or private garage at home, and
4. Facilitating the adoption of other electric power transportation technologies, including those already commercially-available, such as neighborhood electric vehicles (NEVs), bikes, motorcycles, and



Source: Electric Power Research Institute

[2] "Environmental Assessment of Plug-In Hybrid Electric Vehicles," EPRI/NRDC, June 2007.
[3] "Driving the Solution: The Plug-In Hybrid Electric Vehicle." EPRI Journal, Fall 2005.

scooters.

Building an Investment Modeling Tool to Generate Real Cash Flow Scenarios

Further complicating the build-out of charging infrastructure is the lack of a clear financial model outlining the costs and revenues associated with infrastructure investments.

RMI created a user-friendly investment tool to evaluate the business case for investments in charging station infrastructure. Investors can enter cost and benefit information into the tool, as well as baseline data for each unique stakeholder. Using these inputs and a set of researched assumptions, the tool then maps likely future cash flows. This paper discusses and analyzes the general results created by the investment tool. Interested stakeholders can use the tool to explore the results of various investment scenarios. For information on downloading the investment tool as well as a companion document with instructions for using the tool, please see **http://projectgetready.com/category/resources**. For more information, please contact Matt Mattila at mmattila@rmi.org.

This Report Offers a Path Forward for Stakeholders to Invest in Charging Stations

Over the past several months, RMI has worked with industry leaders to catalog the costs and benefits of installing charging infrastructure in public places. This paper outlines the business case for charging stations, and evaluates strategic ways for various stakeholders to optimize infrastructure investments. Key stakeholders include:

- Parking garages and office parks where plug-in drivers park at work,
- Retail facilities where plug-in drivers spend time shopping,
- Municipalities and local governments, which have an interest in serving the plug-in driving public, and,
- Electric utilities, which provide the needed power (and potentially infrastructure) for vehicle electrification.

This report is not a step-by-step checklist; different stakeholders require different approaches. Rather, this document begins a discussion, one that will evolve as we learn more about financial costs, revenues, and risks from our partners. In this paper and its accompanying investment tool, RMI estimates the costs and revenues for each actor based on various assumptions (for more information on assumptions, see Appendix A). Where RMI could not make estimates, sensitivity analyses were used to determine reasonable size and type of investments

Summary of Costs and Benefits of Charging Stations

The costs and benefits considered for this investment guide include:

Thank you to the following participating contributors:

RMI interviewed these industry leaders for this project. The companies and organizations shown above contributed to our ongoing research, but do not necessarily endorse the findings of this report.

Costs of Installing Charging Stations

Category: Hardware Equipment
Key Considerations: Communications, charge-level, consumer interface, revenue generation
Costs: $500–7,000

Hardware options range from the "basic" option— (where an electrician installs weatherproof cable and an electric meter to create a basic charging station)—to pre-built charging station networks (which communicate with and are remotely controlled by a central monitoring station). The former scenario offers limited capabilities, but also the lowest cost—as little as $500 (including professional installation) per station, assuming that an appropriate electrical connection exists. The second scenario can cost significantly more (up to $7,000 per charging station), but can include the capability to remotely collect and communicate electricity usage (smart metering) and customer information (including charging information, creating a revenue stream for the hardware owner). Investors should consider their communications, billing, and security when considering and comparing hardware options.

Takeaway point: Basic charging infrastructure is low-cost, but research suggests that most investors choose to hire a third party for their infrastructure needs.

Category: *Hardware Installation and Maintenance*
Key Considerations: *Installation time can vary from 3 to 4 hours (if the appropriate conduit already exists) to several days of work (if laying new conduit with demolition/construction is necessary). Consult an electrician before investing.*
Hourly Electrician Costs: *$55–100 per hour, vary by region*

Charging station installation costs vary significantly depending on construction requirements, the availability of appropriate electric infrastructure, construction permitting regulations, and land costs..[4] Based on labor, construction, and permitting cost estimates from electricians, as well as estimates from hardware providers and charging station installers, our investment tool calculates installation costs for the hardware chosen by the user. The cost of charging station installation also differs by location. In some locations installation could exceed the cost of the original hardware. Items including panel upgrades, transformer upgrades, hand digging, and laying new conduit will add substantial installation costs to infrastructure installation.

Takeaway point: Hardware installation cost may be the the most uncertain element of charging station investment. Interested investors should research installation costs when they first begin considering investment.

[4] Electrical information is from a series of phone interviews conducted with Boulder, CO area electricians in June 2009.

Category: Electricity
Key Considerations: Charge level impacts costs, time-of-use pricing from utility could increase costs of daytime charging, overall electricity costs not as critical to bottom line as hardware and installation costs
Electricity rates: 11.2 cents/kWh national 2009 average

Charging stations come equipped to handle different levels of charge, and the charge level chosen will affect electricity costs. Level I chargers deliver 120 volts at 15 amps, for a battery charge of 1.8 kW, while Level II chargers deliver a charge of 240 volts at 30 amps, for a battery charge of 7.2 kW.[5] Charging station costs will also depend upon location. Parking garage and residential charging units, for example, will likely charge vehicles for several uninterrupted hours during both peak and off-peak hours, whereas retail facility stations may charge multiple vehicles for a much shorter time during daytime (including peak) hours. Thus, consumers' somewhat unpredictable charging time and duration will influence hardware owners' electricity costs. Please see Figure 1 below for an explanation of how transactions between third-party service providers, owners of charging infrastructure, and plug-in driving consumers could be structured.

Takeaway point: Electricity costs depend upon consumer behavior and plug-in penetration, but, in general, electricity costs are lower than hardware and installation costs.

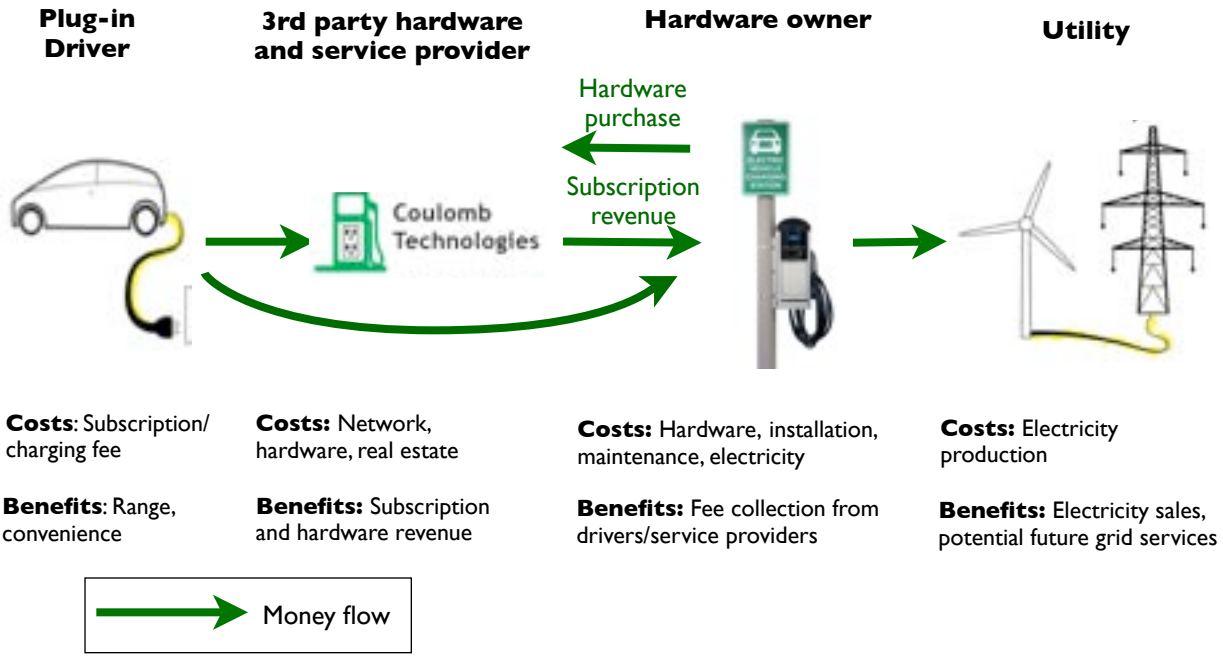


Figure 1: A visual diagram of third-party charging hardware and services, including direct monetary costs and revenues and assuming smart charging infrastructure. Motorists pay a charging (or subscription) fee to the service provider (or possibly the hardware owner directly), who passes on the majority of these fees to the hardware owner to help offset equipment, installation, maintenance, and electricity costs. Hardware and service providers profit from hardware sales and subscription fees. Utilities' ability to profit from increased electricity sales depends on the degree to which their revenues and profits are decoupled.

[5] Level I and II charging parameters vary depending on the hardware manufacturer. Level III chargers are even stronger, but have more electric grid impacts, and are not likely to be necessary for most charging applications. Electricity costs are from EIA. www.eia.doe.gov/cneaf/electricity/epm/table5_3.html

Benefits of Building Charging Stations

Some benefits of installing charging stations are transparent, or at least somewhat predictable, such as user charging fees (for some charging station models), advertising revenue, and the value of avoided carbon emissions. Other benefits are more difficult to conceptualize and calculate. Our investment tool allows the user to enter values for some or all of these less tangible benefits so that the user can explore what these values would need to be in order for the chosen hardware to break even or become profitable. Benefits of charging stations include:

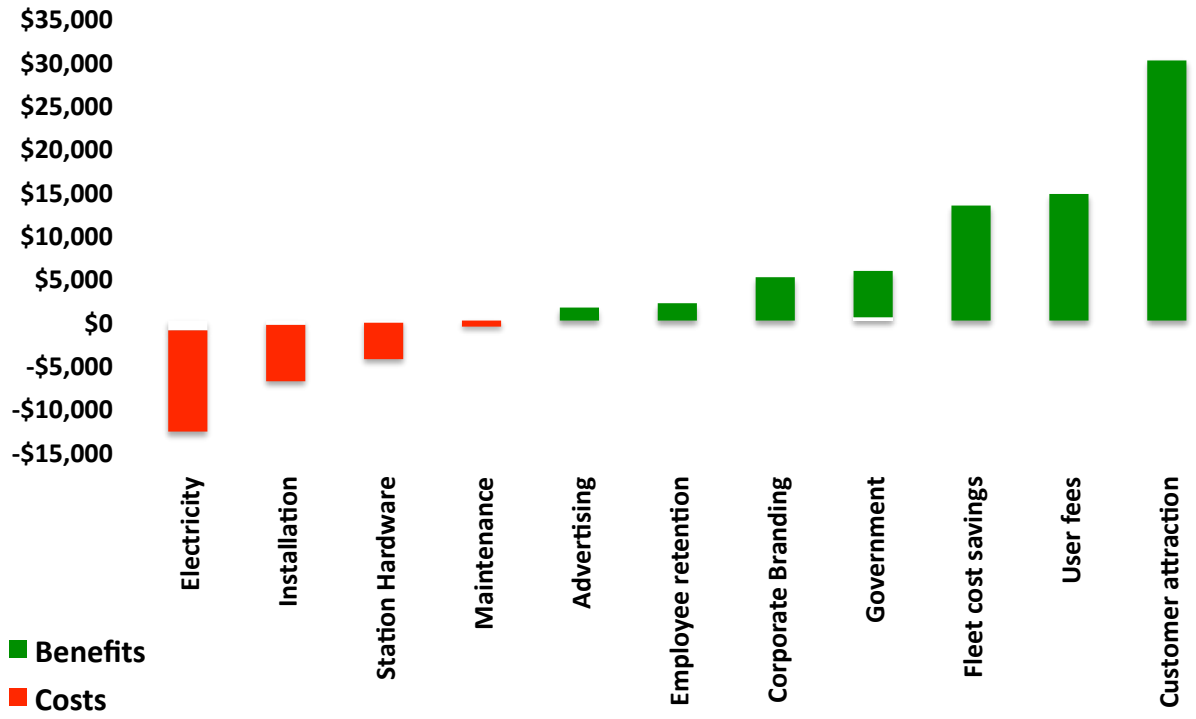


Figure 2: The size ranges of various expected costs and benefits of installing one charging station and operating it for ten years. See Appendix A for more details on these estimated values.

Customer Attraction & Retention: Several large retailers have identified charging stations' primary value, outside of benefitting the environment, as deriving from the increased customer throughput that they could provide. Specifically, retailers have expressed interest in forming relationships with customers they may not currently be reaching. While it is difficult to estimate how many new customers charging stations would help attract, large retailers are well-prepared to calculate the corresponding value added to their businesses once this value has been established. Recent research suggests that 57 percent of consumers feel that it is important to purchase products with environmental benefits, even in a tough economy, and 51 percent are willing to pay more for them. More than 25 percent of consumers strongly agree that it is important to avoid purchases from companies that they disagree with.[6] These consumer beliefs may help attract new consumers to retailers that provide electric charging stations.

Takeaway point: Retail facilities should explore the potential value of attracting more customers versus the cost of installing and maintaing a charging station.

User Charging Fees: Hardware owners may choose to charge plug-in drivers a charging fee. However, interviews with stakeholders reveal that some hardware investors are more interested in

[6] 2009 BBMG Conscious Consumer Report.

offering charging services to plug-in drivers at no charge. Those hardware installers that wish to draw monthly revenue can install more technologically advanced charging stations with built-in revenue generating functionality. The monthly revenue generated would depend on the frequency and duration of charges. Our investment tool assumes that the "do-it-yourself" charging hardware is not capable of revenue generation. However, installation scenarios that use third-party hardware can include revenue generation capabilities if the hardware design accommodates it. Some stakeholders suggested billing customers for premium parking spots.

Takeaway point: RMI research indicates that while third-party hardware (with revenue raising capability) is a popular choice among charging station owners, many of these owners are not staking the success of their stations upon charging-revenue generation.

Employee Attraction & Retention: Office parking lot owners, and perhaps some retail facilities, can benefit from installing charging stations due to the services that they offer to current and potential employees. Preliminary research shows that plug-in owners would prefer to charge their vehicles more than once per day, making the workplace an obvious choice for daytime charging. Charging stations therefore offer real financial benefits to employers who can then retain and perhaps attract employees who drive plug-ins (or would like to drive plug-ins). Even for employees who don't drive plug-ins, research suggests that almost 50 percent of Americans feel that it is at least "very important" that employers are environmentally responsible.[7]

Takeaway point: Charging stations may be able to attract and retain employees, and many companies view this as a key potential benefit of these stations.

Corporate Branding Opportunities: Interviews with key retailers suggests stakeholders are not planning to pursue branding opportunities directly, but they acknowledge the public is aware of their investments in "green" technologies. Charging station installation represents a real opportunity for retail facilities with adjacent parking to hasten the penetration of plug-in vehicles. While several retailers commented that good corporate public relations has benefits, they generally chose not to account for this when deciding whether or not to invest in charging stations. Nevertheless, the investment tool allows users to include the value of corporate branding as a benefit in the tool's calculations.

Takeaway point: The potential branding benefits of charging stations could be substantial, should a stakeholder choose to account for them.

Government Funding & Incentives[8]: A federal tax credit offers up to 50 percent of infrastructure and installation costs, not to exceed $50,000, for charging station equipment that goes into service after January 1, 2009. Furthermore, this credit is available *by site*, so that an interested investor can elect to take advantage of multiple $50,000 credits. This credit, as written, expires on December 31, 2010. In addition to generous federal incentives, state incentives may apply, and several states have state-wide incentive programs that can be used in addition to federal incentives. Other locations have city, county, and regional incentives. Please see Appendix B for a more detailed description of federal and state incentives (including links for more information), and check with your city and state transportation departments to see if you may be eligible for additional incentives.

Takeaway point: Government funding and incentives can significantly reduce the capital and/or operating costs of charging stations. Stakeholders should investigate for which incentives they may qualify early in the process, particularly since many incentives are set to expire soon.

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[7] 2009 BBMG Conscious Consumer Report.

[8] While not really considered benefits of the stations themselves, state and federal incentives greatly increase the potential profitability of charging station investment, so they are included in the discussion about benefits.

Fleet Cost Savings: Companies may be interested in installing charging stations for their own fleets. This on-site charging capability can help these firms reduce fuel costs, which can in turn help offset the capital costs of acquiring plug-in vehicles. Estimates suggest that the cost of driving a gasoline-powered car is $0.14/mile, while for an EV it's $0.03/mile.[9]

Takeaway point: Charging station infrastructure build-out can support both internal and/or public vehicle electrification efforts.

Advertising & Customer Information Opportunities: Every plug-in is a potential advertising impression. Charging stations can provide digital advertising space and marketing opportunities for the hardware owner. Given the customer information available and the time plug-in drivers spend interacting with stations, this could be an effective advertising medium and offer significant value to stakeholders, particularly retailers. Charging station digital advertising could join one of the fastest growing segments in advertising: digital out-of-home advertising. The US digital OOH market tripled in size from 2002 to 2008 to $2.43 billion, comprising 29.1% of overall out-of-home ad spend.[10]

Takeaway point: Charging stations could generate significant advertising revenue for hardware owners.

Contributions to LEED Certification: According to LEED guidelines, charging station installation counts for one credit, called the LEED-NC Sustainable Sites Credit 4.3 for Alternative Transportation: Low Emission & Fuel-Efficient Vehicles. Research indicates that facilities that invest in LEED certification profit from it.[11]

Takeaway point: Charging stations add value by contributing to LEED certification credits, which offers real value to stakeholders investing in certification.

Value of Avoided Carbon Emissions: The U.S. will likely adopt a carbon accounting system in the future, but it is uncertain when that will occur and what carbon will be worth to different stakeholders. Our investment tool calculates carbon saved (in tons) and allows charging station hardware investors to include the revenue from the value of offset carbon emissions. The default carbon price is zero, but tool-users can input a price of their choice. Interestingly, the future profitability of charging stations is not particularly sensitive to the price of carbon. Please see Appendix A for technical information concerning carbon accounting in the investment tool.

Takeaway point: The profitability of charging stations is not particularly sensitive to carbon price, but may become more so as carbon pricing becomes a reality.

Public Health Benefits: Reductions of tailpipe criteria air pollutants due to vehicle electrification are a public benefit. As municipality/government stakeholders are uniquely positioned to represent public interests these are the only stakeholders for which the model quantifies public health benefits.

Takeaway point: Municipalities may use taxpayer money to build public charging stations, and therefore are the best stakeholders to consider air quality-related public health benefits as a real benefit of their investments.

Increased Energy Independence: Vehicle electrification will likely prompt a greater reliance on domestic fuel sources (renewable or otherwise), and reduce our dependence on foreign oil sources. This transition will reduce our exposure and vulnerability to volatile energy prices, and it will

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[9] Assuming a gas price of $2.50/gallon and electricity price of $0.09/kWh. DOE estimate: www1.eere.energy.gov/vehiclesandfuels/avta/light_duty/fsev/fsev_gas_elec2.html

[10] Global Digital Out-of-Home Media Forecast 2008-2012, PQ Media Company

[11] "Green Building Costs and Financial Benefits," Gregory Kats, Capital E. www.cap-e.com/ewebeditpro/items/O59F3481.pdf

increase investment in domestic industries (and jobs). These benefits are difficult to quantify, and, in the investment tool, only municipality/government stakeholders can reap them.

Takeaway point: Increasing energy independence via vehicle electrification can help reduce oil imports, strengthen investment in domestic energy resources and jobs, lower national defense spending, and mitigate national security risks.

Analyzing Scenarios Using the Investment Tool

RMI's investment tool helps forecast future cash flows of various user-selected charging infrastructure build-out scenarios. Model users can choose from pull-down menus or fill in values for the following variables:

- **Stakeholder type**: retailers, parking garages, office parks, utilities, homeowners associations, and municipalities
- **Build-out scenario**: self build-out or contract with third parties, such as Coulomb, Shorepower, eTec (Minit-Charger), Avcon, and Brusa
- **Measures affecting investment**: annual hardware maintenance cost, hourly charging fees, discount and inflation rates, federal and state incentives, price of offset carbon, charging time per user, number of Level I and II units to be built, and expected users per day per charging station
- **Value of expected benefits**: customer attraction/retention, employee attraction/retention, corporate branding, fleet cost savings, advertising opportunities, LEED certification contributions, public health benefits, and increased energy independence

While investment tool users can select their own inputs, this section of the report presents the results of one relatively conservative series of investment choices. Following the presentation and discussion of model outputs is a brief explanation for how these results can vary depending on stakeholders' choices.

Investment Tool Output from Representative Stakeholder: Retailers Business Case

Our research and interviews with retailers indicate that in addition to potential charging fee revenues, retailers are especially interested in expanding and diversifying their customer base. If the presence of vehicle chargers could increase a store's traffic, retailers might be willing to make infrastructure investments, and even offer free charging to plug-in users as a strategic loss-leader. Retailers are also likely to benefit from the corporate branding opportunities of green investments, and, perhaps, from cost savings due to their ability to charge electric fleet vehicles, as well as the charging stations' contribution towards LEED certification for buildings. For the purpose of this demonstration, the only revenue-positive factor considered is charging fee revenue. All other benefits are set to $0 but should be included by users of the investment tool for sensitivity analysis.

Costs incurred by the retailers and entered into the investment tool include hardware purchase and installation costs for both Level I and II chargers, annual maintenance costs for each installed unit, and electricity costs for all installed units. The costs of all of the above increase annually by an inflation rate, and are discounted to 2009 using a discount rate.

In the conservative scenario presented here, we assume that this particular retailer chooses to build one Level 1 station in 2009 and one Level II station in 2011. The model includes the defaults of: a 10 percent discount rate, a 3 percent rate of inflation, a 50 percent federal subsidy for hardware and installation, no additional state incentives, an average user charging time of one hour, and no price for offset carbon emissions. In addition, the model assumes the following number of expected users per day per charging station:

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	2	3	3	4	4	5	5	6	6

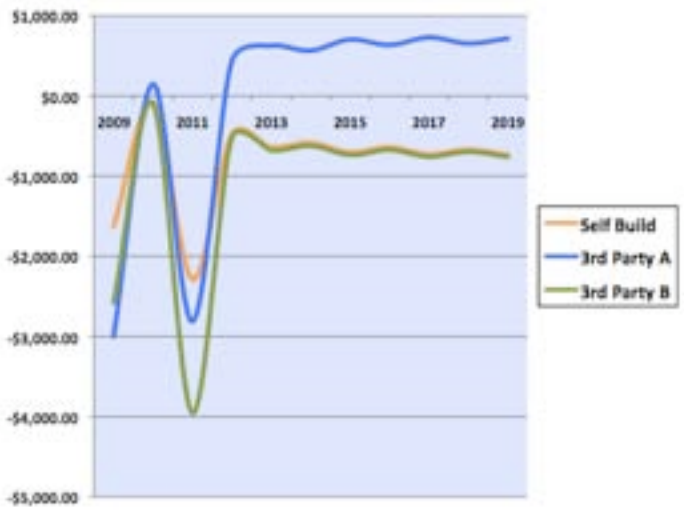
Figure 3: These numbers reflect an estimation by RMI. A more thorough forecast would require estimated ranges of future plug-in vehicle and charging station penetration, consumer subscription fees, average vehicle-miles traveled (VMT), as well as an evaluation of public vs. residential charging frequency.

The following graphs outline the net costs to a retailer of a feasible build-out and the ongoing operation of charging stations for ten years. The graphs map out the annual and cumulative cash flows of three building scenarios, discounted to 2009 USD:

1. The retailer builds its own infrastructure at the lowest possible cost (orange)
   - Annual maintenance cost per unit is assumed to be $25
   - Charging station users are not charged hourly charging fees
2. The retailer contracts with a third party to build the infrastructure (blue)
   - Annual maintenance cost per unit is assumed to be $50
   - Hourly charging revenue for Level I chargers is assumed to be $0.75
   - Hourly charging revenue for Level II chargers is assumed to be $1.00
3. The retailer contracts with a third party to build the infrastructure (green)[12]
   - Annual maintenance cost per unit is assumed to be $50
   - Charging station users are not charged hourly charging fees

Figure 4: Annual cash flow, in 2009 USD, over ten years for retailers building and operating charging stations. This figure does not include any revenue benefits with the exception of charing fees.

As seen above, annual net costs for Scenarios 1 and 3 remain negative for the duration, whereas



annual costs become positive in 2012 for Scenario 2, which charges customers for station use. Note the differences in costs do not reflect brand selection as much as the difference between charging user fees or not.

[12] Model users have the option of choosing the same third-party manufacturer for both Scenarios 2 and 3 in order to test the sensitivity of changing projected charging revenue.

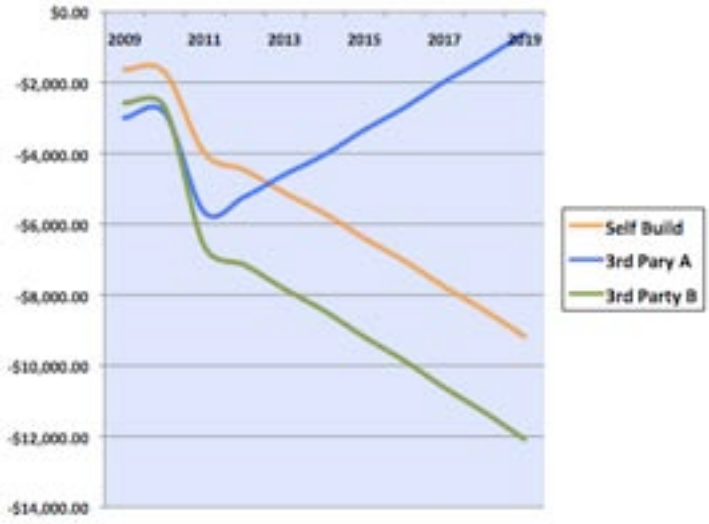


Figure 5: Cumulative cash flow, in 2009 USD, over ten years for retailers building and operating charging stations. All revenue options, with the exception of user fees, are turned off.

Sensitivity of User-Defined Benefits

By year ten in Scenario 1, the retailer would need to realize benefits of their infrastructure build-out at a value of at least $9,000 in order for the project to break even. Once stakeholders are in a position to estimate unquantified benefits, such as customer attraction and employee retention, this investment tool will let them to determine if and when a particular investment strategy will become cash positive. The ability to account for these financial benefits are included in the model but estimating these values for each stakeholder group was beyond the scope of this project.

Although several retailers stated charging plug-in customers a fee was not a priority, other stakeholders may be more receptive to charging fees. And as Figures 4 and 5 demonstrate, hourly charging fees of just $1 per hour (or less) can make a significant difference in future cash flow, especially as expected charging station use increases with greater plug-in vehicle penetration. The results of this investment tool run seem to illustrate the benefit of having simple and effective revenue-generating capabilities built-in to charging infrastructure. Many stakeholders felt the other benefits more than cleared this hurdle, however it is beyond the scope of this project to attempt to estimate the value for each stakeholder as it varies considerably for each case.

Exploration of Other Stakeholder Discussions

The results of the investment tool run described above apply only to a retailer. While the results do not differ drastically for the other stakeholders types, it is important to note some of the factors that change the perspectives of each of these other groups. Please download RMI's investment tool from http://projectgetready.com/category/resources to run scenarios on any of the other stakeholder groups.

Parking Garages: Parking garages are in the business of making money from customers parking their cars, so they are likely to be interested in charging infrastructure with built-in revenue-generating capacity. They may also be more likely to position charging stations strategically in order to charge higher fees for premium parking spaces. According to interviews with electricians, parking garages may offer lower infrastructure installation costs for stations because garages are often already wired for daytime electricity use. In addition, garages' physical infrastructure (walls, low ceilings, etc.)

facilitate the easy installation of equipment and may preclude the need for expensive items such as charging station pedestals, protective bollards, or wiring.

Office Parks: Office parks/employers will likely be interested in installing charging stations in order to offer a service to current employees, or to appeal to future employees. They are also in a position to benefit from corporate branding and savings associated with lowered fleet costs, should they decide to operate electric vehicles. In addition, these investors may be interested in the contribution to LEED certification that charging stations offer. Also, unlike the situation with parking garages or retail facilities, employees will likely plug in for several uninterrupted hours while they work. This would decrease user turnover and increase drivers' time of use, perhaps allowing for more predictable revenue forecasts should employers elect to charge a user-fee.

Utilities: Interviews with utilities reveal a variety of approaches to investing in public charging infrastructure, as well as a desire to be a part of and help guide developments in this industry. Much of the utilities plans are driven by state PUC restrictions more than the utility's desires. Utilities that are not subject to decoupling requirements could benefit from the additional sales of electricity that vehicle electrification could spur. A more developed electric vehicle market in the future may encourage more utilities to make infrastructure investments themselves. Some utilities are working to create critical peak pricing or other rate plans that would encourage off peak charging of PEVs and reduce the risk to the grid. Other utilities are considering bundled plans for PEV owner where utilities take on hardware purchase and installation, permitting, and a reduced rate plan in exchange for smart charging interaction with the user. In an interview with an American hardware provider, RMI found that European utilities are already contracting to purchase charging hardware directly from manufacturers for installation in public places.

Home Owners Associations: Research shows there are 247 million cars on the road in the U.S. but only 53 million garages.[13] Multi-family housing units thus stand as an intuitive place for charging infrastructure to stimulate plug-in vehicle penetration. As with the case of office parks, plug-in drivers are likely to charge for long periods, perhaps overnight. This long charging time may allow homeowners' associations (HOAs) to invest in cheaper Level I infrastructure, as fast chargers may not be required. However, given that not all residents would benefit from electric charging stations, it remains unclear whether or not HOAs would levy assessments on residents to build infrastructure. Research in the Boulder, CO area suggests that developers building environmentally progressive multi-family communities could invest in charging stations in order to appeal to environmentally conscious residents and reduce the requirements for parking spaces.

Municipalities/Government: Much of the charging station infrastructure that has already been installed in the U.S. in recent years has been built by city and county governments. Some charging stations have been designated for free charging, while other infrastructure—such as Sonoma County's stations—will use a service network and charge users service fees. Municipalities differ from other stakeholders in that they usually cannot benefit financially from user charging fees, but many are looking into fees as a way to offset hardware and installation costs..

Concluding Thoughts

A few factors stand out as being particularly critical to a successful investment. Stakeholders should thoroughly investigate hardware installation costs, as these can vary greatly depending on site. Hardware choice is also critical, especially if the investor wants to generate charging fee revenues to offset high initial capital costs. Federal, state, and local incentives can go a long way towards reducing the burden of high initial capital costs, and may also serve to lower operating costs through incentives, such as discounted electricity rates. Some of the stakeholders we interviewed

[13] Presentation by Richard Lowenthal of Coulomb Technologies. University of Colorado, May 6, 2009.

were surprised at how little the electricity costs factor in to the profitability of the investment. While electricity costs will increase with more vehicles and longer charges, the totals are fractions of the cost of gasoline and are more than offset via fees.

The most crucial unknown variable that will impact the success of charging station investment is simply the penetration of electric vehicles in the next decade. Automotive companies are lining up to introduce PHEV models into the U.S. market in 2010–2011, but these are mostly low volume launches. The success of these vehicles will depend on a multitude of interdependent factors, such as the strength of the economy, the price of gasoline, the continuation of federal and state subsidies, and the existence of public and residential charging infrastructure. Preparing for electric vehicles now carries some degree of risk; the cars may never come, or they might eventually lose out to competing technologies, such as hydrogen fuel cells. Building charging infrastructure now cannot guarantee the success of plug-ins, but this information will help stakeholders analyze the profitability of investments in electric vehicle charging infrastructure.

Appendix A: Menu of Hardware Options

This menu does not sponsor any particular technology or vendor. It compiles a representative menu of hardware sold in (or planned for) the US market to help interested hardware investors make profitable decisions about building charging infrastructure. It is important to note that the following technologies are differentiated in more ways than just price: charging level, communications capabilities, security, safety features, networks, branding, business model, location tools, assembly, and simultaneous vehicle charging. This list does not constitute an endorsement but rather the information made available to RMI. The information provided is accurate, to our knowledge, as of August 2009. A running list of charging station providers will be available at www.projectgetready.com .

Avcon Corporation

Avcon manufactures conductive connectors and power supply equipment for electric-powered vehicles. It appears that pedestals are no longer manufactured and sold by Avcon, so we assume that these units must be wall-mounted. Avcon currently sells just one model, the 2PF040-325. This is a Level II charger (240V and 32A), and cannot be used to charge at Level I, 120V and 15A. Also, it is only capable of charging one vehicle at a time. The price for this unit is $546.30.

www.avconev.com

Better Place

Better Place is exploring installing public charging stations, but at the moment they are not making their hardware products available to the public. Rather, Better Place's business model is to invest in a network of battery-swap stations and build out vehicle charging stations themselves in order to increase subscriber membership for their electric-vehicle transportation services.

www.betterplace.com

Brusa/Metric Mind

Metric Mind Corporation is the U.S. distributor of German Brusa plug-in vehicle battery chargers. Chargers are either top air-cooled, side air-cooled, or water-cooled. All units below have an output power of 3.3kW, except for the "lite" model at 1.6kW. All prices below include the cost of a KN51U Mains Cable Set ($149) and KB51A Battery Cable Set ($115), as these are mandatory for any NLG5 charger model. Other options may be required for battery chargers to be used as standalone public vehicle chargers. Please see the website for volume discount information.

Model	Specifications/ Information	Hardware Price	Comments/Additional Info
NLG511-Sx	(side cooled)	$3,870	Output DC voltage range: 130V–260V (25A max)
NLG512-Sx	(side cooled)	$6,353	Output DC voltage range: 180V–360V (18A max)
NLG513-Sx	(side cooled)	$3,870	Output DC voltage range: 260V–520V (12.5A max)
NLG514-Sx	(side cooled)	$6,353	Output DC voltage range: 360V–720V (9A max)
NLG51x-Tx	(top cooled)	$6,353	

Model	Specifications/ Information	Hardware Price	Comments/Additional Info
NLG51x-Wx	(water cooled)	$6,353	
NLG50x-lite		$2,614	Output DC voltage range: 200V–520V (9A max)

www.metricmind.com

Coulomb Technologies

Coulomb sells networked charging stations and provides an electric-vehicle charging service to both subscribers and non-subscribers. At each charging site, at least one charging station must be a "gateway" station that communicates, via a cellular network, with a Coulomb facility. Other charging stations must be situated in a line-of-sight location chain to communicate information back to a gateway unit. Each gateway unit adds about $1,000 to the cost of a charging station. The network capabilities of charging stations offer plug-in drivers the ability to locate available charging stations. Please see Coulomb's website for more information about subscription services.

Model	Specifications/ Information	Hardware Price	Comments/Additional Info
CT1000	Level I charger (120V, 12A)	$2,500	Add $1,000 to one unit that needs to act as the "gateway" to the network
CT2000	Level I and II charger (208V/240V and 32A)	$3,500	Add $1,000 to one unit that needs to act as the "gateway" to the network

www.coulombtech.com/index.php

EV-Charge America]

EV-Charge America sells networked electric vehicle charging stations with communications middleware for interacting with the fully integrated vehicle-to-grid system and obtaining maximum information in both tri-modal, RFID, proximity and full-color, touch display screen modes. Access and activation to the charging station system can be completed through the drivers' cell phones and proximity cards. EVCA also integrates graphics interfaced charging stations into their Solar PV carports, both on-grid and off. Charging units are both Level I and Level II and can simultaneously charge up to 4 vehicles at one time.

Model	Specifications/Information	Hardware Price	Comments/Additional Info
EV2001	Level I and Level II up to 240V, 120A. Retractable, secure cables standard. Can charge up to 4 vehicles simultaneously – Ground Mount	$1,500	Tri-modal RFID, Touchless Proximity, Cell Phone activation via WiFi all standard. Full Color Touch Screen Display user interface optional.

Model	Specifications/Information	Hardware Price	Comments/Additional Info
EV2002	Level I and Level II up to 240V, 120A. Retractable, secure cables standard. Up to 4 vehicles simultaneously – Pole Mount	$1,200	Tri-modal RFID, Touchless Proximity, Cell Phone activation via WiFi all standard. Full Color Touch Screen Display user interface optional.
EV2003	Level I and Level II up to 240V, 120A. Retractable, secure cables standard. Up to 4 vehicles simultaneously – Wall Mount	$1,300	Tri-modal RFID, Touchless Proximity, Cell Phone activation via WiFi all standard. Full Color Touch Screen Display user interface optional.

www.EV-ChargeAmerica.com

GoSmart Technologies

GoSmart plans to sell smart charging stations with the ability to interface with a variety of communication systems including wireless internet, ethernet, and RFID verification. Given this customization, vehicle owners have the ability to determine length and cost of charge. Consumers can use a credit card or sign up for a membership. GoSmart also claims to be smart grid ready with two way metering and software provided by Gridpoint.

Model	Specifications/ Information	Hardware Price	Comments/Additional Info
ChargeSpot	Level II (up to 16.8kw)	$2,200-$3,800	Three different applications depending on configuration requested

www.gosmarttechnologies.com

Minit-Charger

Minit-Charger, made by eTec, offers Level I and II charging stations for plug-in electric vehicles. Their Level I chargers are manufactured by Delta-Q Technologies and they are designed mainly for neighborhood electric vehicles and electric carts. eTec's Level II chargers are for plug-in vehicle charging in public places and come complete as pre-assembled units. They offer ADA compatibility, an access control system to support charging fees, remote data acquisition to facilitate the gathering of marketing data from chargers, as well as an equipment option that allows them to charge two vehicles simultaneously. Please see the table below for information about eTec's Level II chargers, and check the website for more information about Level I equipment.

Model	Specifications/ Information	Hardware Price	Comments/Additional Info
EVI DS-200-DL Charging Station	240v 60A, wall-mount (pedestal optional)	$2,800	Capable of charging two vehicles simultaneously

Model	Specifications/ Information	Hardware Price	Comments/Additional Info
EVI DS-50 Charging Station	240v 30A, wall-mount (pedestal optional)	$1,450	Generally only for residential and fleet operations
EVI DS-100 Charging Station	240V 24A, wall-mount (pedestal optional)	$1,800	Functionally identical to the DS-50, but packaged for public use
Pedestal Mounting Plate, Type B, EVI DS-50	Accessory required for pedestal mounting.	$150	Pedestal mount accessory. Can mount two chargers back to back.
EVI Dual Mount Pedestal Supports	Accessory required to complement pedestal for dual mounting	$140	
EVI 7' Pedestal with Cable Retraction	Accessory includes pedestal, cable retraction, space for signage	$1,400	A deluxe, streamlined package for a stylized, professional look

www.minit-charger.com/other/chargers

Shorepower Technologies/SynkroMotive

Shorepower's original business was supplying plug-in power sources at truck stops so truckers could rely less on fuel-consuming and smog-producing diesel engines to run their onboard "hotel" loads. They joined forces with SynkroMotive to provide hardware for passenger electric vehicle charging. These two companies jointly offer a pedestal charging system and wall units. Both models are offered as Level I chargers (120V and 12A) and have the capability to charge four vehicles simultaneously. Both models can be upgraded to Level II (208V or 240V), making them capable of charging two vehicles simultaneously. All units have remote on/off controls, a payment and control system, and a controller to monitor energy and time of use.

Model	Specifications/ Information	Hardware Price	Comments/Additional Info
Pedestal Charging System	120V and 20A	$2,900	For a visibility enhancing illuminated globe, add $600
Wall Unit	120V and 20A	$2,500	Purchaser is responsible for wall-mounting

www.synkromotive.com www.shorepower.com

"Self" Installation of Charging Station Infrastructure

Another hardware option is for interested investors to bypass pre-constructed options from third-party providers and instead build simple charging stations themselves. A series of estimates from Boulder-area electricians reveal that the necessary materials (weatherproof cable, electric meter, etc.) can be purchased and installed (by a professional electrician) for as little as $300–500, including permitting costs. Electricians were quick to point out, however, that installation costs for all hardware options could vary significantly depending on:

1. *Availability of an appropriate power source*: A retail facility parking lot may be already equipped with pole lighting, but this power may be only switched on at night, presumably not when plug-in drivers will be parking.
2. *Installed oversized conduits already in place*: Many public facilities that are already wired for electricity simply do not have the capacity in their conduits for plug-in vehicle charging. If this is the case, then expensive rewiring is likely necessary. In addition, some public wiring may not be designed for the continuous load that charging infrastructure would require.
3. *Existence of physical mounting infrastructure*: Installing your own charging station is, intuitively, easiest and least expensive when done where the physical infrastructure already exists. For example, a charging station installed in a parking garage with ceilings and walls (as well as daytime electricity) is less infrastructure- and labor-intensive than installing the same station in the middle of a large flat, single-level parking lot.

For the most accurate, up-to-date information on purchasing and installing your own charging stations, check with your local electricians, as well as the city building department (for permits). Building permits are often priced as a percentage of total job cost, but your municipality may offer reduced permitting fees for projects that install environmentally-friendly infrastructure, such as charging stations or renewable distributed generation capacity.

Appendix B: Assumptions for Investment Tool Runs

- Level I chargers run at 120 V and 15 A for a total charge of 1.8 kW, while level II chargers are 240 V and 30 A for a total charge of 7.2 kW. Level III chargers are not included in the model as options for stakeholder investment.
- Electricity price forecasts are from the EIA's Annual Energy Outlook 2009. Emissions data to calculate offset carbon (equivalent) emissions from PHEV use are from Argonne's GREET model. The investment tool assumes that all PHEV use is PHEV-40 (PHEVs with a 40 mile all-electric range).
- All installed infrastructure is assumed to remain functional over the course of the 10 year period forecasted in the model. It is likely that charging equipment could become technologically obsolete before its product lifetime ran out.
- All costs in the model, such as installation, hardware, and maintenance are increased annually by a measure of inflation, which is set at a default value of 3%. All future revenue streams are discounted to 2009 using a discount rate that is set at a default of 10%. Both inflation and discount rates can be modified by the tool user.
- Offset carbon emissions are measured by comparing tailpipe emissions of plug-in and conventional vehicles. As of now, the model does not include the added GHG emissions associated with increased electricity production required to power the plug-ins.
- The model assumes that charging infrastructure built in the year 2009 will only come online by the year 2010. Specifically, Level I and II chargers built out in 2009 in the model neither accumulate benefits for the builders nor incur electricity costs until 2010. From 2010 on, any stations built in a particular year are assumed to be installed and operational instantly on January 1 of that year.
- Some charging hardware has the capability to charge more than one car. Some of these will require additional hardware purchases in order to do this. This factor will only affect the model runs when a non-zero hourly charging fee is selected. The model conservatively assumes that all hardware chargers only charge one vehicle at a time. Please check with the menu of hardware options above to see which hardware options can charge more than one vehicle simultaneously, and what

additional equipment is required to do so. For these hardware options, this model may underestimate revenue generation.

- Coulomb Technologies' infrastructure requires that at least one unit at each location be a "gateway" unit that is in charge of cellular communication with a service center. These units cost about $1000 more than a standard non-Gateway model. The investment tool assumes that the cost of Coulomb charge stations includes a portion of this additional capital cost.
- Federal incentives in support of charge station hardware and installation is set at 50% in the model. Additional state incentives, where available, are assumed to be in addition to this 50% federal incentive.
- Avcon does not currently offer a Level I charger and Shorepower does not currently offer a Level II charger. Thus users should be aware when using the investment tool that no Level I chargers should be built-out when using Avcon products, or Level II chargers when using Shorepower products.
- Estimated costs and benefits from Figure 1 are as follows:
  - Electricity cost range is the cost of running a Level I station for 1 hour per day (minimum) to the cost of running a Level II station 8 hours per day.
  - Installation, station hardware, and maintenance costs come from interviews with hardware providers, as well as publicly available cost data.

Appendix C: Federal and State Incentives for Charge Station Investment

Federal Incentives

A tax credit is available for the cost of installing alternative fueling equipment (including plug-in vehicle charging infrastructure) placed into service after December 31, 2005. The credit amount is up to 30% of the cost, not to exceed $30,000, for equipment placed into service before January 1, 2009. The credit amount is up to 50% not to exceed $50,000, for equipment placed into service on or after January 1, 2009. This credit expires for vehicle charge infrastructure on December 31, 2010.[14] For more details, see the Department of Energy's website at http://www.afdc.energy.gov/afdc/progs/tech_matrx.php or contact:

U.S. Internal Revenue Service
Phone (800) 829-1040
www.irs.gov

State Incentives

State incentives for alternative fuels are changing rapidly, and many more states are getting on board all the time. Thus, the below list should be viewed as a representative selection of state charging infrastructure incentives in the US. For a more detailed look at your state's incentives, please check online with the US Department of Energy's Alternative Fuels & Advanced Vehicles Data Center (AFDC) website: www.afdc.energy.gov/afdc/progs/tech_matrx.php.[15]

California: While not offering a universal state-wide investment incentive, there are a number of local incentives in California (too many to mention here) that encourage the installation of infrastructure, and may also offer discounted electricity rates for plug-in charging. In addition, several municipalities, including San Francisco, San Jose, and Oakland, are already in the process of

[14] www.afdc.energy.gov/afdc/progs/view_ind_mtx.php/tech/ELEC/US/0
[15] Indeed, all of the state incentive information here is from this up-to-date AFDC source.

installing infrastructure in public places. For information about discounted electricity rates, contact your local utility or public utility commission.

Colorado: The Colorado Department of Revenue offers an income tax credit for the cost of purchase and installation of alternative fuel stations (including electric vehicle charging). The credit for tax years 2009-2011 is 20%, but is 25% if the charge station is accessible for public use, or primarily powered (over 70%) by renewable energy sources. The credit has a maximum value of $400,000 in any consecutive five-year period. For more information, please contact:

Tax Information Call Center
Colorado Department of Revenue
Phone (303) 238-7378
www.revenue.state.co.us/main/home.asp

Georgia: An income tax credit is available to any eligible business enterprise for the purchase or lease of each EV charger that is located in the state. The amount of the credit is 10 percent of the cost of the charger or $2,500, whichever is less. For more information, contact:

James Udi: Environmental Specialist
Georgia Environmental Protection Division
Phone (404) 363-7046
james_udi@dnr.state.ga.us

Kansas: Kansas offers an income tax credit for alternative fueling stations placed in service after January 1, 2009. The tax credit, worth up to 40 percent of the total amount, may not exceed $100,000. For more information, contact:

Ray Hammarlund: Kansas Energy Office
Phone (785) 271-3179
r.hammarlund@kcc.ks.gov
www.ksrevenue.org/taxcredits-altfuel.htm

Louisiana: The state offers an income tax credit worth 20 percent of the cost of constructing an alternative fueling station (including electric charge stations). For more information, contact:

Taxpayer Services Division
Louisiana Department of Revenue
Phone (225) 219-0067

Maine: The Clean Fuel Vehicle Fund is a non-lapsing revolving loan fund managed by the Finance Authority of Maine and may be used for direct loans to finance all or part of any clean fuel vehicle project. The Finance Authority of Maine may also insure up to 100% of mortgage payments with respect to mortgage loans for clean fuel vehicle projects.

Nebraska: The Nebraska Energy Office administers the Dollar and Energy Saving Loans Program, which makes low-cost loans available for a variety of alternative fuel projects, including the construction or purchase of a fueling station or equipment for electric vehicles. The maximum loan amount is $150,000 per borrower and the interest rate is 5% or less. For more information, contact:

Nebraska State Energy Office
Phone (402) 471-2867
energy@nebraska.gov
www.neo.ne.gov/loan/index.html

New Hampshire: The New Hampshire Department of Environmental Services (DES) and the Granite State Clean Cities Coalition (GSCCC) provide competitive funding to expand the use of alternative fuels, AFVs, and advanced technology vehicles in New Hampshire. Only projects located in the ozone non-attainment or maintenance areas in the state are eligible for funding. For more information see the GSCCC Web site: www.granitestatecleancities.nh.gov/

New Jersey: New Jersey's Alternative Fuel Infrastructure Program has funding available to reimburse eligible local governments, state colleges and universities, school districts, and governmental authorities for 50 percent of the cost of purchasing and installing refueling infrastructure for alternative fuels (including electricity). Up to $50,000 is available per applicant. For more information, contact:

John Zarzycki: Project Manager
New Jersey Board of Public Utilities, Office of Clean Energy
Phone (973) 648-4967
john.zarzycki@bpu.state.nj.us

New Mexico: The Clean Energy Grants Program is administered by the Energy Conservation and Management Division of the New Mexico Energy, Minerals, and Natural Resources Department and provides grants for projects utilizing clean energy technologies (including alternative fuel vehicles and fueling infrastructure) and projects providing clean energy education, technical assistance, and training programs. These grants are provided on a competitive basis to qualifying entities such as municipalities and county governments, state agencies, state universities, public schools, post-secondary educational institutions, and Indian nations, tribes, and pueblos.

New York: The state offers an Alternative Fueling Infrastructure Tax Credit, which is equal to 50% of the cost of the infrastructure. This includes infrastructure for storing or dispensing an alternative fuel into the fuel tank of a motor vehicle powered by that fuel as well as infrastructure used for recharging electric vehicles. This credit does not apply after December 31, 2010. For more information, contact:

Patrick Bolton: Senior Project Manager, Alternative Fuels & Vehicles
NYSERDA
Phone (518) 862-1090 x3322
ppb@nyserda.org
www.nyserda.org/programs/transportation/

Oregon: Business owners and others who invest in alternative fuel production and fueling infrastructure projects in Oregon may be eligible for a state tax credit of up to 50% of eligible project costs through the Business Energy Tax Credit Program. For more information, contact:

Matt Hale: Clean Cities Coordinator
Columbia Willamette Clean Cities Coalition, Inc.
Phone (503) 373-7560
matt.hale@state.or.us
www.cwcleancities.org

Tennessee: FastTrack Infrastructure Development Program funds may be used for alternative fueling infrastructure improvements. Funds may be used in situations where there is a commitment

by certain private sector businesses to locate or expand in the state and to create or retain jobs for Tennesseans. To see if you may be eligible for funding, contact:

Philip Trauernicht: Director, Program Management, Community Development
Tennessee Department of Economic and Community Development
Phone (615) 253-1903
philip.trauernicht@state.tn.us
www.state.tn.us/ecd/progman_tiip.htm

Washington: The state has electric vehicle charging infrastructure tax exemptions, such that public lands used for installing, maintaining, and operating EV infrastructure are exempt from leasehold excise taxes until January 1, 2020. Additionally, the state sales and use taxes do not apply to EV batteries, labor and services for installing, repairing, altering, or improving EV batteries and EV infrastructure, and the sale of property on land used for EV infrastructure. For more information, contact:

Stephanie Meyn: Clean Cities Coordinator
Puget Sound Clean Cities Coalition
Phone (206) 689-4055
stephaniem@pscleanair.org
http://pugetsoundcleancities.org/

Contact Information

This project is coordinated by the Rocky Mountain Institute, a 501(c)(3) based in Colorado.

Please visit our webiste: www.move.rmi.org

For more information, please write to Matt Mattila at mmattila@rmi.org.