



# *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





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## USEFUL ACRONYMS

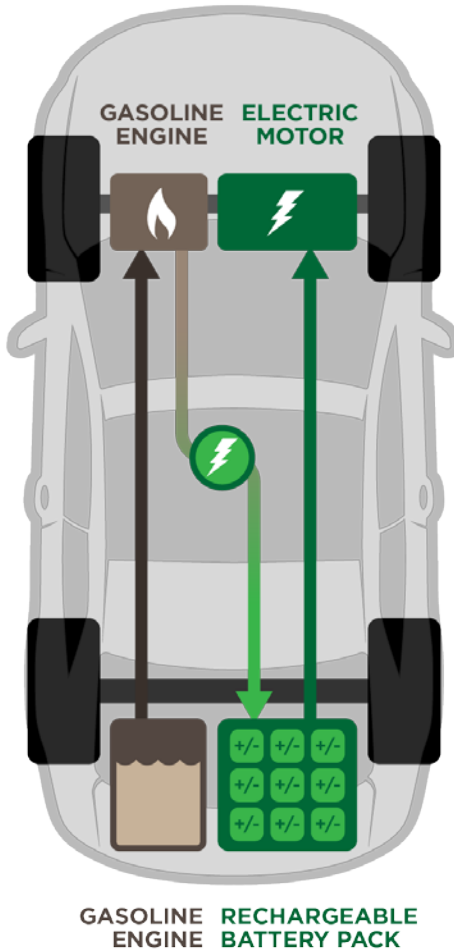
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<b>EV:</b>	<b>Electric Vehicle</b>
<b>PHEV:</b>	<b>Plug-in Hybrid Electric Vehicle</b>
<b>BEV:</b>	<b>Battery Electric Vehicle (fully electric)</b>
<b>ICE:</b>	<b>Internal Combustion Engine</b>
<b>EVSE:</b>	<b>Electric Vehicle Supply Equipment</b>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

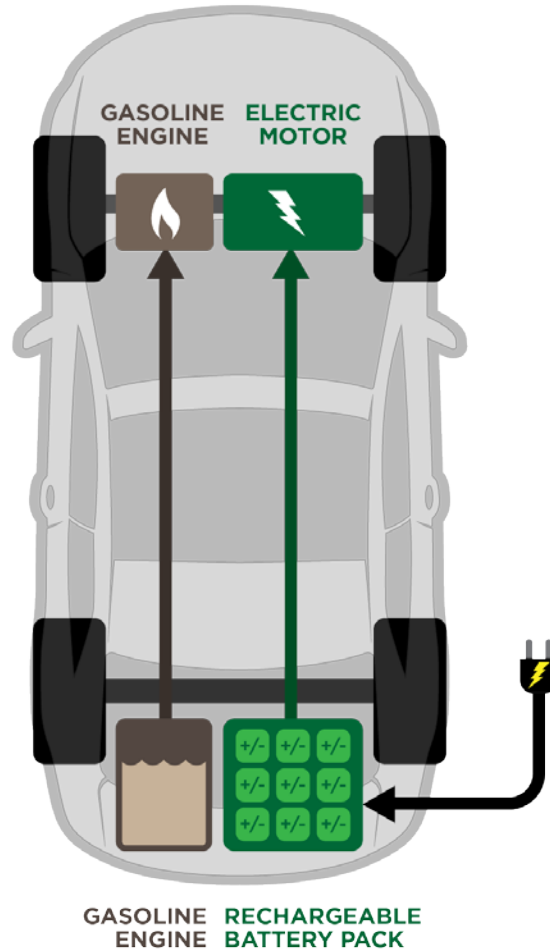


# ELECTRIC VEHICLE TYPES

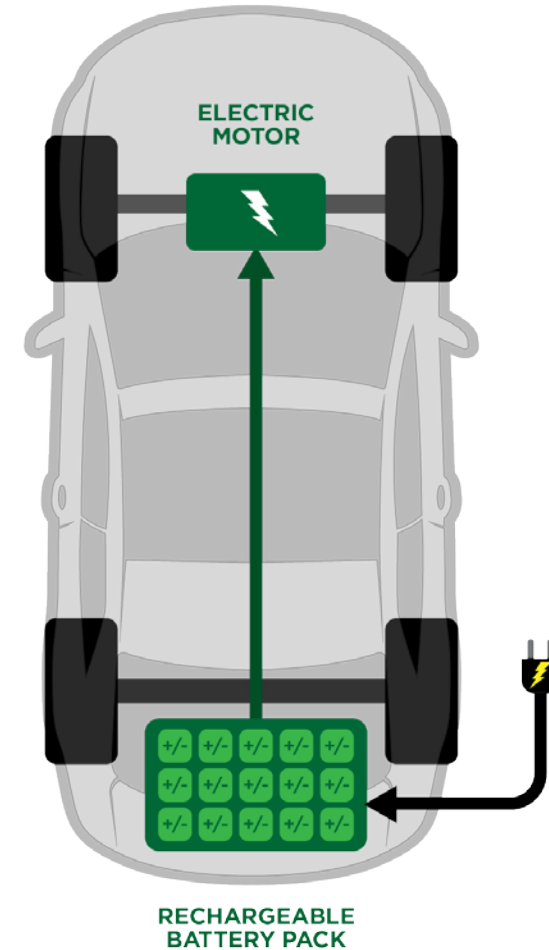
Hybrid



PHEV-Plug-in Hybrid  
Electric Vehicle



BEV-Battery Electric  
Vehicle

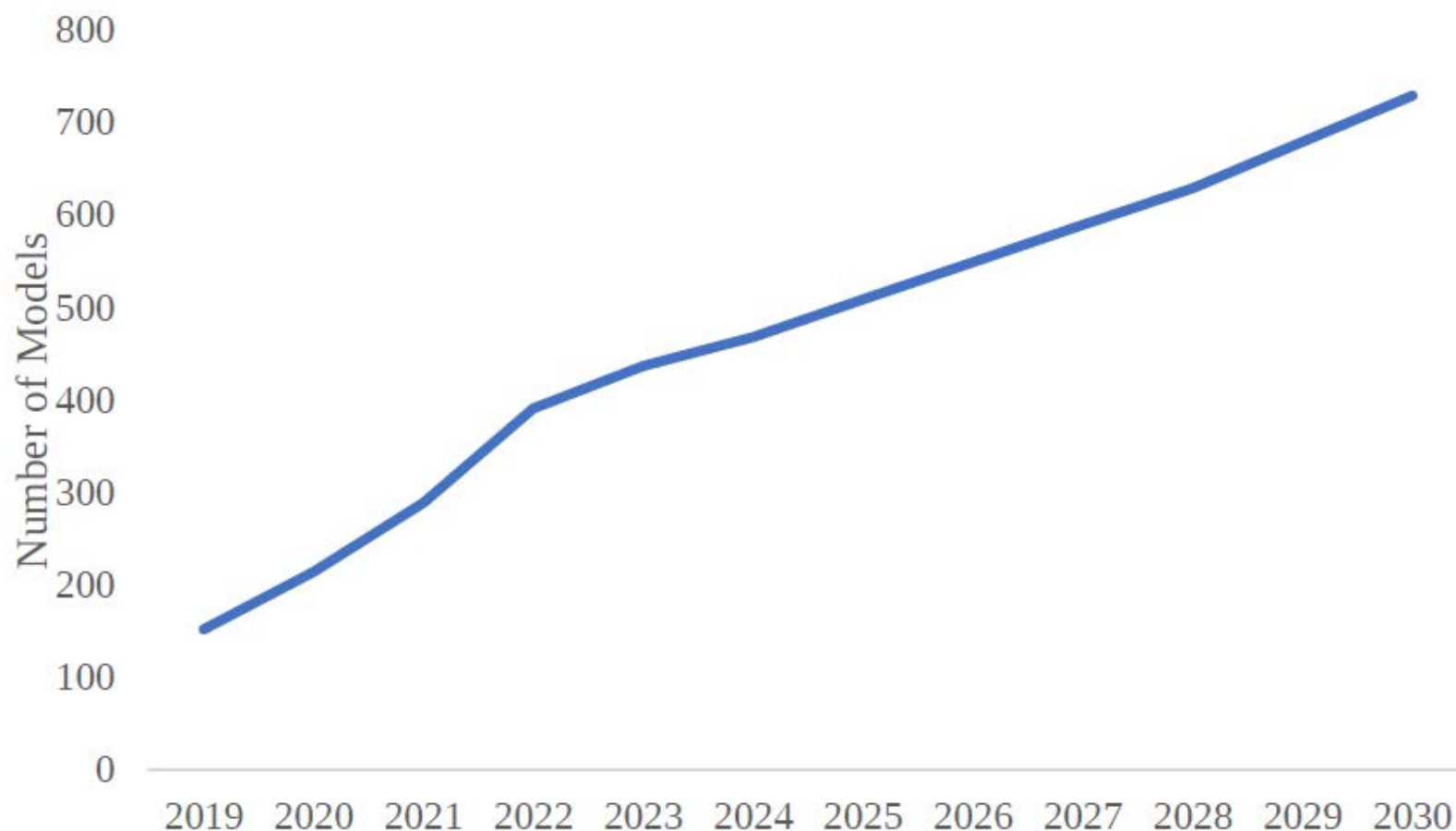




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# EV MARKET OVERVIEW

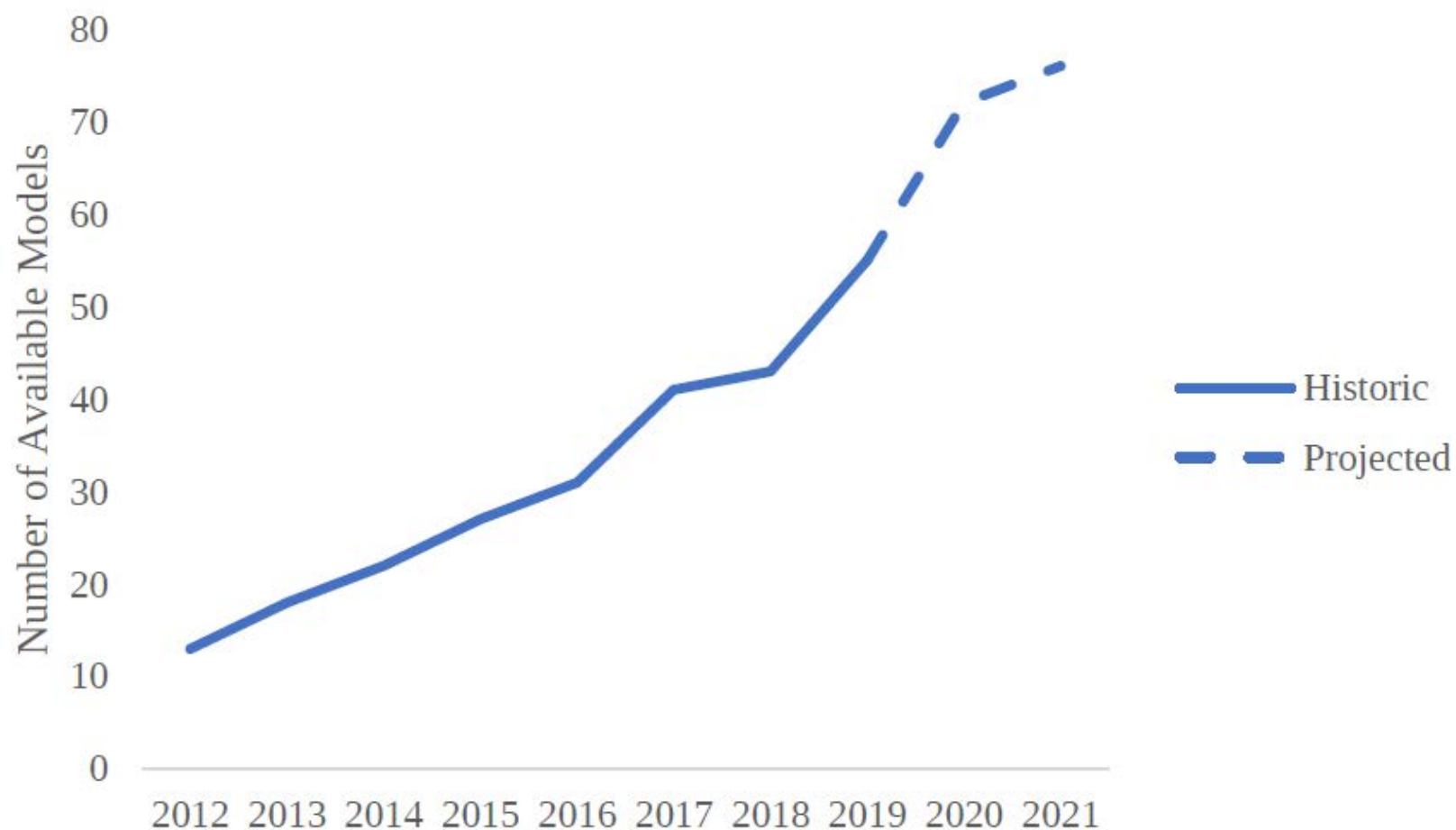
## Global Automaker Electric Vehicle Model Commitments



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



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

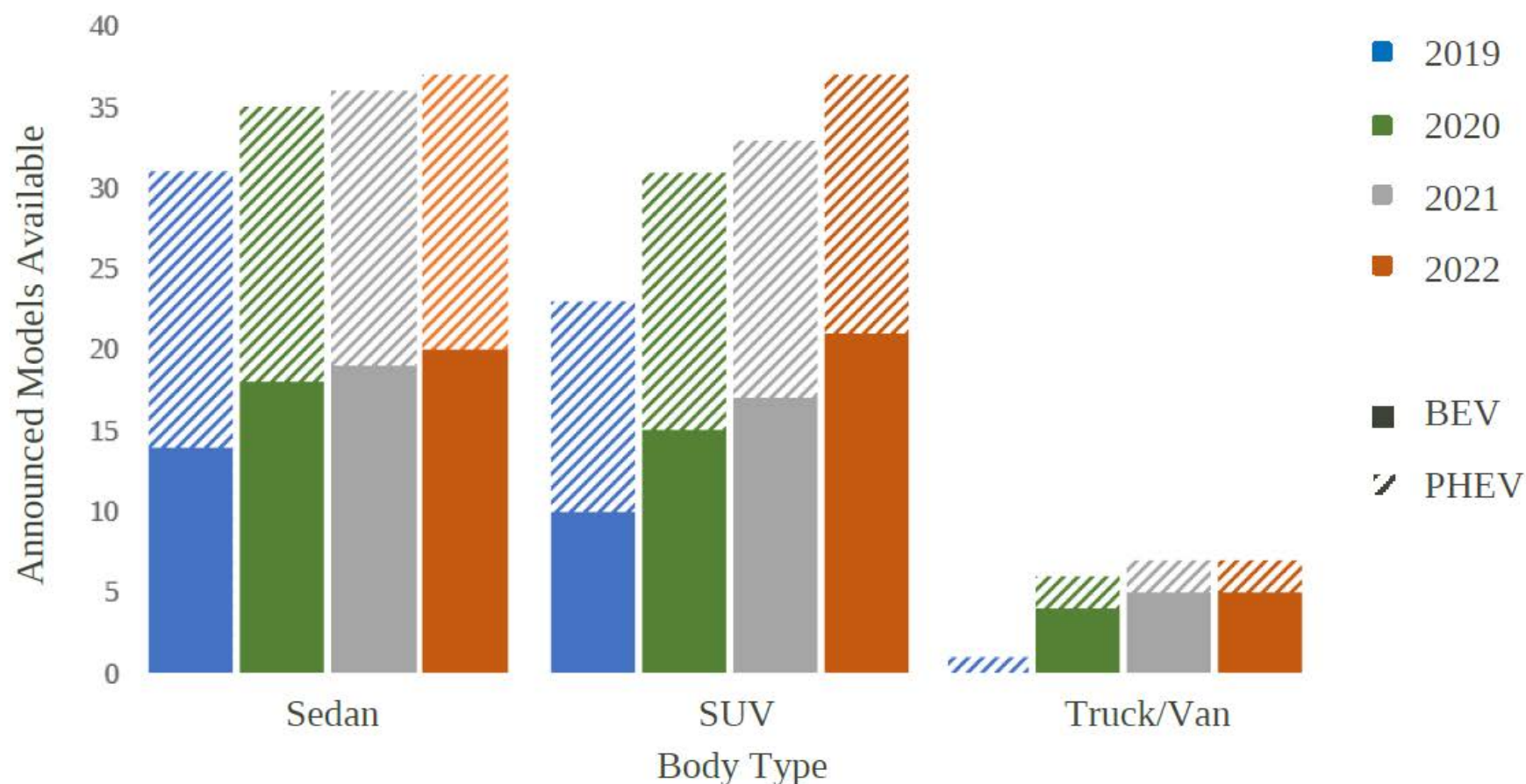


There were 13 plug-in hybrid (PHEV) and battery electric (BEV) models available in the U.S. in 2012. This is projected to reach 55 by the end of 2019, and 81 by the end of 2022.



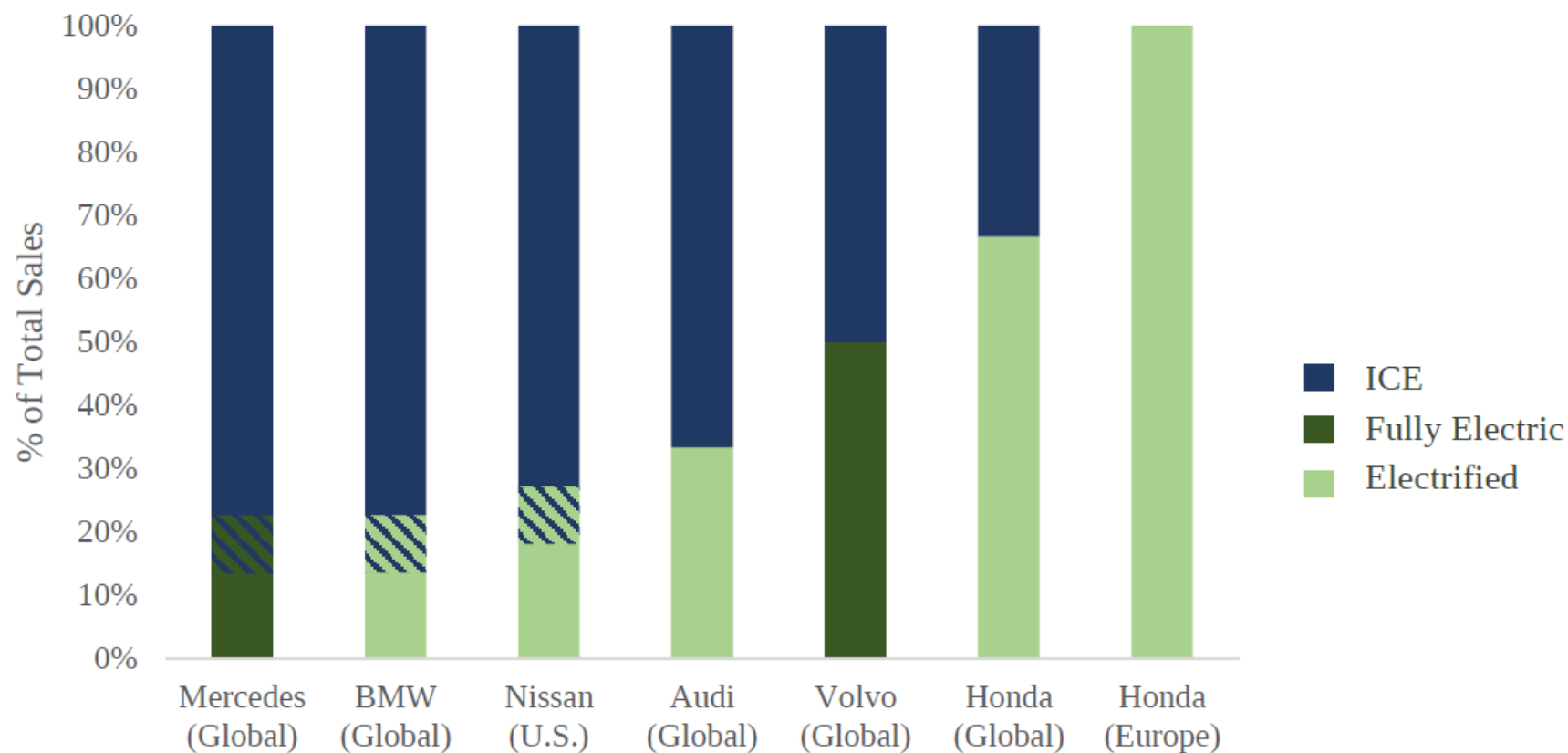
Figure 4

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.

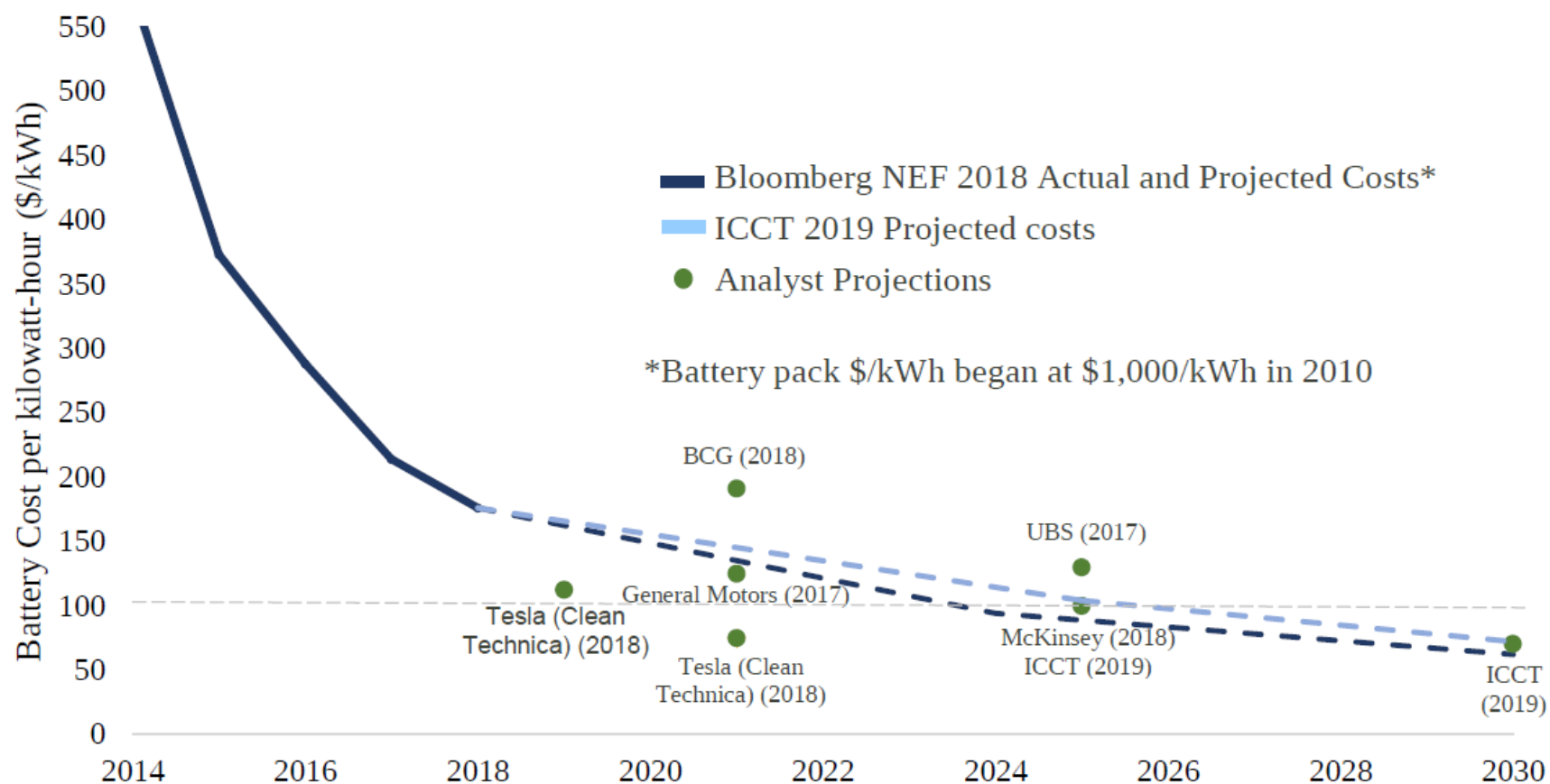
Figure 5 Sales Forecast for 2025 by Manufacturer



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.

Figure 1A








Manufacturer Commitments: Model Announcements, Investments, and Sales Forecasts

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
						\$15.5 billion for electric mobility, digitization and AI		20 electrified models		800,000 EVs annually (1/3 total sales)			
								All model have electrified version					
		500,000 e-vehicles		5 BEV models				25 electrified models (at least 12 BEVs)		15-25% of sales are electric			
		\$22.5 billion battery cell purchase		Smart brand: only selling cars with electric systems in Europe/N. America	10 BEV models								
				Phase out all-diesel passenger car production in Europe	More than 30 electrified models (Jeep: at least 10 PHEV and 4 BEVs)								
					\$10.5 billion for electrification	40 electrified (16 BEV 24 PHEV)							
		\$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			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.**

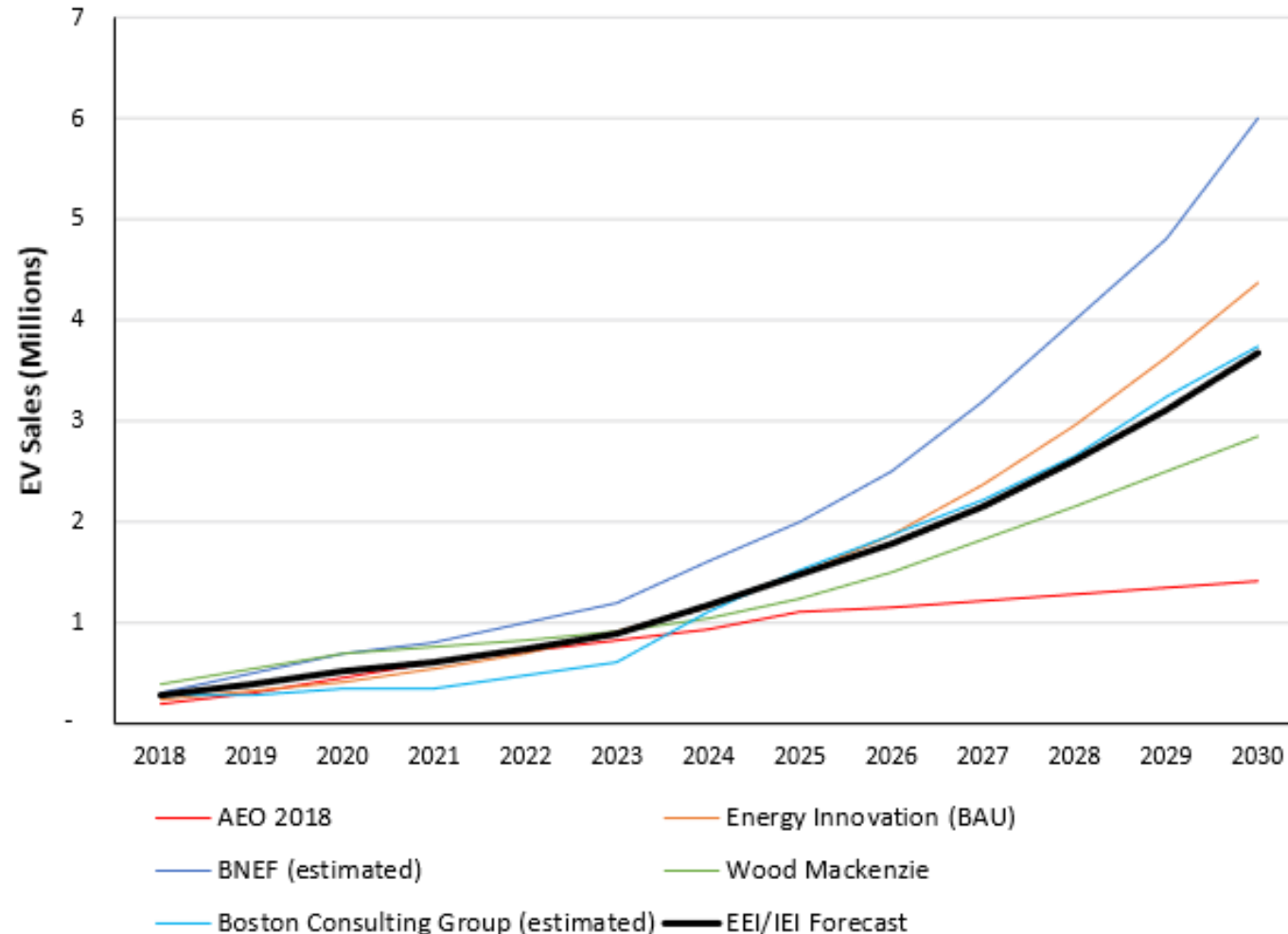


Fiat Chrysler will invest \$4.5 billion in five of its existing Michigan plants and has committed to producing **more than 30 electrified models by 2022.**

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

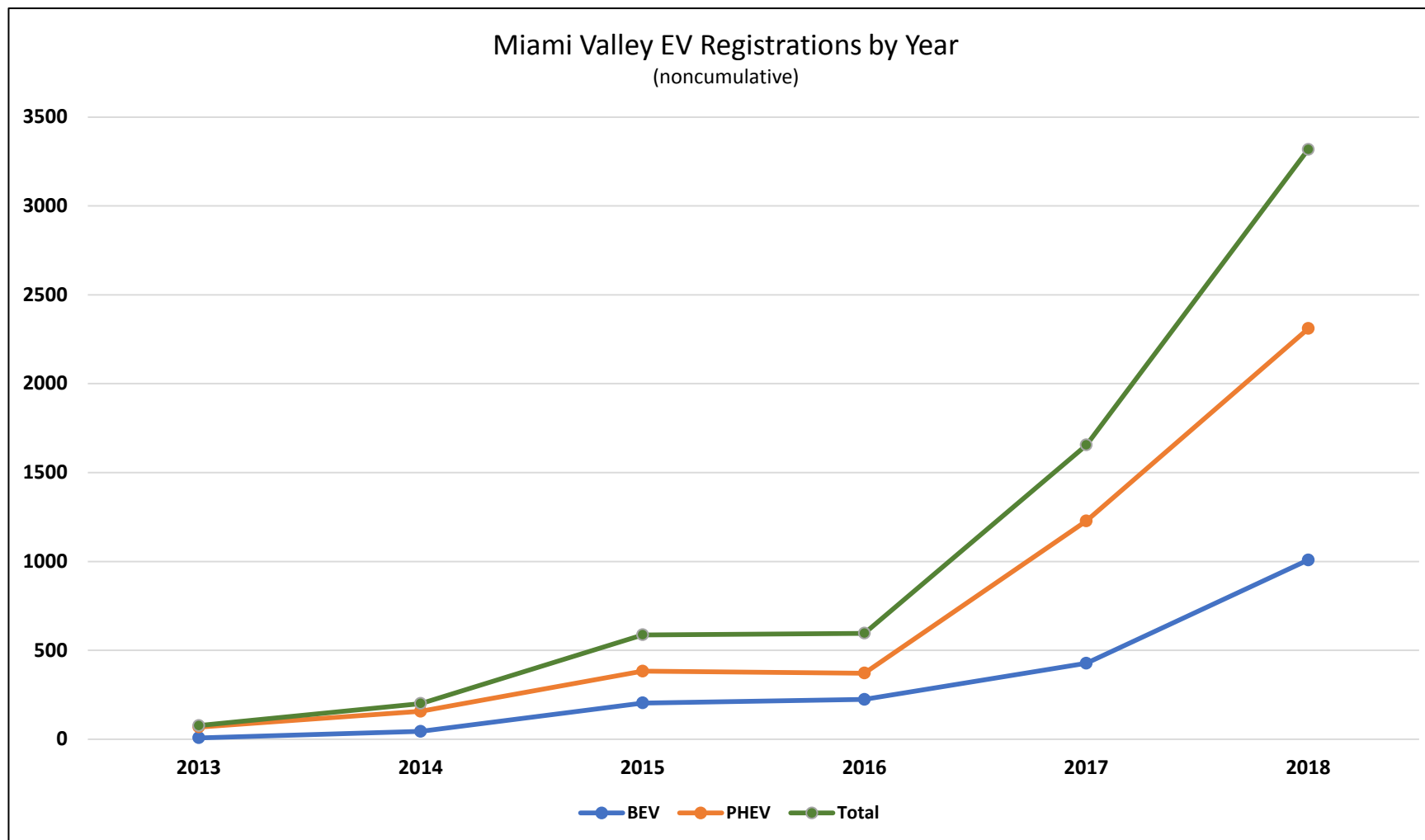
- The Ohio EPA has devoted \$11.25 million of the VW settlement to charging infrastructure
- Smart Columbus is devoting \$50 million to “smart mobility” including training and certifying EV dealers, an EVSE rebate program, and consumer education
- In 2018 Cincinnati and Columbus were both named winners 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



## 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

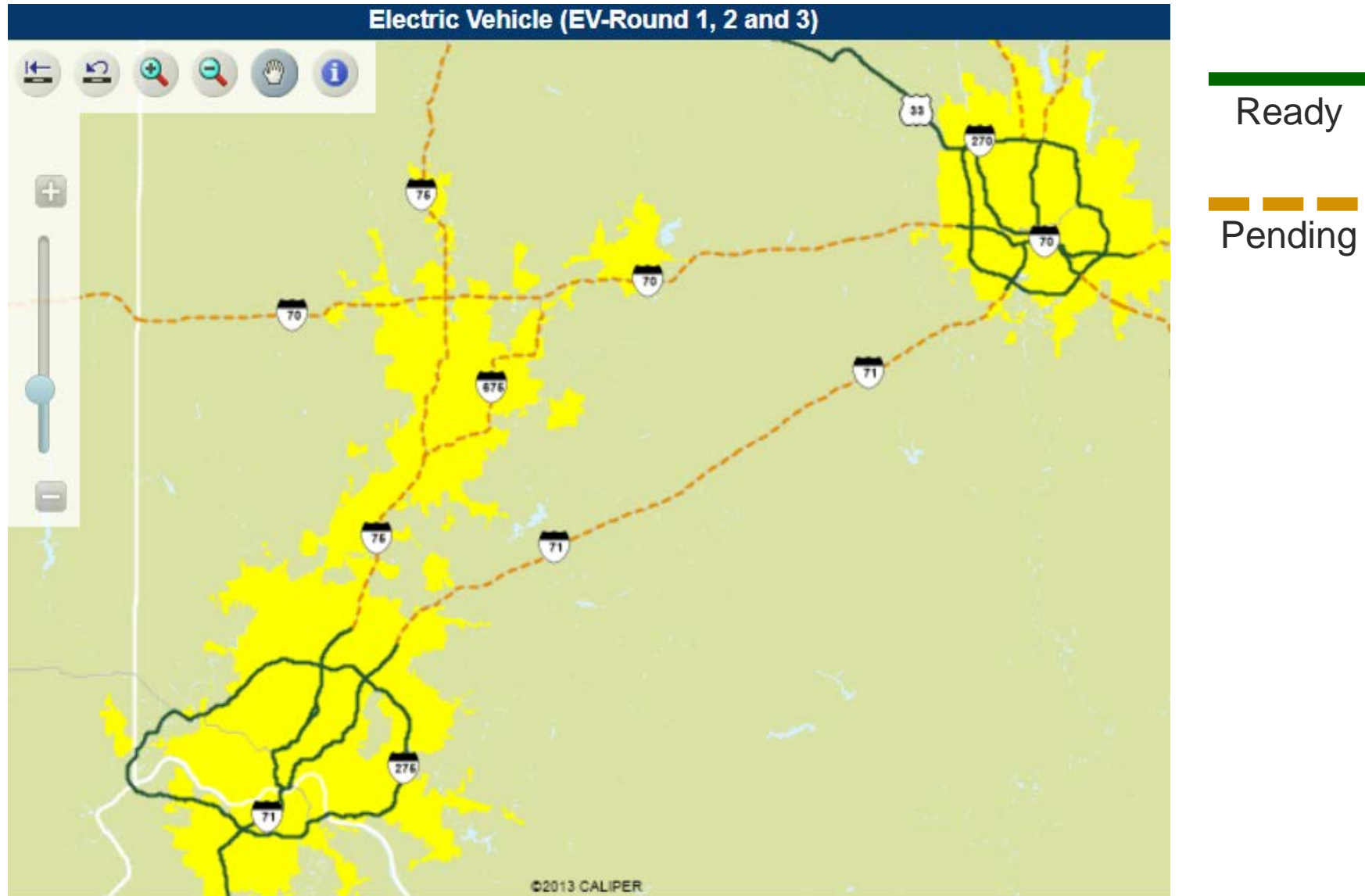






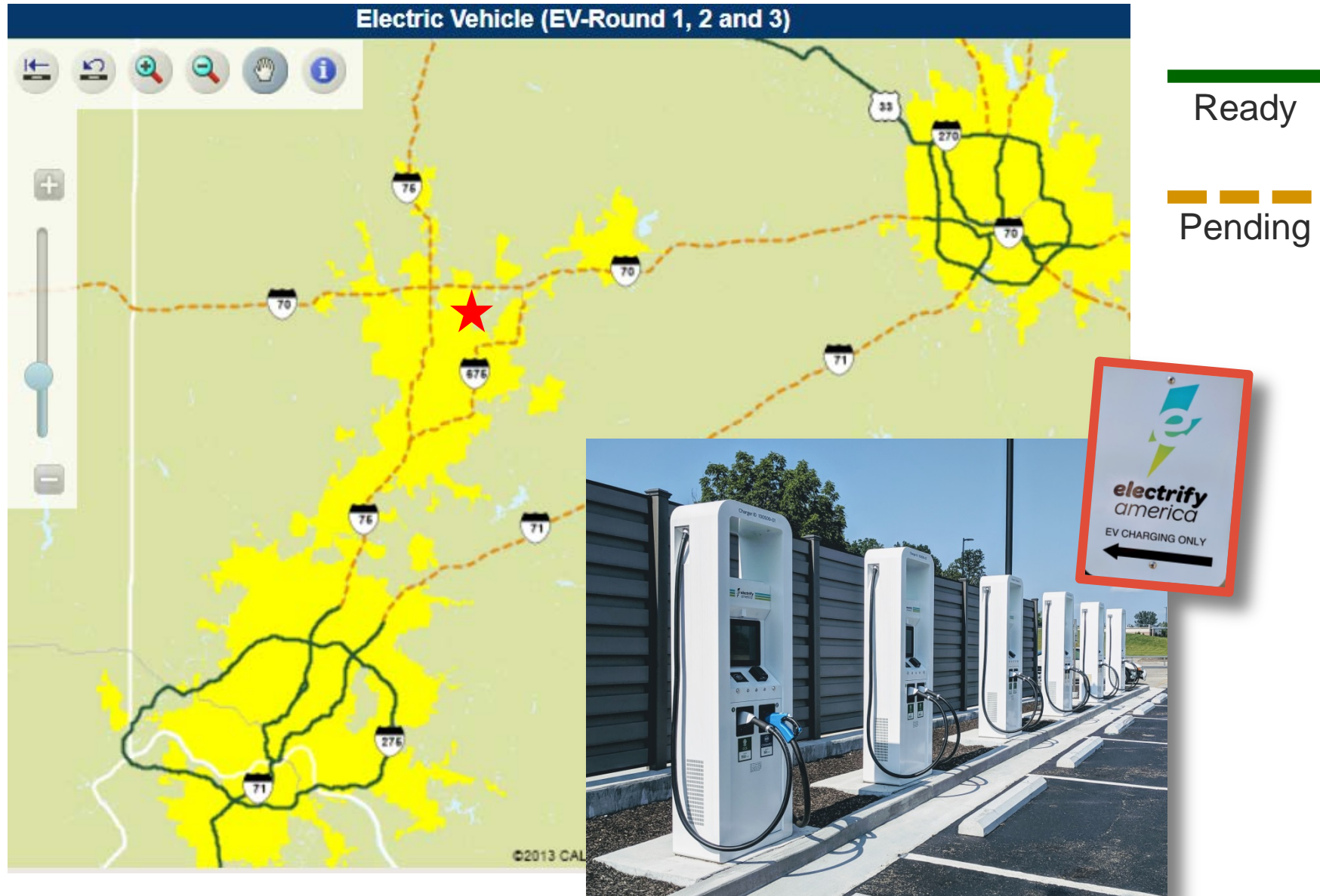
# **EV Charging Corridors**

# FHWA-Designated EV Corridors in the Region





# New DCFC site in Huber Heights!



## MVRPC's Next Steps

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- 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





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# 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**



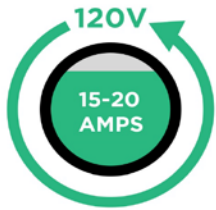
**ORANGE EV**



# EV CHARGING OVERVIEW

# TYPES OF EV CHARGING

## Level 1

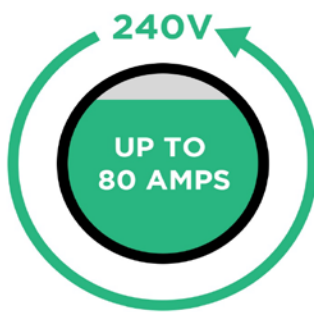


Level 1 chargers use standard 120V electrical outlets. 120V circuits are also used by most home electronics.

**7-8 miles of i3 range per hour charging**

1.4 kW power delivery

## Level 2

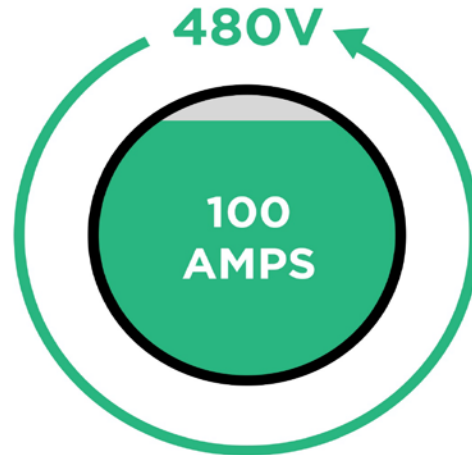


Level 2 chargers use 240V electrical circuits. 240V circuits are also used by electric dryers & electric stovetops.

**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%	-	-



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# 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 FLEET ASSESSMENT & PLANNING



Independent Statistics & Analysis

U.S. Energy Information  
Administration

Conventional Fuels Price Projections Thru 2027<sup>1</sup>

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	



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# EV FLEET DEPLOYMENT DECISION

## 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



## Cooperative Contract in



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

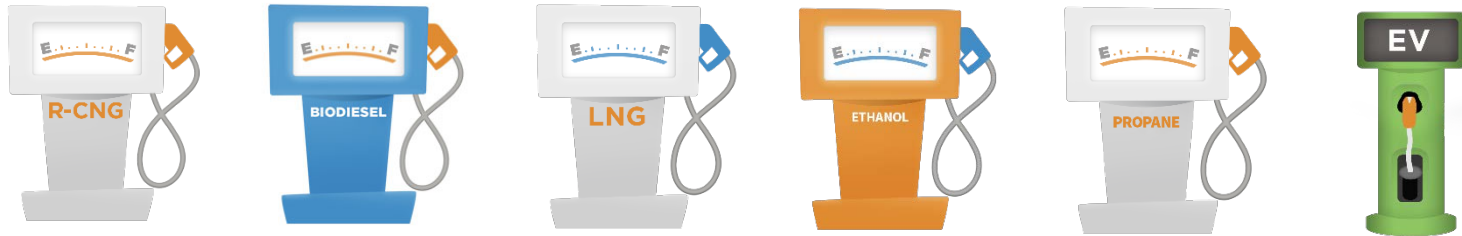
\$11,418.00

\$24,136.22



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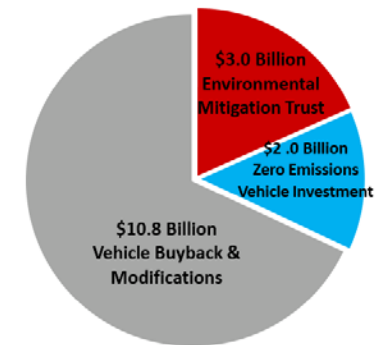
# EV & EVSE GRANTS



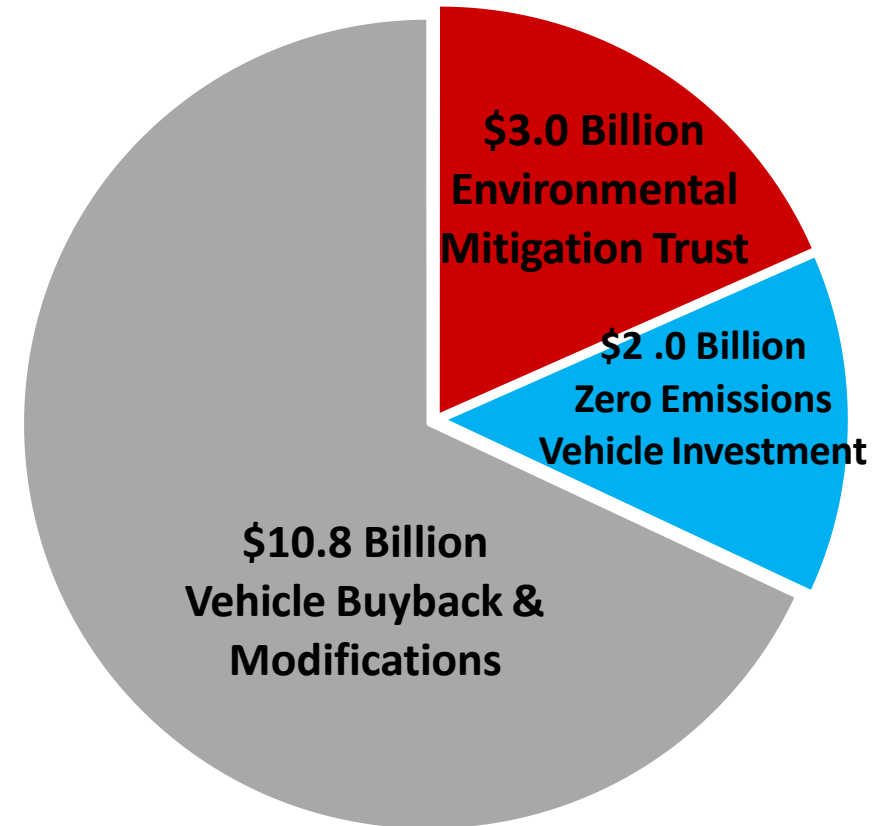
## Grant Support Services:

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

### VW Settlement



# VOLKSWAGEN GRANTS

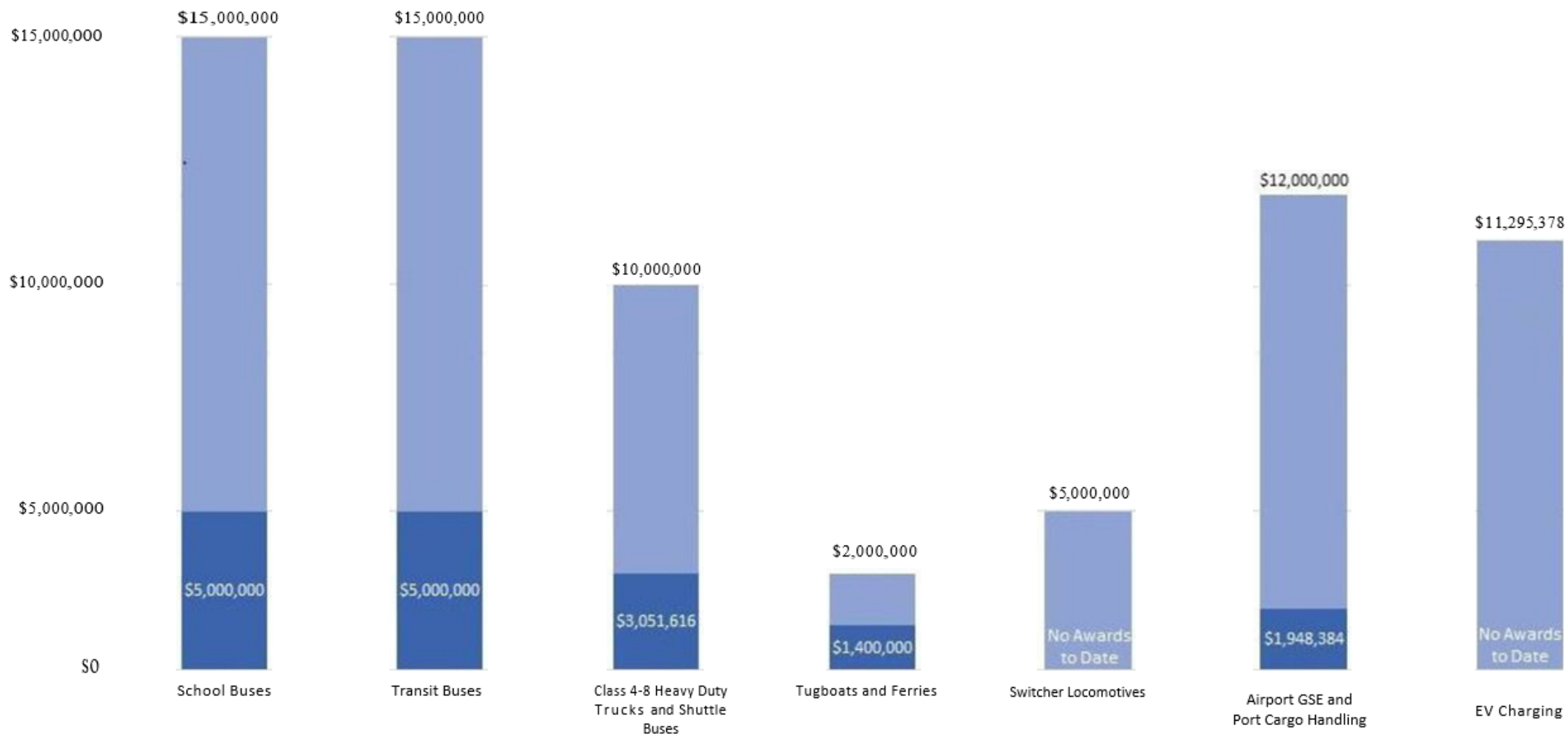






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# VOLKSWAGEN GRANTS



## 2019 VW Vehicle Grants Timeline

- FY 2019: \$15 million
- **RFP June 3<sup>rd</sup>; Deadline August 2<sup>nd</sup>**
- 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)





# 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.

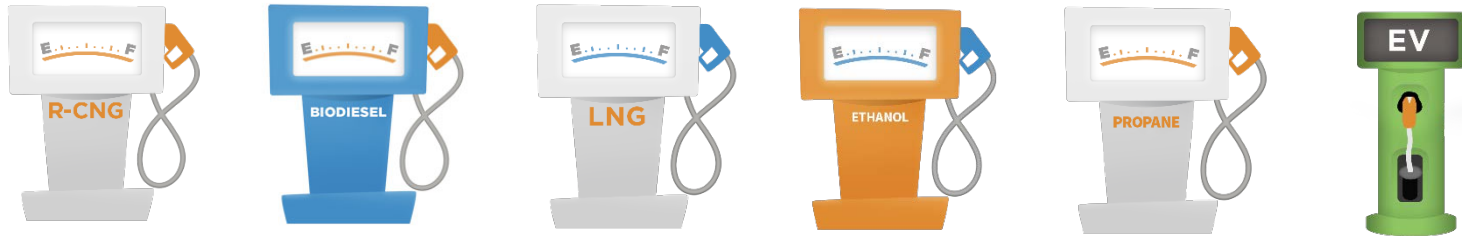




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# RELATED RESOURCES





## Technical Training Services:

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











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## *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



Frito Lay is a one-star certified Green Fleet.



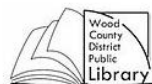
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THE CITY OF COLUMBUS



Village Catering





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# QUESTIONS?



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