CENTER FOR CLIMATE AND ENERGY SOLUTIONS

SOLUTIONS 'TOOLBOX' FOR CONSIDERATION IN THE BREAKOUT GROUPS

New Approaches to Financing the Publicly Available Electric Vehicle Charging Network

The breakout groups will consider how targeted strategies could be pursued to help the private sector address each infrastructure gap, drawing from a 'toolbox' of potential solutions. Participants will consider a range of possible solutions to help improve the financial performance of charging station projects. Participants may also consider how some of these solutions could be combined. The most effective solutions for each gap are likely to differ because the charging needs and key stakeholders vary significantly among the gap types.

Brief descriptions of possible solutions for the breakout groups to consider at the workshop are presented below. Each description identifies the potential target market, key partners, and expected implementation challenges. Each solution can address more than one of the business challenges described in the plenary (i.e., cost, revenue, or finance). They are categorized below by the challenge that they are expected to be most adept at addressing.

Following each brief description, a table provides an overview of the barriers addressed by that solution. An additional table presents the impact of the solution on the financial performance of the EV charging project. As each solution is discussed, a key consideration will be whether the solution can be expected to materially improve the financial performance of charging station projects. As noted earlier, for any entity to consider investing in EV charging, they will need to expect that the project will generate value that is greater than its total cost. The financial performance of the base case scenario is presented in the first row, followed by one or more solution scenarios. The assumptions used to model each solution scenario are detailed in the "Description & Assumptions Modified" column. The financial performance of each scenario is characterized by two metrics. The "Net Value to Project Developer" is the net present value of the investment, which is positive if the project's value exceeds its cost. For those scenarios with positive net value, the "Payback Period" is the time until the project begins to generate net value to the project developer. For solutions that involve financial contributions from other entities, their contributions are totaled in a final column.

Each solution scenario is modeled using the same assumptions as the base case, with the exception of those assumptions detailed in the "Description & Assumptions Modified" column.

SOLUTIONS "TOOLBOX" THESE SOLUTIONS ARE DESCRIBED IN DETAIL ON THE FOLLOWING PAGES	
Cost strategies	
C1	*Low-Power DC Fast Charging* Charging service provider offers lower-powered DC fast-charging stations to save on capital and operating costs.
C2	*Automaker-Supported EV Charging* Automaker subsidizes charging service provider's capital costs (and may provide station utilization guarantee to reduce risk for charging service provider.)
C3	*Electric Utility Charging Site Partnership* Electric utility subsidizes charging service provider's capital costs.
Revenue Strategies	
R1	*Retail Sales Boost through On-Site EV Charging* Retailer subsidizes charging service provider's capital costs and waives site access fees for station.
R2	*Pooled Capital Investments to Promote EV Tourism* Businesses and government pool funds to subsidize charging service provider's capital costs.
Finance Strategies	
F1	*Public-Private Partnerships in EV Charging* Government shares utilization risk with charging service provider by lending project funds to be repaid with low interest rate if project meets performance targets.

Cost Strategies

C1. Low-Power DC Fast Charging: Lowering the power offered by DC fast charging stations to 25 kilowatts (kW) or lower can reduce operating costs of a charging site and equipment and installation costs as well. Although lower powered stations require longer charging times, the trade-off between charging speed and cost may make sense in some locations.

The target market for this concept are sites that are likely to experience high electricity costs associated with high-power electricity use (i.e., "demand charges") and areas where customers would not be averse to acquiring only 12 kW-hours of energy in 30 minutes (rather than 15 to 25 kW-hours). For example, stations could be sited in locations immediately outside of metropolitan areas where drivers need less than 30 miles of range to reach their destination or to recharge in an emergency.

The main challenge to implementing this concept is identifying locations where customers are willing to pay the same for low-power DC fast charging as they would for high-power DC fast charging, or who balk at paying a premium price for DC fast charging.

BARRIERS ADDRESSED	**DESCRIPTION**
Capital Costs – Equipment, Installation	Equipment costs could be reduced by half or more. For example, while the typical per station price for 50 kW fast charging station is currently around $35,000, in July 2014, BMW announced a lower-powered 24 kilowatt (kW) DC fast charging station that will be priced at $6,548. Installation and grid interconnection costs could also be cut considerably since less power is needed at the charging location. For this analysis, we assume that equipment costs are reduced to $6,600 while installation and grid integration costs are each reduced by 50%. As a result, total capital costs are reduced by $51,400.
Operating Costs – Electricity	Demand charges can vary widely and add costs to operating a charging station. For example, large demand customers in Puget Sound Energy's territory can pay between $7.76 and $11.65 per kW for demand charges. If station use causes a host to exceed the demand limit at any point, it could add hundreds of dollars to a monthly bill ($11.65/kW x 50 kW over the demand threshold = $582.50). Lower powered DC fast charging could potentially avoid demand charges.
Operating Costs – Maintenance	A common rule of thumb is that equipment maintenance costs are a percentage of capital equipment costs. Thus, lowering capital costs can also reduce maintenance costs.
Direct Revenue – Energy User Fee, Per-use User Fee, Subscription Fee	Since less power is delivered to station, it will not be able to recharge as many vehicles over a fixed period of time. The decrease in energy delivered could be equivalent to the decrease in power at the station. The effects on business revenue depend on the model used for charging customers for services. This would likely affect subscription fee models less than pay-per-use or energy-based fees. Note that in our analysis we assume that the pricing structure remains the same as in the base case.

SCENARIO	DESCRIPTION & ASSUMPTIONS MODIFIED	NET VALUE TO PROJECT DEVELOPER	PAYBACK PERIOD
DC Fast Charging Station			
Base case	n/a	–$44,589	n/a
C1	Capital costs reduced by $51,400 Demand charges reduced by 50% (reduced by $363/year)	–$91	n/a

C2. Automaker-Supported EV Charging: DC fast charging sites along heavily traveled corridors can provide travel connectivity for EV drivers between intrastate regions and serve as a useful marketing tool for automakers, which can help them sell more EVs. To realize this benefit, automakers may be willing to partner with charging station providers by contributing funds to offset project upfront and/or operating costs. Automakers could also offer a guarantee to charging service providers to cover the revenue differential for a defined amount of energy delivered or some defined number charging sessions during a set time period, thereby substantially lowering the financial risk of a project.

This solution is different from the charging service models offered by Tesla Motors, whereby the automaker directly provides charging services. Instead, this scenario involves an automaker providing financial support to third-party charging service providers.

Locations that might fit this concept include charging site hosts or third party charging providers that operate sites along major roadways. In particular, this concept could target charging sites that rely on direct revenue through energy sales on a per kilowatt-hour basis or through a per-use user fee, because they are likely to face a high cost of capital due to use uncertainty.

The main challenge to implementing this concept is defining the net change in EV sales that would determine the funding contribution from the automaker. A challenge specific to providing guarantee is the terms of the guarantee, such as the duration of the agreement and changes in the guarantee amount over time.

BARRIERS ADDRESSED	DESCRIPTION
Capital Costs – Equipment, Installation	Equipment and installation costs could be reduced via an automaker subsidy.
Cost of Funds – Debt, Equity	An automaker could offer a revenue guarantee to a charging host provider in case charging station use does not meet initial expectations. This revenue guarantee would boost revenue and lower the risk of a project, enabling access to low-cost capital to fund the project. For example, as presented in the plenary, lowering the cost of funds from 15% to 0% can increase the net value of a DC fast charging station project by over $67,000.
Indirect Revenue – Increased EV Sales	EV sales could go up noticeably with more infrastructure. According to Nissan, infrastructure deployment is highly correlated with vehicle sales. To estimate the potential magnitude of automaker investment, consider the following simple calculation experiment. Auto dealers commonly can spend up to 1% of total sales on marketing or $300 for a $30,000 EV. If an automaker was willing to spend its entire EV marketing budget on charging stations, and if it was willing to subsidize each charging station based on the current ratio of EVs to charging stations in Washington (9:1 for Level 2 and 135:1 for DC fast chargers), then the automaker could cover all of the equipment costs for a Level 2 charging station and over 25% of the equipment costs for a DC fast charging station.

SCENARIO	DESCRIPTION & ASSUMPTIONS MODIFIED	NET VALUE TO PROJECT DEVELOPER	PAYBACK PERIOD	COST TO AUTOMAKER
DC Fast Charging Station				
Base case	n/a	–$44,589	n/a	n/a
C2 Case 1	Capital costs subsidized by $17,000 (50% of equipment costs)	–$27,089	n/a	$17,500
C2 Case 2	Capital costs subsidized by $17,000 (50% of equipment costs) Revenue guarantee reduces project risk, reducing cost of funds from 15% to 5%	+$8,232	10 years	$17,500 if revenue target is met $106,646 if revenue falls short of guaranteed level by 50% and automaker must make up the difference
Level 2 Charging Station Site				
Base case	n/a	–$26,076	n/a	n/a
C2 Case 1	Capital costs subsidized by $12,500 (100% of equipment costs)	–$13,576	n/a	$12,500
C2 Case 2	Capital costs subsidized by $12,500 (100% of equipment costs) Revenue guarantee reduces project risk, reducing cost of funds from 15% to 5%	+$119	10 years	$12,500 if revenue target is met $60,831 if revenue falls short of guaranteed level by 50% and automaker must make up the difference

C3. Electric Utility Charging Site Partnership: Electric utilities could substantially offset the cost of charging station installations by using funds to cover all or part of those costs for a charging site, not including the charging station equipment which could be owned by a third party.

The locations that might fit this concept include sites where appropriate power levels are not easily accessible and electricity upgrades are needed to provide service. The business case for charging at these sites would have to be strong otherwise, such as sites that connect key locations or sites in areas of high demand.

The main challenge in implementing this concept is overcoming regulatory priorities that restrict the use of ratepayer funds to add electric load to the system. Also, electricity regulators typically do not discriminate across load sources, and this concept would subsidize costs for electric charging that would not be covered for similar loads.

BARRIERS ADDRESSED	DESCRIPTION
Capital Costs – Installation	If a utility is able to cover the electricity service delivery for a charging station, installation costs could be cut considerably. Covering the utility interconnection costs could reduce capital costs by $20,000 for a DC fast charging station. The utility could also cover other installation costs including the labor and electric-panel upgrade costs, amounting to approximately $26,000 for a DC fast charging station and $4,000 per Level 2 station.

SCENARIO	DESCRIPTION & ASSUMPTIONS MODIFIED	NET VALUE TO PROJECT DEVELOPER	PAYBACK PERIOD	COST TO UTILITY
DC Fast Charging Station				
Base case	n/a	–$44,589	n/a	n/a
C3	Capital costs subsidized by $46,000 ($20,000 for equipment and $26,000 for installation)	+$1,411	10 years	$46,000
Level 2 Charging Station Site				
Base case	n/a	–$26,076	n/a	n/a
C3	Capital costs subsidized by $20,000 ($4,000 per Level 2 station * 5 stations)	–$6,076	n/a	$20,000

Revenue Strategies

R1. Retail Sales Boost through On-Site EV Charging: Offering EV charging at retail locations may increase sales revenue by drawing EV drivers to the destination and by increasing customer time spent parked at these locations. To realize this benefit, retailers may be willing to offer free or discounted access to their property for third-party EV charging projects. In addition, retailers may be willing to contribute funds to offset project upfront and/or operating costs.

The locations that might fit this concept include local retail destinations.

The main challenge to implementing this concept is that retailers may not be confident enough about the impact of EV charging stations on sales to contribute funds towards their deployment. In addition, there may be challenges if retailers do not own their buildings, if they share their buildings with other tenants, and/or if they are unsure how long they will remain at their present location.

BARRIERS ADDRESSED	DESCRIPTION
Capital Costs – Equipment, Installation	Equipment and installation costs could be reduced via a retailer subsidy.
Operating Costs – Site Access	A retailer could offer the land used by the charging station free of charge. This could reduce the operating costs of a charging location by up to several hundred dollars annually.
Indirect Revenue – Increased Retail Sales	The change in sales at a retailer due to charging station use or availability could determine the amount of the subsidy it provides to the project capital cost. Some retailers estimate that shoppers spend approximately $1/minute spent in their stores and that an EV driver may spend 30 minutes longer in stores than a conventional vehicle driver. Using these approximations, for a Level 2 charging site with 5 stations and 1,000 charging sessions per year, the incremental retail sales revenues could be around $30,000 per year. Assuming a retail net profit margin of 3%, the resulting incremental profit to the retailer would be $900 per year.

SCENARIO	DESCRIPTION & ASSUMPTIONS MODIFIED	NET VALUE TO PROJECT DEVELOPER	PAYBACK PERIOD	COST TO RETAILER
DC Fast Charging Station				
Base case	n/a	–$44,589	n/a	n/a
R1	Capital costs subsidized by $10,000 Site access fees waived ($1,200 per year)	–$28,567	n/a	$10,000 (+ $12,000 in foregone site access fees)

Level 2 Charging Station Site				
Base case	n/a	–$26,076	n/a	n/a
R1	Capital costs subsidized by $10,000 Site access fees waived ($1,200 per year)	–$10,053	n/a	$10,000 (+ $12,000 in foregone site access fees)

R2. Pooled Capital Investments to Promote EV Tourism: Pooling funds for third party-operated charging stations can provide access to tourist destinations and be an economic development opportunity for local businesses. Stations can be installed at local businesses to increase retail sales, restaurant visitors, and hotel occupancy. The pooled funds could also be used to add charging stations at public places and along key routes to provide access to the tourist destination.

The locations that might fit this concept include remote tourist destination sites that are currently inaccessible to EV drivers. Local governments and electric utilities, including public utility districts, may also see a public benefit in contributing to these pooled fund projects.

One challenge to implementing this concept is estimating the value proposition for businesses and the public to make the investment. Another challenge is selecting the locations where these charging stations will be hosted.

BARRIERS ADDRESSED	DESCRIPTION
Capital Costs – Equipment, Installation	Equipment and installation costs could be reduced via a public and/or private subsidy.
Indirect Revenue – Increased Retail Sales	The change in sales at a retailer due to charging station use or availability could determine the amount of the subsidy it provides to the project capital cost. Some retailers estimate that shoppers spend approximately $1/minute spent in their stores and that an EV driver may spend 30 minutes longer in stores than a conventional vehicle driver. Using these approximations, for a Level 2 charging site with 5 stations and 1,000 charging sessions per year, the incremental retail sales revenues could be around $30,000 per year. Assuming a retail net profit margin of 3%, the resulting incremental profit to the retailer would be $900 per year.
Indirect Revenue – Increased Tourism	The change in sales at local businesses (e.g., hotels, restaurants, and tourist attractions) due to charging station use or availability could determine the amount of the subsidy entities provide to the project capital cost.

SCENARIO	DESCRIPTION & ASSUMPTIONS MODIFIED	NET VALUE TO PROJECT DEVELOPER	PAYBACK PERIOD	COST TO CAPITAL POOL
DC Fast Charging Station				
Base case	n/a	–$44,589	n/a	n/a
R2 Case 1	Capital costs subsidized by $50,000	+$5,411	9 years	$50,000
R2 Case 2	Capital costs subsidized by $75,000	+$30,411	5 years	$75,000
Level 2 Charging Station Site				
Base case	n/a	–$26,076	n/a	n/a
R2 Case 1	Capital costs subsidized by $20,000	–$6,076	n/a	$20,000
R2 Case 2	Capital costs subsidized by $35,000	+$8,924	6 years	$35,000

Finance Strategies

F1. Public-Private Partnerships in EV Charging: By taking partial ownership of EV charging projects, the public sector could ensure funds are available for these projects as well as reduce the cost of funds (interest on loans and returns on private investor equity) for EV charging service providers. To help ensure a consistent, substantial source of public funds for charging projects, the state could collect fees from all EV drivers to be used to fund public-private partnerships. For instance, a $50 annual fee levied on the 8,200 existing EV drivers in Washington would generate $410,000 in annual revenue.

The locations that might fit this concept would be marginal sites, where third-party charging service provider faces significant risk. The government may choose to take on some of this risk in order to ensure adequate access to charging while assigning the private sector to the role of providing that charging access. From the perspective of the government, a partnership allows for the potential for repayment, unlike grant awards.

The main challenges to implementing this concept are resistance to new public sector expenditures, establishing new revenue sources (such as fees on EV drivers), development and administration of the program, and providing material cost savings while also striking an appropriate balance of risk between the public and private sectors.

BARRIERS ADDRESSED	DESCRIPTION
Cost of Funds – Debt, Equity	Government lends funds to project developer to be repaid with a low interest rate (2.5%) if project meets revenue targets. If the project does not meet those targets, then full repayment to the government does not occur. The final portion of the funds repaid to the government would depend on the structure of the public-private partnership agreement.

SCENARIO	DESCRIPTION & ASSUMPTIONS MODIFIED	NET VALUE TO PROJECT DEVELOPER	PAYBACK PERIOD	COST TO GOVERNMENT
DC Fast Charging Station				
Base case	n/a	–$44,589	n/a	n/a
F1 Case 1	Government provides $90,000 in project funds, expecting repayment Project meets profitability target and charging service provider repays government at 2.5%	+$4,872	10 years	$0
F1 Case 2	Same as above, except project does not meet profitability target Charging provider repays a fraction of funds to government, based on contract	Depends on terms of partnership	Depends on terms of partnership	Up to $90,000
Level 2 Charging Station Site				
Base case	n/a	–$26,076	n/a	n/a
F1 Case 1	Government provides $35,000 in project funds, expecting repayment	–$6,866 (Reducing cost of funds alone does not result in project profitability, so developer cannot meet profitability target.)	n/a	Up to $35,000

Appendix A: Barrier-Solution Project Impact Matrix

A summary of the relative impact of each potential solution on cash flow are summarized in the table below.

Legend: H – High positive impact on project financial performance; M – Medium positive impact; L – Low positive impact;
(H) – High negative impact on project financial performance; (M) – Medium negative impact; (L) – Low negative impact; [blank]: No impact

	CAPITAL COSTS		OPERATING COSTS			COST OF FUNDS		DIRECT REVENUE			INDIRECT REVENUE		
SOLUTION	Equipment	Installation	Electricity	Maintenance	Site access	Debt	Equity	Energy User Fee	Per-use User Fee	Subscription Fee	Increased EV Sales	Increased Retail Sales	Increased Tourism
C1. Low-Power DC Fast Charging	H	H	H	L				(L)	(L)	(L)			
C2. Automaker-Supported EV Charging for Awareness and Access	H	H				L	M				H		
C3. Electric Utility Charging Site Partnership		H											
R1. Retail Sales Boost through On-Site EV Charging	H	H			H							H	
R2. Pooled Capital Investments to Promote EV Tourism	H	H										H	H
F1. Public-Private Partnerships in EV Charging						H	H						

Appendix B: Solution Key Partner Relevancy Matrix

Executing each solution would involve a distinct set of stakeholders. To help workshop participants consider which stakeholders are needed to implement each potential solution, assessments of the key stakeholders involved in each solution are summarized in the table below.

Legend: H – High stakeholder relevancy; M – Medium relevancy; L – Low relevancy; [blank] – No relevancy

SOLUTION	GOVERNMENT	DEDICATED SERVICE PROVIDERS	CHARGING STATION EQUIPMENT MANUFACTURERS	ELECTRIC UTILITIES	MERCHANT ELECTRICITY GENERATORS	SITE HOSTS	AUTOMAKERS
C1. Low-Power DC Fast Charging		M	L	M		M	M
C2. Automaker-Supported EV Charging for Awareness and Access		H				H	H
C3. Electric Utility Charging Site Partnership	M	M		H		L	
R1. Retail Sales Boost through On-Site EV Charging	L	H				H	
R2. Pooled Capital Investments to Promote EV Tourism	M	L		M	M	H	
F1. Public-Private Partnerships in EV Charging	H	H				L	