Electric Vehicle Charging Station Infrastructure Development
Twin Cities Metropolitan Area

Submitted by:

Minnesota Pollution Control Agency

August 2011

Project Background

To prepare Minnesota to be 'electric-vehicle ready' a partnership of local and state government, our largest utility, private business and nonprofit entities are working in collaboration as the Drive Electric Minnesota[1] coalition to bring electric vehicles (EVs) and plug-in charging infrastructure to our state. The Minnesota Pollution Control agency provides leadership and coordination for this coalition which seeks to install publically available plug-in charging stations and to spur the early procurement of electric vehicles by local government. Through this collaboration an initial installation of electric vehicle supply equipment (EVSE) is planned to result in approximately 25 on-street, parking ramp and surface lot charging stations. Four of these stations, designated to be solar powered, are part of the Energy Innovation Corridor, adjacent to the light rail corridor, between the Cities of Saint Paul and Minneapolis.

Early procurement of Ford Transit Connect electric utility vehicles, coalition partners, has resulted in the first of these vehicles being delivered to the City of Saint Paul in December 2010. The Saint Paul Park and Recreation department is currently using the city's Ford Transit Connect for their internal parts delivery services. Deliveries of the Ford Transit Connect will also be made to the City of Minneapolis, the Metropolitan Airports Commission, the MN Department of Administration and Hennepin County in July 2011.

Why support the use of electric vehicles (EVs)? Over half of the hazardous air pollutants in our state are emitted from cars and trucks.[2] EVs emit no toxic air pollutant emissions at the tailpipe and when charged with renewably generated solar or wind-source electricity there is also zero-emissions during the electric energy generation. EVs can be part of solving our state's air pollution problems.

- Efficient: An electric motor is more efficient than a combustion engine and therefore less expensive to operate. Typically it costs 2 to 3 cents per mile for electricity to power an EV.

- Simple: Electric motors operate quietly and have fewer moving parts than a gasoline engine, which means less maintenance. For example, EVs do not have transmissions or require oil or coolant changes.

- Locally-generated renewable energy: Driving an EV offers the option of using renewable solar and wind-source electricity for charging the batteries. The Drive Electric Minnesota coalition has a goal of encouraging the use of renewable sources of electricity to charge EVs. Use of electricity to power these vehicles also keeps most or all of the money used for powering the vehicle in the local community.

- Energy Independence: EVs reduce our dependence on imported fossil fuels.

Jobs Creation

Each plug-in charging station typically requires 8 to 12 hours of technical site review and installation labor depending upon the site conditions. Build of an electric vehicle infrastructure through the installation of plug-in charging stations contributes to local economy while establishing a way to use locally-generated energy to power vehicles.

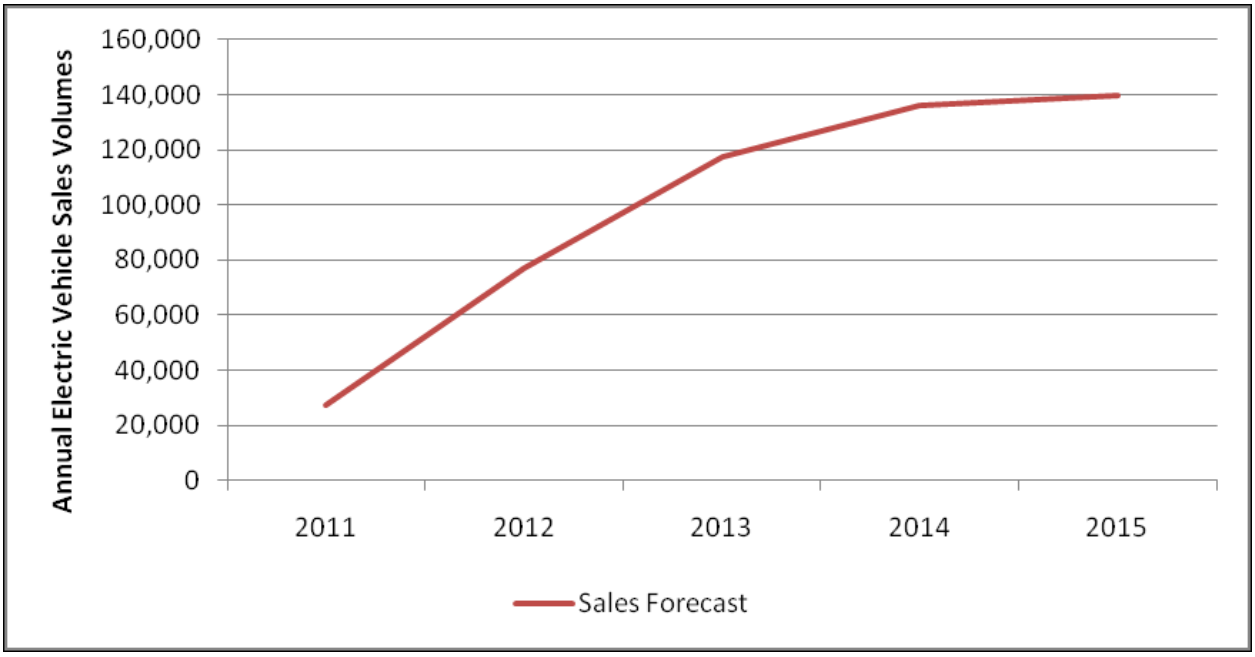
Funding Request

The funding request for this project is for the allocation of $500,000 from the non-competitive Congestion Mitigation Air Quality (CMAQ) program for use toward the procurement and installation 76 electric vehicle charging stations in the metro area. The proposed charging station locations were selected based upon expected high occupancy rates that will result in optimal carbon dioxide, nitrous oxide and volatile organic compound hazardous air emissions reduction. With a 20% match of $125,000 the total project cost proposed is $625,000.

EV Market Assessment

According to the 2010 National Automobile Dealers Association (NADA) Report[3] vehicle registrations for plug-in electric vehicles (PEVs) are anticipated to be 2.8% of the total by 2015. For the approximately 150,000 annual registrations in Minnesota this translates into 4,200 new PEV vehicle registrations per year beginning in 2012. NADA projects a progressive increase in the rate of EV production in future years. The cumulative number of PEVs anticipated on the road in Minnesota by 2015 is 12,600.

U.S. National Electric Vehicle Adoption Assumptions: 2011-2015



Source: HIS Global Insight, JD Power, Center for Automotive Research

As reflected in the above graph from the "Deployment Rollout Estimate of Electric Vehicles" January 2011 report by the Center for Automotive Research, sales growth for EVs are predicted to incrementally, increase over the next 4 to 5 years.

Early last year, Nissan North America opened pre-order reservations for the first 20,000 Nissan Leafs. Of those reservations, 189 are from Minnesotans, which places our state in 20th place for the reserver count. Another 4,472 Minnesotan's have expressed interest in purchasing the Nissan Leaf outside of the closed,

limited reservations list.[3] This reflects the current limiting factor for EV use which is production of this new automotive technology, not demand.

The production rate for the Chevy Volt will be increased to 65,000 vehicles in 2012.[4] Of those vehicles 2% are anticipated to become owned by Minnesotans who will begin to be able to purchase them in November of this year. The result is anticipated sells of 1,300 Chevy Volts each year, during the near future, in the state.

These two frontrunner EV models will quickly be followed by the Ford Focus Electric and C-MAX Energi plug-in hybrid, the Tesla S model (hatchback sedan), Toyota RAV4 EV, Honda FIT EV, Mitsubishi I, Daimler Smart Fortwo ED and the Think car in 2012.

The Minnesota Electric Auto Association reports there are currently approximately half a dozen Tesla Roadsters in use in the state. Later this year another EV sport car model, the Fisker Karma, will become available through a local Volvo dealership. ReGo Electric Conversions, in Minneapolis, has recorded conversion of over 50 hybrid vehicles to plug-in hybrid electrics. As this company continues to provide this service additional plug-in vehicles will be on the streets along with drivers seeking a place to plug-in and charge the batteries.

Federal EV Incentives

Most electric vehicles currently qualify for a $7,500 federal tax credit that requires the vehicle has a battery that has at least four kilowatt hours of capacity, uses an external source of energy to recharge the battery, has a gross vehicle weight rating of up to 14,000 pounds, and meets specified emission standards. The credit will begin to be phased out for each manufacturer in the second quarter following the calendar quarter in which a minimum of 200,000 qualified plug-in electric drive vehicles have been sold by that manufacturer for use in the U.S.

Ratio - Charging Stations to EVs

A recently completed needs assessment by Project Get Ready[5], a national collaboration of cities, local government units and businesses, determined that one charging station is needed for every 100 electric vehicles. This ratio indicates that a minimum of 125 plug-in charging stations should be installed in the Minnesota by 2015. The 25 plug-in stations currently being installed along with the 76 for a total 101 charging stations will bring the state close to this achieving this goal.

Electric Vehicle Supply Equipment (EVSE)

Through a Minnesota Department of Administration open bid process four EVSE vendors were selected and subsequently included in a statewide contract. Local governments and other public entities have the option to use these or other EVSE vendors.

Each EVSE vendor lists optional costs related to networked data collection and billing management features for their charging equipment. These costs vary depending upon the equipment attributes. For example, if a charging station has the capability to read radio frequency identification (RFID) from a charge card and subsequently bill, there is typically a $150 to $400 annual service charge per station. There are less expensive EVSE systems that do not include networking capabilities for billing or energy use data capture that can be used by drivers using leased parking stalls or by publicly-owned fleets.

Under the current statewide contract the cost for EVSE ranges from $1,000 to $4,500 per charging stations depending upon the features selected. Installation costs are additional. The installation costs typically vary with proximity is to electrical service and if any electrical equipment upgrades are needed. Strategic location planning can keep these costs lower; however, a preference may be given to intentionally providing prime EV parking locations even though this will incur additional costs.

Charging Station Maintenance

Project participants, as owners of the electric vehicle supply equipment (EVSE) used for the charging stations will be responsible for their maintenance. EVSE vendors typically partner with local electrician firms should expert repair consultation or services be needed. This includes efficient mobile repair and replacement services if needed.

Project participants will be responsible for collecting any fees from charging station users to cover maintenance and operating costs, in a similar manner as for parking meters. The fee assessed at the charging station will be determined independently by each participating entity. It is anticipated that the revenue collected will offset operations and maintenance costs.

Each EVSE vendor lists optional features and associated costs related to networked data collection and billing management for their charging equipment. For example, if a charging station has the capability to read radio frequency identification (RFID) from a charge card and subsequently bill, there is typically a $150 to $400 annual service charge per station. There are comparatively less expensive EVSE systems that do not include networking capabilities for billing or energy use data capture can be dedicated for fleet use only or installed in leased parking stalls for which operating costs are incorporated into the lease fees.

EVSE maintenance is anticipated be minimal since this is primarily solid state electronic equipment with few moving parts. Occasionally the screens for the chargers may need to be wiped if for some reason they become opaque due to dirt accumulation. The attached plug-in cables will need to be checked for wear. Each EVSE vendor works in partnership with a local electrician company for consultation and service should it be necessary. Overall, the maintenance level for the EVSE is expected to be comparable to that of newer electronic parking meters. The original equipment manufacturer warranty for EVSE is typically for a length of two years.

Charging Station - Location Survey

A survey created by the MPCA was distributed to potential responders through the Minneapolis Transportation Management Organization (TMO), Smart Trips, the 494 Corridor TMO and the Anoka County TMO. These early results indicate an interest by potential EV drivers in having plug-in charging stations located in downtown parking ramps, at Park and Ride facilities, and at transit hubs. These preferred charging station sites are included in the selected locations of this proposal. Other location preferences include public shopping mall, hospital, bank, and large hotel facilities which are not included in the proposal since these are not publically-owned facilities. Complete results of this survey are included in the Appendix section.

Project Emissions Reduction

The levels of CO, NOx and VOC emissions reduction can reasonably be expected from full implementation of this project are reflected in the following chart.

VEHICLE EMISSIONS REDUCTION WORKSHEET (APPENDIX G)

Electric Vehicle Recharging Stations

Year 3 Estimated Daily Usage of the Recharging Stations					104	# electric auto trips	
Estimated average trip distance using electric vehicles recharged on site					18.0	miles	
Year 3 Estimated Daily Electric Auto VMT					1728		
Equivalent Year 3 Estimated Daily Gas Auto VMT					1728		
GAS AUTO EMISSIONS GENERATED							
Average Weekday Auto Travel Speed:				30	mph		
		YEAR THREE					
	Emissions Factor (grams/mile)*	**Daily Gas Auto VMT (miles)**	**Emissions (kg/day)**				
CO Emissions	14.88	1,728	25.7				
NO_x Emissions	1.68	1,728	2.9				
VOC Emissions	1.39	1,728	2.4				
Total Emissions			**31.0**				
ELECTRIC AUTO EMISSIONS GENERATED							
Average Weekday Auto Travel Speed:					mph		
		YEAR THREE					
	Emissions Factor (grams/mile)	**Daily Electric Auto VMT (miles)**	**Emissions (kg/day)**				
CO Emissions	0.00	1,728	0.0				
NO_x Emissions	0.00	1,728	0.0				
VOC Emissions	0.00	1,728	0.0				
Total Emissions			**0.0**				
NET PROJECT EMISSION REDUCTIONS							
	Gas Auto Emissions Generated (kg/day)	**Electric Auto Emissions Generated (kg/day)**	**Net Emission Reductions (kg/day)**				
YEAR THREE	31.0	0.0	**31.0**				

*Appropriate emissions factors are based on average speed.

As reflected in the Vehicle Emissions Reduction Worksheet, the project will reduce emissions by 31.0 KG per day.

Cost Effectiveness = $625,000/31.0 KG = $18,769/KG/DAY reduction in CO, NOx and VOC emissions.

Resource Citations

[1] Drive Electric Minnesota web page at driveelectricmn.org

[2] Air Quality in Minnesota: Emerging Trends. 2009 Report to the Legislature. Found at www.pca.state.mn.us/index.php/view-document.html?gid=5658

[3] National Automobile Dealers Association Data 2010 Report. nada.org/Publications/NADADATA/default.htm

[4] Conversation with Regis BuckleyII, Chevrolet Zone Manager, MN, ND, Wisc

[4] Project Get Ready Menu. projectgetready.com/resources/pgr-docs/project-get-ready-menu-draft

Proposed Twin Cities Metro-Area

EV Charging Station Installation Locations

CMAQ Project: EV Plug-in Charging Station Locations

City of Saint Paul

# stations to be added at this location	Location	Address	City	Daily Ave # EV Trips	Est. Trip Distance	Daily VMT	Type of Location			
							Shopping	Recreation	Community Center	Office / Residence
3	Como Park Zoo and Conservatory	1225 Estabrook Dr	Saint Paul	6	13	78		X		
1	Como Park Golf and Ski Center	1431 N Lexington Pkwy	Saint Paul	2	13	26		X		
1	McMurray fields	1155 W. Jessamine Ave	Saint Paul	2	13	26		X		
1	Jimmy Lee Recreation Center and Oxford Pool	270 N Lexington Pkwy	Saint Paul	2	13	26		X		
1	Wellstone Community Center	179 Robie St. E.	Saint Paul	2	13	26		X	X	
1	Harriet Island	200 Dr. Justus Ohage Blvd	Saint Paul	2	13	26	X			
2	Smith Avenue Ramp			2	22.2	44.4				
1	Block 19 parking ramp	145 7th St E	Saint Paul	1	22.2	22.2				
2	RiverCentre parking ramp	175 Kellogg Blvd	Saint Paul	2	22.2	44.4	X	X		X
					Total Daily Vehicle Miles Traveled (VMT)	**319**				

City of Minneapolis and MnDOT

# stations to be added at this location	Location	Address	City	Daily Ave # EV Trips	Est. Trip Distance	Daily VMT	Type of Location			
							Shopping	Recreation	Community Center	Office / Residence
3	Jerry Haaf Memorial Parking Ramp	424 South 4th Street	Minneapolis	3	22.2	66.6	X		X	X
3	Leamington Ramp	1001 2nd Avenue South	Minneapolis	3	22.2	66.6	X			X
15	TAD, A Ramp (3 each levels 3,4,5,6,7)	101 North 9th Street	Minneapolis	15	22.2	333		X	X	X
4	TAD, B Ramp	516 2nd Avenue North	Minneapolis	4	22.2	88.8		X	X	X
					Total Daily Vehicle Miles Traveled (VMT)	**555**				

Metropolitan Airports Commission

# stations to be added at this location	Location	Address	City	Daily Ave # EV Trips	Est. Trip Distance	Daily VMT	Type of Location			
							Shopping	Recreation	Community Center	Office / Residence
10	Valet Parking at MSP		Minneapolis	30	13	390			X	
					Total Daily Vehicle Miles Traveled (VMT)	**390**				

Minneapolis Public School Headquarters

# stations to be added at this location	Location	Address	City	Daily Ave # EV Trips	Est. Trip Distance	Daily VMT	Type of Location			
							Shopping	Recreation	Community Center	Office / Residence
2	Minneapolis Public School Headquarters	1250 West Broadway	Minneapolis	2	22.2	44.4			X	
					Total Daily Vehicle Miles Traveled (VMT)	**44**				

Ramsey County

# stations to be added at this location	Location	Address	City	Daily Ave # EV Trips	Est. Trip Distance	Daily VMT	Type of Location			
							Shopping	Recreation	Community Center	Office / Residence
1	Ramsey County Plato Building	90 W. Plato Street	Saint Paul	1	22.2	22.2				X
1	Maplewood Library	3025 Southlawn Drive	Maplewood	2	13	26			X	
					Total Daily Vehicle Miles Traveled (VMT)	**48**				11.1

University of Minnesota

# stations to be added at this location	Location	Address	City	Daily Ave # EV Trips	Est. Trip Distance	Daily VMT	Type of Location			
							Shopping	Recreation	Community Center	Office / Residence
2	East Bank - 4th Street Ramp	Intersection 4th Str.SE & 17th Ave SE	Minneapolis	2	22.2	44.4			X	
2	East Bank - Lot 37 (Stadium)	5th Str. SE	Minneapolis	2	22.2	44.4			X	
2	East Bank - Gateway Lot (Stadium)	Intersection University & 23rd Ave SE	Minneapolis	2	22.2	44.4			X	
2	East Bank - New 'Green' Lot	Intersection Oak & Essex	Minneapolis	2	22.2	44.4			X	
2	West Bank - Lot C86	2nd Street South	Minneapolis	2	22.2	44.4			X	
2	Saint Paul Campus	Gortner Ave. Ramp	Saint Paul	2	22.2	44.4			X	
					Total Daily Vehicle Miles Traveled (VMT)	**267**				

Macalester College

# stations to be added at this location	Location	Address	City	Daily Ave # EV Trips	Est. Trip Distance	Daily VMT	Type of Location			
							Shopping	Recreation	Community Center	Office / Residence
1	Athletic Center	125 Snelling Avenue S	Saint Paul	1	18.8	18.8			X	
1	Theatre	130 Macalester Street	Saint Paul	1	18.8	18.8			X	
					Total Daily Vehicle Miles Traveled (VMT)	**38**				

Metro Transit - Park & Ride Facilities										
# stations to be added at this location	Location	Address	City	Daily Ave # EV Trips	Est. Trip Distance	Daily VMT	Type of Location			
							Shopping	Recreation	Community Center	Office / Residence
2	I-35W & 95th Avenue	Blaine	Blaine	2	7.1	14.2				X
2	Louisiana Avenue	Saint Louis Park	St. Louis Park	2	6.4	12.8				X
2	Cottage Grove	Cottage Grove	Cottage Grove	2	3.5	7				X
2	Foley Boulevard	Foley Boulevard	Coon Rapids	2	6.6	13.2				X
2	Fort Snelling South	Fort Snelling South	Fort Snelling	2	10	20				X
					Total Daily Vehicle Miles Traveled (VMT)	**67**				

Data Sources and Assumptions

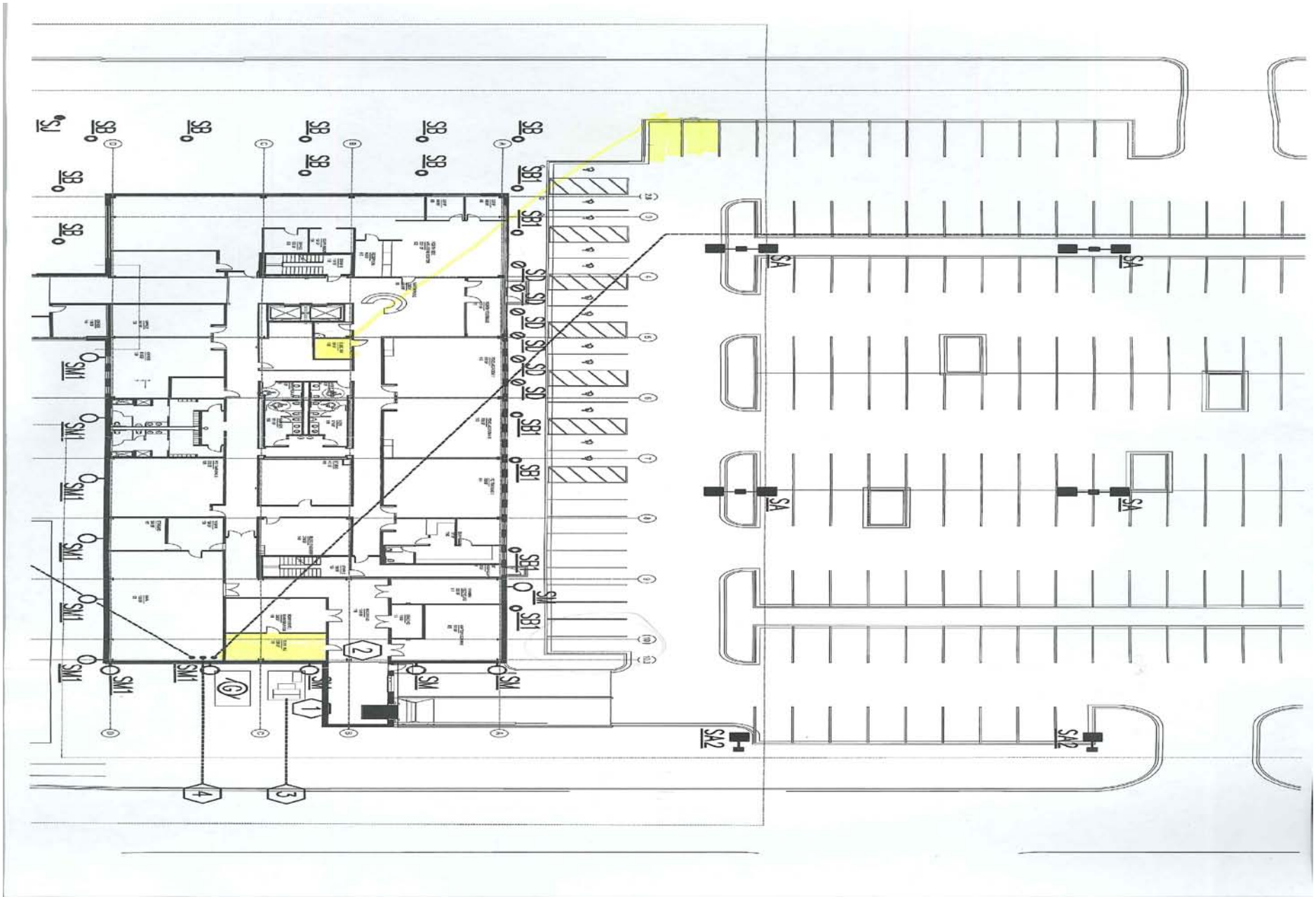
The estimated trip distance metric is from the 2000 Transportation Behavior Inventory Summary Report, Table 57A. The average home to work distance for people who drive is 11.1 miles and for medical, social and recreation purposes it is 6.5 miles. The Metro Transit Park & Ride distances use the straight line (Euclidian) distance to calculate the Average Travel Distance. The actual Travel Distance of a P&R user's trip is probably slightly longer due to the road network. The Macalester College, one-way 9.4 VMT, is take from the 2010 faculty/staff commuter survey, "Macalester College Commuter Options Plan" by St Paul Smart Trips:
www.macalester.edu/sustainability/data/macalestercommuteroptionsplan.pdf
Since the charging stations will provide power to drive distances beyond these metrics, the amounts were doubled to account for evening travel for commuters and other routine daily travel for the other drivers.

Commuter parking in ramps assumes one vehicle occupying the charging station each day. Parking sites associated with shopping and recreation are likely to be used by more than one vehicle per day. In these cases, the assumption is that at minimum two vehicles would be used per charging station per day. The Minneapolis- Saint Paul International Airport parking for charging cars will be in the Valet Parking. The assumption is that a minimum of two vehicles per day will be charged at these stations since the cars are likely to be rotated once they are fully charged.

Location Maps: Plug-in Charging Stations

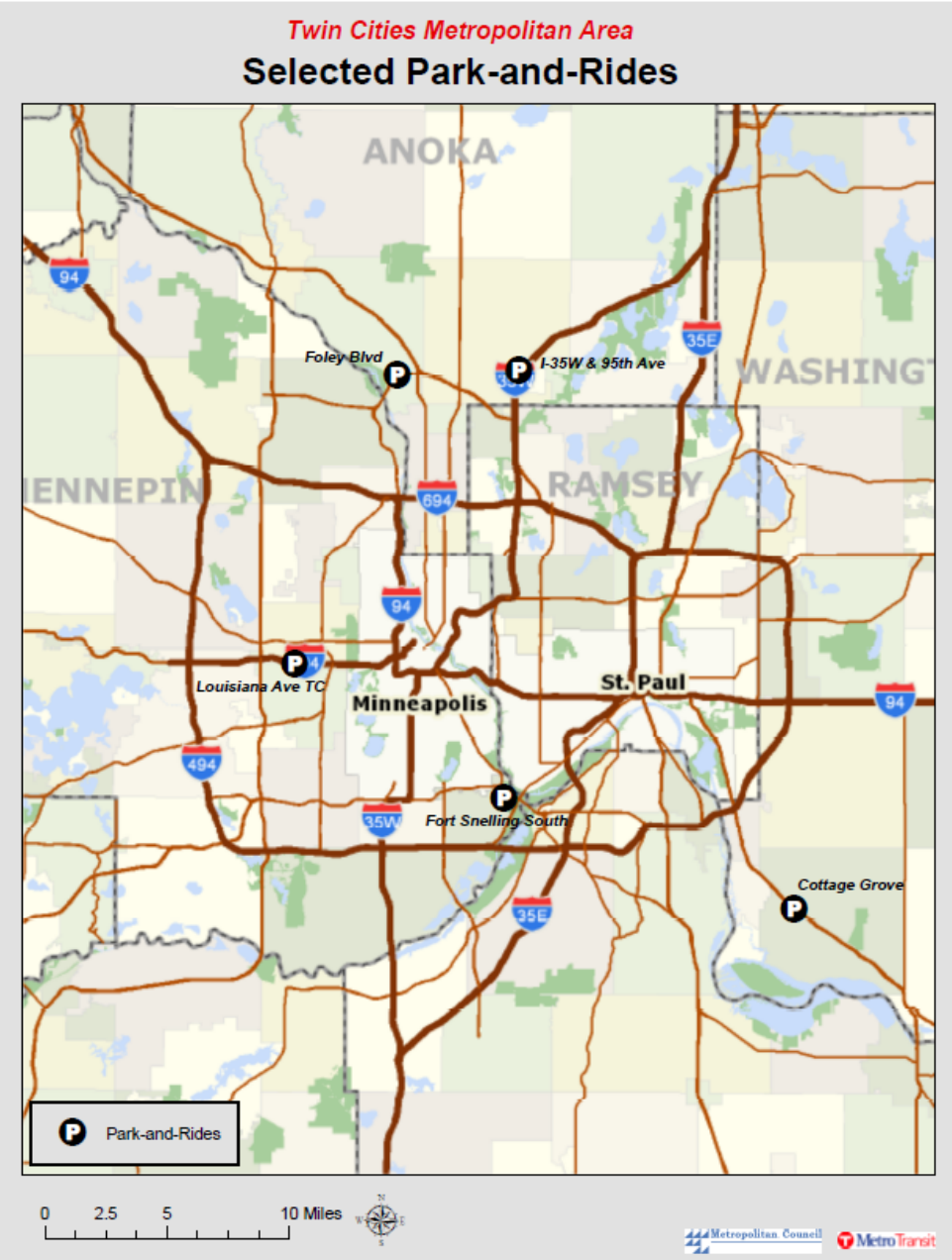
Minneapolis Public School Headquarters Building

Charging Station Locations - Highlighted in Yellow



Metro Transit – Park-and-Ride Facility

Charging Station Locations



Minneapolis – MnDOT Parking Ramps

Selected Ramps - Charging Station Locations

Appendix: Charging Station Location Survey Results

Charging Station - Location Survey Results

Minnesota Pollution Control Agency

Electric Vehicle Plug-ins

The future is here! We need your help in preparing for use of electric vehicles (EVs) in the metro area. This fall as EVs come on the market, drivers will need access to charging stations for repowering their vehicle batteries. It is important to get a good idea of where to place the plug-in charging stations for maximum convenience.

By answering this one minute survey you will be help determine where these EV charging stations should be located and how many are needed.

1. If you were to buy an electric vehicle in the next 5 years, where will you be most likely park it during the day?

16 (59.3%)	Downtown Minneapolis
10 (37.0%)	Metro Transit Park & Ride
1 (3.7%)	Downtown Saint Paul
0 (0.0%)	Minneapolis - Saint Paul Airport
8 (100.0%)	Other location, please describe:

2. Which type of parking facility do you currently use?

7 (20.6%)	Leased spot in a parking ramp or flat lot
3 (8.8%)	Hourly rate spot in a parking ramp or flat lot
1 (2.9%)	Parking lot owned by your employer
24 (70.6%)	I don't use a parking facility

3. If you had an EV, how long would you anticipate leaving your vehicle in the parking space that has a charging station?

22 (68.8%)	A full 8 to 9 hour workday
3 (9.4%)	4 hours or less
3 (9.4%)	2 hours or less
6 (18.8%)	Only as long as it took to charge the car

4. Is there a particularly convienient location where you would like to see an EV charging station installed? If so, please describe it below.

18 (100.0%)

Charging Station - Location Survey Results (as of June 22nd)

Other suggested plug-in charging station locations suggested by survey participants:

- Metro Transit Park and Ride 394 and County Road 73
- Loring Ramp at the Hyatt Hotel on Nicollet
- Applied Parking Ramp by HCMC
- Shopping mall parking areas, especially in the suburbs. Definitely Park and Ride Stations.
- In the private parking area of my condo.
- Foley or Northtown Transit Center
- On the convention center side of downtown within 4 blocks of 9th and Marquette. In cheap parking
- Anywhere there is a public transportation node – NiceRide Kiosks, Transit Hubs, Public Schools
- Near Lexington and University Avenues in Saint Paul
- Midtown area – 28th and Chicago
- 2701 Wells Fargo Way (4th Avenue South) in Minneapolis
- Downtown Saint Paul
- Hopkins Park & Ride at Excelsior Blvd and the Whole Foods store near Lake Street in Minneapolis.
- Third Avenue and 6th street downtown Minneapolis
- Downtown parking garages.
- On the edges of downtown
- On the Abbott Northwestern Hospital Campus
- Hopkins Park and Ride
- Far western suburbs

Example of Inquiry about Charging Stations

From: Sam Villella [mailto:sdvillella@gmail.com]
Sent: Saturday, June 11, 2011 9:01 AM
To: lisa.thurstin@lungmn.org; kay.kelly@go.doe.gov; kelly.marczak@lungmn.org; Nelson, Michael (MPCA); ralph.groschen@state.mn.us; Ellingsworth, Robert (DOT); Morse, Tim (ADM); jon.williams@centerpointenergy.com; scott.benson@gsa.gov; Rebecca Lundberg
Subject: re: EV Incentives & Infrastructure

All-

I recently reserved a Tesla Model S 100% electric vehicle which I will hopefully take delivery on sometime next year. I was wondering what you could tell me about pertaining to potential or planned electric vehicle incentives & infrastructure as in charging stations. Thank you in advance for your insight.

Sincerely-

Sam Villella
10534 Alamo Street NE
Blaine, MN 55449

763-208-2893
763-226-0406