Charged Up:
Making Metropolitan Washington Electric Vehicle Ready

Prepared by

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CEEPC REVIEW DRAFT

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EXECUTIVE SUMMARY

This report seeks to provide a framework for establishing a regional readiness plan for the deployment of electric vehicles (EVs) in the metropolitan Washington region. While total EV ownership in the region is relatively low (compared with other cities such as Portland, Oregon, or Los Angeles), consumer interest in EVs is growing and more EV models are being introduced in the regional market. However, the metropolitan Washington region's charging infrastructure and EV policy frameworks are not yet positioned to accommodate greater market penetration of these vehicles. A coordinated approach will smooth the path to EV deployment and adoption by removing policy barriers and promoting infrastructure development while mitigating potential impacts on the electrical grid. This planning effort will help ensure that the region can receive the health, environmental, and sustainability benefits that this technology offers.

BENEFITS OF EV DEPLOYMENT

EV adoption presents environmental, economic, and energy security benefits to the country and the region. The U.S. Department of Energy (DOE) sees the electrification of vehicles as one of the highest impact strategies for reducing greenhouse gas emissions between now and 2030. In particular, as a bridge to a low-carbon transportation system, electrification of gasoline-powered vehicles through approaches such as plug-in hybrid electric vehicles (PHEVs) is one way the United States could facilitate a transition to future fuel-cell electric vehicles (FCEVs), which are seen to have the lowest life cycle carbon emissions of the range of vehicles analyzed by DOE.

Since the electrical grid serving the metropolitan Washington region has a relatively low greenhouse gas emission profile, regionally EVs produce the equivalent greenhouse gas emissions of a 55–58 mpg conventional internal combustion vehicle.[1] In addition, the electricity grid may be able to more readily integrate renewable power than traditional transportation energy sources. The proportion of renewably produced power available on the grid will increase over the years as a result of the region's renewable portfolio standards and other renewable incentives and policies. EVs allow these emissions savings and environmental benefits to be transferred to the transportation sector.

[1] Union of Concerned Scientists. *State of Charge: Electric Vehicles' Global Warming Emissions and Fuel-Cost Savings across the United States.* Rev. April 12, 2012. Available at http://www.ucsusa.org/clean_vehicles/smart-transportation-solutions/advanced-vehicle-technologies/electric-cars/emissions-and-charging-costs-electric-cars.html

As Corporate Average Fuel Economy (CAFE) standards increase, automobile original equipment manufacturers (OEMs) are investing more in EVs. In July 2011, President Obama announced that vehicle manufacturers would be required to meet a fleet-wide average fuel economy of 55 mpg by 2025. To meet a fleet-wide average fuel economy of 35.5 mpg in 2016, manufacturers are releasing more high-efficiency vehicles. Since 2009, the number of subcompact vehicles rated at least 30 mpg has tripled and large increases have also been seen in the midsize and crossover categories.[2] EVs, which offer ratings of 75 to over 100 miles per gallon equivalent (MPGe), will play an increasingly important role in auto manufacturers' fleets as they seek to meet the ambitious 2025 goal.[3]

EVs also offer economic benefits through fuel cost savings. They have very high energy efficiency ratings compared with conventional cars and can achieve as high as 94–112 MPGe. This energy efficiency gain translates directly to operational cost savings. Depending on fuel and electricity costs and miles driven, annual cost savings can be as high as $900/year or more. On the basis of the U.S. average electricity price, EVs cost $0.02 to $0.04 per mile to operate,[4] compared with $0.10 to $0.15 per mile for conventional cars (see http://www.afdc.energy.gov/afdc/vehicles/electric_benefits.html). Table ES-1 shows the EV efficiency ratings of four EV models.

Table ES-1
Electric Vehicle Efficiency Ratings

2012 Models	Mitsubishi "i"	Ford Focus EV	Nissan LEAF	Chevy Volt
Electric efficiency (kWh/mile)	0.3	0.32	0.34	0.36
Energy efficiency rating (MPGe)	112	105	99	94

Source: U.S. Department of Energy, www.fueleconomy.gov

[2] Natural Resources Defense Council. *Relieving Pain at the Pump*. May 2, 2012. Available at http://www.nrdc.org/energy/relievingpainatthepump.asp
[3] U.S. Department of Energy. *2011–12 Electric Vehicles.* Available at http://www.fueleconomy.gov/feg/evsbs.shtml
[4] In the metropolitan Washington region, EVs are estimated to cost approximately $0.04 to $0.06 per mile (based on the Pepco standard offer rate). Union of Concerned Scientists, *State of Charge: Electric Vehicles' Global Warming Emissions and Fuel-Cost Savings across the United States*. Rev. April 12, 2012. Available at http://www.ucsusa.org/clean_vehicles/smart-transportation-solutions/advanced-vehicle-technologies/electric-cars/emissions-and-charging-costs-electric-cars.html

While studies have shown that it can take seven years or more for the operational savings to offset the incrementally higher up-front cost to buy an EV (even when gas prices are in the $4–$5 range), EV buyers are also motivated by factors other than the time it takes to pay off the initial investment in a cleaner vehicle. EVs offer their owners protection against future gasoline price volatility. In Houston, for example, members of the NRG network enjoy a low fixed monthly fee for unlimited charging at home and at any of the network charging locations in the metropolitan area. And because EVs rely on domestically produced electricity rather than on petroleum, a largely imported fuel, they promote energy security.

Reducing vehicle emissions is critical to achieving the region's air quality goals, and EVs can play an important role in realizing these reductions. In the metropolitan Washington region, transportation emissions accounted for 55 percent of NOx emissions and 16 percent of fine particle ($PM_{2.5}$) emissions in 2007. EVs' zero or low emission status makes them good candidates to contribute significantly to the regional efforts to reduce pollution from mobile sources.

Despite the benefits of EVs, challenges such as unfamiliarity with the technology, range anxiety, underdeveloped charging networks, and the limited availability and relatively high cost of vehicles have hindered their adoption. In addition, the absence of a clear and robust policy framework for EV planning and infrastructure—which considers permitting, siting, zoning, utility policy, and other issues—has amplified existing market barriers. A regional strategy is needed to bridge these obstacles and clear the way for wider EV recognition and use.

RECENT COG EV PLANNING INITIATIVES

COG held an EV Workshop in early 2011 to examine successful local and regional EV readiness strategies and to begin the conversation at a regional level on how to effectively and collectively deploy EV transportation technology. Participants, including local governments and industry experts, agreed on the need for an EV readiness strategy to facilitate deployment of EVs in the metropolitan Washington region.

To understand the current landscape of the metropolitan Washington region, COG conducted a survey of its 22 member jurisdictions in early 2012 about their EV permitting and infrastructure planning. Results of the survey indicated that with some exceptions, most local jurisdictions in the region were not aware of or looking at EVs as a potential issue.

COG's Transportation Planning Board (TPB) conducted a scenario study examining the role of regional transportation in climate change mitigation in the metropolitan Washington region called *What Would It Take? Transportation and Climate Change in the National Capital*

Region.[5] The study tries to answer the question of what it would take to meet aggressive greenhouse gas emission reduction goals in transportation in the metropolitan Washington region. Although EVs were not specifically mentioned in the study, it concluded that national-level CAFE standards and alternative fuel mandates are needed to reduce emissions and contribute to the environmental resilience of the region.

In 2011, to respond to the interest in EV planning in the metropolitan Washington region, COG and the Greater Washington Region Clean Cities Coalition embarked on a new regional Electric Vehicle Planning Initiative. The Electric Vehicle Planning Initiative is heavily stakeholder-driven. The scope of the strategy development is to identify the issues for regional EV deployment and to make recommendations for the region and local jurisdictions to consider in designing and implementing programs to facilitate adoption of EVs.

The primary Electric Vehicle Planning Workgroups (referred to herein as the Task Force) were focused on infrastructure development and local government policy. The Task Force considered information on vehicle ownership and usage patterns, as well as best practices locally and from around the United States, to assist in developing considerations, recommendations, and priorities for an EV strategy for the metropolitan Washington region. Subgroups were formed to address infrastructure siting, comprehensive planning, zoning, building codes, permitting/inspection, electric utility policy, EV use in fleets, and outreach and education. This report addresses each of these topics.

EV and EVSE DEPLOYMENT PLANNING

Regional Forecast for EV Ownership

Currently, there are approximately 500 EVs registered in the metropolitan Washington region. At least three major EV and PHEV models are available in the region, and service to convert hybrids to PHEVs is available. Nationwide, there were approximately 57,000 EVs in operation as of 2009,[6] and DOE projects that there could be 1.2 million EVs on the road by 2015.[7]

While there is no way to know exactly how many EVs will be operating in the region in coming years, one approach to predicting future regional EV demand is to analyze the experience of hybrid vehicles and the early adopters. COG staff analyzed registration data available from TPB from 2005 to 2011. In just six years, the number of registered hybrid vehicles grew by more than

[5] COG Transportation Planning Board. *What Would It Take? Transportation and Climate Change in the National Capital Region.* May 18, 2010. Available at http://www.mwcog.org/uploads/committee-documents/kV5YX1pe20100617100959.pdf

[6] U.S. Energy Information Administration. *Frequently Asked Questions*. Available at http://www.eia.gov/tools/faqs/faq.cfm?id=93&t=4

[7] U.S. Department of Energy. *One Million Electric Vehicles by 2015*. February 2011. Available at http://www1.eere.energy.gov/vehiclesandfuels/pdfs/1_million_electric_vehicles_rpt.pdf

600 percent, from approximately 12,000 vehicles to more than 70,000. However, total registered hybrid vehicles in the region still represent approximately 1.5 percent of all vehicle registrations. Using the most conservative estimate of regional EV adoption by 2015–2020, if EVs experience a 600% increase in five years—mirroring the rate of adoption of hybrids—the region could have 1,500 to 3,000 EVs operating on the roadways (up from the current number of approximately 500 vehicles). As a high estimate, if total EV sales in the next eight to 10 years reach fleet levels comparable to current levels of hybrids, the region could see anywhere from 50,000 to 75,000 EVs operating on the roadways by 2020.

Potential for EV Use

According to COG's Household Travel Survey, most vehicle trips in the region are relatively short, with an average vehicle trip length of 7.7 miles. This is well within the range of one charge for most vehicles. Therefore, for most daily commutes and other trip purposes, the relatively short length of the trips would not cause significant range anxiety.

Trips to Work. Most automobile commuting trips in the region, 55 percent, end in one of the metropolitan area's Regional Activity Centers (see sidebar). A high proportion of these commuting trips—91 percent—are shorter than 20 miles one way. A small proportion of auto commute trips—1.3 percent—are longer than 40 miles. This suggests that EVs could serve the needs of most daily work commuters headed to Regional Activity Centers.

Trips for Shopping. Shopping trips also involve a significant number of automobile trips that are shorter than 20 miles—96 percent. EVs could be accommodated by home charging or car-share charging, with some retail charging locations helpful as a backup or for drivers who conduct more than one trip on a charge.

Trip Length and Electric Vehicle Range. Electric-only and hybrid-electric models available in the region that could reasonably rely on electric fuel alone are designed to travel from 56 to 72 miles on one charge. A fairly conservative rule of thumb for EV range is 20 miles one way, although some models handle a much longer journey depending on driving conditions.

Evse Site Locations

A growing EV charging infrastructure exists in the metropolitan Washington region as a result of stimulus funding through state governments and private investment. The companies and EV initiatives using federal stimulus funds to site public and residential EV infrastructure in parts of the metropolitan Washington region include ECOtality's The EV Project, Coulomb's ChargePoint America Program, the Maryland Electric Vehicle Infrastructure Program (EVIP)/BEVI (Baltimore–Washington Electric Vehicle Initiative), and the Northeast Regional Electric Vehicle Network project**.**

For plug-in electrical vehicle (PEV) owners, most charging will likely occur at home, with workplace charging a close second. Multifamily and urban dwellers without a dedicated garage or driveway will require innovative charging solutions.

As part of their *Park and Charge* Pilot Program, the District of Columbia installed the first public curbside electric vehicle charging station in the United States at the intersection of 14th & U St., NW, in 2010 in partnership with ChargePoint America and Pepco and partially supported by federal grants. Between installation and April 2012, the station was utilized for 135 charging sessions. The District plans to open at least two more stations at the Washington Canal Park in May 2012.

Source: The District of Columbia Department of Transportation. *Park and Charge Pilot*. Available at http://ddot.dc.gov/DC/DDOT/Services/Parking+Services/View+All/Park+and+Charge+Pilot

PUBLICLY ACCESSIBLE EV CHARGING STATIONS

COG staff developed an inventory of EV charging stations for the metropolitan Washington region. A robust network of charging stations is beginning to take shape in the region. Altogether, the inventory identified 332 chargers in 133 charging station locations, 11 of which are planned stations. The District of Columbia has the most charging stations among COG jurisdictions (36), followed by Arlington County, Virginia (15); Fairfax County, Virginia (18); and Charles County, Maryland (11). The District of Columbia and Arlington County, Virginia, have the highest number of chargers (85 and 62, respectively). About 40 percent of the chargers are Level 1, and the remaining 60 percent are Level 2. No DC fast chargers were installed when the inventory was developed. The inventory indicates that building managers are installing EVSE in a variety of land uses.

LOCAL GOVERNMENT POLICY

Local governments will play a critical role in the region's EV readiness. To facilitate continued growth of the market and smooth the transition to higher rates of EV adoption, local governments must ensure that EV infrastructure development is addressed in comprehensive planning efforts and that zoning, building codes, and permitting and inspection processes provide a pathway to the expeditious installation of charging equipment. Streamlined permitting and inspection processes, EV and charging incentives, infrastructure readiness, low permitting and inspection costs, and nominal installation costs all contribute to a more EV-friendly policy environment.

The January 2012 COG survey of EV initiatives in the region provided an overview of the current status of local government EV initiatives. Most COG jurisdictions reported having no EV

policy development in place. Two exceptions in the area of zoning were the integration by the District of Columbia and Fairfax County, Virginia, of EV zoning considerations into the permit review process, building code policy, and ADA parking restrictions.

Reducing the cost of obtaining electrical permits, in terms of both time and money, can facilitate the installation of EV charging stations. The District of Columbia and Fairfax, Virginia, reported the fastest turnaround times for obtaining electrical permits. Falls Church, Virginia, reported the least expensive permitting costs for all types of electrical permits, and most reporting jurisdictions indicated that they offer online permit applications. The tracking of EV charging permit applications yields important data on planned EVSE infrastructure. Of responding jurisdictions, only the City of Frederick, Maryland, and the City of Falls Church, Virginia, indicated that they are tracking EV charging permit applications.

ELECTRIC UTILITY POLICY

The regulatory status of EV charging stations—contained in provisions of electric utility policy—can help or hinder the ability of private companies and utilities to provide EV charging services. Across the region, the regulatory status of EV charging service providers is inconsistent and in some cases unclear. Clear state-level policies are needed to promote private investment in EV charging infrastructure for charging in the for-pay charging market. Ideally, local and state policy would allow utilities to be notified in advance about the location of EV charging equipment so they can ensure that appropriate infrastructure is in place to accommodate the increased load and avoid service disruptions for their customers.

Maryland, Virginia, and the District of Columbia have all taken steps in recent years to resolve areas of uncertainty in their electric utility policy as it relates to EVs and EV charging. However, room for improvement remains, particularly when it comes to notifying utilities about EV charging station locations.

BENEFITS OF EV FOR FLEET USE

A 2012 survey of fleets in the metropolitan Washington region found that EVs are being adopted slowly. The Greater Washington Region Clean Cities Coalition's[8] survey of 11 fleet managers found that most EVs currently in operation are used onsite, such as trucks used on landfills or campus landscaping equipment. According to the Coalition, fleet managers cite the cost of EVs and infrastructure as obstacles to purchasing additional EVs.

[8] Greater Washington Region Clean Cities Coalition. *Clean Cities 2011 Annual Report*. Spring 2012.

OUTREACH AND EDUCATION

The current information gap for the public's knowledge of electric and conventional vehicles is substantial. Education efforts by private and public entities (including nongovernmental organizations, electric utilities, PEV service providers, auto dealers, other businesses, and government) are needed to bridge the gap.[9] To set the stage for EV marketplace success in the metropolitan Washington region, regional partners involved in the Metropolitan COG Electric Vehicle Planning Initiative have identified key target audiences and information needs for those audiences.

SUMMARY OF RECOMMENDATIONS

Achieving EV readiness in the metropolitan Washington region will require a coordinated approach among local governments, utilities, players in the EV industry, and nonprofit groups. This report contains recommendations for these stakeholders to promote a consistent set of practices across the region that will remove barriers to EV adoption and infrastructure planning.

The top five recommendations to facilitate EV deployment in the region are as follows:

1. Stakeholder partnerships should be formed to align incentives toward maximizing the rollout of EVs and EVSE, to present the business case for EVs, and to make the community return on investment clear.
2. Local and state officials, employers, property managers, and other EV stakeholders should consider offering incentives to spur early stages of the EV market, including preferred parking and HOV occupancy exceptions for EV drivers and benefits for developers who invest in EVSE infrastructure.
3. Electric permitting procedures should identify EVSE installations and notify electric utilities of their locations.
4. Outreach and education is needed to promote EV adoption and inform the public of its benefits.
5. Comprehensive plans and zoning regulations should guide EV infrastructure development and ensure that the built environment can accommodate future EVSE installations.

Further details are provided in the report and appendices.

[9] Center for Climate and Energy Solutions. *An Action Plan to Integrate Plug-in Electric Vehicles with the U.S. Electrical Grid.* March 2012. Available at http://www.c2es.org/docUploads/PEV-action-plan.pdf