



Minnesota Pollution Control Agency

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TO: Transportation Advisory Board Program Committee
FROM: Fran Crotty, Renew. Energy & Alt. Fuels Team Lead, MPCA
DATE: November 8, 2011
RE: Electric Vehicle Charging Station Questions

The following are responses to Transportation Advisory Board member questions related to the 'Electric Vehicle Charging Station Infrastructure Twin Cities Metropolitan Area' proposal submitted by the Minnesota Pollution Control Agency.

1) Can someone "disconnect" a car during the day and plug-in another car, or does it lock somehow?

To use a charging station a charge card or a membership card (your choice) is held in-front of the charging station reader. Once authorized, for Level 1 (110V) charging, an access door unlocks allowing the charger cord, which comes with your electric vehicle (EV), to be plugged in. This door locks once the connection between the vehicle and the station is complete. It cannot be unlocked until you swipe your charge or membership card once again to authorize release. Until it is released no one else can access use of the charging station.

For Level 2 charging (220V) the card authorization step is the same, however, in this case, the charge cord attached to the charging station is used. *Once the cord is attached to your EV, if for some reason it is removed, the charging will immediately stop.* In some charging systems, a message will be sent to your cell phone if the charge has been disrupted.

2) Does the location map take into account major employers that would probably also provide some plug-ins?

Yes, it does if the stations are available for the general public. The U.S. Department of Energy maintains an interactive map of charging stations. If charging stations are available for public use, including those installed at major employer facilities, they are included in this online map.

3) Do we create a perceived issue if we don't supply enough access at each location so that it in effect becomes a deterrent?

A key objective of the proposed project is to learn more about charging stations use patterns and data including:

- Number of charging events
- Amount of electricity consumed (AC kWh)
- Percent of time with vehicle connected to charging unit
- Percent of time with vehicle drawing power from the charging unit

This information will help determine how to optimize the number and locations of future charging stations, in addition to uncovering and addressing the potential perception concerns as mentioned in the question. This TAB funding request supports a relatively small number of



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charging stations that will be part of the necessary infrastructure for the Twin Cities metro area and the state as a whole.

4) Are there any plans by Xcel to “participate” in this cost?

Xcel Energy is contributing \$22,500 to the matching funds for the project. As a regulated utility they may need to consult with regulators to make a major contribution beyond what is included in this proposed TAB-supported project. Xcel has and continues to support the initiatives of the Drive Electric Minnesota partnership.

Nationally, a vast majority of charging station installations are funded through U.S. Department of Energy (DOE) grants. We had applied for these resources and more recently have submitted a planning grant proposal to DOE, however in either case, we were not selected to be a funding award recipient. One of the reasons given is the perception we are not supporting EVs due to a lack of an initial local investment in charging stations.

5) Are any major employers willing to participate for locations near them or on the route to them?

The A, B, and C Ramps in Minneapolis, included this project, currently provide parking for major employers including Target, U.S. Bank, and Butler Square employees and other downtown commuters. The EV charging stations at the University of Minnesota will also be accessible to a large number of University employees. The ten charging stations proposed for Park and Ride sites are likely to be used by employees whose route to work includes use of these facilities. We plan to share what we will learn in this project with private entities and encourage them to install charging stations in privately-owned parking facilities for employee use.

6) If we can get business on board to clean up the roadsides, why not ask them to sponsor a plug in for free advertising?

This is an approach offered by one of the charging station vendors. It entails targeted advertising and sponsorship as a long-term source of revenue for the vendor and the station owner. For the public entities involved in this project, revenue from this type of advertising presents challenges due to potential conflicts of interest and fairness concerns. The Drive Electric Minnesota partnership will undoubtedly continue to actively explore scenarios involving advertising through signage at public charging station sites.

7) Is it safe to assume that costs will go down as the technology is more available (should we wait)?

The technology (charging equipment) is relatively low in cost. Installation outlay for the charging equipment is typically the major cost factor. These expenses are likely to increase in the future years as labor and building material costs (e.g., concrete costs etc.) continue to increase.

8) Is there any potential that the technology will change format (ala Beta/ VHS) and we will be down the wrong format?

The stations installed through the project will use Level 1 and Level 2 charging options which use the Society of Automotive Engineer (SAE) standard J-1772 connectors. This SAE connector was adopted globally as a standard through an expedited process and extraordinary



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collaborative efforts by automotive engineers. Because we are using technology that has been through a rigorous approval process, is uniformly agreed upon, and is universally complied with, the chances it will become outdated in the near future are unlikely. We are not promoting use of the Level 3 DC fast chargers at this time because this standard has not been agreed upon across-the-board.

9) If the cars are not here yet, why not just do an advertising campaign now saying we will support in the future?

This proposal is an initial investment which will propel migration toward increased use of EVs. Our strategy must include both increasing EV vehicle acquisition (public, private, and individual) as well as a solid network of publicly available EV charging stations. It is likely that an increase in use of EVs will not be realized without adequate charging stations.

The array of benefits from EV use including: no emissions from the tailpipe; the option to use locally produced, renewable energy; freedom from imported fossil fuels and pricing; fuel-cost savings (2 to 3 cents per mile); and significant maintenance cost reductions (U.S. Post Office study documents savings of 54% for maintenance) merit support now.

10) I would like the City of Minneapolis to explain why their units are so much more expensive on a per unit basis than any other location. (Perhaps you could explain this?)

In preparation for future EV charging stations, the City of Minneapolis commissioned an extensive feasibility and proposed installation drawings study to obtain information related to installation of charging stations in the downtown A, B, C Ramps, Haaf and Leamington Ramps. This study indicates that for the targeted number of stations the existing electrical distribution systems in the ramps would need to be upgraded. The aggregated total of the expenses for these upgrades is reflected in the installation costs.

The electric vehicle supply equipment (EVSE or charging station equipment) costs are predictable and explicitly stated in the statewide EVSE contract, however, installation costs can vary significantly. The deployment of the first charging stations in the metro area has confirmed a need to budget for a range of installation costs. This is due to variations in the state of the electrical service, including the need for upgrades and improvements, along with the distance of charging station installation from the service.

For the entire project, there will need to be some flexibility accorded between the actual cost for each station and the number of stations installed. The total budget allocated by TAB and the corresponding dollar amounts will not be exceeded. If the installation costs come in under budget, we will return the savings.

11) I would also like MPCA to explain why the units are so heavily concentrated in the core cities with very little presence in the suburbs.

During the project approval process, members of the Transportation Advisory Committee (TAC) advised MPCA to target placement of the charging stations in 'high-use density' locations. Under the guidance of TAC members we used Metro Transit maps and data to identify these optimal locations and placement of the stations. Charging stations will be in suburban locations



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at Park and Ride facilities. Suburban commuters will have access to charging stations in the core cities.

12) 104 electric auto trips at 0 emissions = 31kg reduction? Therefore, we are eliminating the equivalent of 104 car trips per day? How does this significantly affect metro emissions compliance?

The vehicle emissions calculated in CMAQ applications are tailpipe emissions. Electric vehicles have zero emissions from the tailpipe—regardless of the number of trips. In contrast, gasoline-powered cars making 104 vehicle trips per-day results in 31 kg of emissions. Therefore, use of electric vehicles with no emissions instead of gasoline-powered cars results in a net reduction of 31 kg in emissions per-day.

The intent of this project is to build a foundation for getting Minnesota 'EV Ready'. This will lead to a continual increase in the number of EVs being driven therefore contributing to improved regional air quality.

13) How many kg per day do our newest, most efficient buses generate in an 18 mile trip? Looks like each car generates .30 kg or 323.10 grams per day on an 18 mile trip? (I believe the bus emission rate comes right out of the CMAQ emission rate table and the auto emission amount is simply the rate times the mileage)

The most efficient Metro Transit hybrid buses emit 31.1 grams NO_x and 1.2 grams for particulate matter (PM) for 18 miles. Because CO levels are relatively low for diesel engines the EPA focuses on measuring NO_x and particulate levels.¹ The combined total is an impressive 32 grams per day for an 18 mile trip (not including CO emissions).

Gasoline-powered cars powered emit a combined total of 323 grams per day of NO_x, PM and CO for an 18 mile trip as stated in the question. Electric vehicles compare favorably to these options because they emit no emissions from the tailpipe. The levels for all air pollutant emissions from EVs is zero grams per day for an 18 mile trip.

14) What kind of charging stations are they? Are these all located at places where there are a lot of people like a park and ride, or are some of these free standing, out there on their own?

Our proposal seeks to install Level 2 charging stations. In some instances, these stations will include both Level 1 and Level 2 charging options. The charging stations installed through this project will be placed only in publicly-owned surface, ramp and on-street locations. The surface lot locations include Park & Ride facilities. The locations were chosen to assume early, strong usage rates.

15) Is there any research data to support MPCA's theory that public installation of charging stations is necessary to permit potential buyers of electric vehicles to overcome "range anxiety" and result in increased purchases of EVs?

Use data collection is in the process of being collected by the first federal Transportation Electrification grant recipients. A trial program by the Tokyo Electric Power Company suggested that even with minimal charging infrastructure their drivers became more comfortable driving further and approaching their maximum speed.² From a literature review by the Pew



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Center for Environmental Excellence, "The installation of public charging infrastructure can also help reduce range concerns and spur BEV [battery powered electric vehicles] sales."³

Our goal of installing 1 station per 100 electric vehicles is based upon the recommendations of Project Get Ready⁴, a national collaboration of major U.S. cities and private businesses. This is a conservative goal relative to the concept of 'blanketing' an area with charging stations.

16) It's my understanding that during the 1990's, California installed electric charging stations in response to a state statute that mandated a % of vehicle sales had to be emission-free. What lessons were learned from that experience? Did that increase the number of electric vehicles that were purchased and used? How much were the stations actually used?

California did mandate a percentage of zero emission vehicles by the State of California and installed charging stations, in the 1990s. The General Motors EV1, Ford EcoStar and the Toyota RAV electric vehicles were produced during this time period. The use of these vehicles was short-lived due to the withdrawal of these vehicles from the market by the automotive manufacturers.

We were unable to source any data related to how much the charging stations were used. It would be difficult to make a correlation between the purchase of the EVs since they were limited in number and available for a relatively brief period. The majority of the public did not have access to purchase or lease them.

17) Assuming vehicle manufacturers are successful in selling lots of EVs; does MPCA intend to continue public installation of charging stations statewide? Does MPCA have a plan to increase private development of these stations?

The data we collect from this proposed project will assist private property owners. Through the Drive Electric Minnesota partnership, along with our private, non-profit, utility, and local government members, we plan to continue to promote the installation of publicly-available charging stations throughout the state. Our current focus is on the metro area. We will encourage private installations especially at places of employment. Charging stations in public parking facilities will complement charging station installations at privately-owned locations.

18) Would \$250K or some other amount and a scaled down project still be acceptable?

The proposed funding level was established through consultation with TAB staff, TAC members, and project partners. While this proposed fund level is preferred, we would be willing to provide a modified proposal for a reduced funding amount.

19) Another idea I had was using some of the CMAQ money for partial subsidy of the charging stations. For example, if these stations are going to be owned by the entity where they are installed, why don't we develop a program where we help the owner of the facility with install by offering a \$2,000 subsidy (amount arbitrarily selected) per charging station to help reduce the cost of installation? This might incent certain property owners to install the stations and we would not have as much money invested in this system but would still be offering some level of assistance to encourage the establishment of electric vehicle charging stations. Maybe we could cap out the program at something like \$100,000-150,000 and then have any unspent funds revert to us after 3 years and we will use that money in some other way.



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For future projects, we are open to other ideas related to funding for the charging stations.

20) How is the request for \$500,000 for charging stations better use of funding than for other transit options?

Electric vehicles are complementary rather than competitive with other efforts to improve how we get from one location to another. For example, you could drive an electric vehicle to the light rail station or to a Park & Ride then take the train or bus to your final destination.

As reflected in the following table, when this EV recharging project is compared to two CMAQ bus purchases and all the submitted CMAQ System Management projects after normalizing their cost equal to the EV project, the emission reduction and emission reduction cost effectiveness is comparable. EV project has third best emission reduction and third best emission reduction cost effectiveness.

	total project cost	emission reduction in KG per day	cost effectiveness cost per KG per day	factor	revised cost	revised emission reduction	revised cost effectiveness
2009 CMAQ Transit Expansion projects							
CMT-09-11: Purchase 3 buses and fund start-up service	\$2,010,000	82.5	\$ 24,364	3.21	\$ 626,168	25.7	\$ 24,364
CMT-09-12: Purchase 6 buses and fund start-up service	\$3,606,923	66.4	\$ 54,321	5.77	\$ 625,117	11.5	\$ 54,321
2009 CMAQ System Management projects							
Airport South ITS	\$1,275,000	45.4	\$ 28,084	2.04	\$ 625,000	22.3	\$ 28,084
TH 61 Signal Retiming and Coordination	\$1,741,400	373.2	\$ 4,666	2.78	\$ 626,403	134.2	\$ 4,666
TH 5 Signal Retiming and Coordination	\$1,677,930	81.9	\$ 20,488	2.68	\$ 626,093	30.6	\$ 20,488
TH 55/ TH 13/ TH 149 Signal Retiming and Coordination	\$1,127,380	67.7	\$ 16,653	1.80	\$ 626,322	37.6	\$ 16,653
TH 61 Freeway Management System Project	\$3,600,000	98.1	\$ 36,697	5.76	\$ 625,000	17.0	\$ 36,697
TH 610 and 252 Freeway Management System Project	\$2,600,000	60.0	\$ 43,333	4.16	\$ 625,000	14.4	\$ 43,333
EV recharging					\$625,000	31.0	\$ 18,769

When the EV recharging project is compared to two CMAQ bus purchases and all the submitted CMAQ System Management projects after normalizing their cost equal to the EV project, the emission reduction and emission reduction cost effectiveness is comparable. EV project has third best emission reduction and third best emission reduction cost effectiveness.

Reference Sources:

¹ Metro bus (hybrid) data provided by Chuck Wurzinger, Metro Transit.

² Hiroyuki, Aoki. Toyota Electric Power Company Report Presentation. November 5, 2010. climate.dialogue.org.hk/files/res/69/en_HiroyukiAoki.pdf (Accessed 11-3-11).

³ Ralston, Monica. Nigro, Nick. Plug-in Electric Vehicles: Literature Review. www.pewclimate.org/docUploads/PEV-Literature-Review.pdf (Accessed 11-3-11).

⁴ Project Get Ready. projectgetready.com (Accessed 11-3-11).



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