

# Fleet and Facility Considerations for Electric Transportation

Jesse Bennett, Research Engineer - NREL  
June 2022 ISWG Meeting  
Thursday June 16<sup>th</sup>, 2022

# Administration Priority



## **Executive Order 14008 Section 205: “Federal Clean Electricity and Vehicle Procurement Strategy”**

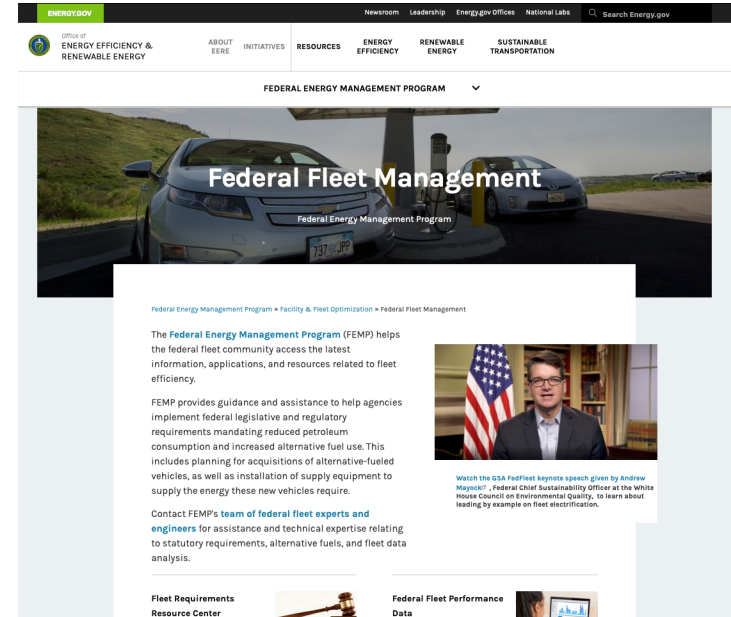
GSA, CEQ, and OMB in coordination with DOE, DOL, and DOC to develop a plan to convert Federal, state, local, and Tribal fleets to EVs



# FEMP Fleet EV Support

Tools to plan and execute agency fleet electrification goals:

- Statutory Requirements
- Fleet Data
- AFV Acquisition
- EV Technology Training
- EVSE Installation Planning
- Workplace Charging Programs
- Cybersecurity Considerations
- Best Practices and Case Studies



<https://www.energy.gov/eere/femp/federal-fleet-management>

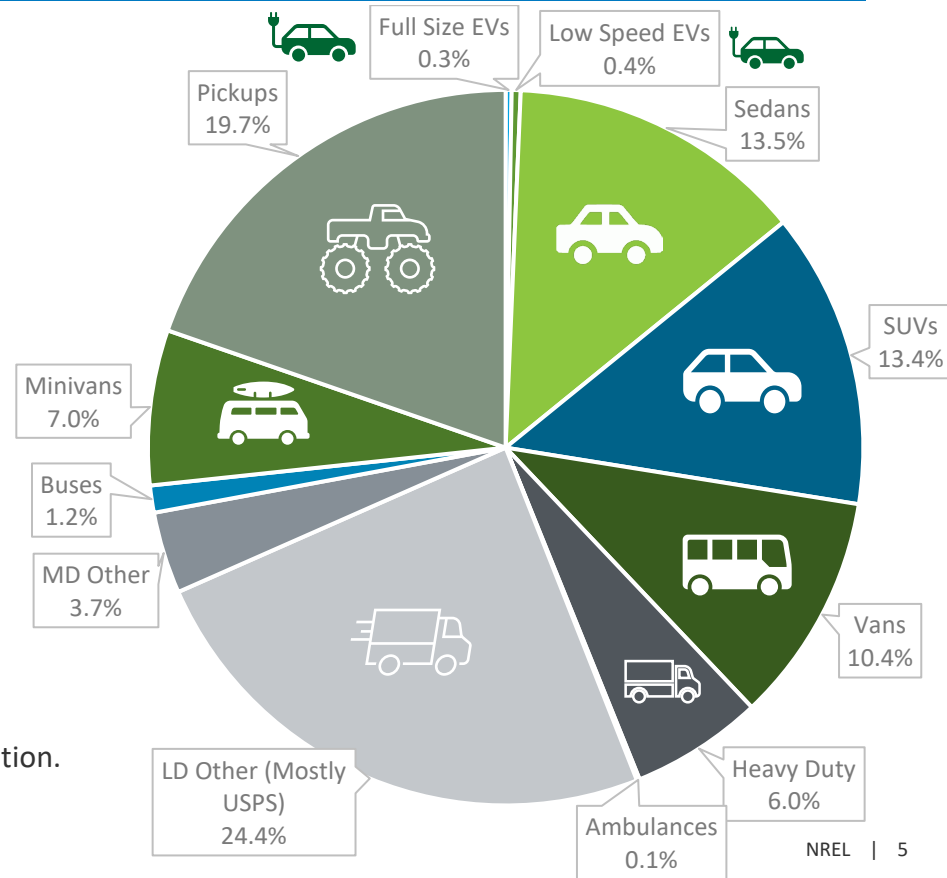
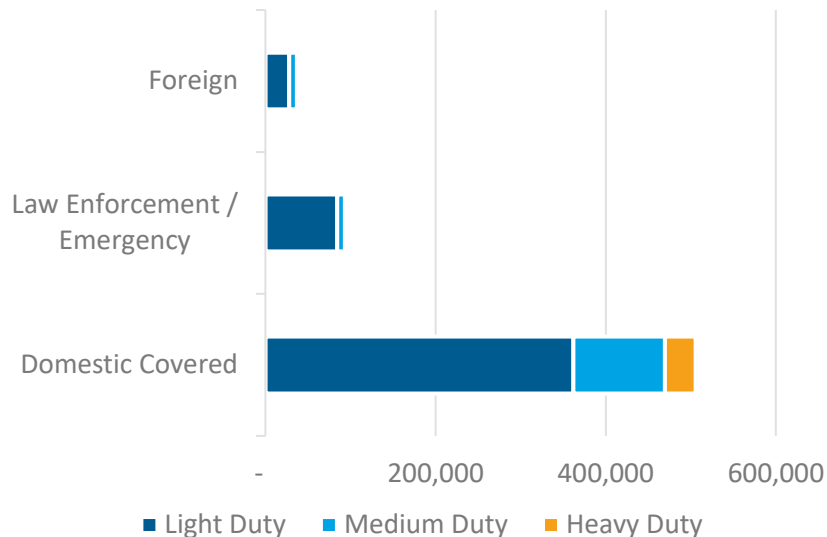
# Fleet Electrification

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Determine the best use cases for EVs

# Breakdowns of the Federal Fleet

## Federal Fleet by Classification



- LE2 and LE3 vehicles (~85% of all LE) are well suited for electrification.
- Ford Mustang Mach-E approved for LE-pursuit applications<sup>1</sup>



# ZEV Planning and Charging (ZPAC)

- ZPAC helps fleet managers identify good candidates for electrification
- Users decide whether each vehicle will be replaced by a ZEV
- Vehicles are aggregated by site to determine EVSE needs



BEV Considerations					
BEV SIN Availability	BEV Replacement SIN	Modeled BEV Range Concerns*	Reported BEV Range Concerns (Dropdown)	BEV GHG Emission Reduction Potential	Quality of BEV Candidate
3 - Consider PHEV	20P	1 - Minimal Public Charging Likely		5 - Limited	5 - Consider PHEV
1 - Identical BEV	96E	2 - Some Public Charging Likely		4 - Moderate	2 - Good
1 - Identical BEV	105E	1 - Minimal Public Charging Likely		2 - High	1 - Great
4 - Reassess Next Year	-	5 - Very Frequent Public Charging Likely		1 - Very High	6 - No FY22 ZEV Option
1 - Identical BEV	8E	5 - Very Frequent Public Charging Likely		1 - Very High	4 - Challenging

\*Novel machine learning model predicts number of days a vehicle needs to charge away from home based on 20 metrics captured in FleetDASH

# Infrastructure Deployment

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Plan for the installation of EVSE

# FEMP EV Champion Training Curriculum



## EV Technology

- ICE, HEV, PHEV, BEV
- L1, L2, DCFC
- FAST VLD Reporting



## EV Financials

- EV TCO calculations
- Utility bill analysis
- FAST EVSE reporting



## EVSE & Energy

- EVSE charging/install
- Electric service review
- EVSE cybersecurity



## Site Design

- Equipment requirements
- Construction planning
- Utility interconnection



## Site Operations

- Construction details
- Special considerations
- Managed charging

**Training 1**

**Training 2**

**Training 3**

**Training 4**



# EVSE Installation Considerations

- **Site Equipment**
  - **Circuit Breaker**
    - NEC 625.41: overcurrent protection shall be rated for 125% of the maximum EVSE load
  - **Panel Capacity**
    - Spare breaker positions must be available
  - **Main Breaker**
    - Must be sized large enough to supply the peak coincident demand from all branch circuits
  - **Transformer Capacity**
    - Distribution transformer must be large enough to supply peak load demand
- **EVSE Requirements**
  - **J1772 AC Level 1**
    - Single 20 A Breaker
      - 1.9 kW (120 V x 16 A)
  - **J1772 AC Level 2**
    - Double pole 40 A breaker
      - 7.7 kW (240 V x 32 A)
      - 6.7 kW (208 V x 32 A)



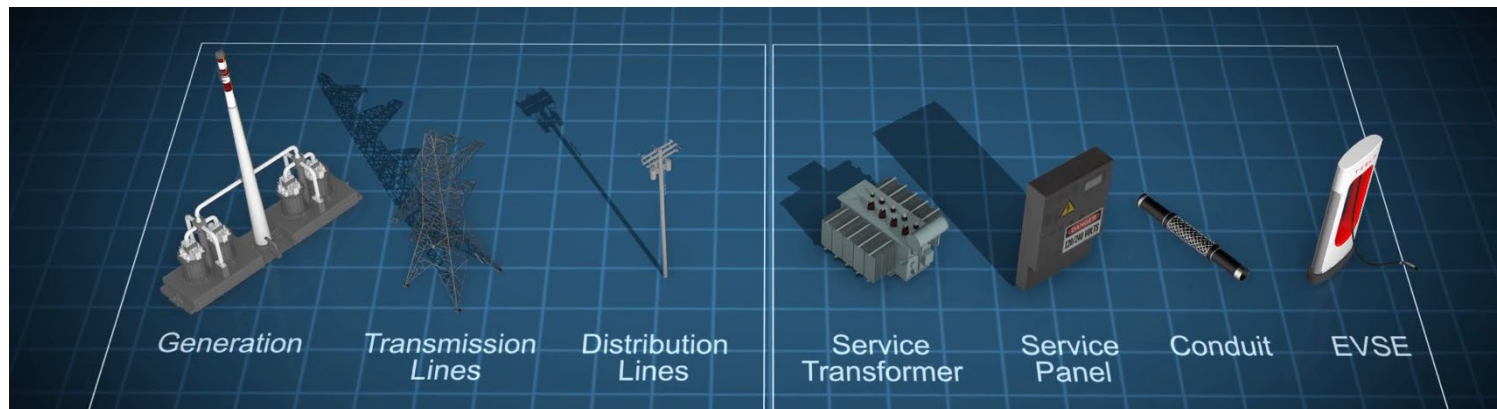
# Utility Interconnection

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Work with the local electric utility

# Electric Utility Interconnection

- Reach out to the local electric utility early in the planning process.
- The electric utility company must prepare the grid with possible equipment upgrades to supply the maximum of power your site could require.
- Grid Upgrade Considerations
  - New Service Line
  - New Interconnection
  - Distribution Transformer Upgrade
- Facility Upgrade Considerations
  - Additional Branch Circuits
  - Service Panel or Main Breaker Upgrade
  - Distribution Transformer Upgrade



# EV U-Finder

- Electric Vehicle Utility-Finder
  - Helps federal fleet managers connect with utilities
  - Identifies incentives and publicly available contacts with simple ZIP code lookup

## EV U-Finder

Enter ZIP code to identify local utilities, electric vehicle support programs, and Clean Cities Coalitions.

20003

Powered by the U.S. Utility Rate Database  
 (https://openei.org/apps/USURDB/)  
 Utility territories last updated February 2021.

**\*Customer Types:**

G: Government or Public; C:  
 Commercial; R: Residential



### Identified active utilities in 20003

Utility	Utility Name	Utility Ownership	Known EVSE Funding Eligibility? *	Known Advisory Services Eligibility?*	Known Federal EVSE Incentives ?	GSA Areawide Contract?	Identified Utility Contact or Phone Number (as available)	Identified Utility Contact Email	Known UESC Contact?	Known UESC Email?
1	Potomac Electric Power Co	INVESTOR	GCR		Y	Y	Greer, Felecia	flgreer@pepco.com	Pringle, James	jpringle@pepco.com

<https://www.energy.gov/eere/femp/articles/electric-vehicle-utility-finder-ev-u-finder>

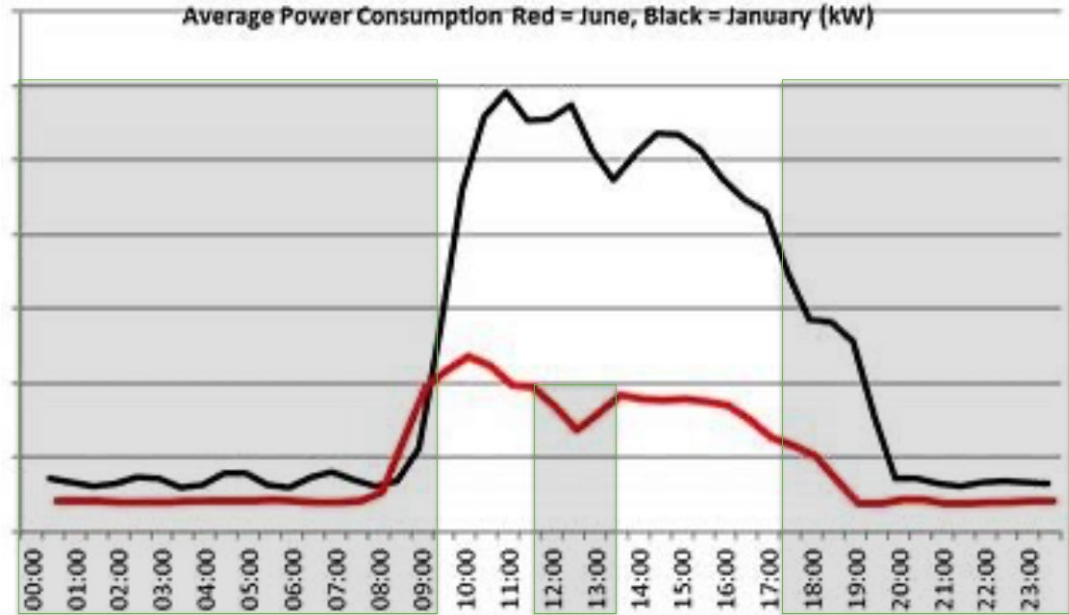
# Managed Charging

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Integrate EV charging with building loads

# Building Load Considerations

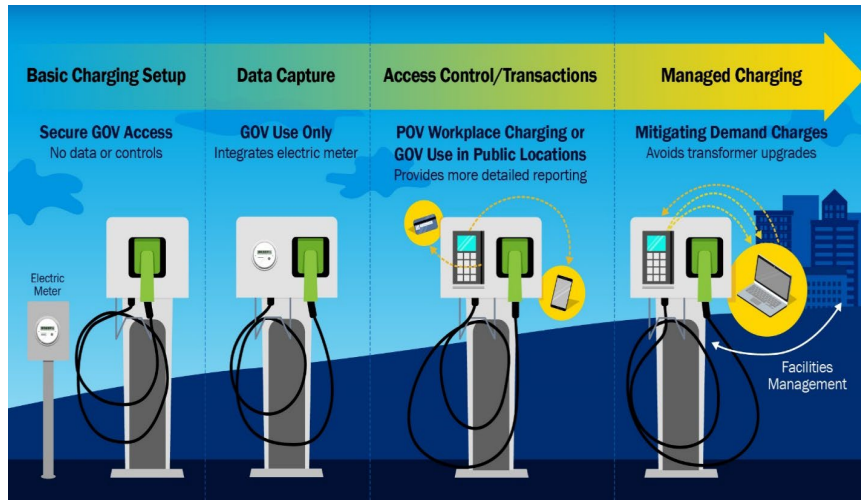
- Understand the nearby building load profile to determine the peak demand.
- Consider how load profiles may differ by season
- Periods of high peak demand will determine the facility demand charge
- Coordinate EV charging to occur during off-peak hours to reduce the cost to charge



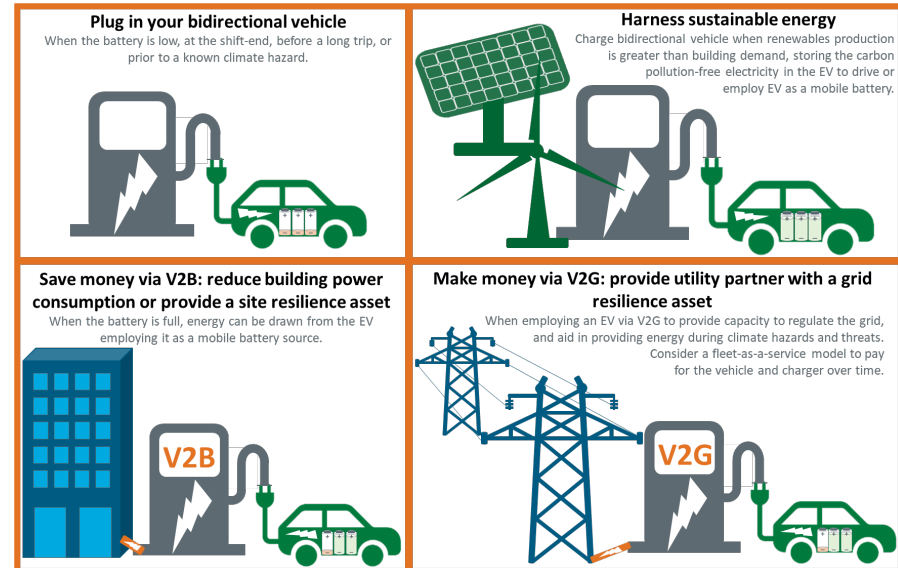


# Load management with EVs and EVSE

- Managed Charging
- An adaptive means of charging EVs which considers vehicle energy needs & control objectives
  - Typically designed to provide grid support or mitigate the impacts of EV charging



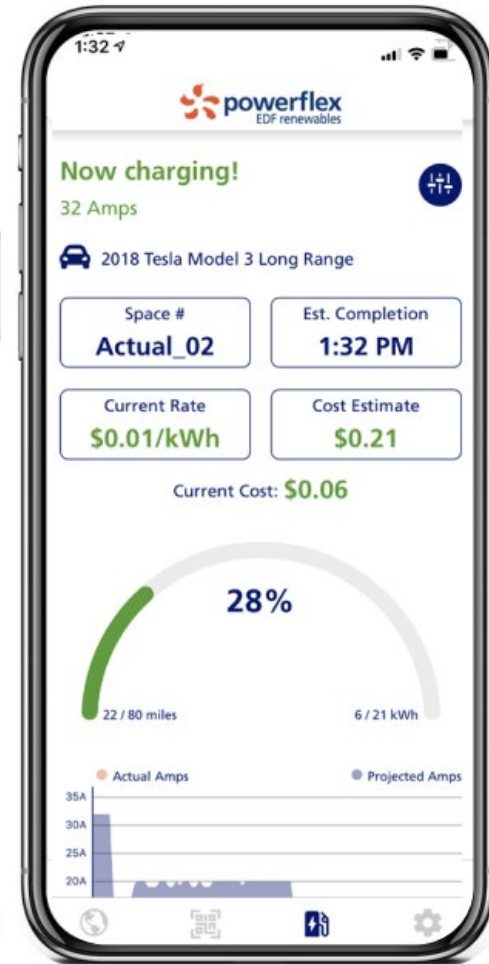
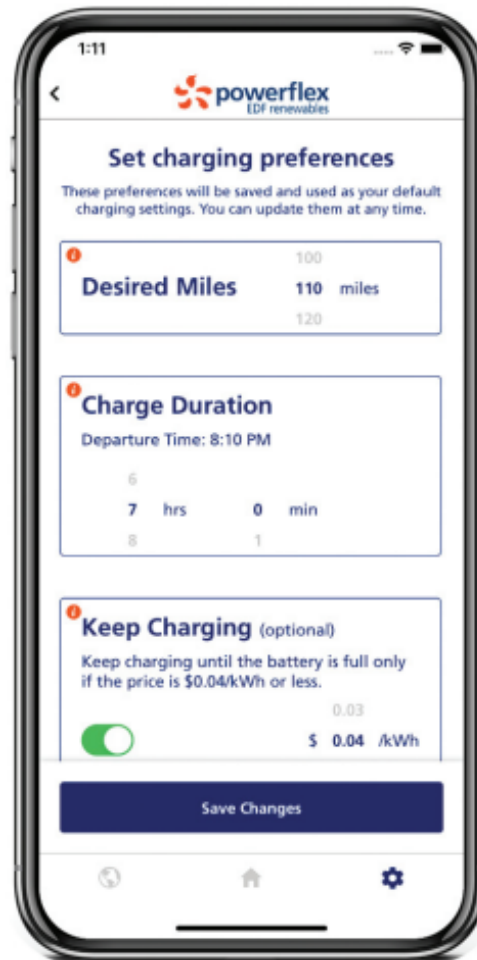
- Bidirectional Charging
- Bidirectional EVs can both receive energy from an EVSE (charge) and provide energy to an external load (discharge), pairs with bidirectional EVSE
- Mobile batteries have advantages over stationary



# Charging at NREL

Staff and visitors are permitted to charge their personal vehicles at the charging stations located at the STM garage and Flatirons campus.

NREL is required to recover the costs of electricity, operations, and maintenance from EVSE users to align with the federal [FAST Act](#).



# NREL Garage Workplace Charging Program

- NREL Installed 72 EVSE ports expanding workplace charging from 36 to 108 ports.
  - Total peak demand capacity of 720 kW!
  - Exceeding transformer and panel capacity (\$\$\$)
- Managed charging solution
  - Employees input desired mileage and dwell period
  - Limit max garage load to less than transformer rating
  - Limit specific service panel circuits to avoid overloads
  - Schedule charging to meet requirements and limit facility peak demand
- Mitigating upgrade costs and demand charges, while meeting the energy needs of all users



NREL Parking Garage – 108 Level 2 charging ports



# Expand EVSE Usage

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Share EVSE between GOVs and POVs

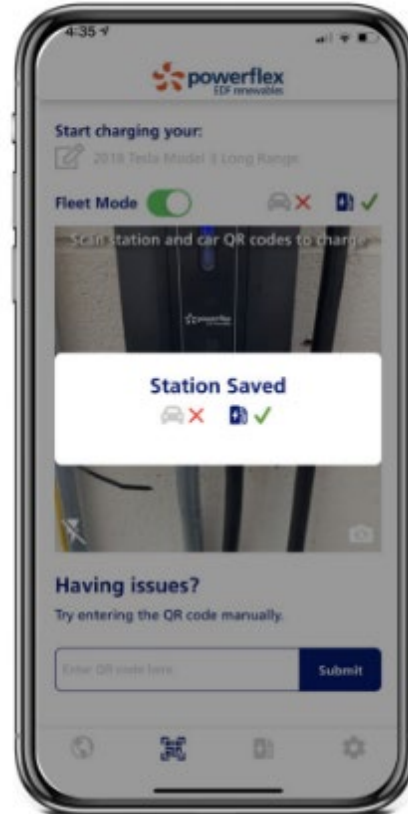


# Fleet Electrification

1. NREL has a goal to electrify 100% of our Fleet of 40+ vehicles.
2. Utilize workplace charging for Fleet vehicles where possible
3. Leverage fleet electrification to support research and create guidance for other Federal Facilities

*This initiative is consistent with NREL's Mission to advance the science and engineering of **sustainable transportation** and supports the **Integrated Energy Pathways** critical objective*

# Fleet Charging at Workplace Charging Stations



- To use – must be a registered user
- QR code on the Fleet vehicle is scanned
- Delivered energy is reported separately from workplace charging



# Workplace Charging Program Guide

- A document prepared by the FEMP Fleet Team to provide:
  - Example WPC program structure
  - Steps to plan for and implement a new agency-wide program
  - Example fee structure and calculations to recoup all program costs
  - Industry best practices for steps such as EVSE installation and fee collection

<https://www.energy.gov/eere/femp/federal-workplace-charging-program-guide>



## Charging Programs in Practice

Read about lessons learned from federal agencies that have piloted workplace charging programs.



[Learn more](#)

## Workplace Charging Case Study at the National Renewable Energy Laboratory

Learn how managed charging allowed NREL to install over 100 EVSE ports for employee POVs.



# Total Charging Fee/Session

$$\text{Electricity} + \text{Network} + \text{Unit} + \text{Installation} = \text{Total Fee}$$

	Electricity Fee	Network Fee	Unit Fee	Installation Fee	Total Session Fee
<b>120 V Receptacle</b>	\$0.41	-	\$0.04	\$0.05	<b>\$0.50</b>
<b>Networked Level 2</b>	\$0.41	\$0.54	\$0.67	\$0.05	<b>\$1.67</b>

## Workplace Charging Fee Calculator:

- Calculation spreadsheet with custom input variables
- Determine the best fee structure for a workplace charging program

The screenshot shows a spreadsheet titled "Workplace Charging POV Fee Calculator" with the following sections:

- Session Fee:** Equation:  $\text{Session Fee} = \text{Electricity Cost} + \text{Network Cost} + \text{Unit Cost} + \text{Installation Cost Per Session}$ . Result: \$ 1.65 /Session.
- Fee Per kWh:** Equation:  $\text{Fee Per kWh} = \text{Session Fee} / \text{Energy Per Day}$ . Result: \$ 0.49 /kWh.
- Electricity Cost Per Session:** Variables table:
 

Name	Value	Unit
Electricity Rate	\$ 0.103	\$/kWh
Commute Distance	12	Miles
Vehicle Efficiency	3.6	mile/kWh

 Equation:  $\text{Electricity Cost Per Session} = \text{Electricity Rate} \times (\text{Commute Distance} / \text{Vehicle Efficiency})$ . Result: \$ 0.34 /Session.



# Thank You

[www.nrel.gov](http://www.nrel.gov)

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Transforming ENERGY

**45**<sup>th</sup>  
anniversary