

Roadmap Conference  
May 15-17, Portland, OR



# Electric Vehicles, EV Charging, and the Future of Transportation

Whitaker Jamieson, April 11th, 2023





Forth's mission is to electrify transportation by bringing people together to create solutions that reduce pollution and barriers to access.

# OUR FOCUS AREAS

## Access to Electric Cars

Forth builds programs for drivers who have traditionally faced the most barriers to electrification.

## Access to Charging

Forth is working to make it as easy to charge a car as it is to park a car.



## Progressive EV Policy

We build influence and knowledge at the national, state and local levels.

## Events & Partnerships

Forth convenes diverse stakeholders to collaborate and advance equitable transportation systems.

## Access to Emerging Modes

We're increasing access to micro-mobility, electrifying farm equipment, school buses, and supporting e-mobility in lower-income countries worldwide.



# Agenda

- Basics of EVs - (30 mins)
- Mini Q/A (10)
- Charging - (30 mins)
- Break - (10)
- Innovations and Final Q&A (40)



# Electric Vehicle Types

- **Battery Electric Vehicle**
  - 100% electric
  - Plug-in to recharge
  - Ex: Chevy **Bolt**, Ford Mustang Mach-E, all Teslas (pictured)
  
- **Plug-in Hybrid Vehicle**
  - Both electric and gasoline powered
  - Most have an “Electric only” mode
  - Plug-in to recharge, fill tank when needed
  - Ex: RAV4 Prime (pictured), Kia Niro PHEV, Chevy **Volt**, BMW i3 w/ Range extender



# Poll Questions

**Please raise your hand if  
you have ridden in an EV?**

# Question 2

**Please raise your hand if you drive a BEV  
regularly?**

# Question 3

**Please raise your hand if you have driven a PHEV?**



# Some Crossovers here or coming soon



Kia EV6



Hyundai Ioniq 5



Blazer EV



Ford Mustang Mach-E



Nissan Ariya



Polestar 3

Even if the vehicles aren't particularly easy to find in ID, they will be here sooner than you think

# Trucks/SUVs here or coming soon



Ford 150 Lightning



2023-24 Chevrolet  
Silverado EV



2025 RAM 1500 REV



Rivian R1S SUV



2024 GMC Hummer EV SUV



2024 Kia EV9

# Some Vehicle Cost Trends

1. Small Battery Entry model vs Longer range (Larger pack) models only available in a higher trim. **Don't trust the "Starting at" phrase**
1. Usually AWD option adds \$2500-5000+ and reduces range by 5-10%
1. Range, Size, and AWD basically determine price with few exceptions
1. Demand > Supply for most vehicles models right now

If you have questions about Vehicle cost trends, write them down!

# EV Federal tax credit - for new vehicles



## Clean Vehicle Credit

- \$7,500 non refundable tax credit
  - \$3750 domestic battery assembly
  - \$3750 domestic critical minerals
  
- Types of restrictions
  - Income restrictions
    - \$150,000 - individual
    - \$300,000 - household
  
  - MSRP caps
    - SUV, pickup truck, van \$80k
    - Sedan/Hatchbacks \$55k

**8936** Qualified Plug-in Electric Drive Motor Vehicle Credit  
 (Including Qualified Two-Wheeled Plug-in Electric Vehicles and New Clean Vehicles)  
 Attach to your tax return.  
 Go to [www.irs.gov/Form8936](http://www.irs.gov/Form8936) for instructions and the latest information.

OMB No. 1545-2137  
 Attachment Sequence No. 69

Form 8936 (Rev. January 2022)  
 Department of the Treasury  
 Internal Revenue Service

Name(s) shown on return: \_\_\_\_\_ Identifying number: \_\_\_\_\_

Note: This credit is for qualified plug-in electric drive motor vehicles placed in service before 2023, qualified two-wheeled plug-in electric vehicles acquired before but placed in service in 2022, and new clean vehicles placed in service after 2022. See separate instructions for vehicle definitions and other requirements.

**Part I Tentative Credit**  
 Use a separate column for each vehicle. If you need more columns, use additional Forms 8936 and include the totals on lines 12 and 19.

|  | (a) Vehicle 1 | (b) Vehicle 2 |
|--|---------------|---------------|
| 1 Year, make, and model of vehicle . . . . .   | 1             |               |
| 2 Vehicle identification number (see instructions) . . . . .   | 2             |               |
| 3 Enter date vehicle was placed in service (MM/DD/YYYY) . . . . .  | 3             |               |
| 4a If the vehicle is a two-wheeled vehicle, enter the cost of the vehicle. If the vehicle has at least four wheels, see instructions . . . . . | 4a            |               |
| b Phase-out percentage (see instructions) . . . . .  | 4b            | %             |
| c Tentative credit. Multiply line 4a by line 4b . . . . .  | 4c            |               |

Next: If you did NOT use your vehicle for business or investment purposes and did not have a credit from a partnership or S corporation, skip Part II and go to Part III. All others, go to Part II.

**Part II Credit for Business/Investment Use Part of Vehicle**

|   |    |       |       |
|---|----|-------|-------|
| 5 Business/investment use percentage (see instructions) . . . . .   | 5  | %     | %     |
| 6 Multiply line 4c by line 5. If the vehicle has at least four wheels, leave lines 7 through 10 blank and go to line 11 . . . . .   | 6  |       |       |
| 7 Section 179 expense deduction (see instructions) . . . . .  | 7  |       |       |
| 8 Subtract line 7 from line 6 . . . . .   | 8  |       |       |
| 9 Multiply line 8 by 10% (0.10) . . . . .   | 9  |       |       |
| 10 Maximum credit per vehicle . . . . .   | 10 | 2,500 | 2,500 |
| 11 For vehicles with four or more wheels, enter the amount from line 9. If the vehicle is a two-wheeled vehicle, enter the smaller of line 9 or line 10 . . . . .   | 11 |       |       |
| 12 Add columns (a) and (b) on line 11 . . . . .   | 12 |       |       |
| 13 Qualified plug-in electric drive motor vehicle credit from partnerships and S corporations (see instructions) . . . . .  | 13 |       |       |
| 14 Business/investment use part of credit. Add lines 12 and 13. Partnerships and S corporations, stop here and report this amount on Schedule K. All others, report this amount on Form 3800, Part III, line 1y . . . . . | 14 |       |       |

Note: Complete Part III to figure any credit for the personal use part of the vehicle.

For Paperwork Reduction Act Notice, see separate instructions. Cat. No. 3751E 12 Form 8936 (Rev. 1-2022)

# EV Federal tax credit - for used vehicles

## Previously Owned Clean Vehicles

- \$4,000 or 30% of the vehicle sale price (whichever is lower)
- Types of restrictions
  - Income restrictions 75k Filing Single | 150k Married
  - Vehicle type
    - 2+ yrs old
    - <14,000 lbs (Class 1-3)
    - <\$25,000
    - Not have previously used the credit (check by VIN)
    - Sold by a dealership
  - Credit can be claimed once every 3 yrs

**8936**  
Form  
(Rev. January 2022)  
Department of the Treasury  
Internal Revenue Service

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(Including Qualified Two-Wheeled Plug-in Electric Vehicles and New Clean Vehicles)  
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# Used BEVs under \$30k



Chevy Bolt EV  
238 mile range 2017-2019



Nissan Leaf  
150 mile range 2018-19



Hyundai Kona EV  
258 mile range 2018-19



Kia Niro EV  
238 mile range 2018-19



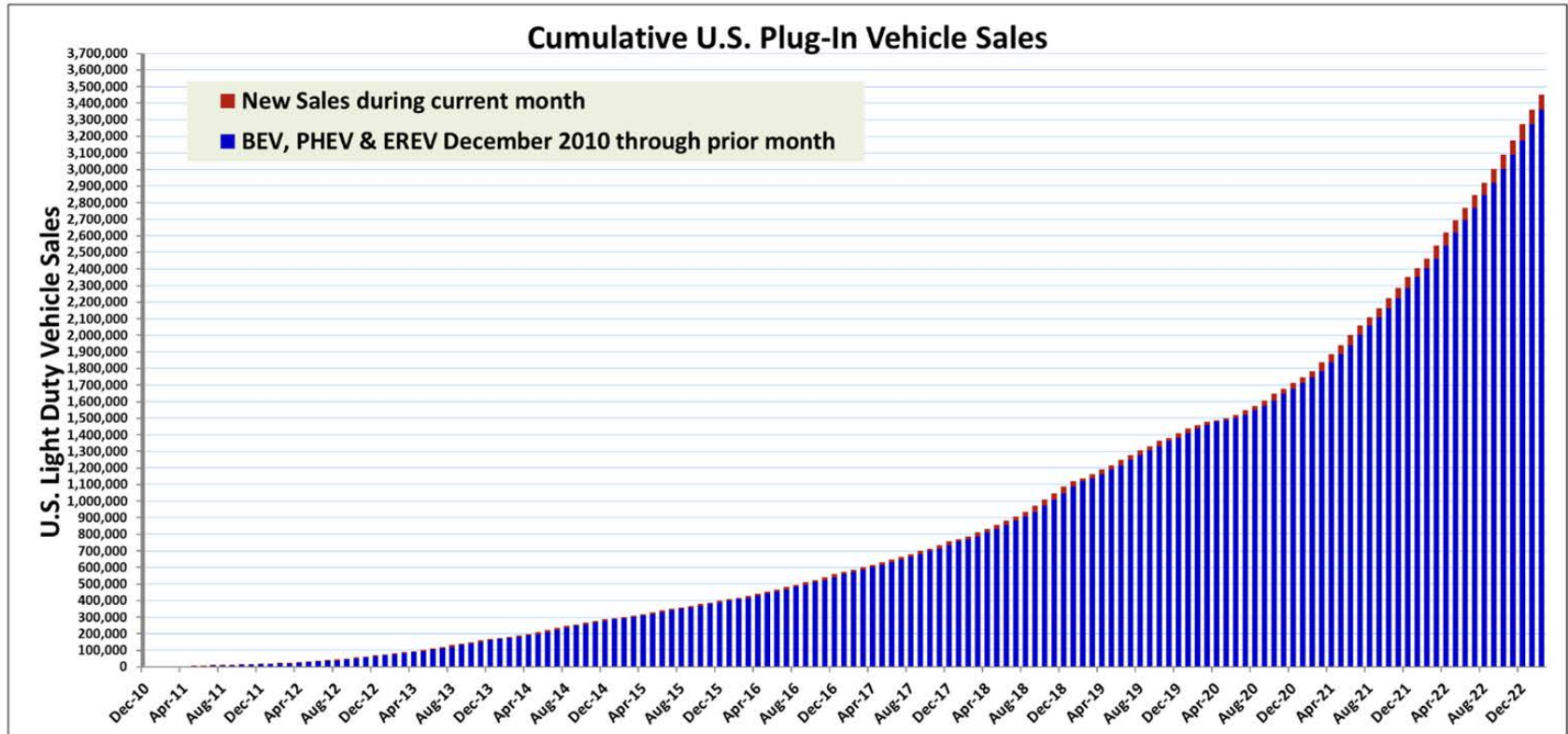
Hyundai Ioniq EV  
125 mile range 2018-19  
170 miles 2020



2019 Tesla Model 3\*  
240 mile range 2019



# 3.5 Million sold since 2010!



# Social benefits of EVs

## Cleaner Air

- Improved air quality for every EV

## Energy Dollars Generally Stay Local

- Electricity is produced locally or regionally

## Climate Change Mitigation

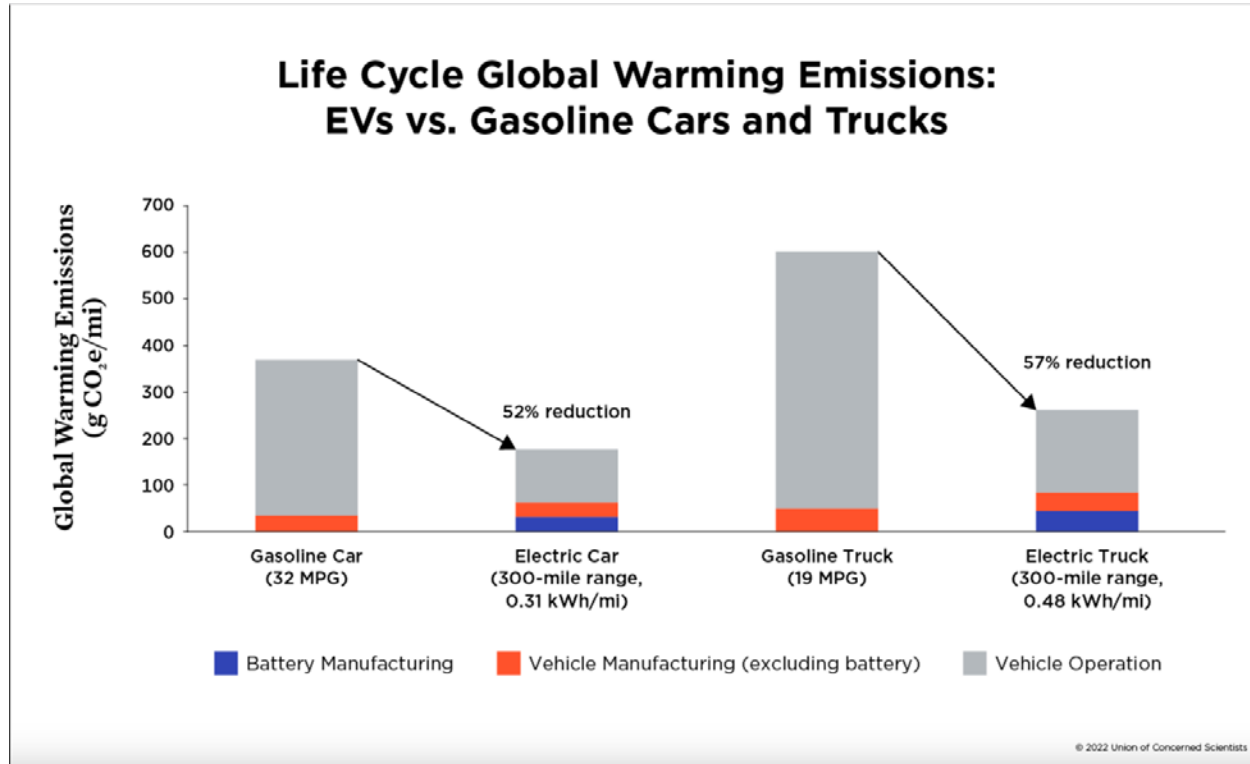
- Transportation is the number one source of CO2 emissions in ID and US

## EV Drivers Can Save Money

- Over the lifetime of ownership, EVs can be less expensive than ICE (Internal Combustion Engines)

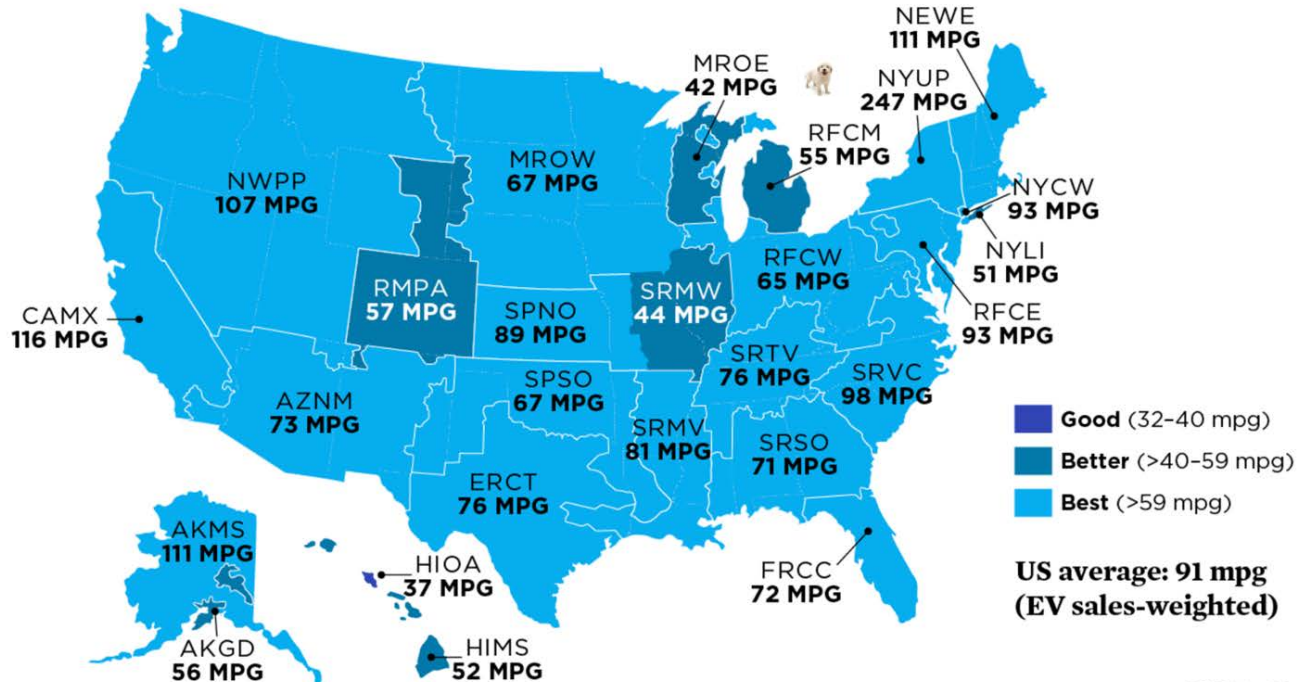


# EVs are Cleaner



# EVs are getting even Cleaner

## Comparing Emissions: Driving the Average EV as a Gasoline MPG Equivalent, 2020



# Micromobility





# Not just 4 wheels



Transit buses

PHEV bucket  
trucks



School buses

Garbage  
trucks



Yard Trucks

Delivery/Box  
Trucks





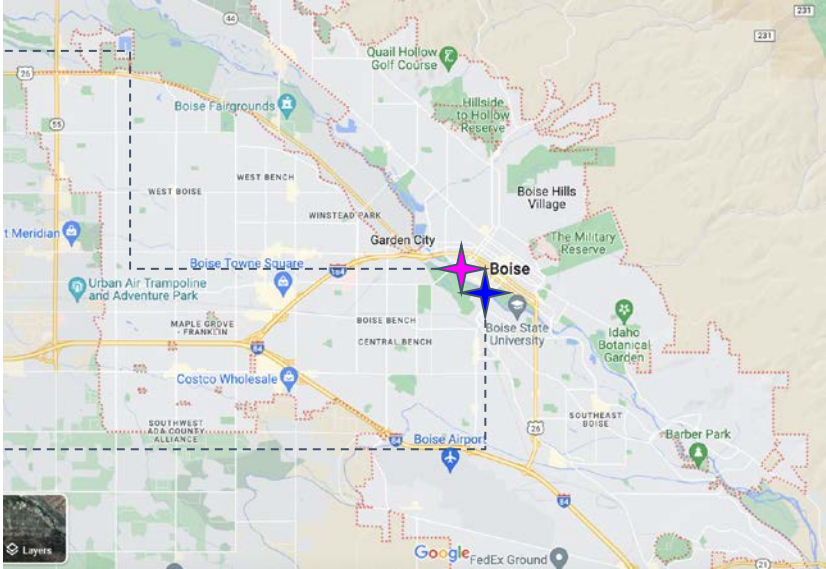
# EVs are Everywhere



Valley regional transit  
(introduced in Treasure valley)



Electrified recycling vehicle  
(by Republic services and City of Boise)



# BEVs are cheaper to maintain

BEV maintenance costs **a fraction** of that of gas-powered cars:

- A 2020 [Consumer Reports study](#)
  - EVs can cut maintenance costs by 50% over similar gas cars
- EVs offer solid warranties
  - batteries and electric drivetrains (usually around eight years or 100,000 miles)



# EVs are fun to drive!

- Instant acceleration and torque
- Lower center of gravity for tight handling
- Quiet
- Regenerative braking



# Nothing is Perfect

**EVs are still expensive**

**Public charging experience can be rough  
(Especially in Rural locations)**

**Used market not really here yet**

**Affordable Long Range AWD vehicles**

**Weather can dramatically impact range**



# Trends

- 200+ miles of range standard for short-range EVs
- 300+ miles of range standard for longer range EVs
- Towing still a conundrum due to battery size/range/weight/aerodynamics
- Costs of many new vehicles types will remain high for a few more years
- Companies adjusting business model to sell EVs
- Used market will evolve, usually/unfortunately 3+ year lag time from when vehicles are launched
- Vehicle efficiency is key to range and will be prioritized long-term due to impact on range/price



**Questions on EVs?  
Q/A + Mini Break**

**Up next: Charging  
Hold your Charging Questions for later!**



**Please raise your hand if  
you have used an EV charger?**

# Question 2

**How many of you have a L2 charger at home?**

# Question 3

**How many of you have used a DC charger?**

# Question 4

**How many of you have used a DC charger on a road trip (500+ miles)?**



# Level Setting for EV Charging

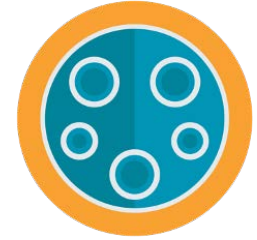
(Pun intended)

# Electric vehicle charging - Level 1

- Cable included w/ purchase of car
- 2-5 miles gained per hour of charge (light-duty vehicles)
- Best for
  - Plug-in hybrids
  - Short commutes
  - People that don't drive every day



120 Volt outlet



Standard Port



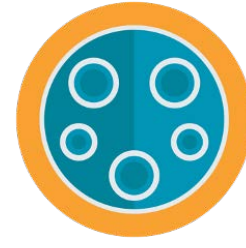


# Electric vehicle charging - Level 2

- 12-40+ miles gained per hour of charge
- Ideal for installation in homes, apartments, or workplace



240 Volt Outlet  
or Hardwired

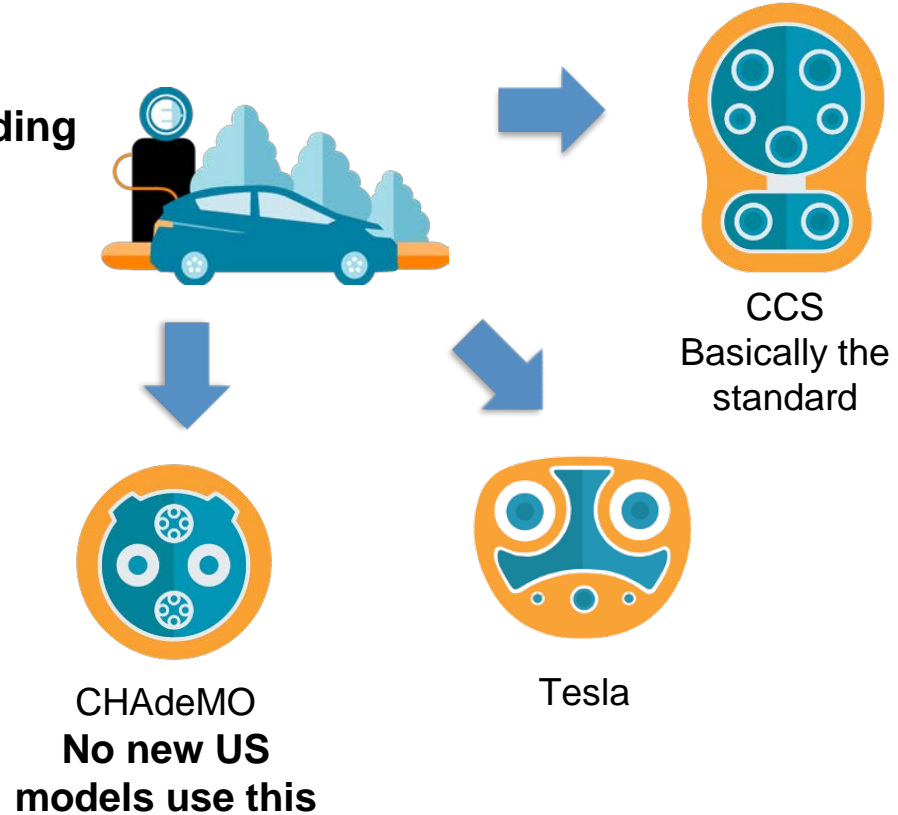










Standard Port



# DC Fast charging (Level 3)

- **Fleet or Public Infrastructure**
- **10->80% in 15-60 minutes depending**
  - Charger's Max charging speed
  - Vehicles Max charging speed
  - State of charge start/stop
  - Battery management System factors
    - Temperature of battery
    - Ambient Temperature



| Slowest                      |  | Fastest  |  |
|------------------------------|--|--|--|
| Level                        | Level 1  | Level 2  | DC Fast Charging   |
| Use Case                     | Home   | Home/Work/Public   | Public   |
| Power                        | <2 kW<br><i>(Usually 1.2 kW)</i>   | 2.4 - 19.2 kW<br><i>(Usually 6.7 kW)</i>   | 25 - 350 kW<br><i>(Usually 150, 50, or 250 kW respectively)</i>  |
| Plug Shape<br>(Into Vehicle) | <br>J1772 | <br>J1772 | <br>CCS <br>CHAdeMO <br>Tesla |
| Outlet Shape                 | <br>120 V | <br>240 V | Electric Vehicle<br>Supply<br>Equipment<br>(EVSE)   |
| Cost                         | \$   | \$\$   | \$\$\$\$   |

# Chevy Bolt EUV Display

KiloWatts (kW) -  
measure of power



Electric motors are  
super efficient  
(90%+) and they  
work as generators  
when going downhill  
or slowing down

# Some “math stuff” for those that want it

- Miles per kilowatt-hour is equivalent to miles per gallon
- Most vehicles have between 40 and 120 kWh battery packs
- Most efficient sedans/hatchbacks get 5+ miles per kWh
- Least efficient trucks/SUVs are getting 2 miles per kWh
- When you go uphill you may be getting  $\frac{1}{2}$  mile per kWh or worse, but going downhill your efficiency can be extremely high due to recharging the battery



Some common battery cell sizes and battery packs are often made up of thousands of cells like these [Source](#)

# Charging use cases put simply

Single Family Homes-L1/L2

Multi-Family Homes- L2 but it can depend on electrical configuration

Public charging-L2/DC

Destination- L2

Workplace- L1/L2 (very unusual cases DC)

Corridor charging-DC

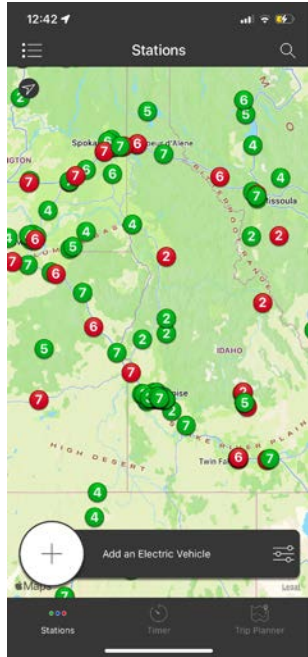
Fleet (depends on fleet vehicles/use profile)



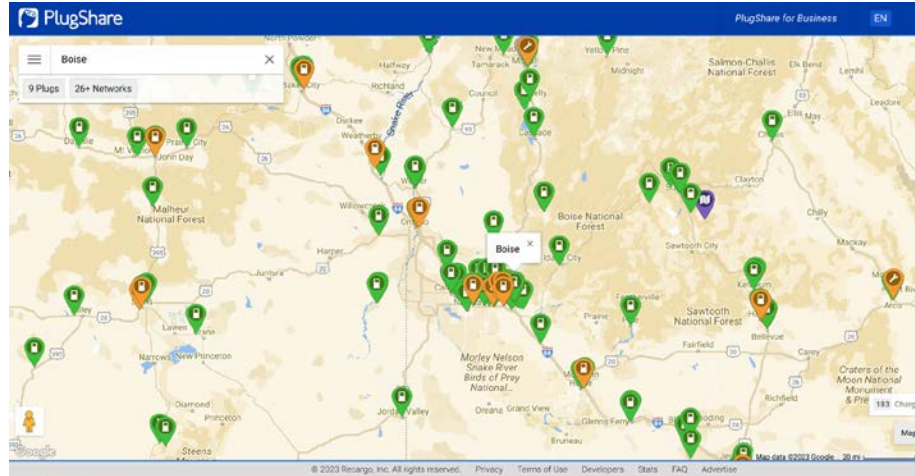
**It is all about how long the car is parked for**



# Find Public Charging Stations

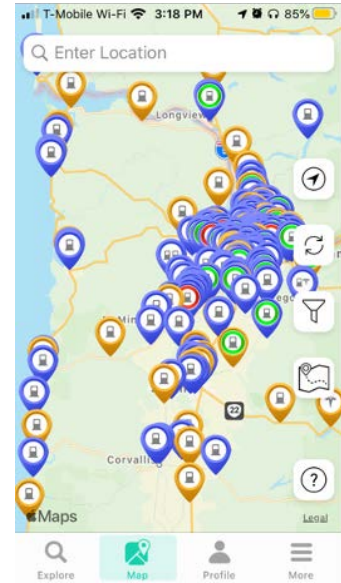


Chargeway  
(App only)



PlugShare (Website & App)

Public EV Charging Companies have **phone apps** that can be used to find chargers and start charging sessions

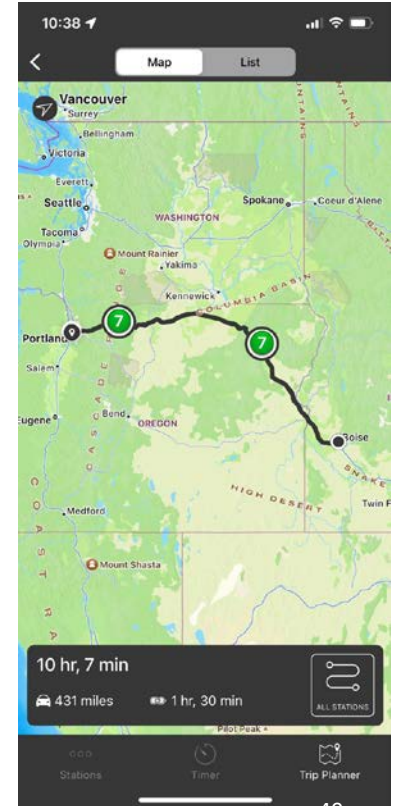
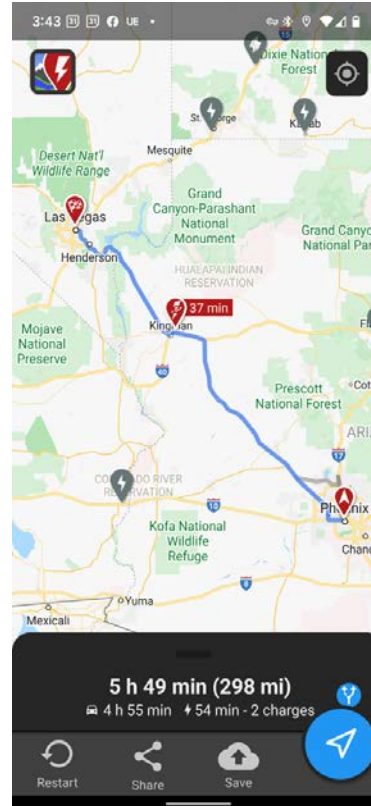


ChargeHub  
(Website & App)

# Travel longer distances

## Apps like A Better Route Planner or Chargeway

- Plan longer trips and see charging times
- How long to expect to be charging



# How to use a charger?

1. Read instructions at site
1. Using Phone apps
  - a. Download app
  - b. create an account and card details
1. When in doubt, plug in charger and start the charge through the phone app
1. Check that you're starting the charge on the right charger (find charger ID to help with this)
1. Sometimes chargers will need rebooting, in which case a phone call may be required
  - a. Check charger for phone number



## **Plug and Charge Protocols (Like what Tesla already has)**

**Simply plug in and charging will start quickly and  
account associated with the car will be billed**

# EV Charging Tax Credits

# Alternative Fuel Vehicle Refueling Property Credit



For Individuals:

- Beginning January 1, 2023
- Purchase qualified equipment may receive a tax credit of up to \$1,000
- Non refundable
- You must file your taxes to claim the credit

**Talk with a Tax expert to learn more**

| Form <b>8911</b>  |  | Alternative Fuel Vehicle Refueling Property Credit  |                    | OMB No. 1545-0123              |
|---|--|---|--------------------|--------------------------------|
| (Rev. January 2023)<br>Department of the Treasury<br>Internal Revenue Service |  | Attach to your tax return.<br>Go to <a href="http://www.irs.gov/Form8911">www.irs.gov/Form8911</a> for instructions and the latest information. |                    | Attachment<br>Sequence No. 151 |
| Name(s) shown on return   |  |   | Identifying number |                                |
| <b>Part I Total Cost of Refueling Property</b>                                |  |   |                    |                                |
| 1   | Total cost of qualified alternative fuel vehicle refueling property placed in service during the tax year (see <i>What's New</i> in the instructions)  |   | 1                  |                                |
| <b>Part II Credit for Business/Investment Use Part of Refueling Property</b>  |  |   |                    |                                |
| 2   | Business/investment use part (see instructions)  |   | 2                  |                                |
| 3   | Section 179 expense deduction (see instructions)   |   | 3                  |                                |
| 4a  | Subtract line 3 from line 2  |   | 4a                 |                                |
| b   | Enter any amount included on line 4a attributable to property placed in service after 2022 as part of a project subject to project requirements that were not met (see instructions)   |   | 4b                 |                                |
| c   | Subtract line 4b from line 4a  |   | 4c                 |                                |
| 5a  | Multiply line 4b by 6% (0.06)  |   | 5a                 |                                |
| b   | Multiply line 4c by 30% (0.30)   |   | 5b                 |                                |
| c   | Add lines 5a and 5b  |   | 5c                 |                                |
| 6   | Maximum business/investment use part of credit (see instructions)  |   | 6                  |                                |
| 7   | Enter the smaller of line 5c or line 6   |   | 7                  |                                |
| 8   | Alternative fuel vehicle refueling property credit from partnerships and S corporations (see instructions)   |   | 8                  |                                |
| 9   | Business/investment use part of credit. Add lines 7 and 8. Partnerships and S corporations, stop here and report this amount on Schedule K. All others, report this amount on Form 3800, Part III, line 15   |   | 9                  |                                |
| <b>Part III Credit for Personal Use Part of Refueling Property</b>            |  |   |                    |                                |
| 10  | Subtract line 2 from line 1. If zero, stop here; do not file this form unless you are claiming a credit on line 9  |   | 10                 |                                |
| 11  | Multiply line 10 by 30% (0.30)   |   | 11                 |                                |
| 12  | Maximum personal use part of credit (see instructions)   |   | 12                 |                                |
| 13  | Enter the smaller of line 11 or line 12  |   | 13                 |                                |
| 14  | Regular tax before credits:<br><ul style="list-style-type: none"> <li>• Individuals. Enter the sum of the amounts from Form 1040, 1040-SR, or 1040-NR, line 16, and Schedule 2 (Form 1040), line 2.</li> <li>• Other filers. Enter the regular tax before credits from your return.</li> </ul> |   | 14                 |                                |
| 15  | Credits that reduce regular tax before the alternative fuel vehicle refueling property credit:   |   |                    |                                |
| a   | Foreign tax credit   | 15a   |                    |                                |
| b   | Certain allowable credits (see instructions)   | 15b   |                    |                                |
| c   | Add lines 15a and 15b  |   | 15c                |                                |
| 16  | Net regular tax. Subtract line 15c from line 14. If zero or less, enter -0- and stop here; do not file this form unless you are claiming a credit on line 9  |   | 16                 |                                |
| 17  | Tentative minimum tax (see instructions):<br><ul style="list-style-type: none"> <li>• Individuals. Enter the amount from Form 6251, line 9.</li> <li>• Other filers. Enter the tentative minimum tax from your alternative minimum tax form or schedule.</li> </ul>                            |   | 17                 |                                |
| 18  | Subtract line 17 from line 16. If zero or less, stop here; do not file this form unless you are claiming a credit on line 9  |   | 18                 |                                |
| 19  | Personal use part of credit. Enter the smaller of line 13 or line 18 here and on Schedule 3 (Form 1040), line 6j; or the appropriate line of your return. If line 18 is smaller than line 13, see instructions   |   | 19                 |                                |
|   |  |   |                    | <b>1041</b>                    |



# Alt Fuel Refueling Property Credit—Businesses (+ other orgs)



- Beginning January 1, 2023
- Nonrefundable
- Eligible for a tax credit
  - 6% or up to \$100,000 per port so long as:
    - Property subject to depreciation
  - 30% (or up to \$100,000) if:
    - Prevailing Wages
    - % of work done by apprentices
    - Location specific
      - Not an urban area
      - Poverty rate is at least 20%
      - median family income is less than 80% of the state median family income level

**Talk with a Tax expert to learn more**

| Form <b>8911</b><br>(Rev. January 2023)<br>Department of the Treasury<br>Internal Revenue Service |  | <b>Alternative Fuel Vehicle Refueling Property Credit</b>   |                    | OMB No. 1545-0123              |
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| 9   | <b>Business/investment use part of credit.</b> Add lines 7 and 8. Partnerships and S corporations, stop here and report this amount on Schedule K. All others, report this amount on Form 3800, Part III, line 15                      |   | 9                  |                                |
| <b>Part III Credit for Personal Use Part of Refueling Property</b>                                |  |   |                    |                                |
| 10  | Subtract line 2 from line 1. If zero, stop here; do not file this form unless you are claiming a credit on line 9  |   | 10                 |                                |
| 11  | Multiply line 10 by 30% (0.30)   |   | 11                 |                                |
| 12  | Maximum personal use part of credit (see instructions)   |   | 12                 |                                |
| 13  | Enter the <b>smaller</b> of line 11 or line 12   |   | 13                 |                                |
| 14  | Regular tax before credits:<br>• Individuals. Enter the sum of the amounts from Form 1040, 1040-SR, or 1040-NR, line 16, and Schedule 2 (Form 1040), line 2.<br>• Other filers. Enter the regular tax before credits from your return. |   | 14                 |                                |
| 15  | Credits that reduce regular tax before the alternative fuel vehicle refueling property credit:<br>a Foreign tax credit<br>b Certain allowable credits (see instructions)<br>c Add lines 15a and 15b                                    | 15a<br>15b  | 15c                |                                |
| 16  | Net regular tax. Subtract line 15c from line 14. If zero or less, enter -0- and stop here; do not file this form unless you are claiming a credit on line 9  |   | 16                 |                                |
| 17  | Tentative minimum tax (see instructions):<br>• Individuals. Enter the amount from Form 6251, line 9.<br>• Other filers. Enter the tentative minimum tax from your alternative minimum tax form or schedule.                            |   | 17                 |                                |
| 18  | Subtract line 17 from line 16. If zero or less, stop here; do not file this form unless you are claiming a credit on line 9  |   | 18                 |                                |
| 19  | <b>Personal use part of credit.</b> Enter the <b>smaller</b> of line 13 or line 18 here and on Schedule 3 (Form 1040), line 6j; or the appropriate line of your return. If line 18 is smaller than line 13, see instructions           |   | 19                 | 5                              |

**Break**

**Up next: Questions and Innovations**

**What are some topics you'd like to hear more about?**

# Charging Use Cases

# Charging at Single Family Homes

- L1 or L2 chargers
  - Need access where you are parked
  - Outlet or Hardwired
- Factors to consider, while choosing the right home charger
  - Hardwire/Plug-in
  - Length of cable
  - Size
  - Weatherproofing if outdoor
  - Features
  - **UL Listed**



# Multi-Family Charging



- Hard to want to buy an EV if you don't know where you're going to charge it
- People want to charge where they park
- Many barriers such as
  - Parking
  - Electrical access
  - Electrical Capacity
  - Internet signal
  - Billing
  - Appropriately allocating costs



# Workplace Charging

- Workplace charging implementation
  - Employee amenity
  - Can double for Fleet charging when not used by employees
  - Customers
- Resources on planning, organizing, and executing successful and educational workplace charging events in the [Clean Cities Workplace Charging Toolkit](#).



# Public Charging Overview

- Level 2 or DC fast charging
  - Should be deployed based on community needs
  - At destinations like business or neighborhood parks
  - Along highway corridors or at urban charging hubs
- Builds range security (as opposed to range anxiety)
- Destination charging can sometimes be public charging



# Corridor Charging

## Primarily DC chargers

### Best for:

- Long distance trips
- Regular mid-distance trips
- If you live nearby, backup for a lack of access to chargers at SF or MF homes



# Light Duty VS Heavy Duty Charging Locations

Key differences are

- More space needed
- Turning Radiuses
- Charging speeds
- Utility infrastructure
- Battery storage
- Faster Charging speeds (MegaWatt Charging Standard-MCS)



**Vehicle to X**  
**Vehicle to Grid**  
**V2Load**  
**V2Home**  
**V2Building**  
**V2Vehicle**

**When your vehicle can export power at high levels,  
what will you do?**

**Still in the works**  
**Up to 4.5MW per port**

**Ships**  
**Airplanes**  
**Semi trucks**  
**Construction**  
**Mining**  
**More**




# When EVs are just cars. What then?

Do our public spaces magically become greenified with perfectly located chargers wherever people want them?

Where do chargers need to be? Where should they not be?

Let's not install chargers we're going to need to rip out in a few years, right?



**Roadmap Conference**  
**May 15-17, Portland, OR**

<https://www.roadmapforth.org/>

# ENABLING COMMUNITY ACCESS TO CHARGING FUNDS

- If the groups with the most barriers receive public investments, everyone benefits
- Under a grant from the GM Climate Fund, Forth is helping communities access this generational investment
- Make sure the money is spent efficiently and in ways that center equity
- Matchmaking partners and funding sources
- Educating local governments excited about applying
- Forth workshop to help communities win federal TE funding May 15:  
<https://www.roadmapforth.org/rm23/workshop>





zero Emission

# QUESTIONS?

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