

Supporting EV Adoption via en-route Charging Stations in Delaware

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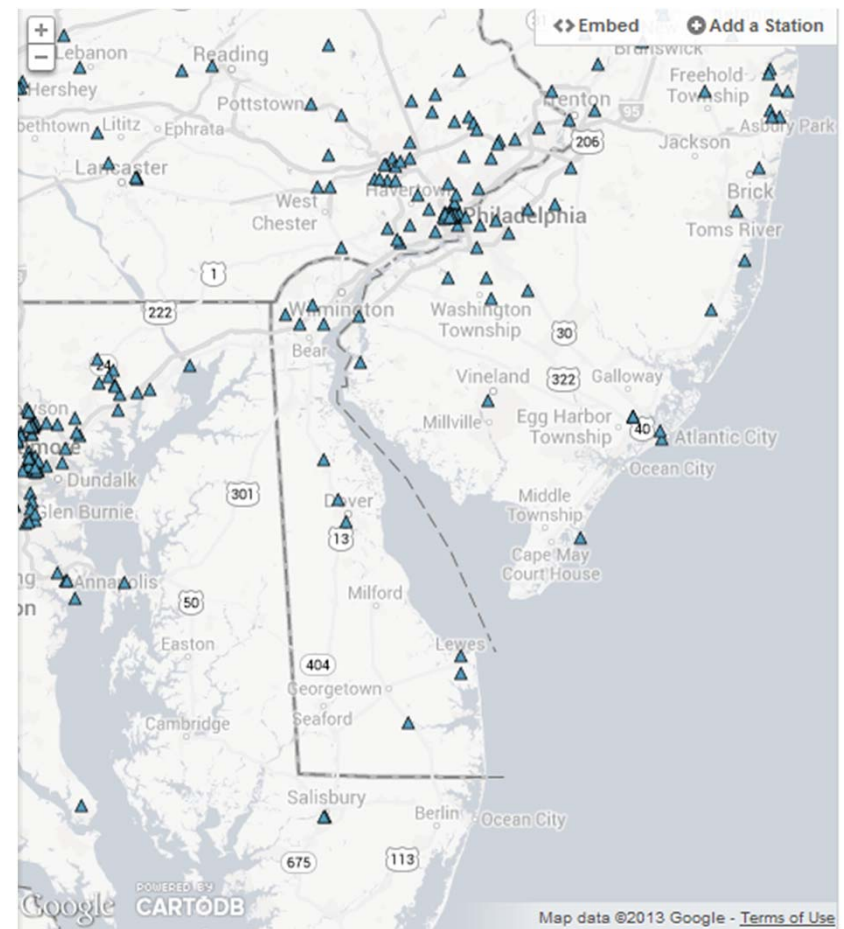


Large multi-year EV research program

- UD research since 1997, running EVs since 2007
- Currently ~\$800K/year, ~15 researchers
- Driving EVs, registered PJM power provider from EVs, design and install EVSEs, surveys of drivers
- All above informs the Charging Station program

Introduction

- En-route recharge biggest boost for EV sales
 - Extend travel cheaply
 - Reduce range anxiety
- Only 9 charging stations in Delaware
 - Most are not accessible to all electric vehicles
 - Low power, slow recharge
 - Only one at each location
 - Not located to extend trips



Source: Alternative Fuels Data Center

The Big Question:

Where in Delaware can charging stations most encourage EV travel?



Need to locate well to support en-route recharge

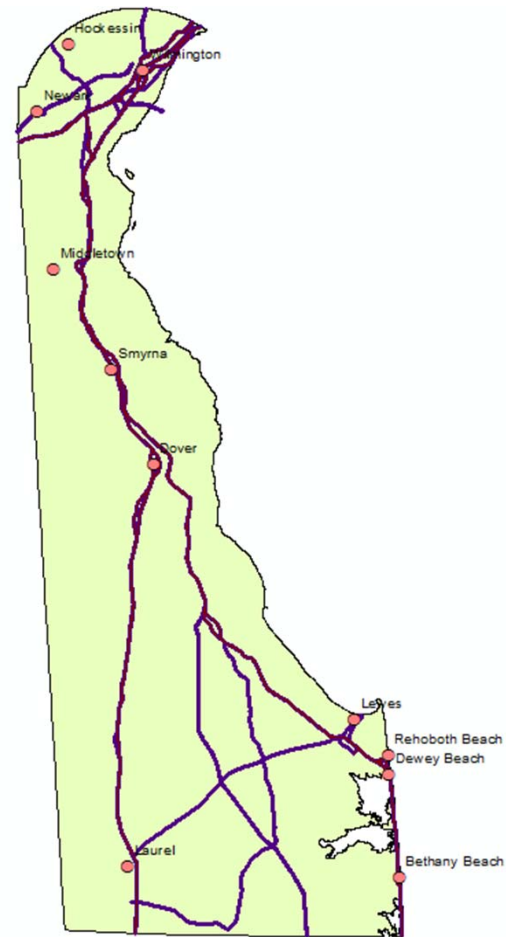
Step 1: Determine Parameters

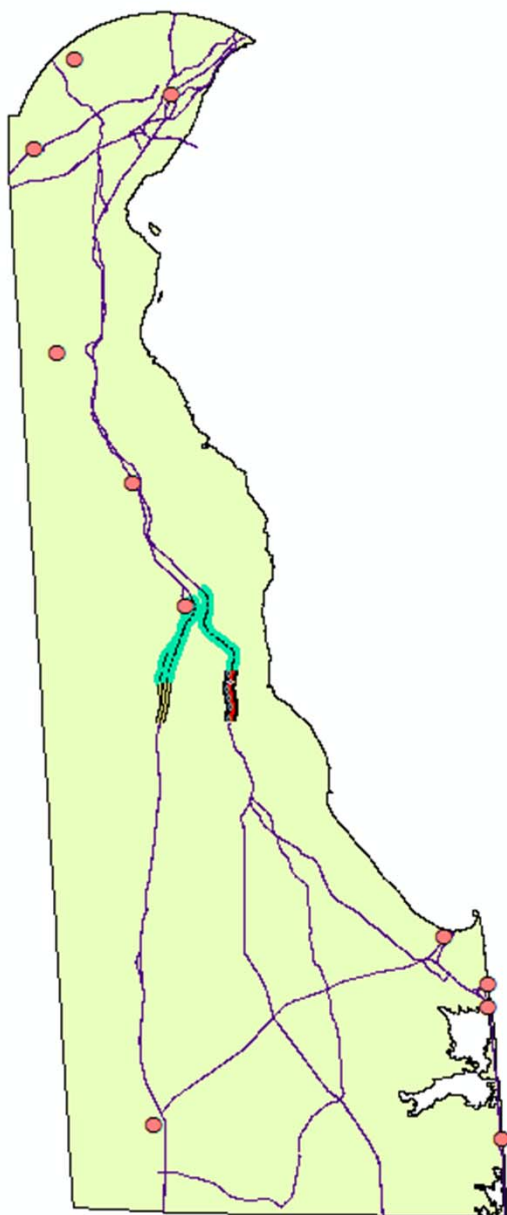
- Nissan Leaf used as baseline
 - Lowest range on market (Average of 73 miles/charge)
 - But can't count on 73 miles, lowered by:
 - Air-conditioning/ Heating
 - Cold battery
- 50 miles used as a “worst-case scenario”



Step 2: Determine Long Routes in DE

- Wilmington - Rehoboth Beach
- Wilmington - Bethany Beach
- Laurel, DE - Wilmington
- Hockessin - Rehoboth Beach
- Hockessin - Bethany Beach





Step 3: Analyze Routes

- 50 mile radii circles were drawn around each major city
 - Ensures “worst-case scenario” is met.
- Circles were clipped to fit major roads
- The routes were overlaid
 - This created a “Critical Recharge Zone” (CRZ) for the state.
- The CRZ for the State
 - South Dover

Step 4: Site and facilities

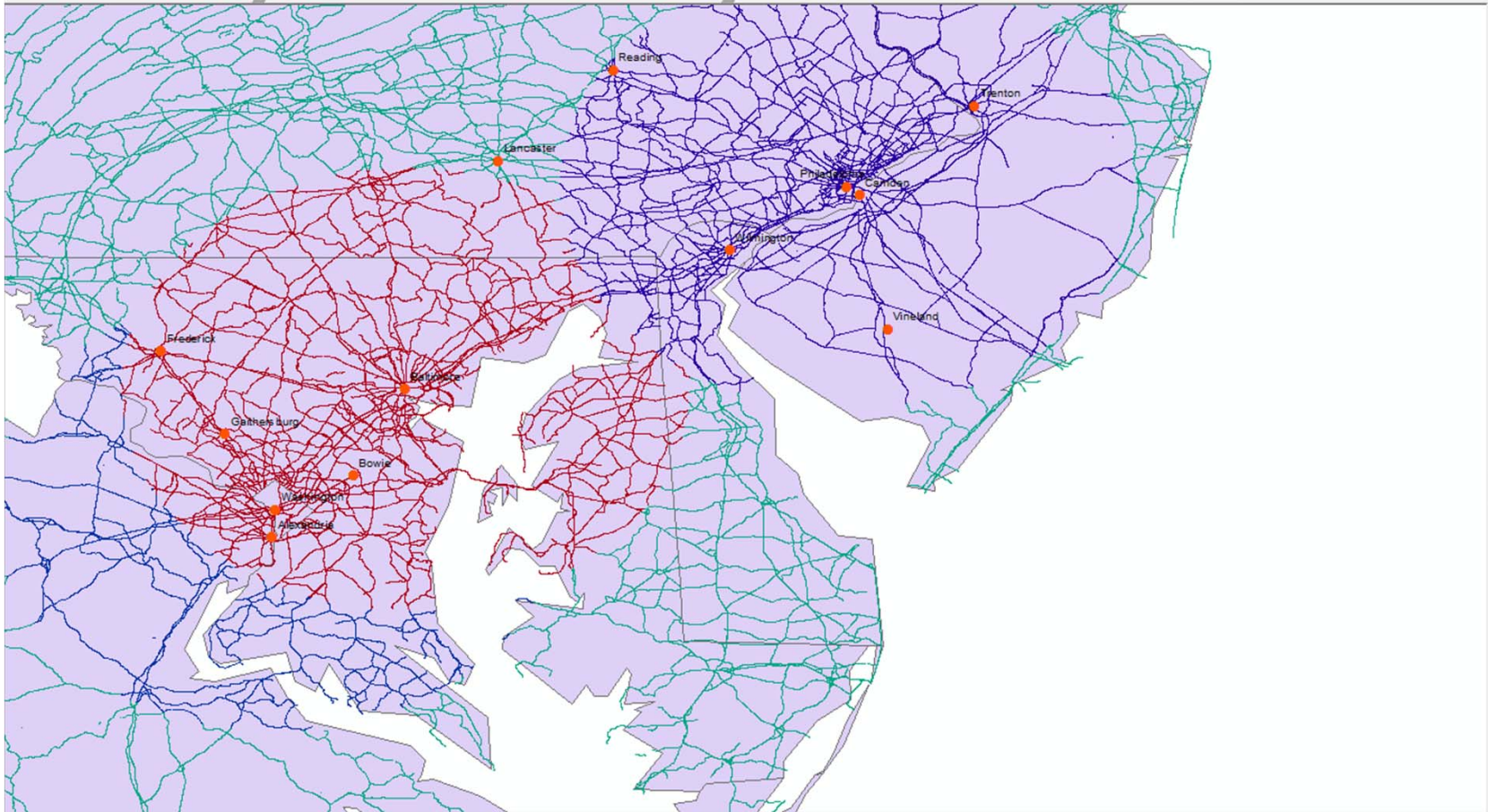
- Pick a location with these attributes:
 - Easy on/Easy off access from through route
 - Something to do during charge (food, recreation, shop)
 - Site owner agrees to host charging station
 - Agrees to continue availability after 2 year initial period
 - Commercial entities may be asked to pay for station/install
- Charging station
 - Durable, outdoor equipment
 - No cost to user for initial 2 year period, to encourage use
 - Max power for standard J1772 charger (16-18 kW)
 - A few IEC chargers (low cost, high power), 52 kW
 - Two stations per location
 - High power charging station adds little cost, allows for and encourages faster recharge EV models

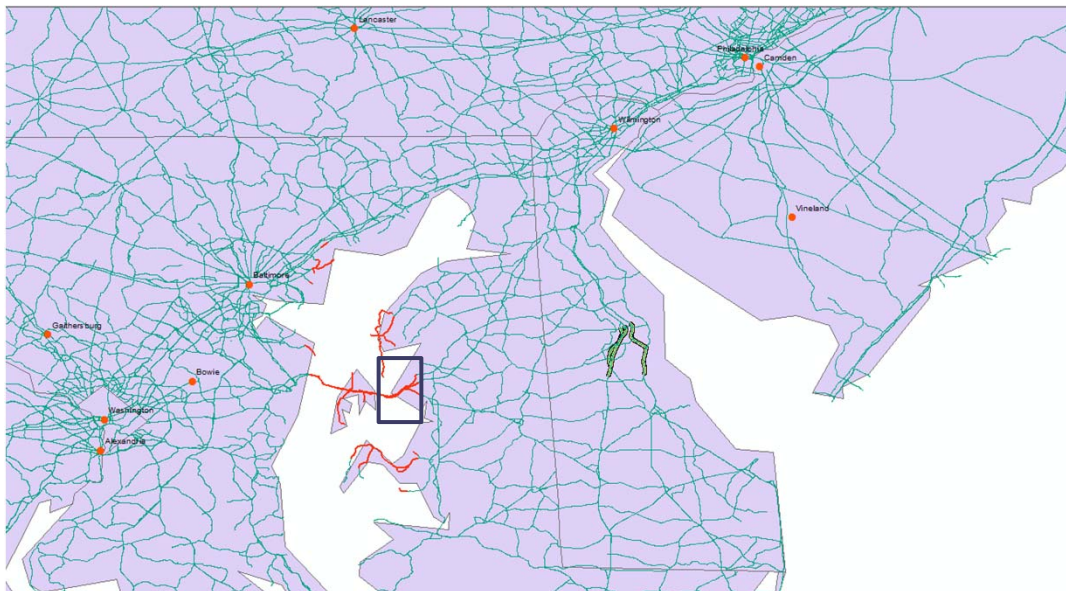
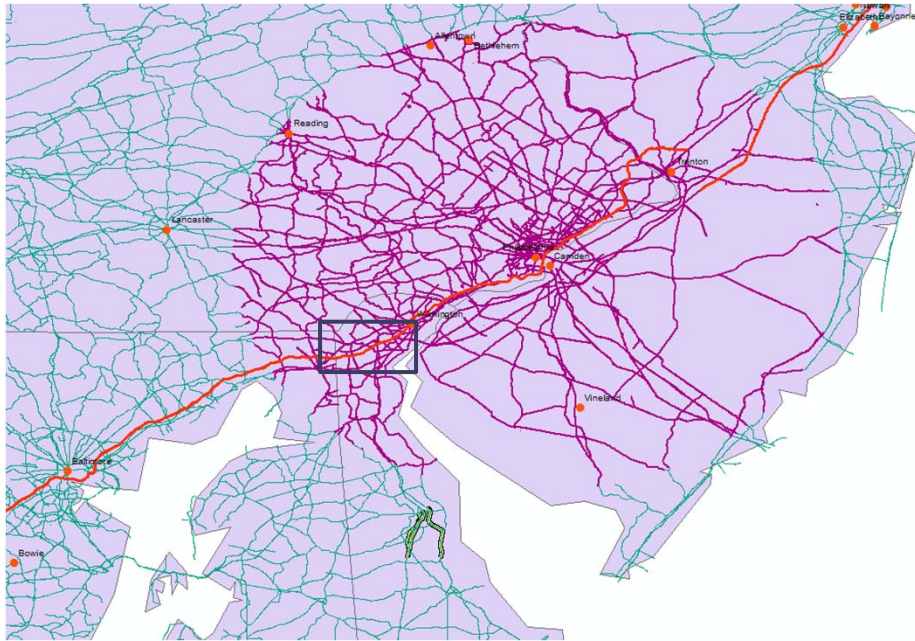


Step 4: Site and facilities

- Signage and communication
 - Signs on road and leading to station
 - Sign gives connector type and kW rating
 - Enter in data bases, such as US DOE, Recargo
 - Other information/education possible
- Possible synergistic programs
 - Charging at popular destinations
 - Beaches
 - Shopping
 - Work with neighboring states for I95, state 301, state 202 and other throughways (see following)

Does this work on a Regional Level?

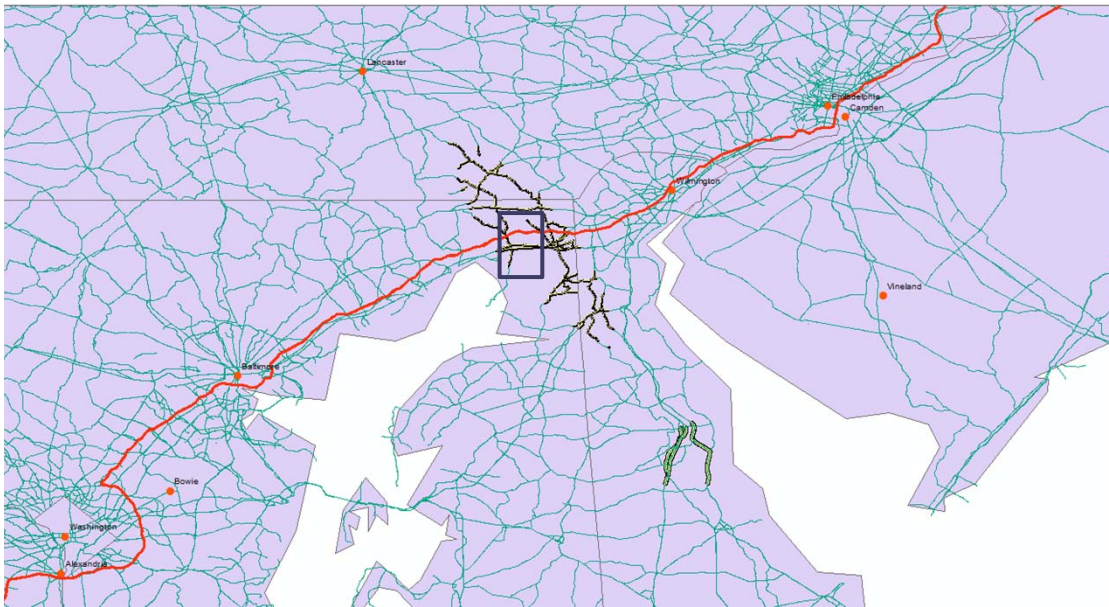




Does this work on a Regional Level?

- **By placing charging stations at origin/destinations**
 - Can create a regional network for EV's.
- **Traveling from Philly (top photo)**
 - A charging station in Newark would allow travelers to make it to Dover.
- **From Baltimore and D.C.**
 - Charging station placed after Chesapeake Bay Bridge and in Southwestern DE would allow travel to beaches and Dover.

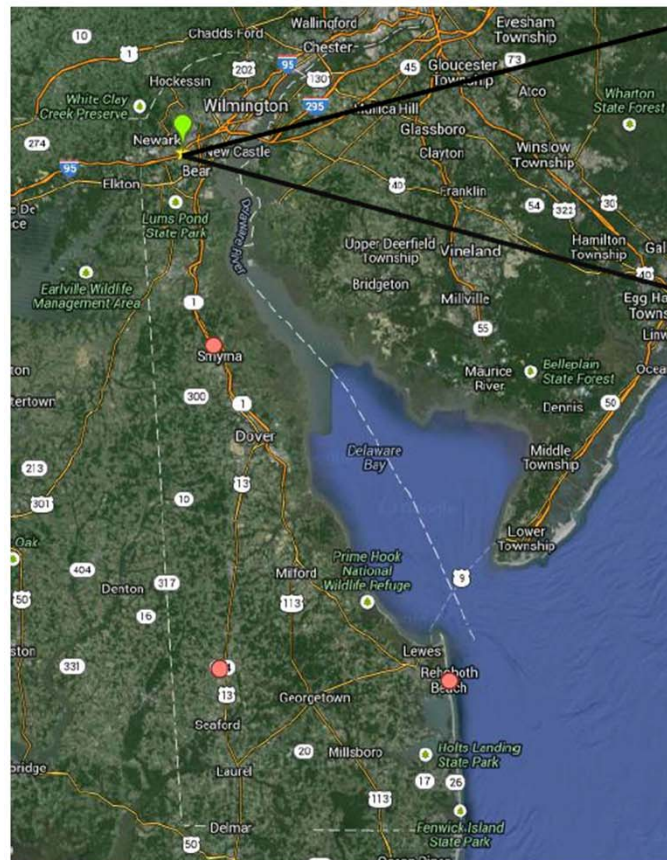
Does this work on a Regional Level?



- From Philly- Baltimore:
 - Another charging station needed
 - I-95 rest stop
 - Chesapeake House
 - Havre de Grace

Example: I-95 Welcome Center

- The Delaware Welcome Center in Newark
 - Allows for in-route charging
 - Travel to Dover (and therefore beaches)
 - Travel to Maryland (and therefore Baltimore and D.C)
- Draft parking lot designs and signage have been created for this location



Parking Lot Design

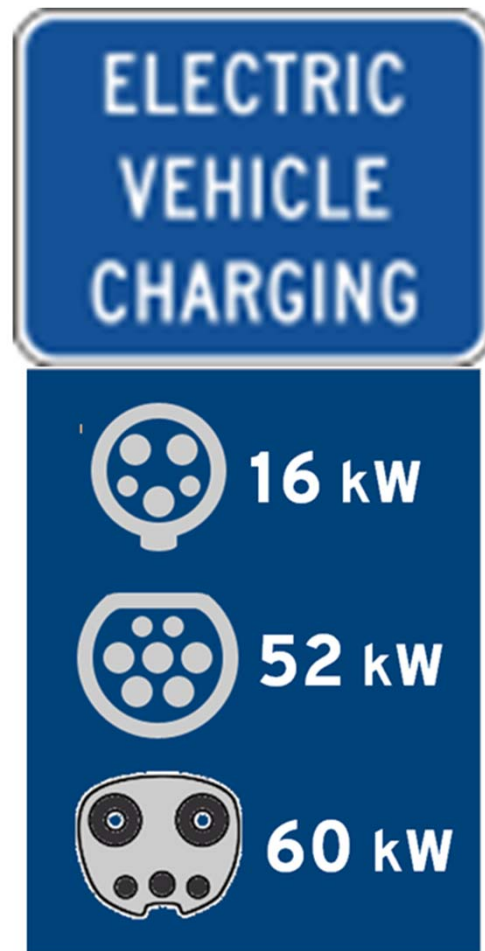


EV Parking Spaces: 9'4" x 17'10"
3-Phase EV Parking Space: 17' x 26'
Space between EVSEs: 43 ft.

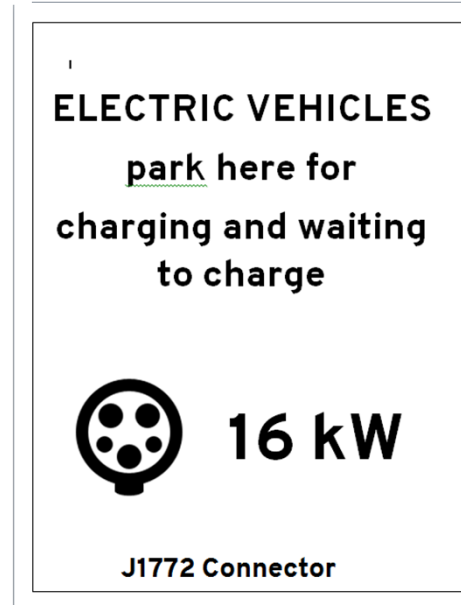
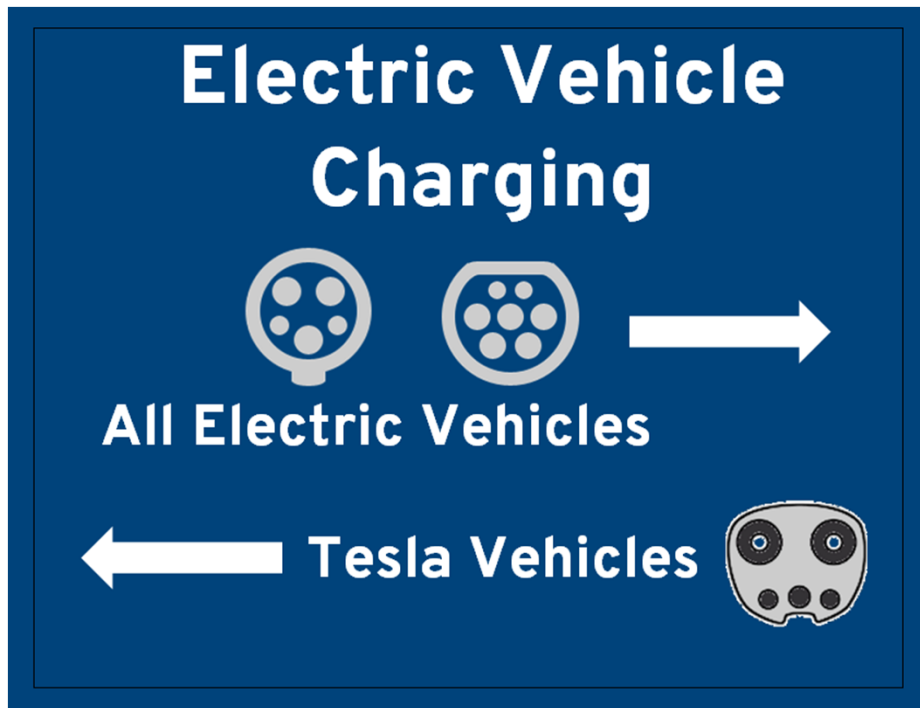
Key:

- =EVSE
- = 3 phase EVSE
- = EV parking spot
- =Bollard
- =Guide for EV Parking Lot

Signage- On the Highway



Signage- In the Parking Lot



Signage- Rules and Etiquette

Charging Rules and Etiquette

- Green spaces are for charging or waiting to charge your electric vehicle only.
- When your battery is full, please move to free up the charger.
- If you see that another car is fully charged, you may unplug and begin charging.
- Be considerate of other cars waiting! Charge your battery only the amount you need to get to your destination today. Let waiting vehicles have a turn.

Installed by DNREC, [DelDot](#) and the University of Delaware

Questions or Comments?

