



Clean Fuels Ohio

A non-profit Clean Cities coalition working to improve Ohio's economy, environment, and energy security by helping fleets assess options and implement sustainability strategies.





EDUCATE & ADVISE

Natural Gas



Propane

Clean Diesel
Technologies



Plug-In & Hybrid
Electric



Biofuels



Creating future-focused planning tools to help fleets deploy cost-effective sustainable fuels, technologies, and management solutions

Consulting Services

- Analysis & Planning
- Grants & Incentives
- Technical Training
- Government Affairs





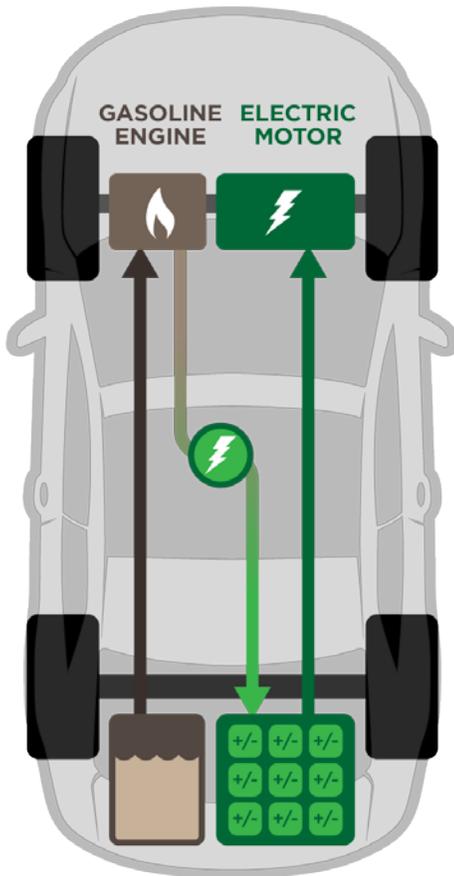
Drive Electric Ohio

USEFUL ACRONYMS

| | |
|--------------|--------------------------------------------------|
| EV: | Electric Vehicle |
| PHEV: | Plug-in Hybrid Electric Vehicle |
| BEV: | Battery Electric Vehicle (fully electric) |
| ICE: | Internal Combustion Engine |
| EVSE: | Electric Vehicle Supply Equipment |
| DCFC: | DC Fast Charging |
| OEM: | Original Equipment Manufacturer |
| kW: | Kilowatt |
| kWh: | Kilowatt Hour |

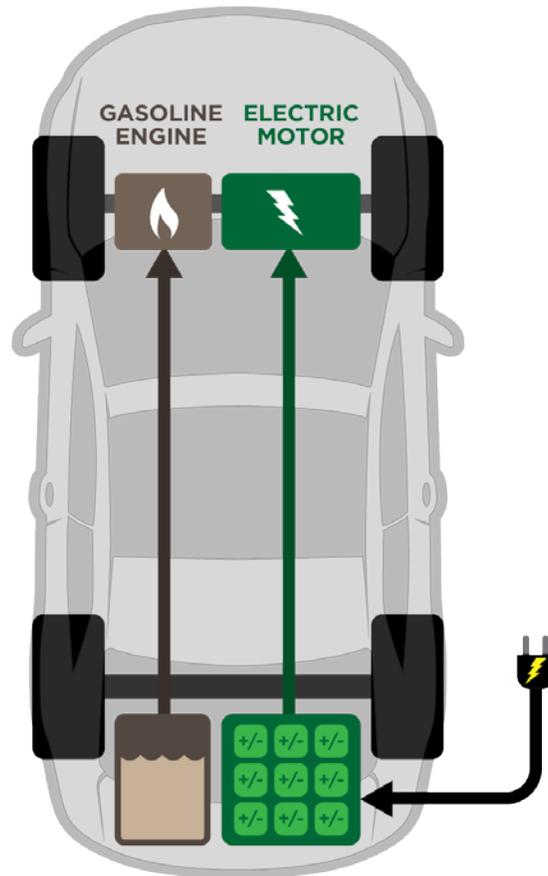
ELECTRIC VEHICLE TYPES

Hybrid



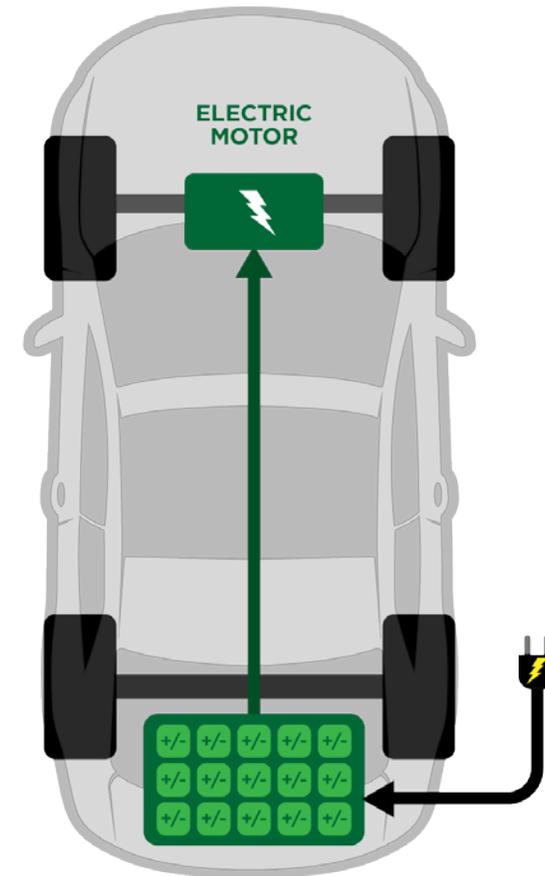
GASOLINE ENGINE RECHARGEABLE BATTERY PACK

PHEV-Plug-in Hybrid Electric Vehicle



GASOLINE ENGINE RECHARGEABLE BATTERY PACK

BEV-Battery Electric Vehicle



RECHARGEABLE BATTERY PACK



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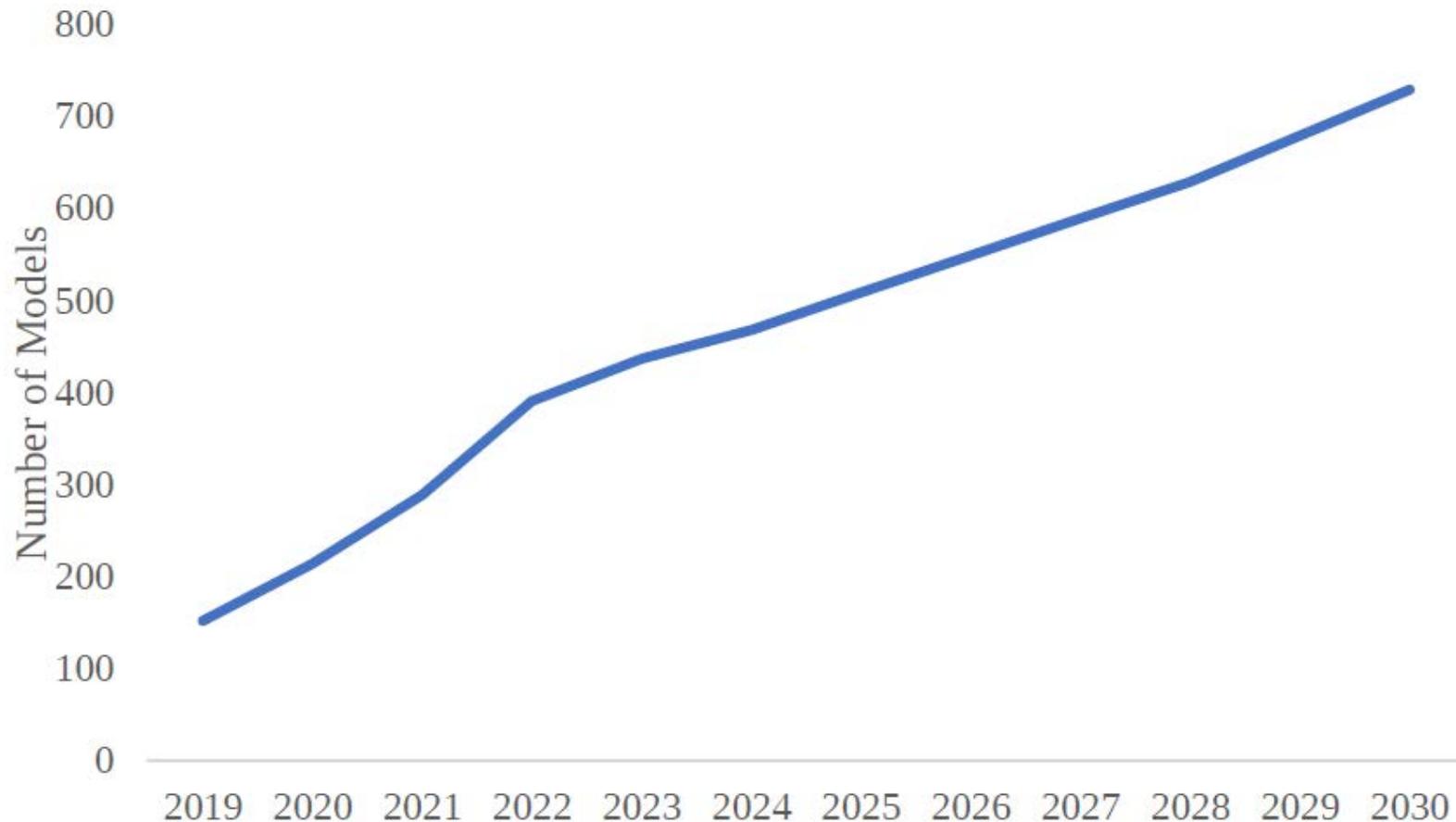
EV MARKET OVERVIEW



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EV MARKET OVERVIEW

Global Automaker Electric Vehicle Model Commitments



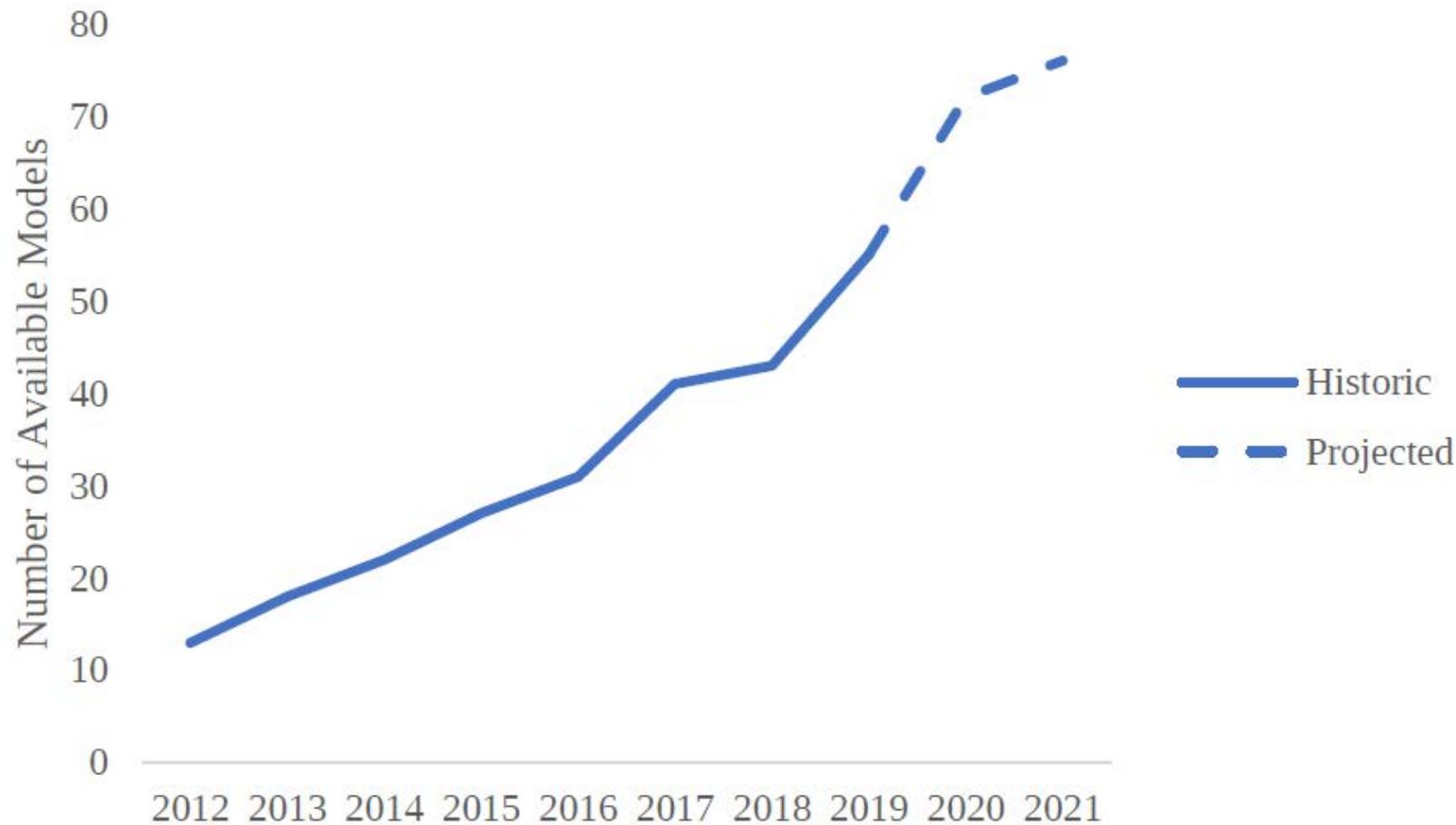
Automakers have announced plans to offer about 700 EV models worldwide by 2030, nearly five times the number of models currently available.



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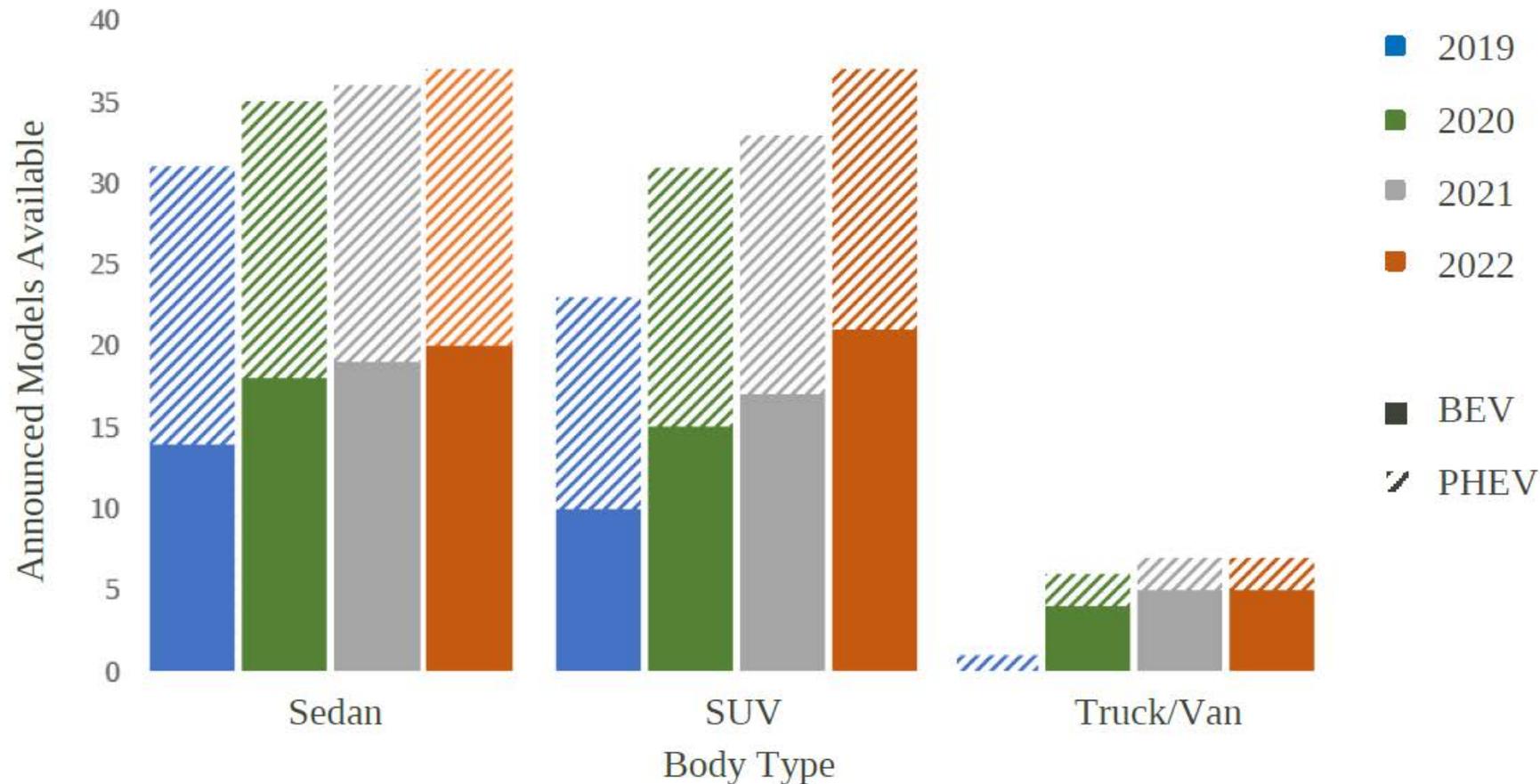
EV MARKET OVERVIEW

Total PHEV and BEV U.S. Models Available by Year



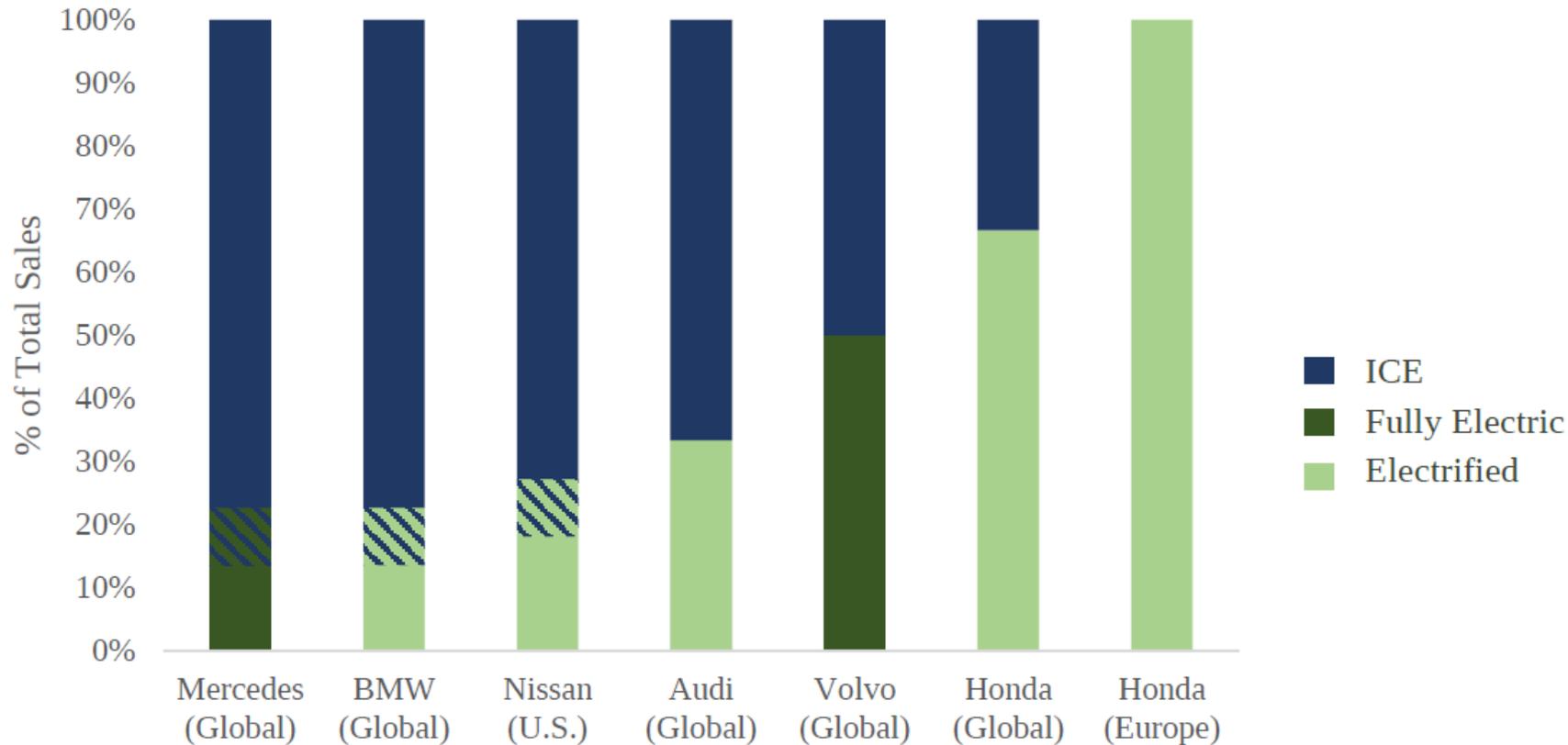
There were 13 plug-in hybrid (PHEV) and battery electric (BEV) models available in the U.S. in 2012. This is projected to reach 55 by the end of 2019, and 81 by the end of 2022.

Figure 4 Cumulative Announced U.S. BEV and PHEV Models 2019-2022 by Body Type



The number of PHEV and BEV models available is projected to increase across a variety of vehicle types.

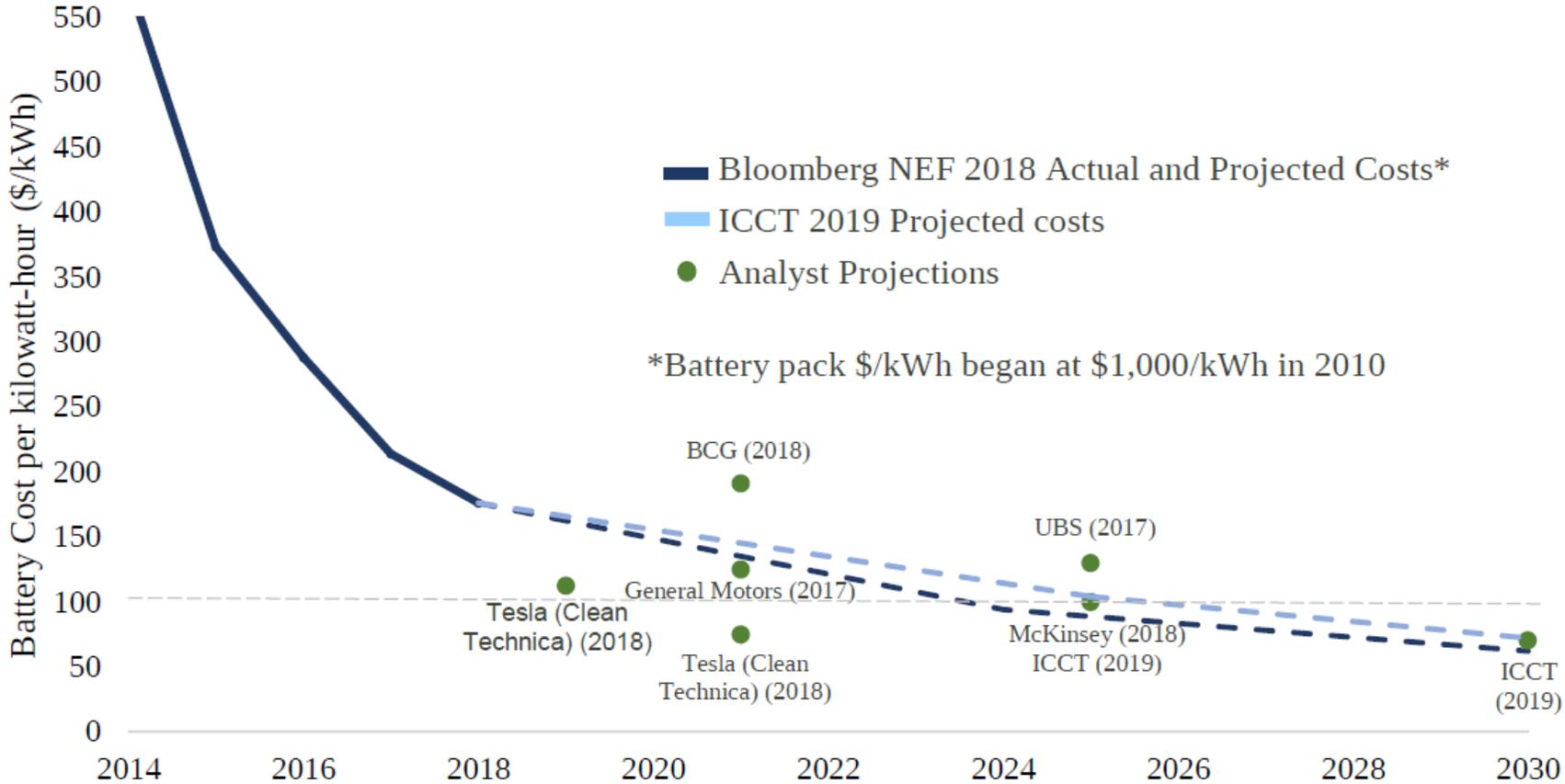
Figure 5 Sales Forecast for 2025 by Manufacturer



Many manufacturers are projecting that EVs will account for a significant share of their total sales by 2025.

ICE: Internal Combustion Engine

Figure 6 Actual and Projected Battery Pack Costs



Most analysts agree that price parity between EVs and internal combustion engine vehicles will occur sometime between 2020 and 2025.

EV MARKET OVERVIEW

Figure 1A Manufacturer Commitments: Model Announcements, Investments, and Sales Forecasts

| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|--------------------------------------------------------------------------------------------------------------------------------|------|-----------------------------------------|------|---------------------------------------------------------------------------|------|---------------------------------------------------------------------|------|--------------------------------------------------------------------------|------|------|------|------|------|
|  Audi | | | | | | \$15.5 billion for electric mobility, digitization and AI | | 20 electrified models 800,000 EVs annually (1/3 total sales) | | | | | |
|  BENTLEY | | | | | | | | All model have electrified version | | | | | |
|  BMW | | 500,000 e-vehicles | | 5 BEV models | | | | 25 electrified models (at least 12 BEVs) 15-25% of sales are electric | | | | | |
|  DAIMLER | | \$22.5 billion battery cell purchase | | Smart brand: only selling cars with electric systems in Europe/N. America | | 10 BEV models | | | | | | | |
|  FCA FIAT CHRYSLER AUTOMOBILES | | | | Phase out all-diesel passenger car production in Europe | | More than 30 electrified models (Jeep: at least 10 PHEV and 4 BEVs) | | | | | | | |
|  Ford | | | | | | \$10.5 billion for electrification | | 40 electrified (16 BEV 24 PHEV) \$11 billion for electrification | | | | | |
|  GM | | \$300 million MI EV manufacturing plant | | Cadillac will introduce new model every 6 months through 2021 | | 20 all electric models | | 1 million EV units globally | | | | | |

Green – Model announcements
 Orange – Investments (converted to USD\$) or acquisitions
 Blue – EV sales forecast

Figure 1A (cont.) Manufacturer Commitments: Model Announcements, Investments, and Sales Forecasts

| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|-------------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------|------------------------|-----------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------|------|------|------|----------------------------|----------------------------------------------------------------------------------------------|
|  HYUNDAI | | | | | | | | 44 electrified models | | | | | |
|  Mercedes-Benz | | \$1 billion U.S. production plant | | | 130 electrified variants | | | 15-25% of new vehicles are electric | | | | | |
|  NISSAN | | \$11 billion in fleet electrification, \$1.18 billion in battery tech | | | 1 million electrified vehicles | | | Electrified vehicles make up 20-30% of US sales | | | | | |
|  PORSCHE | | \$70 million DCFC investment at dealerships | | | \$6.7 billion in electrification | | | 50% of new vehicles "could have an electric drive system" | | | | | |
|  TOYOTA | | | 10 BEVs in early 2020s | | | | | Every model is dedicated electric or has electric option | | | | | \$13 billion for battery technology 5.5 million electrified vehicles (1 million BEV/FCEV) |
|  | | \$50 billion in EV/autonomous vehicle development | | | | | | 80 electrified models (50 BEV) Up to 3 million EV sales annually | | | | 22 million e-cars produced | Electric version for entire brand (300 models) |
|  VOLVO | | Every future car will have electric motor | | Invested in Freewire Technologies | Invested in Momentum Dynamics | Invest 5% of annual revenue annually (~\$1 billion) in the next few years to develop and build EVs | | BEVs make up 50% of sales | | | | | |



OEM INVESTMENT IN EV'S



Ford committed to spending \$11 billion to offer more than **40 electrified models by 2022.**



GM announced plans to invest \$300 million in its plant in Michigan to manufacture a vehicle based on the battery powered Chevy Bolt, and plans to offer **20 all-electric models by 2023.**



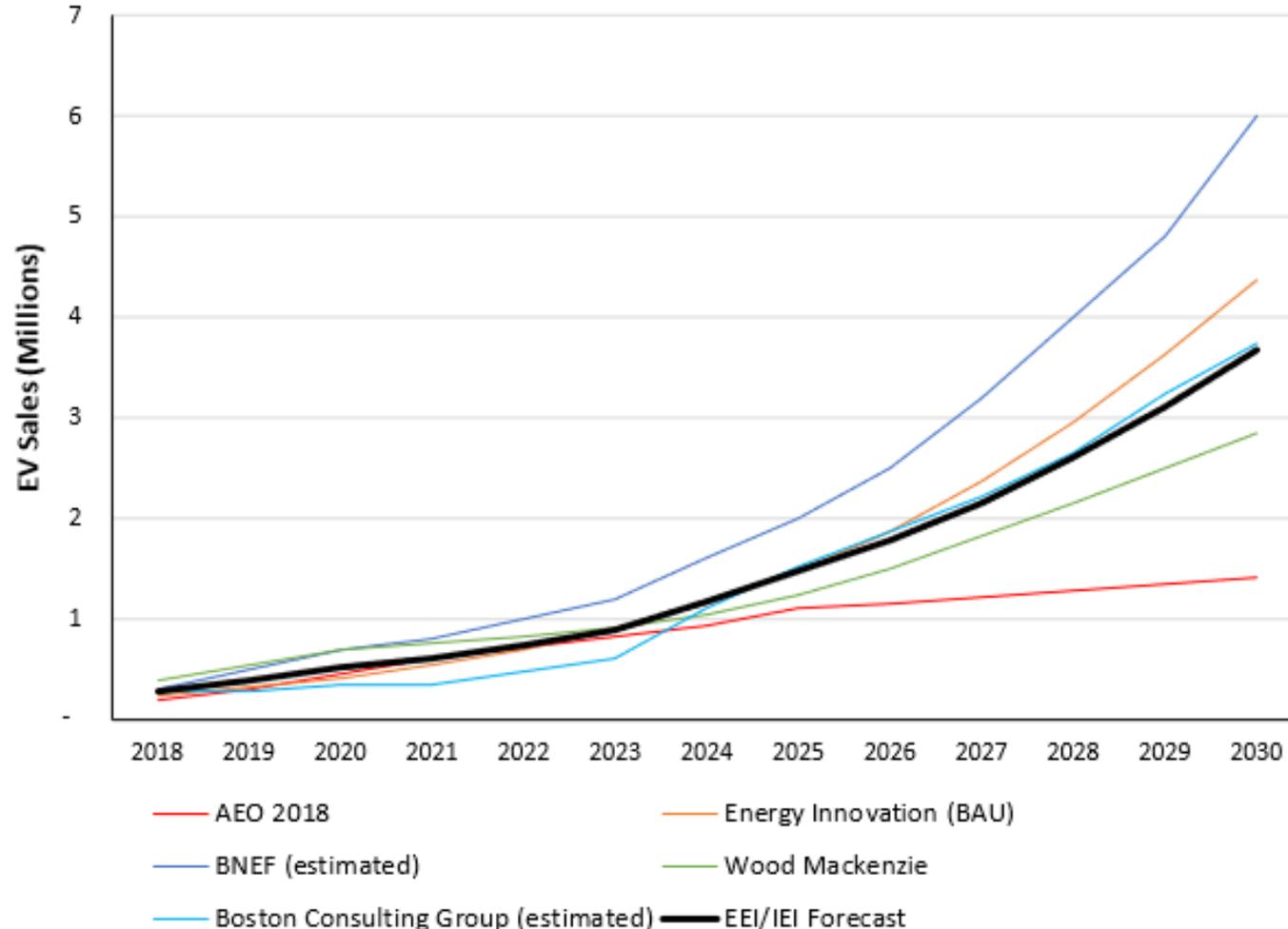
Fiat Chrysler will invest \$4.5 billion in five of its existing Michigan plants and has committed to producing **more than 30 electrified models by 2022.**

In total, car makers worldwide will spend **more than \$135 billion** through 2030 **developing new electric models.**



EV ANNUAL SALES FORECAST

Annual EV Sales Forecast (2018-2030)



Based on the investments in EV's and decreasing battery costs, U.S. EV sales are projected to be in the millions and up to **25% of the market by 2030.**



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OHIO EV MARKET OVERVIEW

- The Ohio EPA has devoted \$11.25 million of the VW settlement to charging infrastructure
- Smart Columbus is devoting \$50 million to “smart mobility” including training and certifying EV dealers, an EVSE rebate program, and consumer education
- In 2018 Cincinnati and Columbus were both named winners of the Bloomberg American Cities Climate Challenge
- Local governments are electrifying their fleets and passing EV-ready ordinances
- Ohio EV sales grew by 28.3% from 2016 to 2017 and 113.1% from 2017 to 2018





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OHIO EV MARKET OVERVIEW

Utility programs with PUCO support

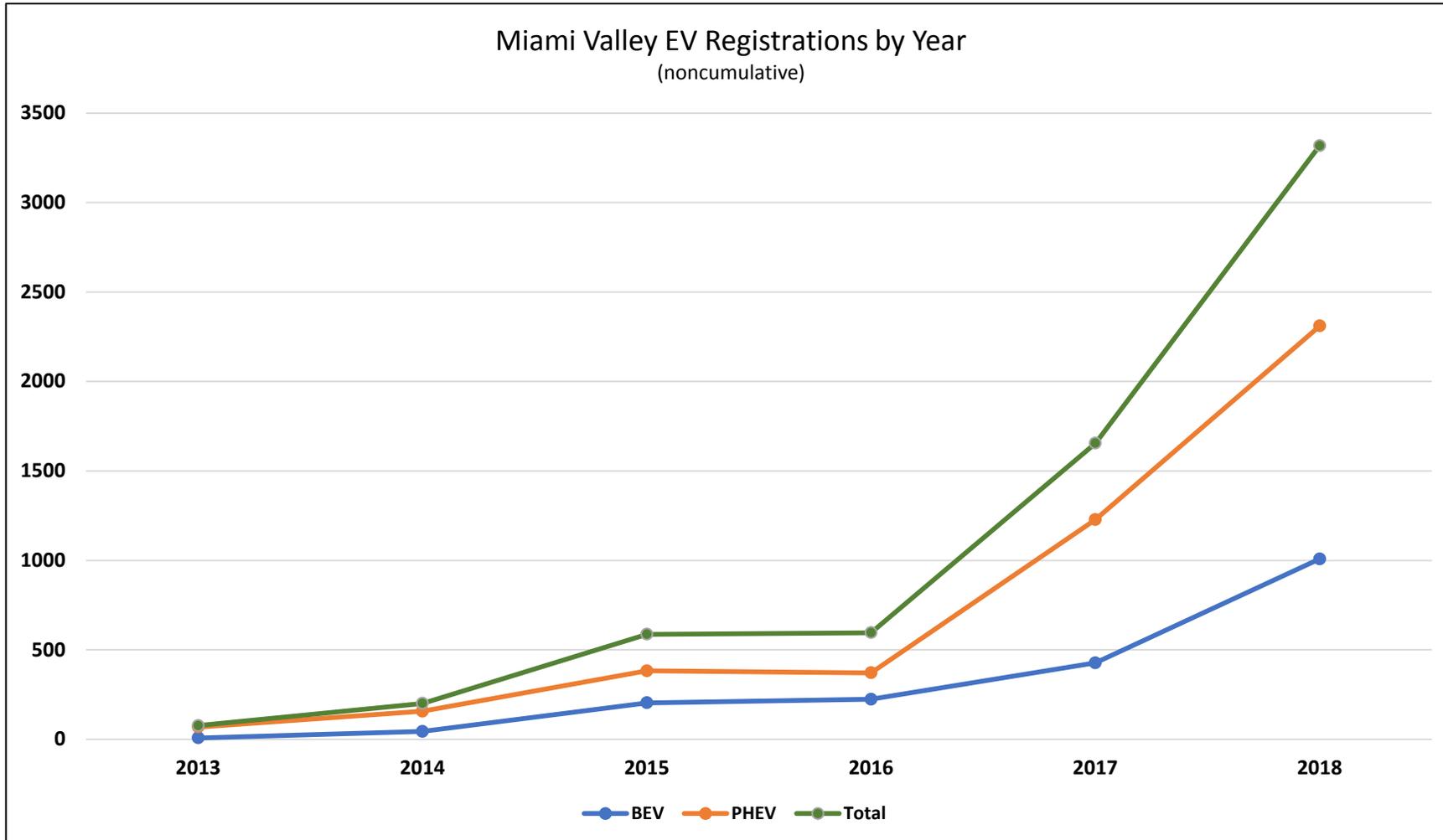
- AEP Ohio has committed \$10 million to fund 375 charging station in their service area
- DP&L has a similar proposal awaiting PUCO approval
- Duke Energy and FirstEnergy plan to file proposals this year or next year





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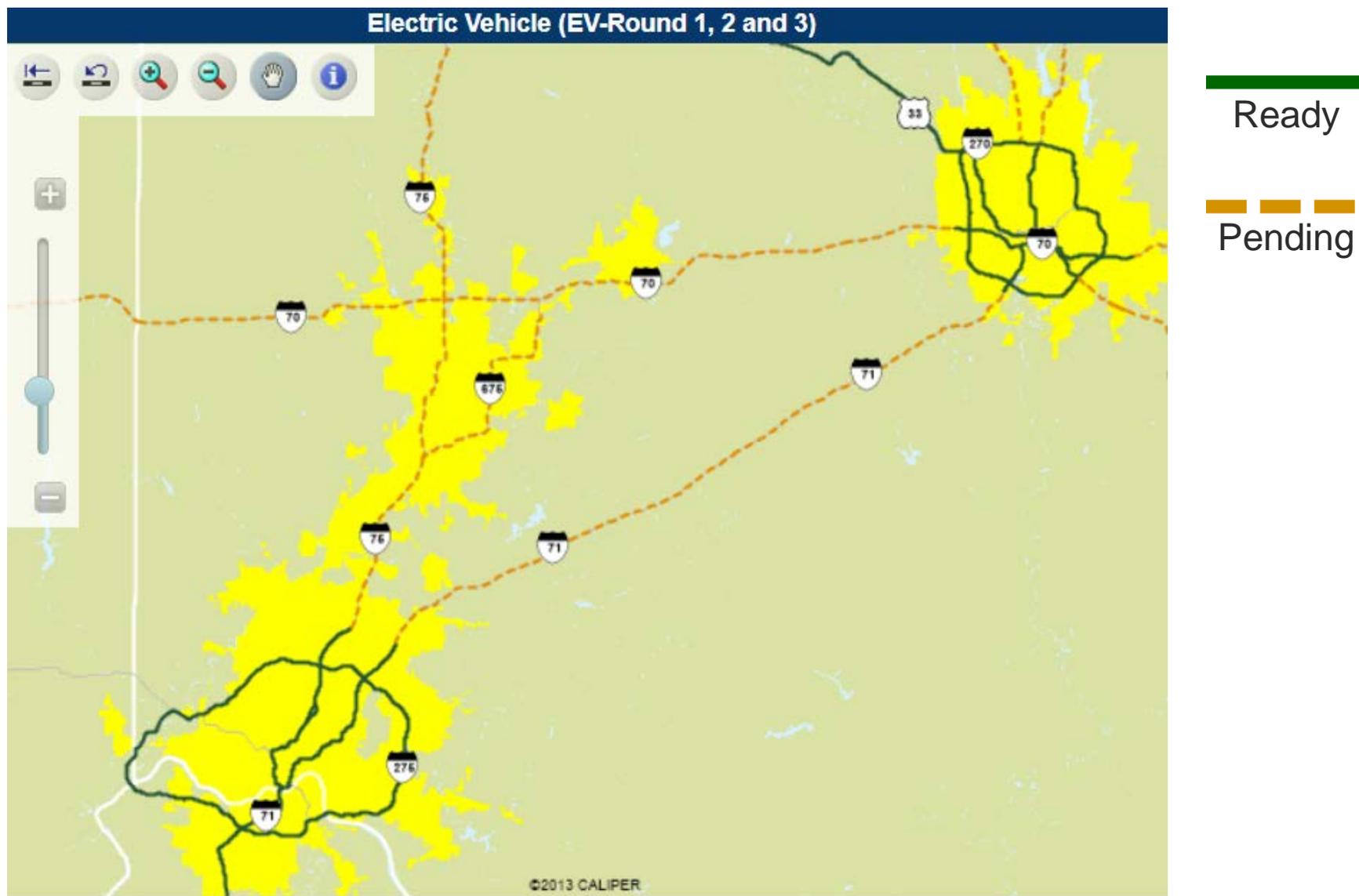
EV MARKET OVERVIEW



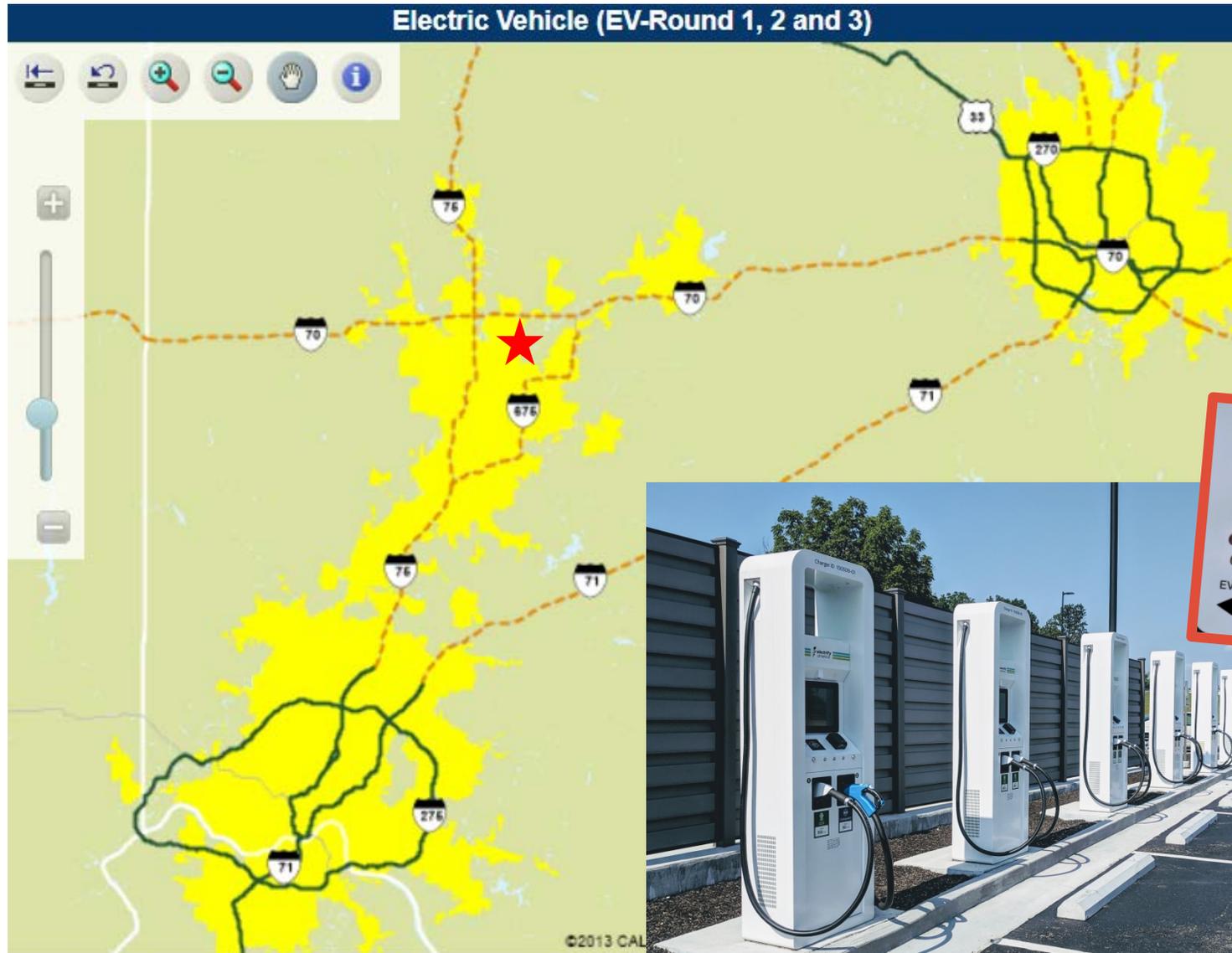


EV Charging Corridors

FHWA-Designated EV Corridors in the Region



New DCFC site in Huber Heights!



Ready

Pending



MVRPC's Next Steps

- Encouraging applications to Ohio EPA for VW funds to develop DCFC sites
 - Multi-disciplinary teams
 - Site visits
 - Education
- Partner with Drive Electric Dayton for public outreach
- Continue dialogue with ODOT on corridor signage





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EV POLICY BEST PRACTICES

Financial Incentives

- Funding the purchase and installation of public EV charging equipment
- Free or discounted public parking rates
 - Through Cincinnati's All Electric Vehicle Incentive Program, EVs receive free parking at any parking meter within city limits
- Incentives that focus on workplace, public, and multi-unit residential charging stations
 - In 2018 the City of Powell, Ohio installed a charging station in order to encourage economic development downtown



Financial Incentives

- Tax waivers, rebates, and tax credits to incentivize the purchase of EVs
 - Smart Columbus is offering a rebate of up to \$3,000 to transportation service providers to replace a gas vehicle with an EV
- Discounted or means-tested fares for EV buses, Uber/Lyft/taxis, car share, and scooters.



Streamlined EVSE permitting

- Streamlining the EVSE permitting process cuts down on wait times and makes it more convenient to buy an EV
 - Los Angeles has instant, online permitting approval for residential EVSE. Once the charger is installed a city official will come within 24 hours to inspect it.



Building Codes and Zoning

- Requirements for new publicly funded parking garages including:
 1. A minimum ratio of charging stations to total spaces
 2. Having a dedicated electrical circuit in the garage with the capacity for charging
 3. Installing the conduit and wire required for electricity to get to charging spaces
- Cincinnati requires 1% of spaces in publicly funded parking garages to have level 2 charging stations and 5% are required to have the capacity for level 2 charging.
- Zoning to allow more chargers in more places
- Right-of-way EV charging on public sidewalks allows residents relying on street parking to charge their EV
 - New Orleans offers permits for personal/noncommercial chargers on sidewalks





ELECTRIC VEHICLES FOR FLEETS

Between 2019 and 2022, the number of EV models will increase from 55 to 81.

RANGE under 200 Miles BATTERY 40KWH OR LESS

LEAF



MSRP: \$29.9k
Range: 150 mi
Battery: 40 kWh
Power: 147 HP (110 kW)

Volkswagen e-Golf



MSRP: \$29k
Range: 124 mi
Battery: 36 kWh
Power: 134 HP (100 kW)

Hyundai Ioniq Electric



MSRP: \$29.5k
Range: 124 mi
Battery: 28 kWh
Power: 118 HP (88 kW)

RANGE over 200 Miles BATTERY 62KWH+

LEAF PLUS



MSRP: TBD
Range: Up to 226 mi
Battery: 62 kWh
Power: 214 HP (160 kW)

Chevrolet Bolt EV



MSRP: \$36.6k
Range: 238 mi
Battery: 60 kWh
Power: 200 HP (150 kW)

Tesla Model 3



MSRP: \$42.9k
Range: 331 mi
Battery: 75 kWh
Power: 271 HP

Hyundai Kona EV



MSRP: \$36.4k
Range: 258 mi
Battery: 64 kWh
Power: 201 HP (150 kW)



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EV MARKET EXPANDING OPTIONS

XLplug-in™



XLP™ Plug-in Hybrid Electric Solution

tropos
technologies, inc.



WORKHORSE



ORANGE EV

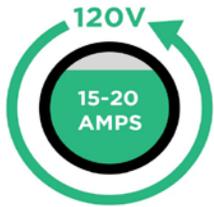




EV CHARGING OVERVIEW

TYPES OF EV CHARGING

Level 1

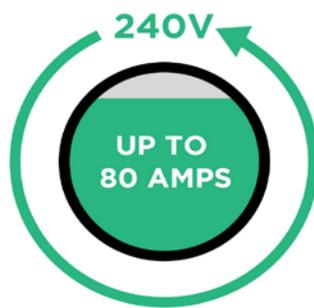


Level 1 chargers use standard 120V electrical outlets. 120V circuits are also used by most home electronics.

7-8 miles of i3 range per hour charging

1.4 kW power delivery

Level 2

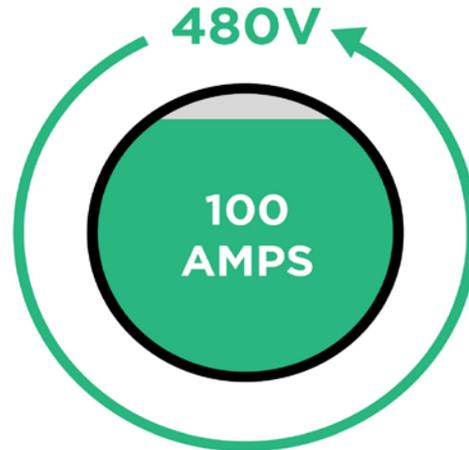


Level 2 chargers use 240V electrical circuits. 240V circuits are also used by electric dryers & electric stovetops.

10 - 26 miles of i3 range per hour charging

3.7 - 7.7 kW power delivery

Level 3



Level 3 direct current fast chargers use ultra high-power 480V circuits at public charging stations.

Up to 80% of i3 range in just 30 mins charging

Up to 50 kW power delivery

Example Level 2 Station:

ChargePoint CT4000

- ✓ All-purpose (residential, business, fleet)
- ✓ 7.2 kW power delivery
- ✓ Up to 25 RPH (miles of Range Per Hour)

~\$7,500



Example DCFC Station:

ChargePoint Express 200

- ✓ Depot
- ✓ Mixed use
- ✓ 50 kW power delivery
- ✓ Up to 200 RPH (miles of Range Per Hour)

~\$36,000



TIMES FOR EV CHARGING

2019 Nissan Leaf



40 kWh battery
150 mile range

2019 Chevrolet Bolt



60 kWh battery
238 mile range

Tesla Model X



100 kWh battery
305 mile range

Level 2 Charging when battery is at 0%

| Battery at 0% | | % Charged Per Hour | | | | | | | |
|----------------|---------|--------------------|-----|-----|------|-----|-----|-----|------|
| Charging Hours | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Battery Size | 100 kWh | 7% | 13% | 20% | 26% | 33% | 39% | 46% | 52% |
| | 50 kWh | 13% | 26% | 39% | 52% | 65% | 78% | 91% | 104% |
| | 25 kWh | 26% | 52% | 78% | 104% | - | - | - | - |

DC Fast Charging when battery is at 0%

| Battery at 0% | | % Charged Per Hour | | | |
|----------------|---------|--------------------|------|-----|------|
| Charging Hours | | 0.5 | 1 | 1.5 | 2 |
| Battery Size | 100 kWh | 13% | 25% | 38% | 50% |
| | 50 kWh | 25% | 50% | 75% | 100% |
| | 25 kWh | 50% | 100% | - | - |



EV FLEET ASSESSMENT & PLANNING

1.) Establish Fleet Criteria & Goals

2.) Understanding Fleet Operations

- a) Total Cost of Ownership
- b) Drive and Duty Cycle
- c) Max Daily Miles
- d) Dwell Time (parked at base)

3.) Evaluate Available Options





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EV ROI & LOWER LIFECYCLE COST

US DOE Vehicle Cost Calculator: <https://afdc.energy.gov/calc/>

| Vehicle | Price | Fuel Economy (City/Hwy) | Fuel Type |
|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-------------------------|-----------|
|  2019 Nissan Leaf (40 kW-hr battery pack) Automatic (A1) EV | \$ 23,381 Tax credit? | 27/34 kWh/100m | Electric |
|  2019 Ford Fusion FWD 4cyl 2.5L Automatic 6-spd Gasoline | \$ 22,840 | 21/31 mpg | Gasoline |

[Clear all](#)

Fuel Prices

Gasoline \$ 2.88 /gal

Normal Daily Use

Average daily driving distance: 34 miles
 Days per week: 5
 Weeks per year: 49
 Percent highway: 45

Other Trips

Annual mileage: 3596 miles
 Percent highway: 80

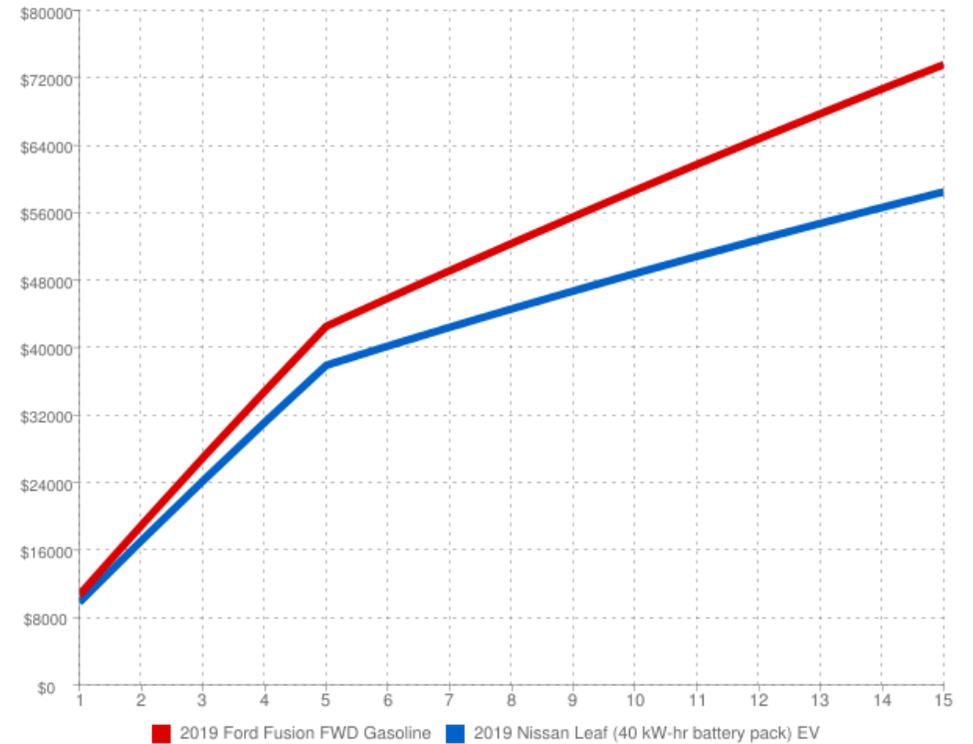
Electricity Use

Select a state so we can find the electricity price and calculate the emissions from generating electricity in your area.

Ohio

Annual Driving Distance: 11926 miles
 City Distance: 5301 miles
 Highway Distance: 6625 miles

Cumulative Cost of Ownership by Year (Dollars)



| | Annual Fuel Use | Annual Electricity Use | Annual Fuel/Elec Cost | Annual Operating Cost | Cost Per Mile | Annual Emissions (lbs CO2) |
|---------------------------------------------|-----------------|------------------------|-----------------------|-----------------------|---------------|----------------------------|
| 2019 Nissan Leaf (40 kW-hr battery pack) EV | 0 gal | 3,684 kWh | \$455 | \$2,560 | \$0.21 | 6,131 |
| 2019 Ford Fusion FWD Gasoline | 466 gal | 0 kWh | \$1,342 | \$3,600 | \$0.30 | 11,187 |



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EV FLEET ASSESSMENT & PLANNING



Independent Statistics & Analysis

U.S. Energy Information Administration

Conventional Fuels Price Projections Thru 2027¹

| Year | Gasoline Gallon (2016 Dollars) | | | Diesel Gallon (2016 Dollars) | | |
|------|--------------------------------|------------------|----------------|------------------------------|------------------|----------------|
| | Low (Oil) Reference | Median Reference | High Reference | Low Reference | Median Reference | High Reference |
| 2018 | 1.55 | 2.17 | 3.37 | 1.85 | 2.71 | 4.08 |
| 2019 | 1.62 | 2.37 | 3.85 | 1.88 | 2.88 | 4.63 |
| 2020 | 1.65 | 2.49 | 4.27 | 1.88 | 2.98 | 5.07 |
| 2021 | 1.69 | 2.60 | 4.60 | 1.88 | 3.06 | 5.40 |
| 2022 | 1.74 | 2.71 | 4.88 | 1.89 | 3.16 | 5.68 |
| 2023 | 1.72 | 2.74 | 4.95 | 1.88 | 3.20 | 5.79 |
| 2024 | 1.71 | 2.76 | 4.96 | 1.88 | 3.23 | 5.85 |
| 2025 | 1.73 | 2.81 | 4.89 | 1.91 | 3.31 | 5.78 |
| 2026 | 1.74 | 2.84 | 4.89 | 1.93 | 3.36 | 5.83 |
| 2027 | 1.75 | 2.85 | 4.91 | 1.96 | 3.40 | 5.90 |

Gas/Electric Vehicle Comparisons: Passenger Car

| Current Vehicle | | Propane Replacement | |
|------------------------|----------|------------------------|---------|
| Base Cost | \$20,000 | Incremental Cost | \$9,355 |
| Avg. Fuel/Year | 1,239 | Avg. Fuel/Year | 1,239 |
| Annual Mileage | 23,757 | Annual Mileage | 23,757 |
| Maintenance Costs/Mile | \$0.03 | Maintenance Costs/Mile | \$0.015 |

Gas vs. Electric Operating Costs: Passenger Car

| | Low Oil Price | | Median Oil Price | | High Oil Price | |
|---------------|---------------|----------|------------------|----------|----------------|----------|
| | Gas | Elec | Gas | Elec | Gas | Elec |
| O&M | \$7,127 | \$3,564 | \$7,127 | \$3,564 | \$7,127 | \$3,564 |
| Total | \$28,074 | \$18,660 | \$39,760 | \$19,071 | \$63,597 | \$19,514 |
| Total Savings | \$9,414 | | \$20,689 | | \$44,082 | |
| Net Savings | \$59 | | \$11,334 | | \$34,727 | |

1.) Ensure EV Models Meet Fleet Operational Needs

- a) EV has lower total cost of ownership
- b) EV can perform necessary drive and duty cycle
- c) EV has range for max daily miles
- d) EV will dwell (parked at base) long enough to charge

2.) Purchase Vehicles

3.) Install Needed Charging



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EV FLEET PURCHASING

SM
RT
COLUMBUS

Cooperative Contract in

Blues



MIKE ALBERT

Vehicle

Monthly
Rent

Term

First Payment

Payoff

Total Vehicle
Expenditures

2019 Nissan Leaf S Hatchback - EV

\$997.04

12

\$12,402.98

\$10,978.50

\$23,381.48

2019 Chevrolet Bolt FWD LT 4DR - EV

\$1,469.14

12

\$18,068.18

\$16,305.47

\$34,373.65

2019 Kia Niro Plug-in Hybrid

\$1,114.55

12

\$13,813.10

\$12,418.25

\$26,231.35

2019 Honda Clarity Plug-in Hybrid*

\$1,432.10

12

\$17,623.70

\$15,899.39

\$33,523.09

2019 Toyota Prius Prime Plus

\$1,023.31

\$12.00

\$12,718.22

\$11,418.00

\$24,136.22

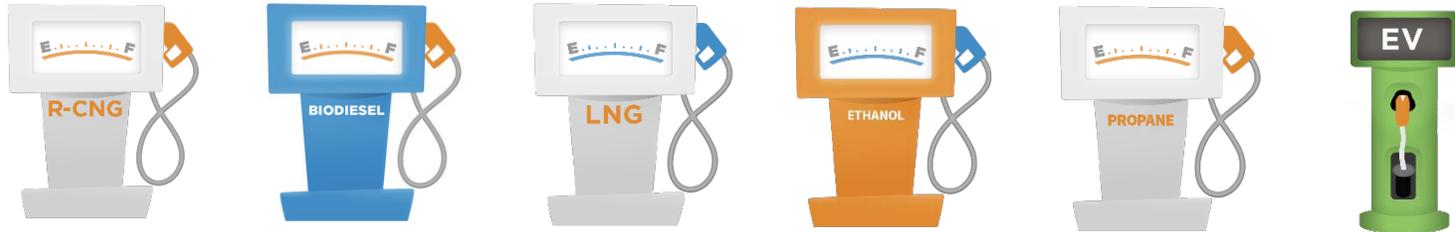


EV & EVSE GRANTS



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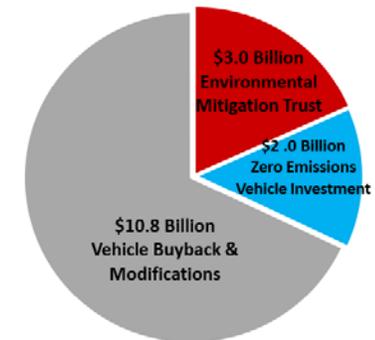
GRANT SUPPORT SERVICES



Grant Support Services:

- Webinars, summaries, and best practices
- Project competitiveness vetting
- Up-front or success fee based contracting
- Grants administration & reporting

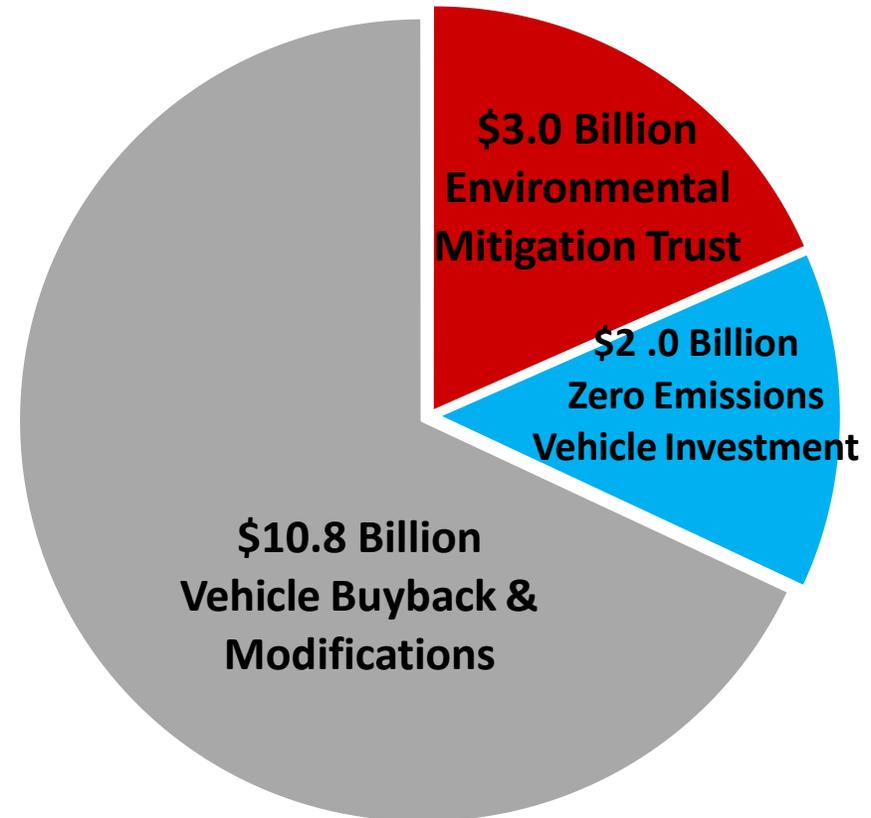
VW Settlement





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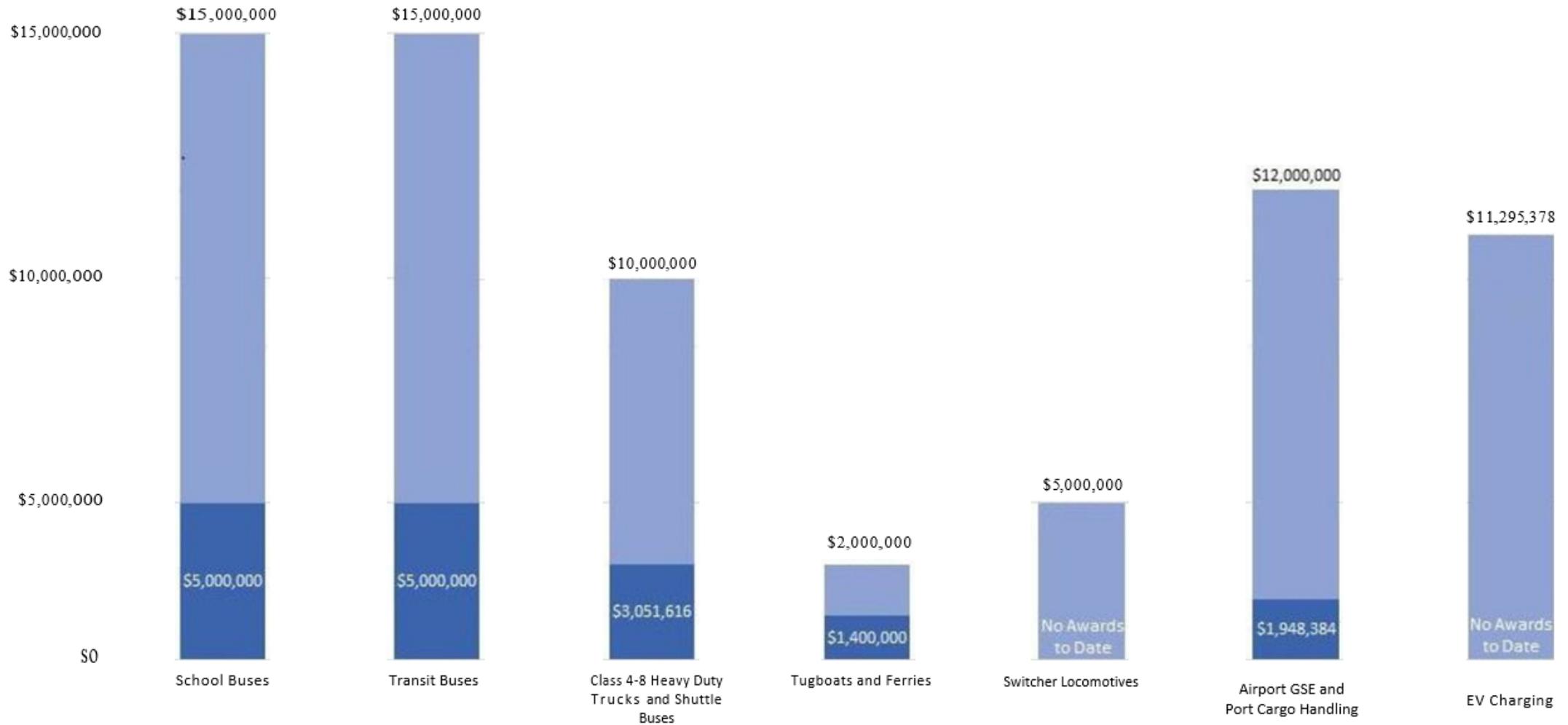
VOLKSWAGEN GRANTS





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VOLKSWAGEN GRANTS





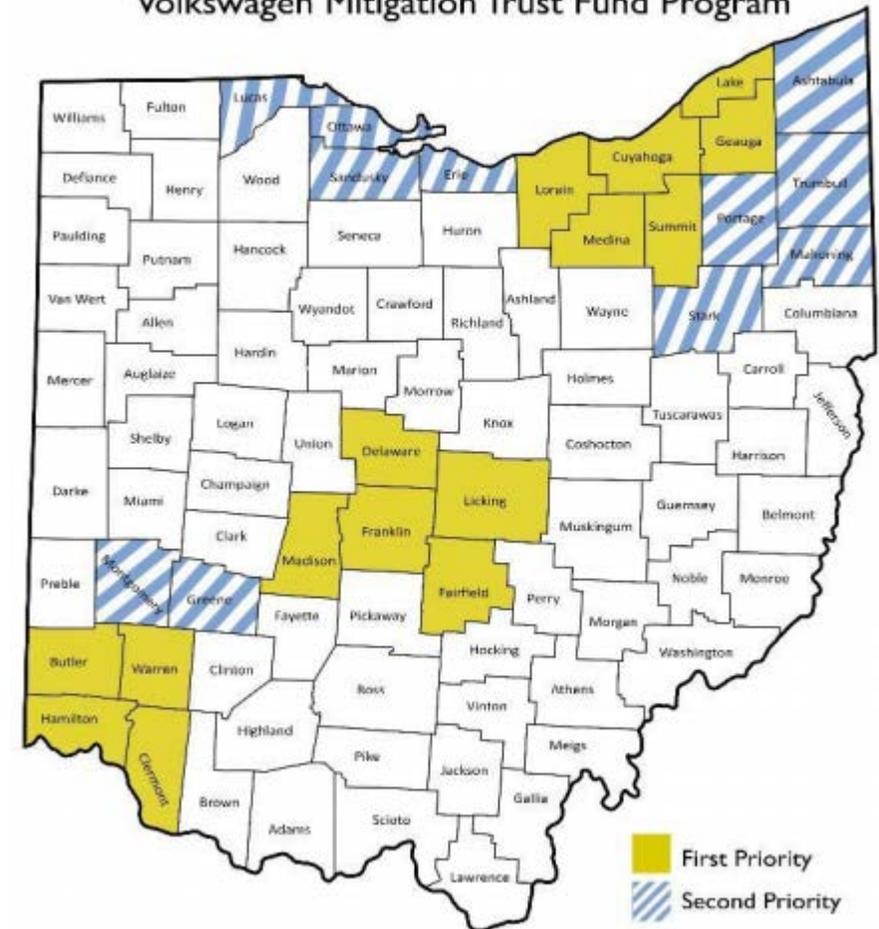
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VOLKSWAGEN VEHICLE GRANTS

2019 VW Vehicle Grants Timeline

- FY 2019: \$15 million
- **RFP June 3rd; Deadline August 2nd**
- Q&A will be posted and updated regularly
- Applications due **3:00 p.m. 8/2/19**
- Grant awards announced October 2019

Possible Ohio Priority Counties for Volkswagen Mitigation Trust Fund Program



Electric Vehicle Charging Stations: Publicly Available DCFC and Level 2



ZEV Infrastructure Projects Timeline

- Prioritize Locations (2018)
 - Gather input from municipalities, regional planning organizations, utilities, other stakeholders
 - Consider other siting efforts underway, e.g. Electrify America, utilities
- Pre-Qualify vendors/installers through state-term contract (2019)
- Release RFPs by region (2019)





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VOLKSWAGEN GRANTS SCHEDULE

OUTLOOK FOR 2019-2020 (SUBJECT TO CHANGE):

2019

- June 3: Release RFA for 2019 fleet projects; webinars and application assistance.
- August 2: Application deadline for 2019 fleet projects.
- October: Announce 2019 fleet project awards. Release first RFA for EV charging stations.

2020

- March: Release second RFA for EV charging stations.
- June: Release RFA for 2020 fleet projects.
- August: Application deadline for 2020 fleet projects.
- September: Release RFA for two-year electric school bus pilot project.
- October: Announce 2020 fleet project awards.





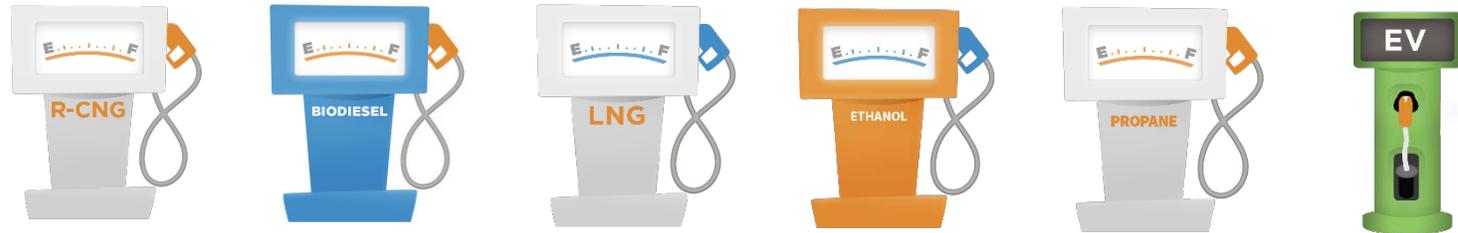
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RELATED RESOURCES



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TECHNICAL TRAININGS



Technical Training Services:

- Fleet Management Best Practices
- Driver & Operator Training
- Technician & Maintenance Training
- Code, Safety, Facilities, & First Responders



Recognizing leaders for Green Fleet Success

| NOx | PM | VOCs | CO2 | Petroleum Use | Overall Fuel Use |
|--------------------|--------------------|----------------------|--------------------|----------------------|----------------------|
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 pt / % Reduction | 1 pt / % Reduction | 0.1 pt / % Reduction | 1 pt / % Reduction | 0.5 pt / % Reduction | 0.5 pt / % Reduction |



Earn 40+ Points



Earn 80+ Points



Earn 120+ Points



Frito Lay is a one-star certified Green Fleet.





QUESTIONS?



Drive Electric Ohio

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