# The Path to 2030 – Electric Transportation

## Accelerating EV Adoption

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Regional Executive

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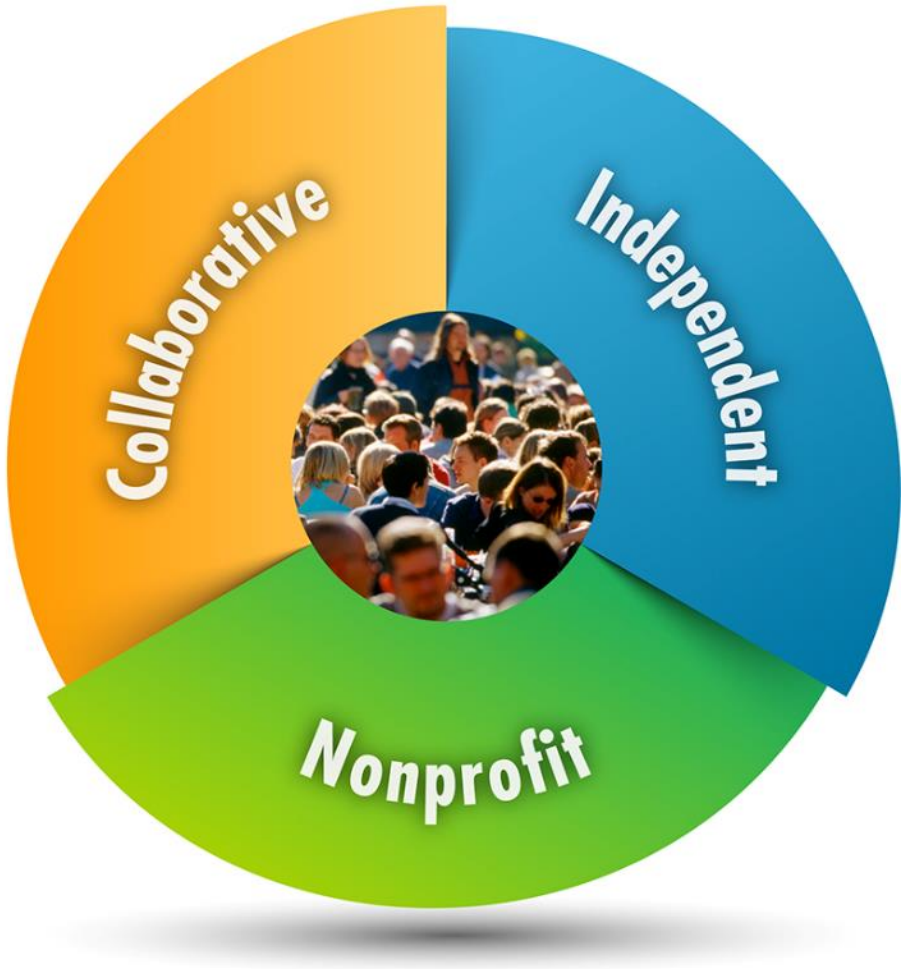
Dec. 9th, 2019

# Who is EPRI?




## Independent

Objective, scientifically based results address reliability, efficiency, affordability, health, safety, and the environment

## Nonprofit

Chartered to serve the public benefit

## Collaborative

Bring together scientists, engineers, academic researchers, and industry experts

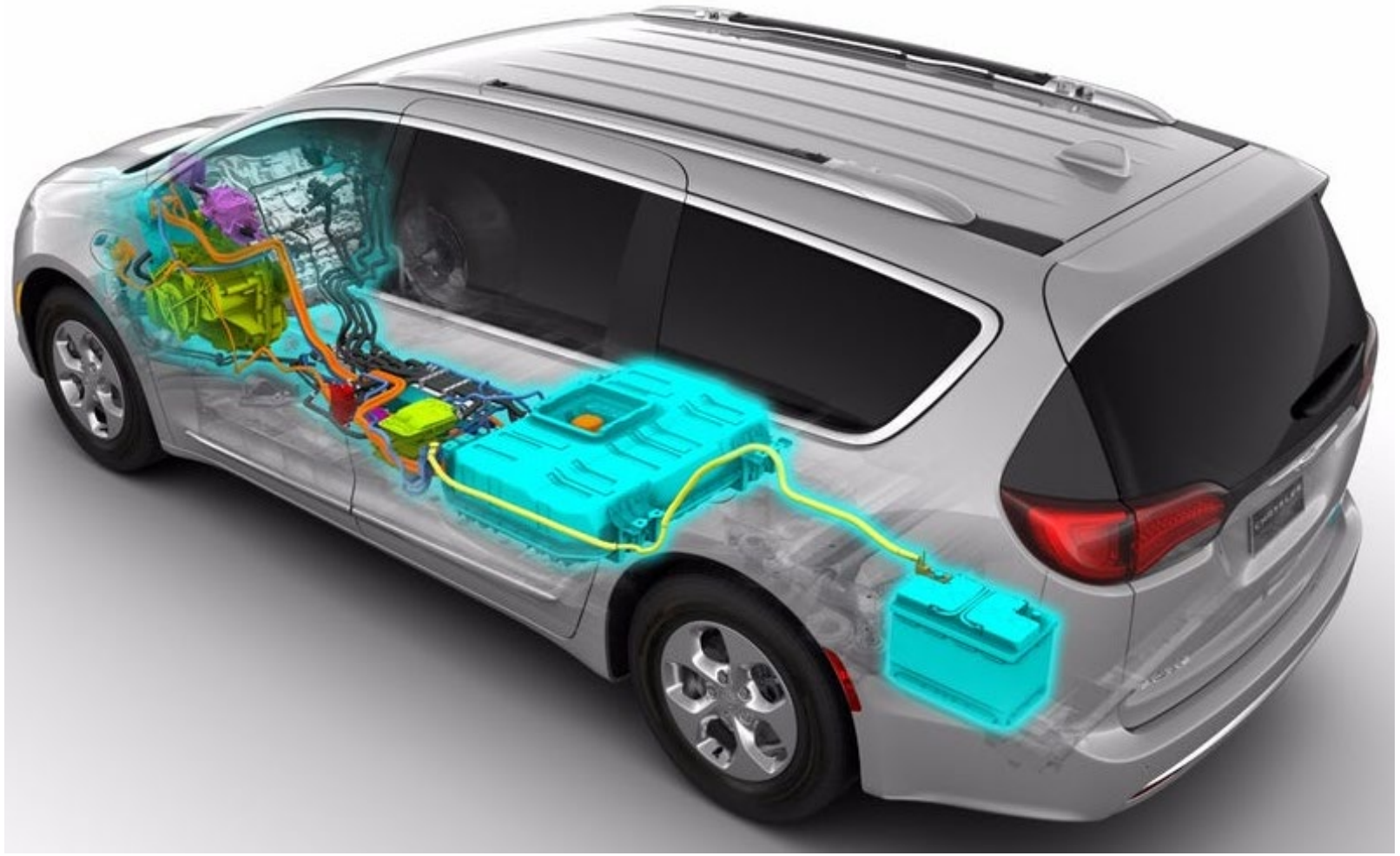
# Personal Shopping Experience

## Chrysler Pacifica

- Plug-in Hybrid (PHEV)
- 33 Mile Battery Range
- MSRP $40 - $46K

### Pros

- ✓Range
- ✓Convenience
- ✓Fuel Savings
- ✓Emissions
- ✓Performance



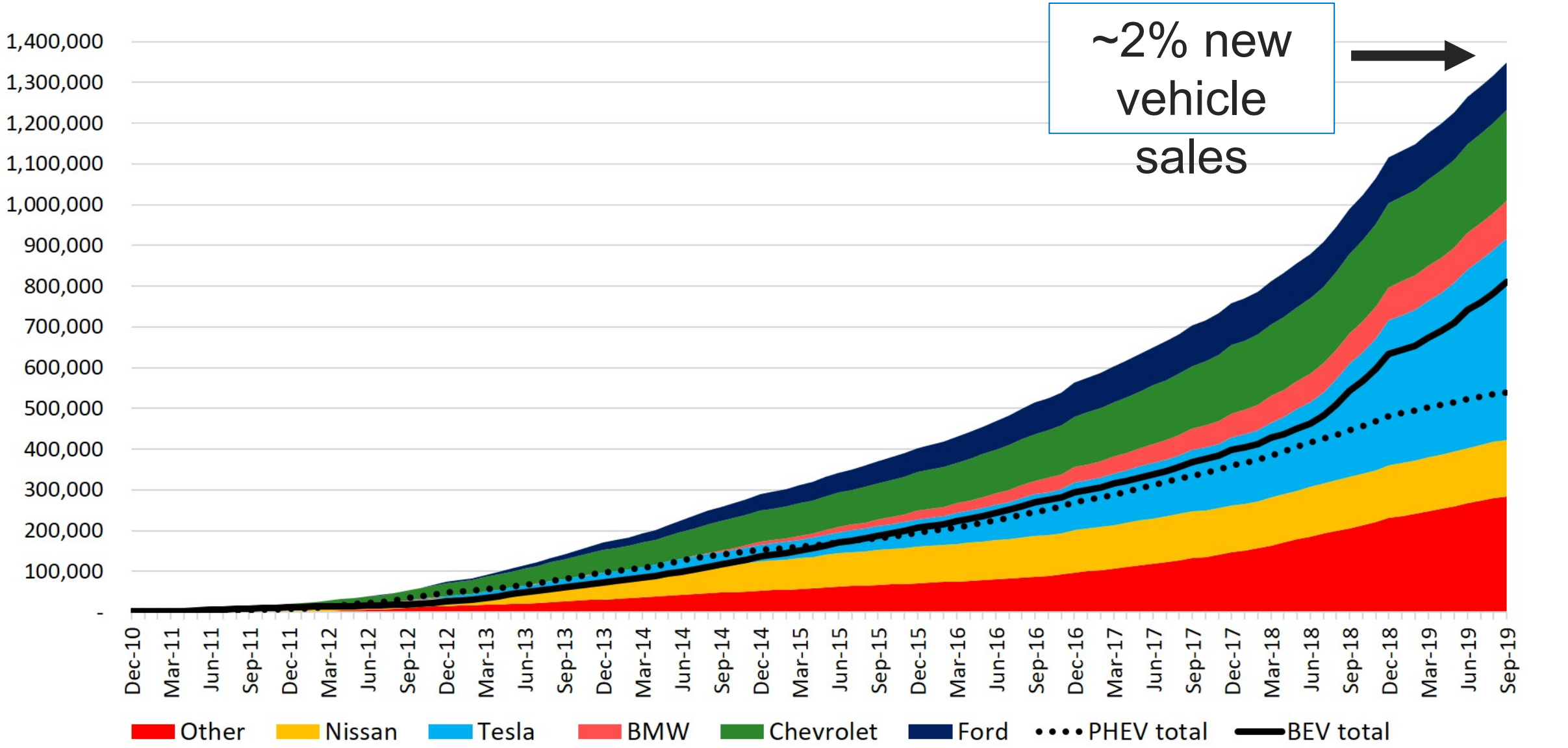
### Cons

- ❖Choice
- ❖Availability
- ❖Cost
- ❖Incentive Program

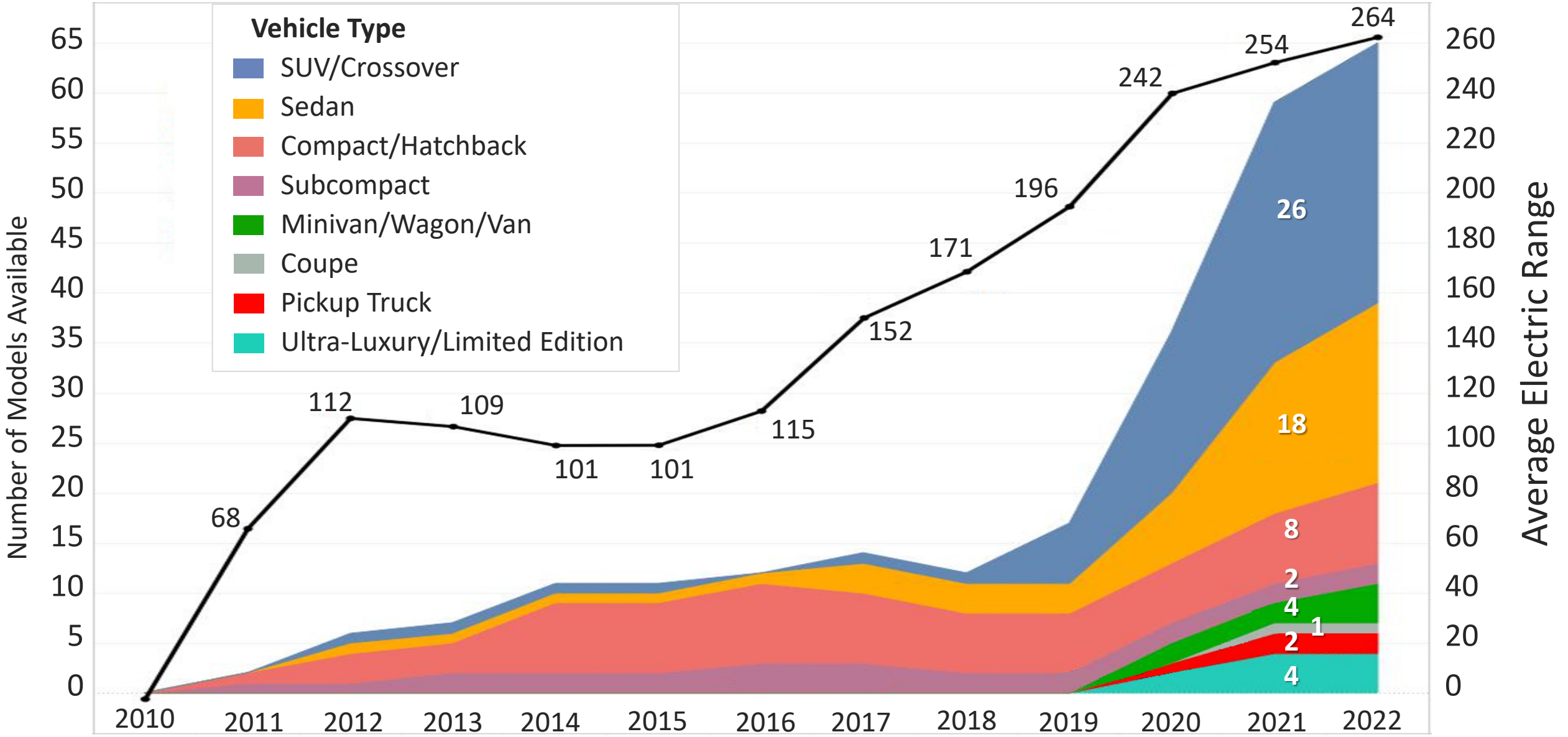
# What is the current state of EVs?

# U.S. EV sales are increasing since late 2010

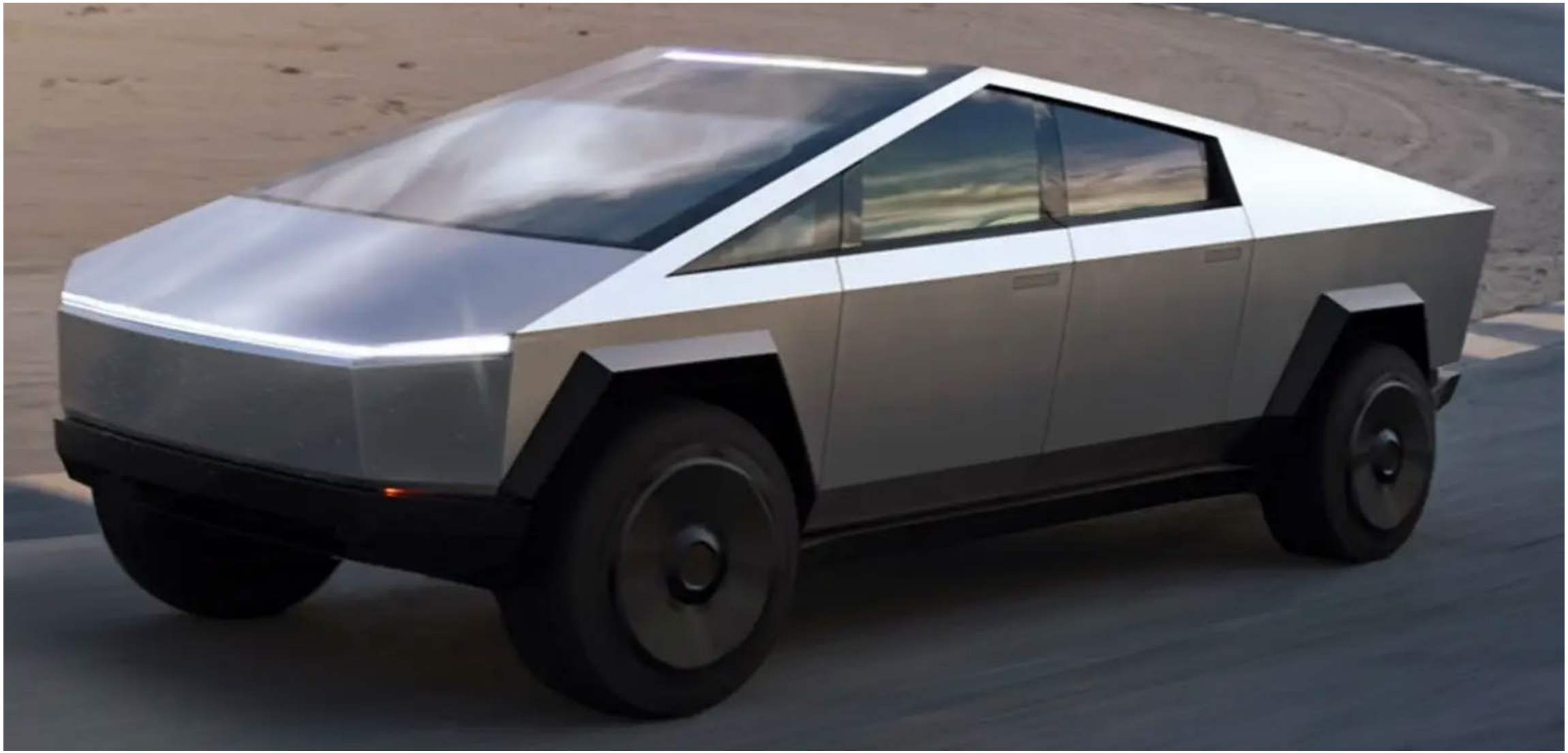
## More than 1.3M on the road



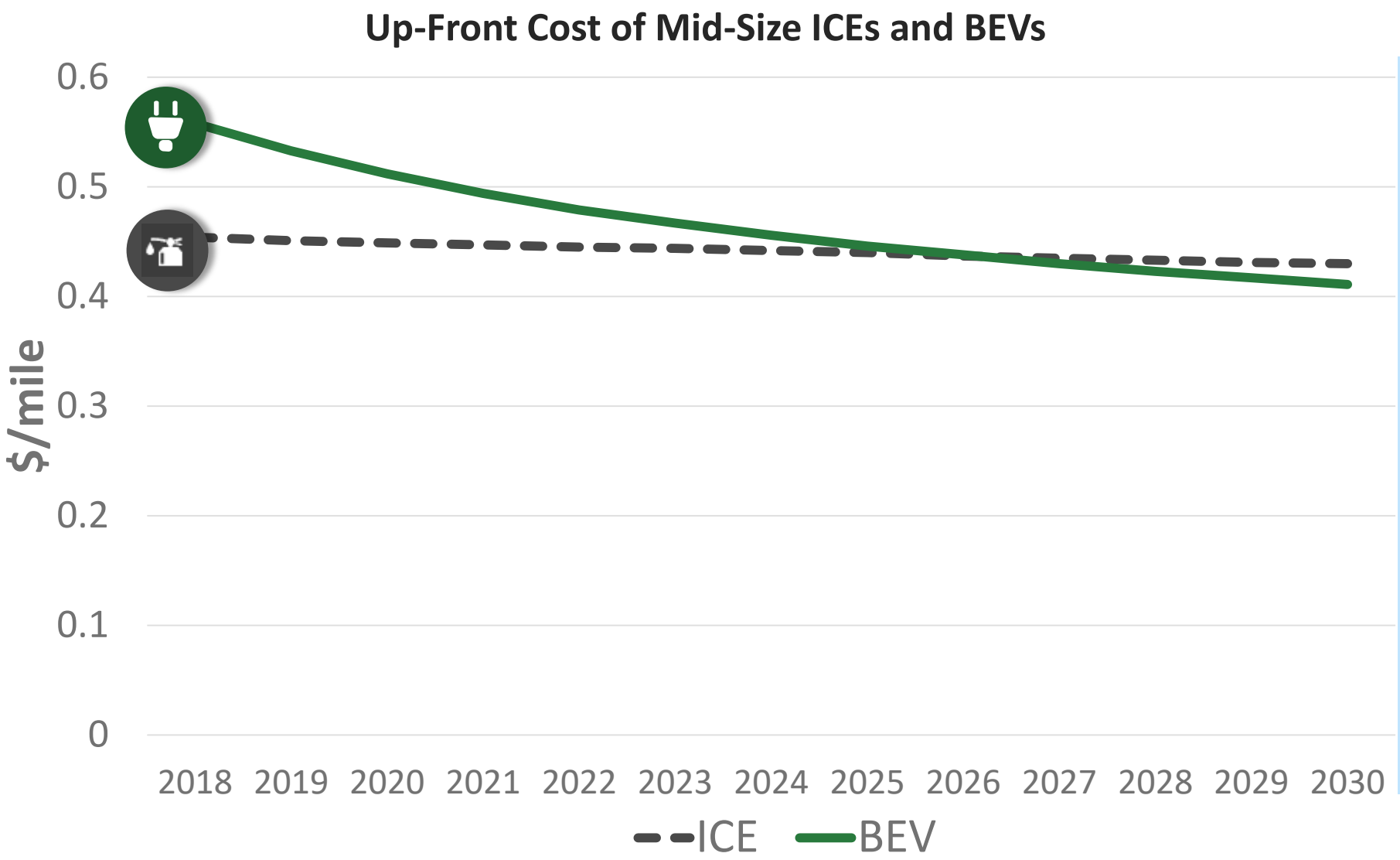
# More models with more range



# Tesla Cybertruck coming in 2021



# EV vs Internal Combustion Engine (ICE) Cost




Maintenance cost savings

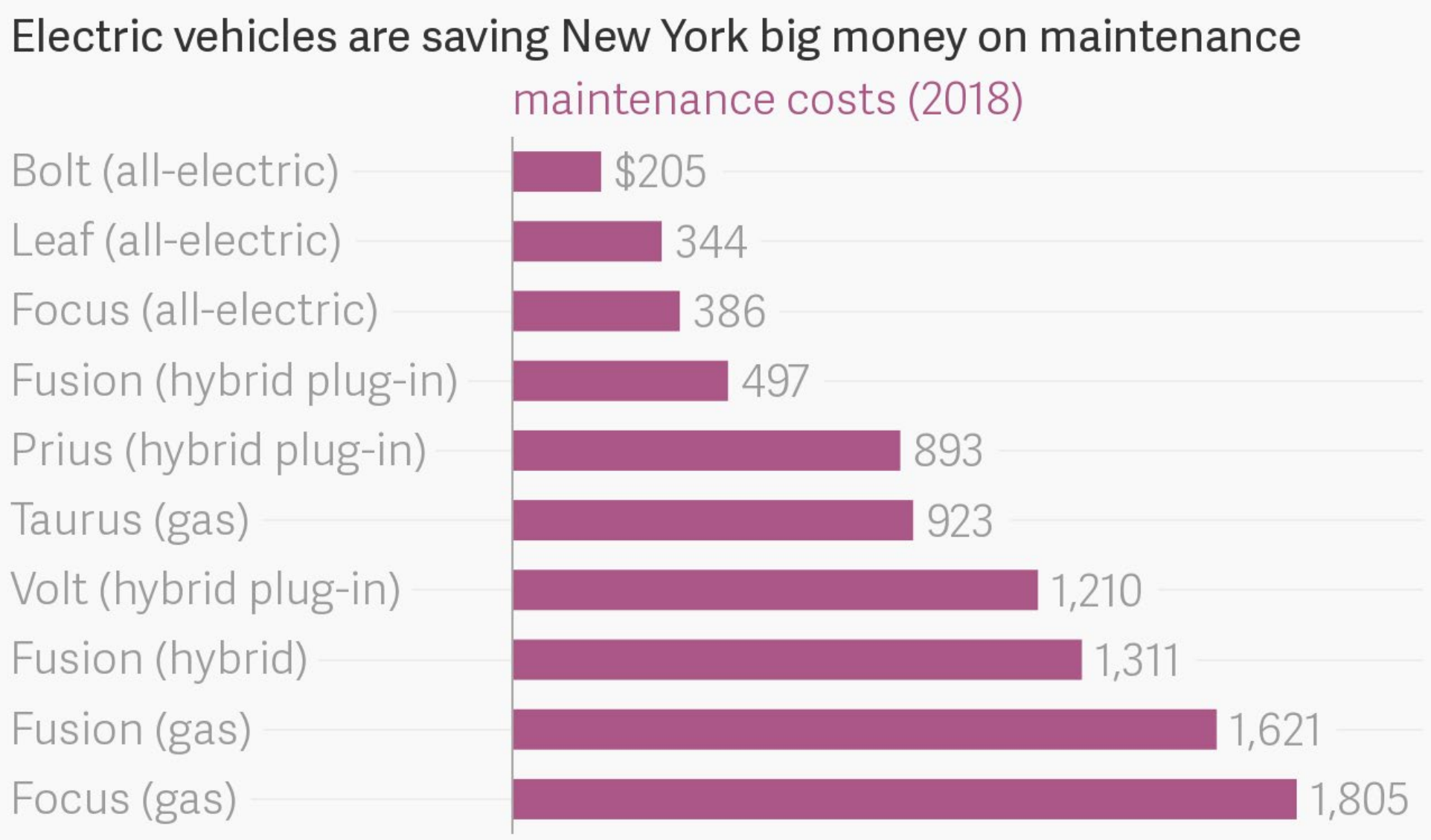
Fuel cost savings

Battery costs

Source: *Electric Vehicle Outlook 2019*, BloombergNEF.

# Significant Maintenance Cost Reduction

*Fleet managers make cost-based decisions*




Source: NYC fleet newsletter; The Atlas

Costs from 1,893 fleet vehicles

- 197 PHEVs
- 246 BEVs
- 1,336 HEVs

# Electric bus deployments across the US


**MANUFACTURERS**

Volvo Bus UK: **6**

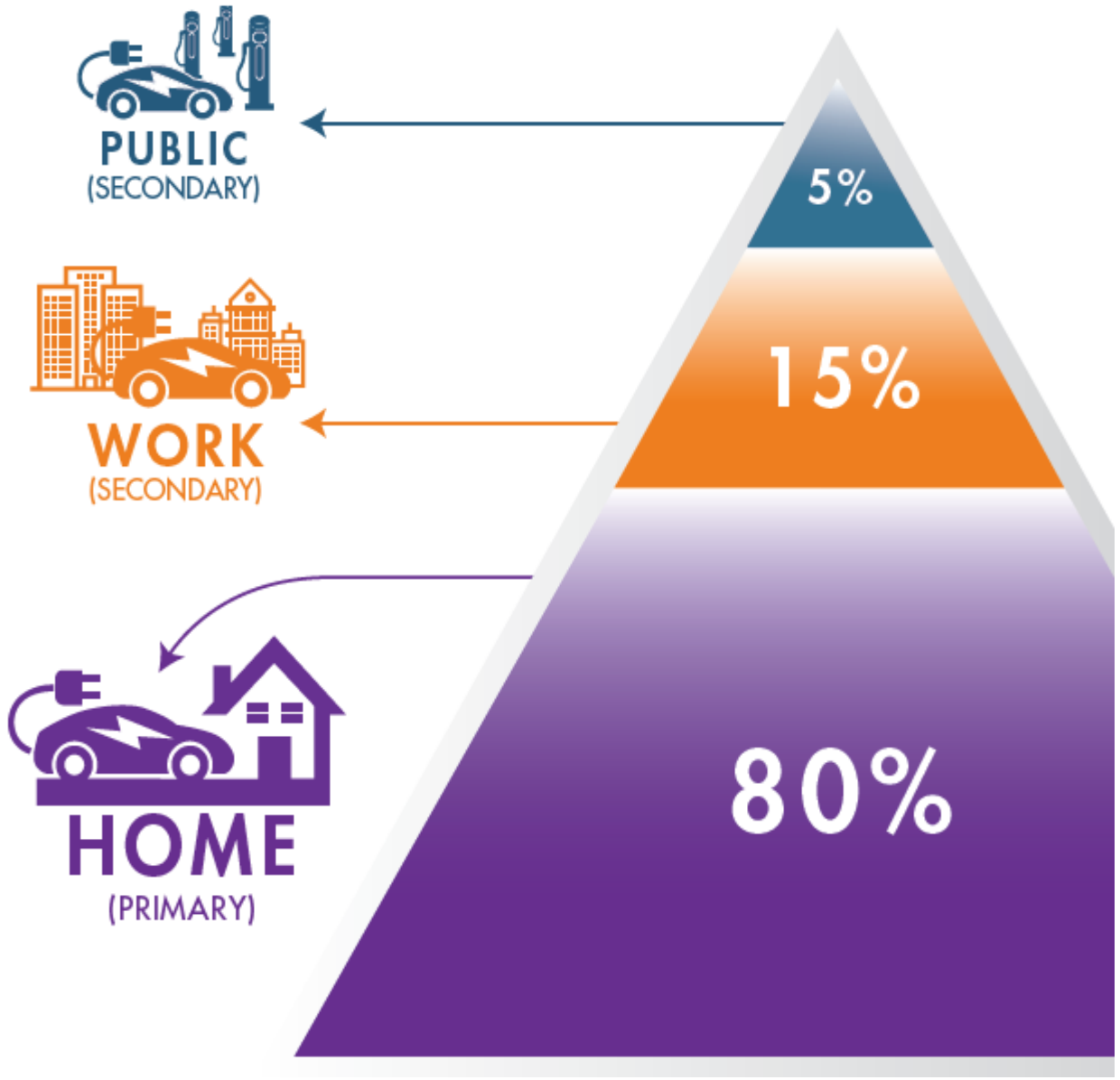
# What about charging?

# EV Charging Today

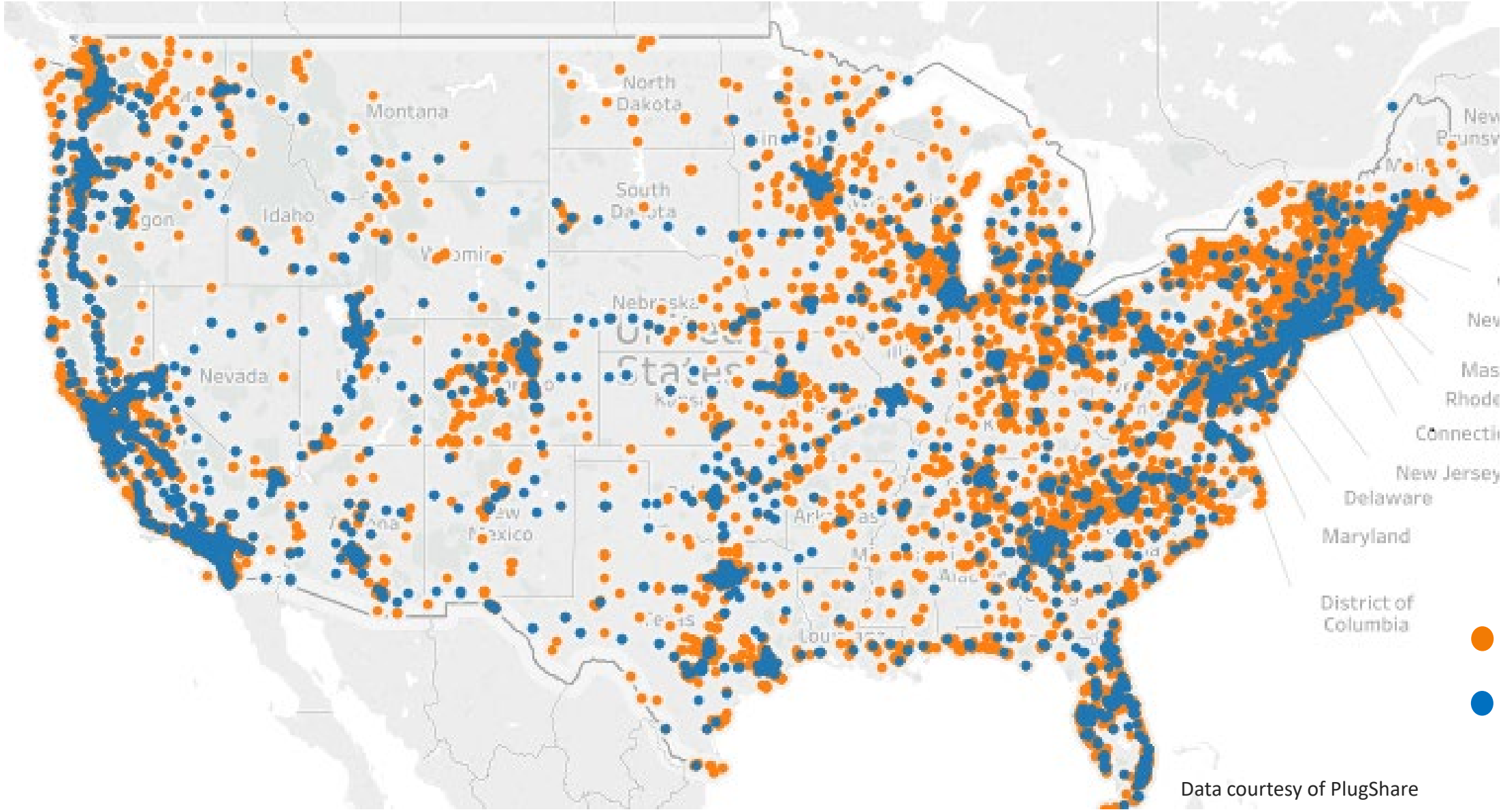
**DC Fast**
- Public
- 20-30min

**AC Level 2**
- Home, Work, Public
- Charging station

**AC Level 1**
- Home, Work
- Household outlet



# Public charging infrastructure density is increasing

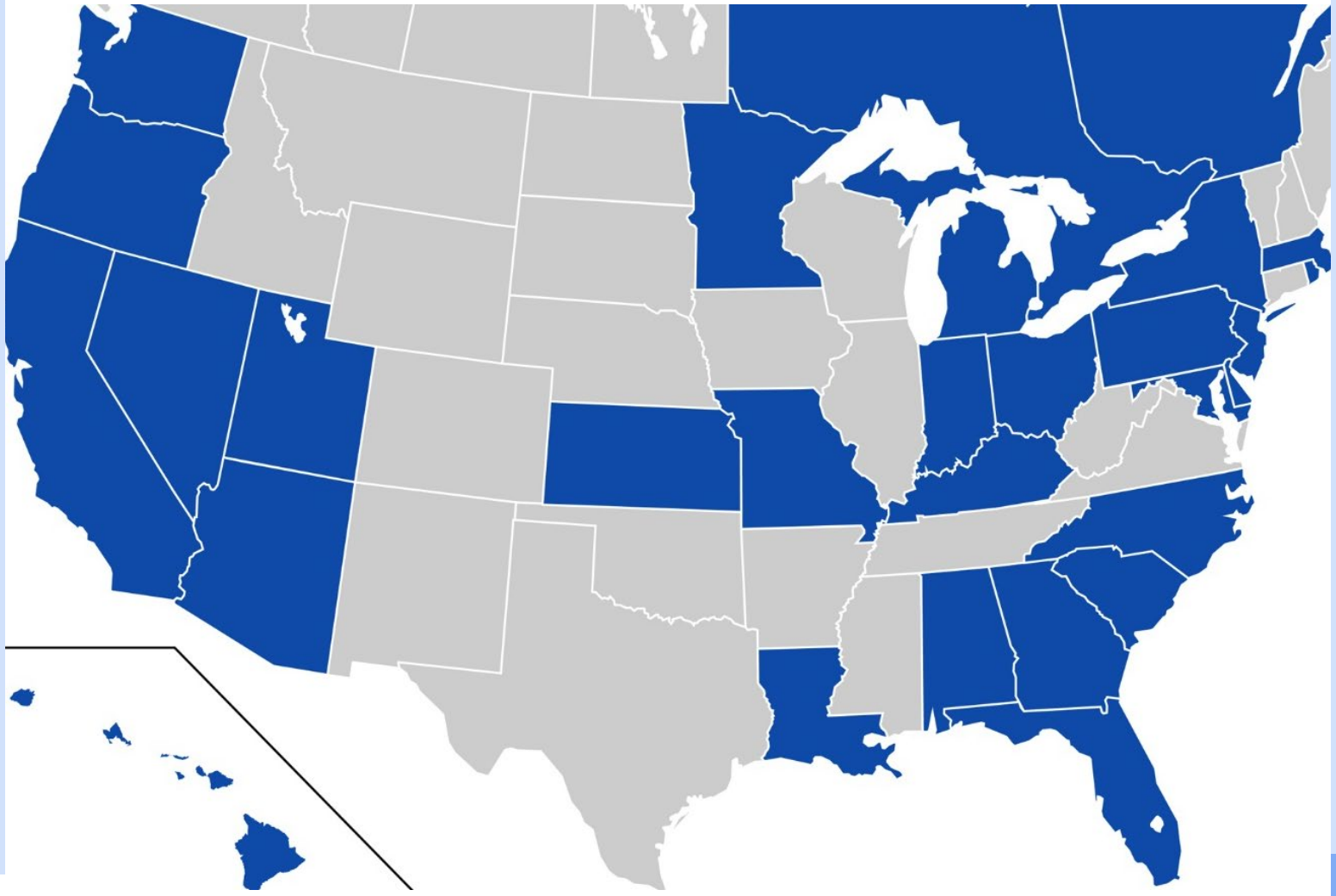



Data courtesy of PlugShare

# U.S. & Canadian Utilities are Investing Billions in EV Charging Infrastructure

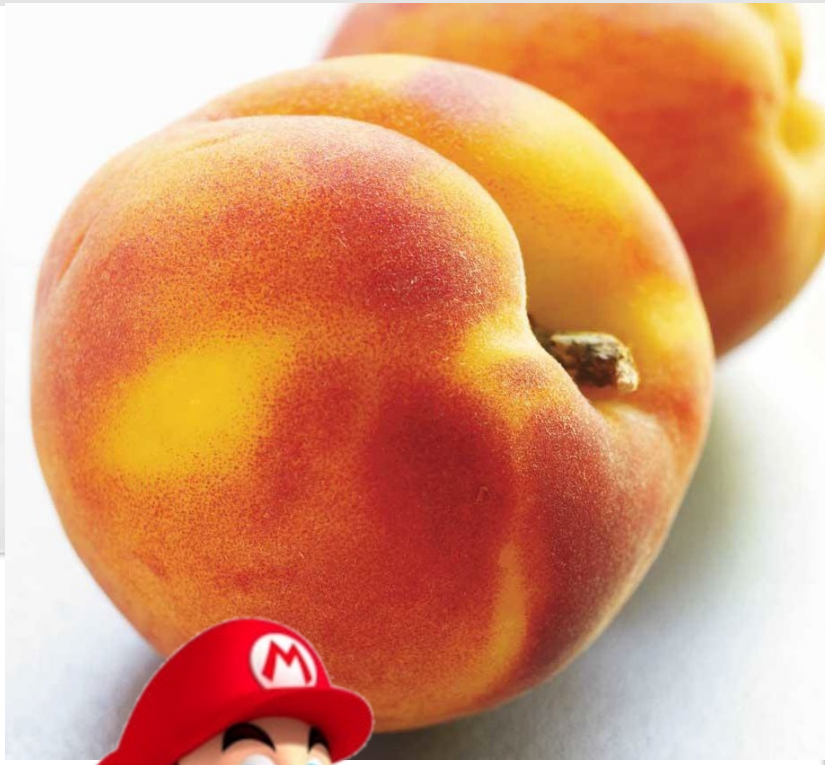
*Ubiquitous public charging infrastructure empowers customers considering purchasing EVs*

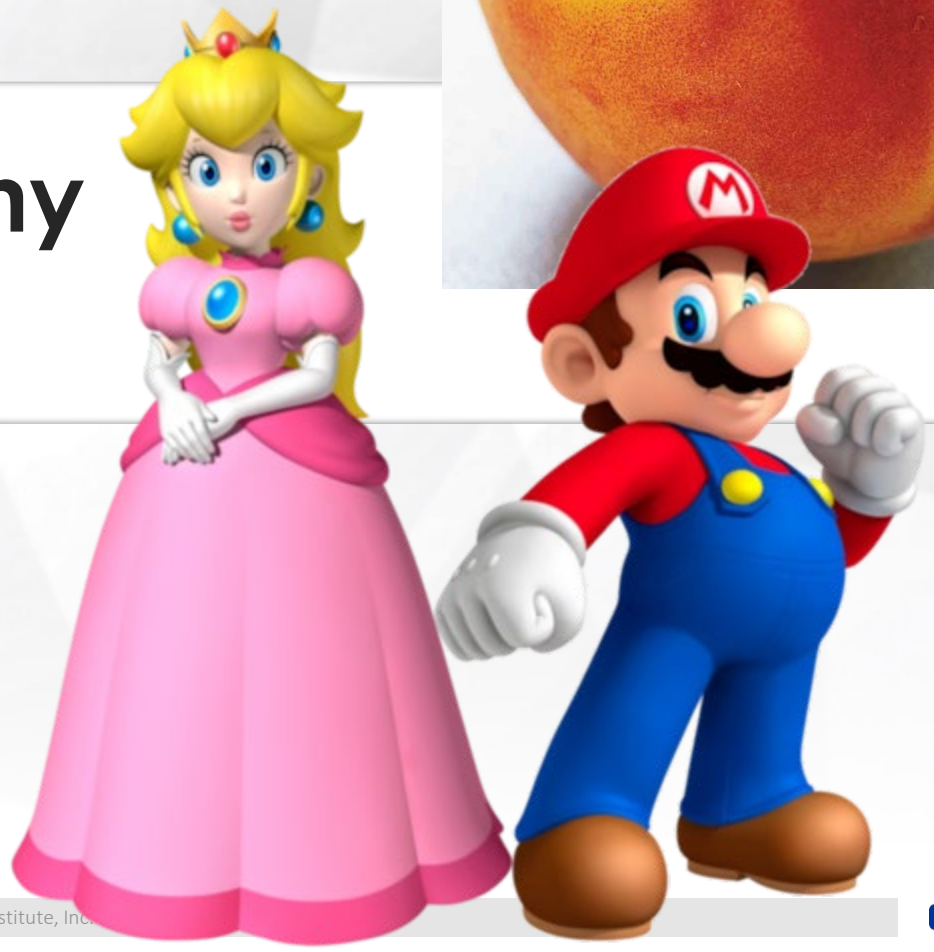
| Budget | ($M) |
|---|---|
| Alabama | $2 |
| Arizona | $6 |
| California | $1,881 |
| D.C. | $5 |
| Delaware | $2 |
| Florida | $9 |
| Georgia | $10 |
| Hawaii | $4 |
| Indiana | $6 |
| Kansas | $6 |
| Kentucky | $1 |
| Louisiana | $1 |
| Maryland | $30 |
| Massachusetts | $75 |
| Michigan | $23 |



| Budget | ($M) |
|---|---|
| Minnesota | $24 |
| Missouri | $17 |
| Nevada | $15 |
| New Jersey | $379 |
| New York | $324 |
| North Carolina | $72 |
| Ohio | $17 |
| Oregon | $24 |
| Pennsylvania | $2 |
| Rhode Island | $9 |
| South Carolina | $15 |
| Utah | $10 |
| Washington | $22 |
| Quebec | $10 |
| Ontario | $20 |
| **TOTAL** | **$3,017** |

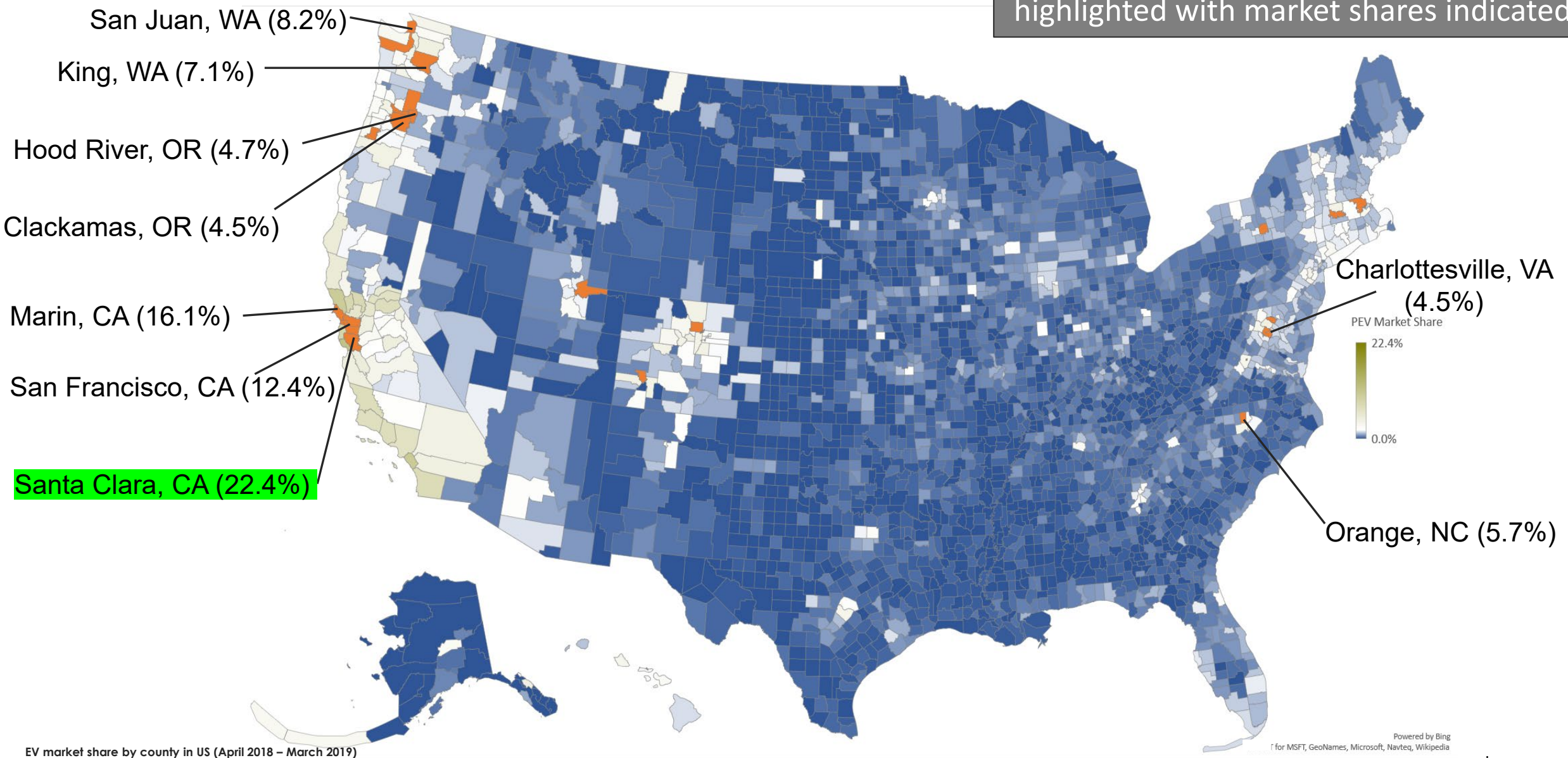
# So everything is just Peachy … right?





# U.S. EV sales are clustered

Top 5 counties all in CA & top 20 counties outside of CA by market share are highlighted with market shares indicated




EV market share by county in US (April 2018 – March 2019)

# Additional education & awareness needed

42% of Brits think electric cars can’t go into a car wash

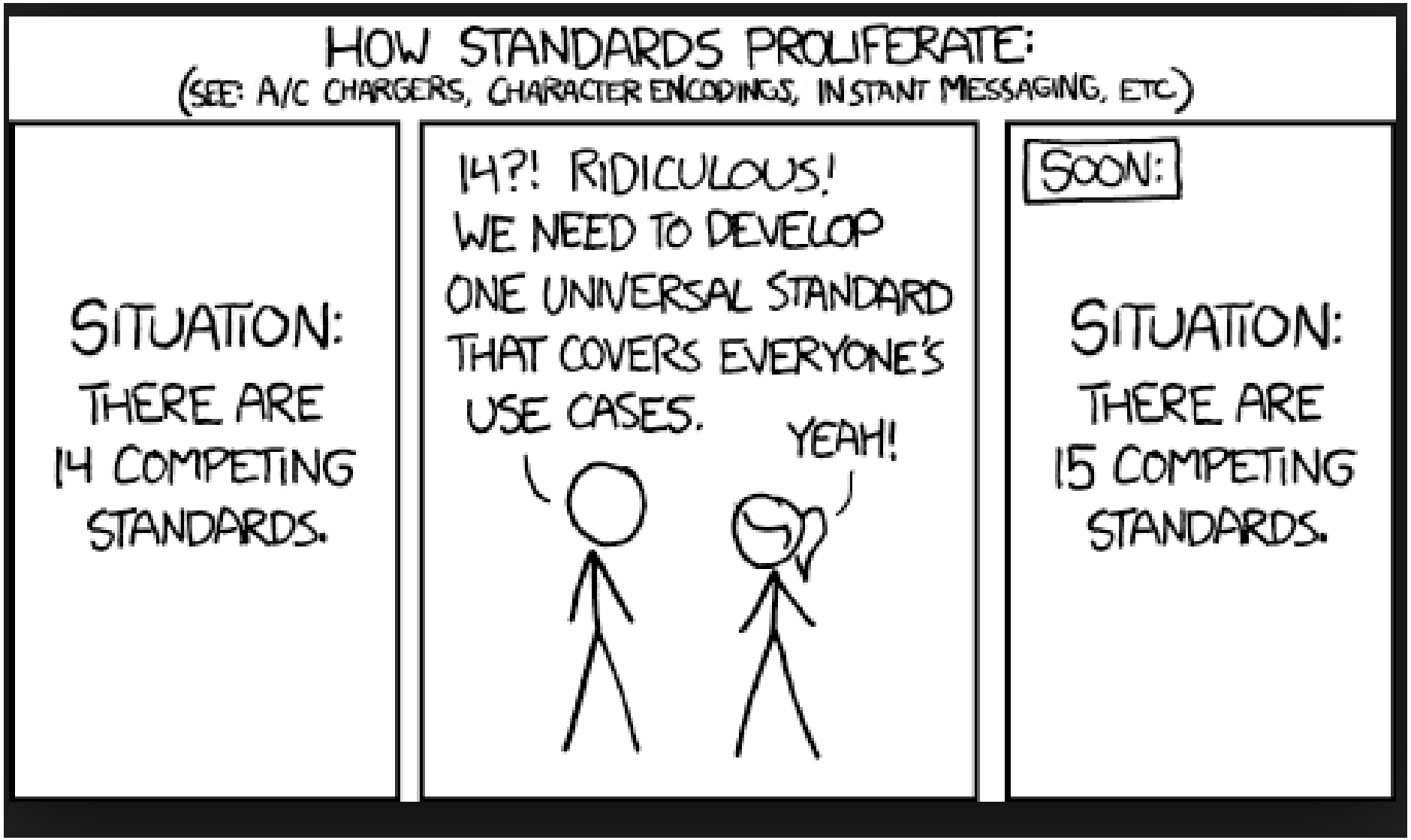

https://insideevs.com/news/339335/42-of-brits-are-confused-think-electric-cars-cant-go-in-a-car-wash/

# Consumer charging needs – from individuals to fleets


# Preparing the grid for high-power DC fast charging

| Grid Impacts from DCFC | DC Now | DC Midterm | DC Future |
|---|---|---|---|
| Power level | 50 kW | ~200 kW | ~350 kW |
| Charge time (~100 mi) | <30 min. | <10 min. | <5-6 min. |
| C&I: Service connection & transformer impacts | Possible | Likely | Likely |
| Utility distribution impacts | Unlikely | Possible | Possible |

# Aligning standards



# Encouraging smart charging behavior


Photo courtesy of SRP

# Looking ahead to 2030 and beyond

*Numerous key questions remain*

- What will the transportation market look like?
- What is the utility's role be?
- Will individual car ownership prevail?
- What will the impact of autonomous EVs be?
- Will buses evolve into smaller electric shuttles?
- What about last-mile technologies (e.g. scooters)?
- How will EVs of all sizes charge?
- How can utilities speed up this transition?

*Photo credit: Dan Bowermaster, EPRI*

# EPRI Electric Transportation R&D Program

## Vehicle Technologies

- Battery Technologies
- Commercial & Industrial EVs
- Future Technologies

## Charging Infrastructure

- DC Fast Charging
- Charging Infrastructure Planning & Development

## Utility Grid Integration

- EV Load Profiles & Grid Impacts
- Understanding EV Rates
- Integration of EVs Across T&D

## Market, Policy, and Programs

- Customer Preferences
- EV Programs
- Policy Objectives

**Stakeholder communication, education, and tech transfer**

# Together…Shaping the Future of Electricity