



Electrifying the Vehicle Market

*Evaluating Automaker Leaders and Laggards
in the United States*

Electrifying the Vehicle Market

*Evaluating Automaker Leaders and Laggards
in the United States*

David Reichmuth

Don Anair

August 2016

© 2016 Union of Concerned Scientists
All Rights Reserved

David Reichmuth is a senior engineer in the UCS Clean Vehicles Program.

Don Anair is deputy director and research director of the program.

The Union of Concerned Scientists puts rigorous, independent science to work to solve our planet's most pressing problems. Joining with citizens across the country, we combine technical analysis and effective advocacy to create innovative, practical solutions for a healthy, safe, and sustainable future.

More information about UCS and the Clean Vehicles Program is available on the UCS website: www.ucsusa.org

This report is available online (in PDF format) at www.ucsusa.org/EVavailability.

Designed by:
Penny Michalak

Cover photo: © Aerial Archives/
Alamy Stock Photo
Printed on recycled paper

[CONTENTS]

- v Figures, Tables, and Boxes
- vii Acknowledgments

1 EXECUTIVE SUMMARY

CHAPTER 1

- 7 Introduction
- 8 The Need for EVs
- 8 Evaluating the State of the Electric Vehicle Market
- 9 EVs Sales and Availability in the United States
- 12 Leaders and Laggards in EV Sales

CHAPTER 2

- 13 EV Sales in California
- 13 The Zero Emission Vehicle Program
- 13 California Sales
- 16 State-Level Availability of EV Models
- 16 Availability of EVs at Dealerships

CHAPTER 3

- 19 Ranking the Companies on EV Progress
- 20 BMW (BMW and Mini brands)
- 21 Daimler (Mercedes-Benz and Smart brands)
- 22 Fiat Chrysler (Fiat, Jeep, Chrysler, Dodge, and Ram brands)
- 23 Ford (Ford and Lincoln brands)
- 24 General Motors (GM) (Chevrolet, Cadillac, Buick, and GMC brands)
- 25 Honda (Honda and Acura brands)
- 26 Hyundai Motor Group (Hyundai, Kia, and Genesis brands)
- 27 Nissan (Nissan and Infiniti brands)
- 28 Toyota (Toyota and Lexus brands)

29 VW (Volkswagen, Audi, and Porsche brands)

30 Tesla Motors

CHAPTER 4

31 **Summary and Conclusion**

31 Market Evaluation

32 Automaker Evaluation

32 Conclusion

33 References

35 Appendix: Data Collection and Sources

[FIGURES, TABLES, AND BOXES]

FIGURES

- 2 Figure ES-1. Automakers That Make EVs Available Nationwide Have Higher Sales
- 2 Figure ES-2. BMW and General Motors Lead in California with More Than 5% of New Car Sales EVs
- 3 Figure ES-3. Many More EV Models Are Available in California
- 4 Figure ES-4. Total EV Sales in the United States
- 5 Figure ES-5. The Availability of EVs in Selected Metropolitan Areas, January-June 2016
- 9 Figure 1. US Sales of Electric Vehicles Are Increasing and Nearing Half a Million Cumulative Sales
- 10 Figure 2. Availability Timing for Electric Vehicles in the United States
- 11 Figure 3. Only Six Models Comprise Almost 80 Percent of US EV Sales to Date
- 12 Figure 4. Automakers That Make EVs Available Nationwide Have Higher Sales
- 14 Figure 5. BMW and General Motors Lead in California with More Than 5% of New Car Sales EVs
- 15 Figure 6. Fiat Far Outpaced Other Brands of EVs in California in 2015
- 16 Figure 7. Many More EV Models Are Available in California
- 17 Figure 8. Only Six EV Models Were Available in More Than Thirty States in 2015
- 18 Figure 9. The Availability of EVs in Selected Metropolitan Areas, January-June 2016
- 21 Figure 10. Listings of Mercedes B-class EVs vs. the Similar-size GLA-class Gasoline Vehicle
- 22 Figure 11. Listings of the Fiat 500 vs. 500e
- 23 Figure 12. Listings of the C-MAX Energi (PHEV) vs. the Gasoline-only C-Max
- 23 Figure 13. Listings of the Focus EV vs. the Gasoline Focus
- 24 Figure 14. Listing of the Volt vs. the Cruze
- 24 Figure 15. Listings of the Chevrolet Spark vs. the Spark EV
- 25 Figure 16. Sales of Honda Accord PHEV and Ford Fusion PHEV
- 26 Figure 17. Listings of the Kia Soul EV vs. Gasoline Kia Soul
- 27 Figure 18. Listings of the Nissan LEAF (EV) vs. the Nissan Versa
- 28 Figure 19. US Prius Plug-in Sales
- 29 Figure 20. Listings of the VW eGolf vs. the Gasoline-only VW Golf
- 29 Figure 21. Listings of the Audi A3 e-tron vs. the Gasoline-only A3

TABLES

20	Table 1. BMW
21	Table 2. Daimler
22	Table 3. Fiat Chrysler
23	Table 4. Ford
24	Table 5. General Motors
25	Table 6. Honda
26	Table 7. Hyundai Motor Group
27	Table 8. Nissan
28	Table 9. Toyota
29	Table 10. VW
30	Table 11. Tesla Motors
35	Table A-1. EV Brands and Models Surveyed
36	Table A-2. Metropolitan Areas in this Study

BOXES

8	Box 1. What Are Electric Cars?
12	Box 2. Measuring Tesla's Availability and Effort

[ACKNOWLEDGMENTS]

This report was made possible by the generous support of the Energy Foundation, the William and Flora Hewlett Foundation, 11th Hour Project of the Schmidt Family Foundation, the John Merck Fund, and UCS members.

The authors would like to thank Will Barrett, American Lung Association in California; Nic Lutsey, International Council on Clean Transportation; Matt Solomon, Northeast States for Coordinated Air Use Management; and Brett Williams, Center for Sustainable Energy for reviewing this report and providing helpful information. We also acknowledge the help of the staff of Edmunds.com, Jeff Osborn and Reed Spool at Graphicacy, and Ben Southgate for assistance in obtaining vehicle inventory data.

The authors would also like to thank their colleagues at the Union of Concerned Scientists in the Clean Vehicles program for their input and advice. A special thanks to Cynthia DeRocco, Bryan Wadsworth, Heather Tuttle, and Marc Miller for their roles in editing and report production.

The opinions expressed herein do not necessarily reflect those of the organizations that funded the work or the individuals who reviewed it. The Union of Concerned Scientists bears sole responsibility for the report's content.



The mass-market introduction of electric-drive vehicles represents an extraordinary change for the automotive industry, offering a viable alternative to the internal combustion engine for the first time since the early 20th century.

Global sales of electric vehicles (EVs) have topped a million in just the five years since they became available on the market.¹ US sales over the same period are on track to hit a total of a half million by the end of 2016. Buyers are compelled by EVs' lower fuel costs and better driving experience, as well as the convenience of avoiding gas stations and the environmental benefits of driving on electricity.

In the race to bring electric vehicles to market in the United States, some automakers are leaders but others are laggards, and efforts vary widely. That is the conclusion of this detailed analysis by the Union of Concerned Scientists (UCS) of automakers' efforts to bring EVs to market and make them available to consumers. This UCS analysis covers the number of vehicles sold in the United States, the number of models available, and the percentage of EVs sold compared with total vehicle sales for each company. It also looks at variations in the availability of EVs by manufacturer and location.

Market Leaders and Laggards

Market leaders have developed multiple EV models and made them available to buyers in many states. Market laggards have been slower to shift to EVs, either by making them available in only a handful of states or by not designing or selling any EVs (see Figures ES-1 and ES-2, p. 2).

THE LEADERS

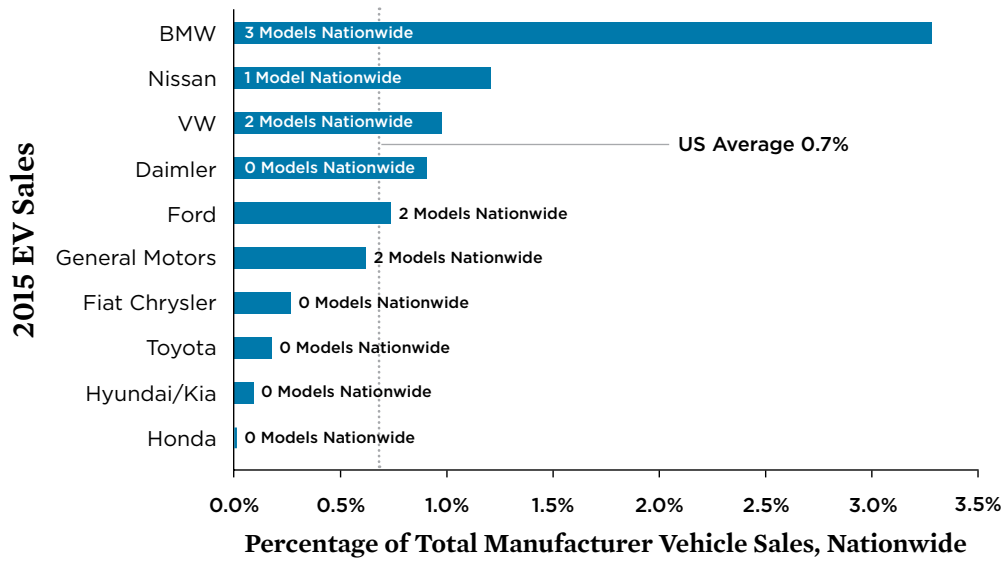
- **BMW** has made a major commitment to electrification, and its EV sales reflect that. BMW leads all major automakers in EVs sales as a proportion of total sales: more than 3 percent across the United States and topping 7 percent in California.
- **General Motors**, with the Chevrolet Volt, and **Nissan**, with the LEAF, were early leaders in developing and selling EVs. The Volt is the top-selling plug-in hybrid EV, and the LEAF is the top-selling battery EV since 2010.
- **Tesla** is a leader among automakers, producing only EVs. It was the top-selling EV carmaker in 2015 and its upcoming Model 3 has attracted unprecedented interest.

THE LAGGARDS

- **Honda** currently offers no plug-in electric vehicles in the United States. Even when the company did sell EVs here, its efforts lagged behind those of other automakers. Honda's total EV sales in the United States since 2011 are lower than General Motors' EV sales in a single month (April 2016).
- While **Toyota** is a leader in hybrid-vehicle technology, it lags in deploying plug-in electric vehicles. Toyota had success in selling the Prius Plug-in, but the company

¹ Unless otherwise noted, the term "electric vehicle" refers here only to plug-in electric vehicles and excludes fuel-cell electric vehicles.

FIGURE ES-1. Automakers That Make EVs Available Nationwide Have Higher Sales

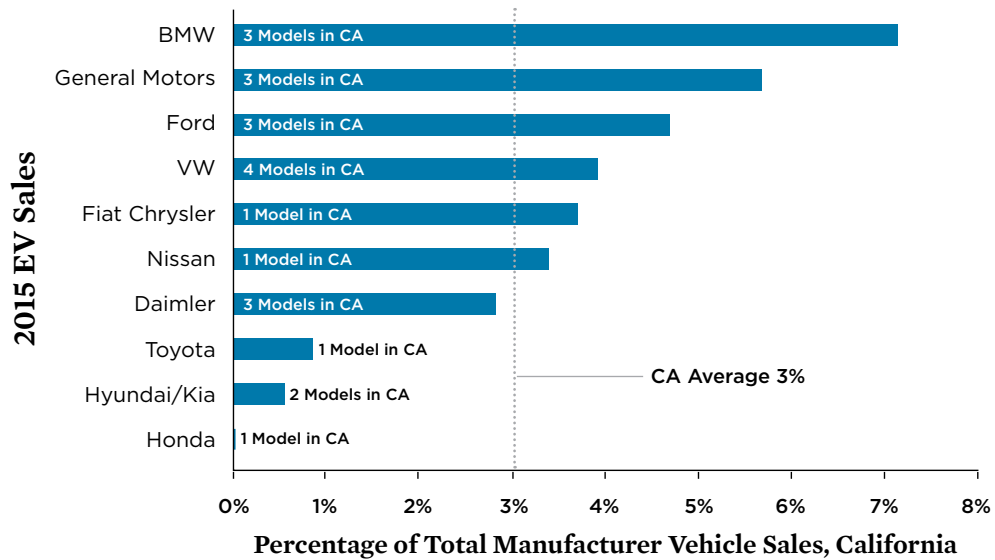


Automakers that offered more EV models and made them available across the United States sold a higher percentage of such vehicles. BMW was the clear leader among major manufacturers, while Fiat Chrysler, Toyota, Hyundai/Kia, and Honda were far behind in both EV sales and model availability.

Note: Available Nationally = Registrations in 40+ states

SOURCES: INSIDEEVS.COM, WARDAUTO.

FIGURE ES-2. BMW and General Motors Lead in California with More Than 5% of New Car Sales EVs



BMW and General Motors led in California, with EVs representing more than 5 percent of all of their sales. Honda and Toyota sold few EVs in California because they stopped selling plug-in vehicles during 2015.

SOURCES: IHS AUTOMOTIVE, CALIFORNIA NEW CAR DEALERS ASSOCIATION'S CALIFORNIA AUTO OUTLOOK.

removed the model from the market and currently has no plug-in EV for sale in this country.

- **Fiat Chrysler** sells its only EV, the Fiat 500e, successfully in California and Oregon. However, the company does not offer any electric option in the rest of the country.
- **Hyundai/Kia** has not made its two plug-in EVs, the Kia Soul and Hyundai Sonata plug-in hybrid, widely available and its EV sales are significantly lower than those of most other major automakers.

Strong Consumer Interest in EVs

In a 2016 survey of drivers in California and the Northeast, conducted by UCS and Consumers Union, drivers expressed a strong interest in EVs. Most drivers would consider an EV for their next car. The survey also found that over 40 percent of households could potentially use an EV based on access to parking, access to a plug, and usage requirements (UCS 2016).

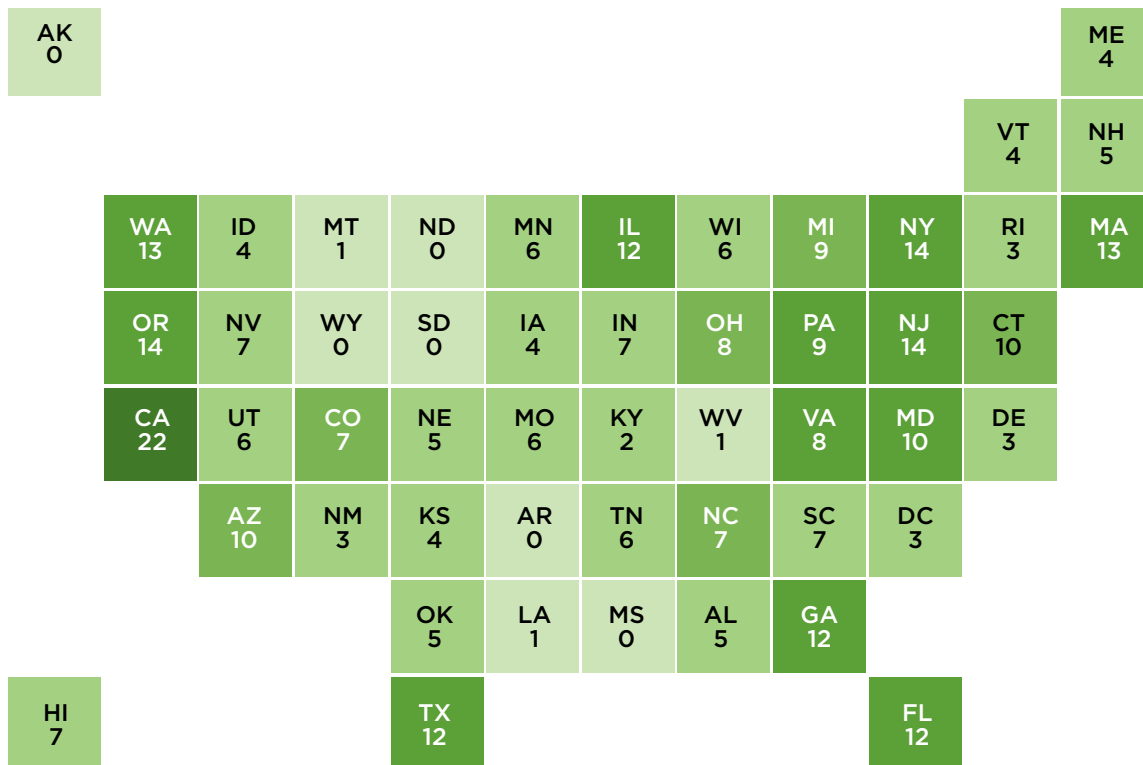
The unprecedented interest in Tesla’s upcoming Model 3 further demonstrates strong consumer interest in EVs, with over 350,000 reservation deposits (Fehrenbacher 2016).

Limited EV Choices Outside California

While interest in EVs is strong across regions, their availability is not. Our analysis finds that California consumers have considerably more opportunity to buy electric cars than do consumers in the rest of the United States. This is in terms of both the number of vehicles available and the choice of models (see Figures ES-3 and ES-4, p. 4).

All electric vehicle models on the market in the United States are available in California, where consumers could choose among 22 models of EVs in 2015. In contrast, some EVs are available in only a handful of states, or they are available in such small numbers as to be effectively unavailable. Automakers collectively made more than 12 models available in only five states besides California, where the greater model availability

FIGURE ES-3. Many More EV Models Are Available in California



California buyers bought 22 different EV models in 2015. No other state had more than 14 different EV models purchased. A minimum of 20 vehicle registrations is required to qualify as sold in the state.

SOURCE: IHS AUTOMOTIVE.

is due in large part to the state's Zero Emission Vehicle policy.

California also has a much greater rate of electric vehicle sales. For example, one in 14 BMWs sold in the state in 2015 was an EV, and BMW offers California car buyers four EV models.

EVs Often Hard to Find at Dealerships

While many factors influence EV sales, new-car buyers cannot choose vehicles that are not available for purchase. An examination of new EVs listed for sale shows that consumers, especially outside California, would have a far harder time locating an EV than they would when seeking a similar gasoline model.

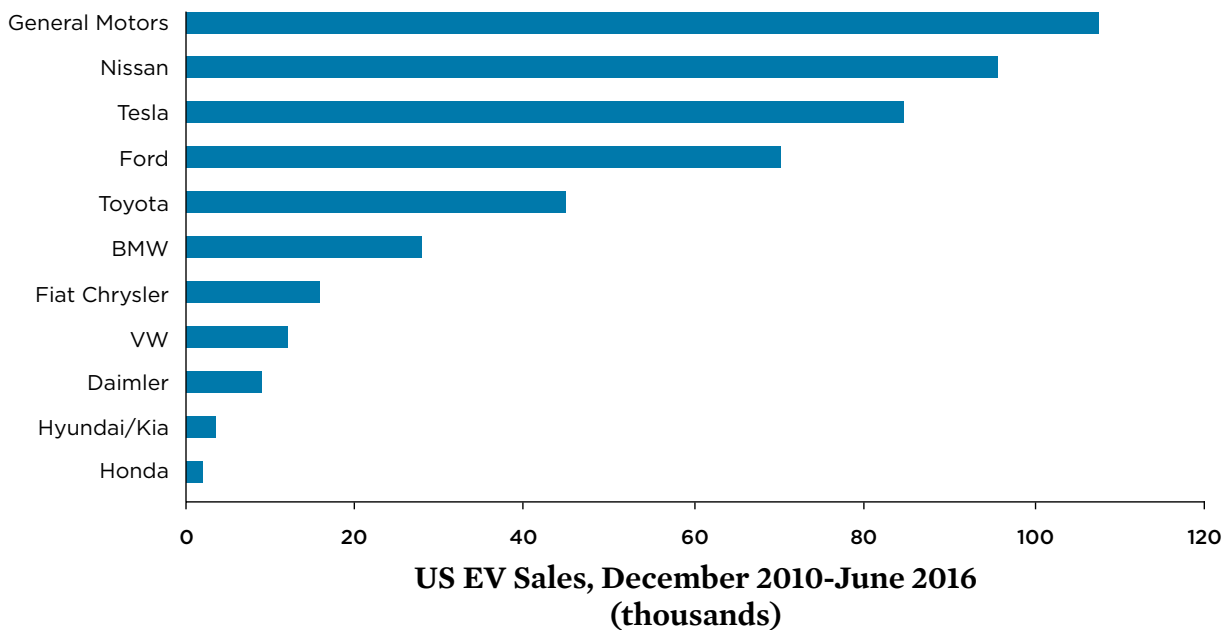
To collect data on the availability of EVs and comparable gasoline-powered vehicles, a popular automotive website was searched for vehicles listed for sale at dealerships. The search found far fewer new EVs on dealers' lots in cities outside California. For example, dealers near Los Angeles offered an average of over 3,000 EVs during the first half of 2016, but those in the New York City area offered about 1,000 (see Figure ES-5). Even fewer vehicles were found for sale in other cities,

Some EVs are available in only a handful of states, or they are available in such small numbers as to be effectively unavailable.

with an average of just over 300 listings for Boston-area dealers. This trend is seen even when adjusting for the total number of vehicles in use in each metropolitan area. For example, Boston had just 10 percent of the EVs listings of Oakland when adjusting for relative car ownership.

Because of the lack of EVs at dealerships in many areas, sales data are a poor indicator of the extent of consumer interest in electric vehicles. EV sales will be smaller if an automaker does not build or offer an EV model for sale or a consumer cannot find one on a dealer lot easily. While leading automakers make their EVs relatively widely available, all automakers could improve the availability of EVs and the number of models available at dealerships.

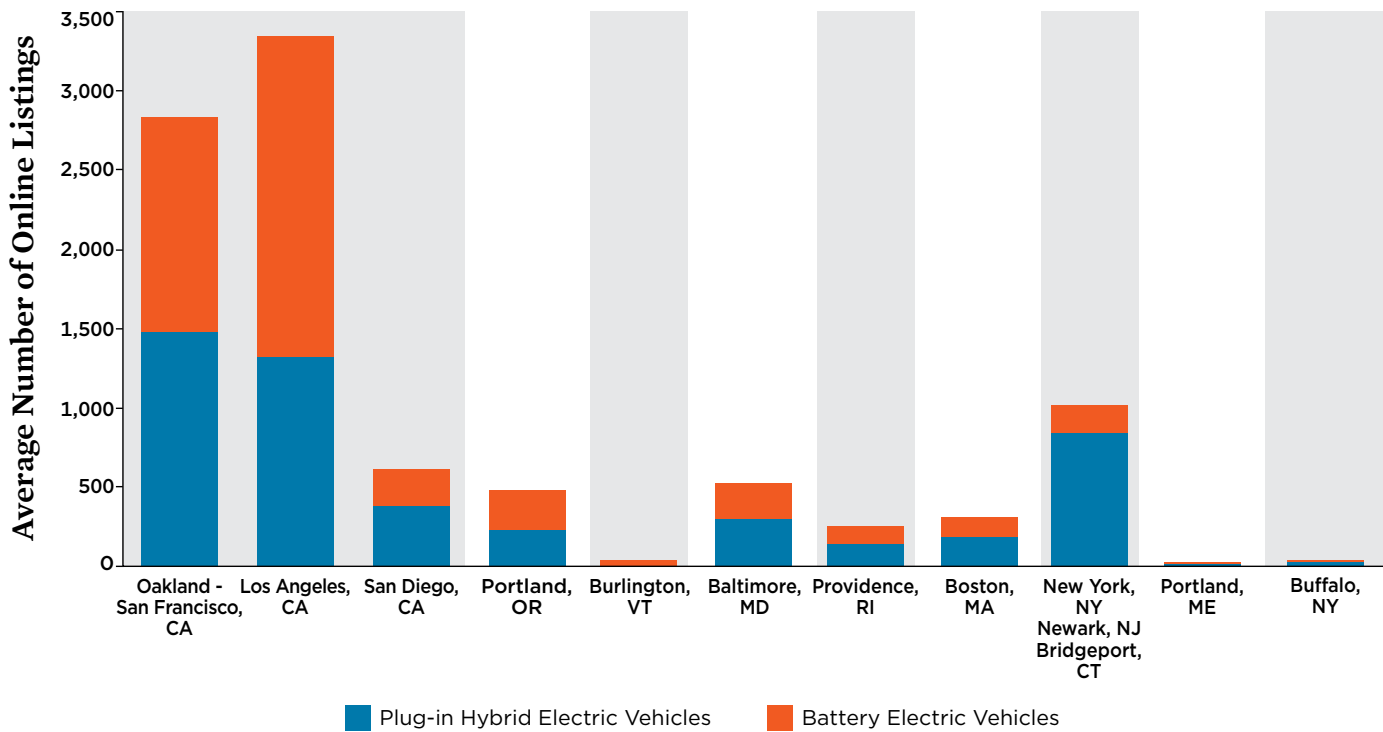
FIGURE ES-4. Total EV Sales in the United States



General Motors and Nissan lead in sales of EVs due their early entry into the EV market. Honda has sold the fewest EVs out of all major automakers.

SOURCE: INSIDEEVS.COM.

FIGURE ES-5. The Availability of EVs in Selected Metropolitan Areas, January-June 2016



City	Unique EV Listings per 1 Million Vehicles	EV Availability (Relative to Oakland - San Francisco)	Average EVs Listed for Sale	Proportion of Dealers offering an EV*
Oakland - San Francisco, CA	1,718	100%	2,822	93%
Los Angeles, CA	783	46%	3,323	97%
San Diego, CA	567	33%	614	89%
Portland, OR	558	32%	490	85%
Burlington, VT	551	32%	47	44%
Baltimore, MD	507	30%	524	66%
Providence, RI	417	24%	259	61%
Boston, MA	179	10%	317	61%
New York, NY - Newark, NJ - Bridgeport, CT**	137	8%	1,022	66%
Portland, ME	132	8%	28	53%
Buffalo, NY	81	5%	38	39%

Significantly fewer EVs are available outside California, both in terms of the absolute number of vehicles and their relative availability.

* Excluding Honda and Toyota, which do not currently offer a plug-in EV.

** Because the search radii for these cities overlap, the analysis combined EV and availability metrics.

Conclusions

This assessment of automaker efforts to bring EVs to market provides a snapshot of current and past sales and availability data, looking at a relatively new and dynamic part of the auto industry. In summary:

- Progress has been uneven, with some automakers clearly ahead in offering multiple EV models and making the vehicles available to more consumers across the country, while others offer few if any models with only limited availability.
- In California, which has the highest EV sales of any state, significantly more plug-in EV models are available compared with the rest of the United States.
- While leading automakers make their EVs relatively widely available, all automakers could improve the availability of EVs and the number of models available at dealerships, especially outside of California.

Through tax credits, rebates, infrastructure support, and other incentives, federal and state governments are taking important steps to accelerate the adoption of electric

vehicles. Consumer interest in EVs is growing as well, as shown by the nearly 500,000 EVs sold in the United States to date and the strong interest in cars like the newly announced Tesla Model 3. However, consumers need more EV options in local car showrooms, especially outside California. Policies like California's Zero Emission Vehicle program are critical for ensuring that automakers do their part to help the country transition to electric vehicles and other cleaner vehicles.

Looking forward, many automakers have announced or stated plans to expand their offerings of EV models, expand their efforts to new regions, and invest more in R&D, driven by competition and underpinned by regulatory measures like the Zero Emission Vehicle program. Some companies, including Honda, Toyota, and Hyundai, have placed greater emphasis on fuel-cell vehicles, a complementary electric-drive technology that could fit the needs of many consumers, yet automakers have been slow to bring these vehicles to market. If automakers deliver on their commitments, electrification of passenger vehicles could rapidly reshape the automotive industry, bringing a change that is needed to reduce carbon emissions and avoid the worst effects of climate change. Automakers who do not invest in EVs may miss out on a potential market that will be vital to the future of the auto industry.



General Motors is a leader in the EV industry with the best-selling EV, the Chevrolet Volt. Sales of the Volt (and the Chevrolet Spark EV) led to EVs making up over 5% of General Motors' sales in California.

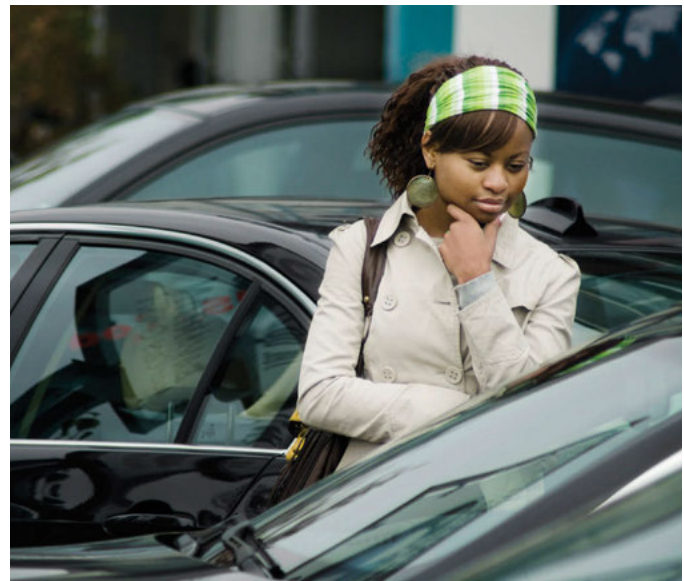
Introduction

Personal transportation in the United States is poised to undergo a remarkable transition: from petroleum-based combustion engines to electric-drive vehicles. Global sales of electric vehicles (EVs), available in quantity only since late 2010, have topped a million in just over five years, and cumulative US sales are on track to hit a half million in 2016 (EDTA n.d.).²

Many factors are compelling car buyers to switch to EVs: lower costs to fuel and operate, a better driving experience due to quiet operation and quick acceleration, the convenience of recharging at home, and the air-quality and climate benefits of driving on electricity. This last factor is particularly important: EVs are central to long-term plans to reduce carbon emissions and avoid the worst effects of climate change (Williams et al. 2014). Meeting climate goals will require the vast majority of US cars and trucks to be powered by an electric motor by mid-century (Greenblatt 2015).

For drivers to choose a vehicle powered by an electric motor, such cars need to be available for sale, with models that meet consumers' driving needs. Since 2010, major automakers have made progress in developing these vehicles and delivering them to US consumers. However, progress has been uneven. Some automakers have led in bringing electrified options to market, while others have done the minimum required by regulations.

This progress report examines automakers' efforts to bring EVs to market, looking at total and recent EV sales, model availability, geographic availability, and actual availability at dealerships near selected major cities. The results



© iStock/Willie B. Thomas

EVs offer car buyers lower costs to fuel and operate, a better driving experience due to quiet operation and quick acceleration, and the convenience of recharging at home. However, drivers can't choose EVs if automakers don't offer them for sale.

EVs are central to long-term plans to reduce carbon emissions and avoid the worst effects of climate change.

² Unless otherwise noted, the term "electric vehicle" refers here only to plug-in electric vehicles and excludes fuel-cell electric vehicles.

show that car companies can produce and sell electric vehicles that consumers want, as illustrated by industry leaders like BMW, General Motors, Nissan, and Tesla. Their efforts prove that automakers can sell the types of cars required to meet climate goals, reduce oil use, and meet the industry's own environmental commitments.

However, not all automakers make or sell electric vehicles in an effective manner. Some automakers put minimal effort into bringing EVs to market. Others make EVs available but offer few models or make it difficult to find the cars at dealerships. As a result, consumers outside California have fewer choices in EV models, and they have fewer opportunities to find or test drive them at local dealerships.

The Need for EVs

The need to electrify transportation is clear. To avoid the worst effects of climate change, the international scientific consensus dictates drastically curtailing carbon emissions. For transportation, meeting climate and air-pollution goals means replacing fossil fuels like gasoline and diesel with better biofuels and renewable electricity and hydrogen (UCS 2016a).

Not only do we need to switch to EVs, the transformation must begin quickly in order to yield significant reductions in emissions decades from now. Cars and trucks on the road today will have an average life of over 11 years; many vehicles sold this year will remain on the road and burning gasoline for well over a decade (USDOT n.d.). In addition, automakers typically have multiyear product-design cycles, and new technologies take significant time between their introduction and their inclusion in all of a brand's models (Taylor 2016). Given these inherent multi-decade delays in the adoption of transportation technologies, EVs must become available in volume now.

Evaluating the State of the Electric Vehicle Market

The current generation of EVs appeared in late 2010 with the introductions of the Chevrolet Volt and Nissan LEAF. Since then, automakers have sold over 400,000 new EVs in the United States, and 13 manufacturers have introduced over 25 models (see Figures 1 and 2, p. 10).

The number of EV models available on the market does not completely reflect the actual availability of EVs. Only three models account for almost 60 percent of total EV sales (see Figure 3).

Total US sales do not necessarily indicate consumer demand for EVs. Consumers cannot buy cars that are not

BOX 1.

What Are Electric Cars?

Conventional vehicles use only a gasoline- or diesel-powered engine. In electric cars and trucks, electricity from batteries or a fuel cell powers the motor. Plug-in electric cars run at least partially on electricity from the electric grid. Non-plug-in hybrids, like most models of the Toyota Prius, have an electric motor but can only use the energy from gasoline or diesel and therefore are not considered EVs.

Automakers offer two major types of plug-in electric vehicle: plug-in hybrid EVs and battery EVs. A third type, the fuel-cell EV, is on the horizon.

Plug-in Hybrid Electric Vehicles (PHEVs)

PHEVs have both an electric motor and a gasoline or diesel engine. The electric motor is powered by a battery that can be plugged in and recharged. Some PHEVs blend mechanical power from the engine with the output from the electric motor; other PHEVs use the gasoline engine only as a generator to recharge the batteries. Regardless, PHEVs replace some petroleum with power from the electric grid, but they retain the ability to refuel at gasoline stations for extended driving. The best-selling example is the Chevrolet Volt.

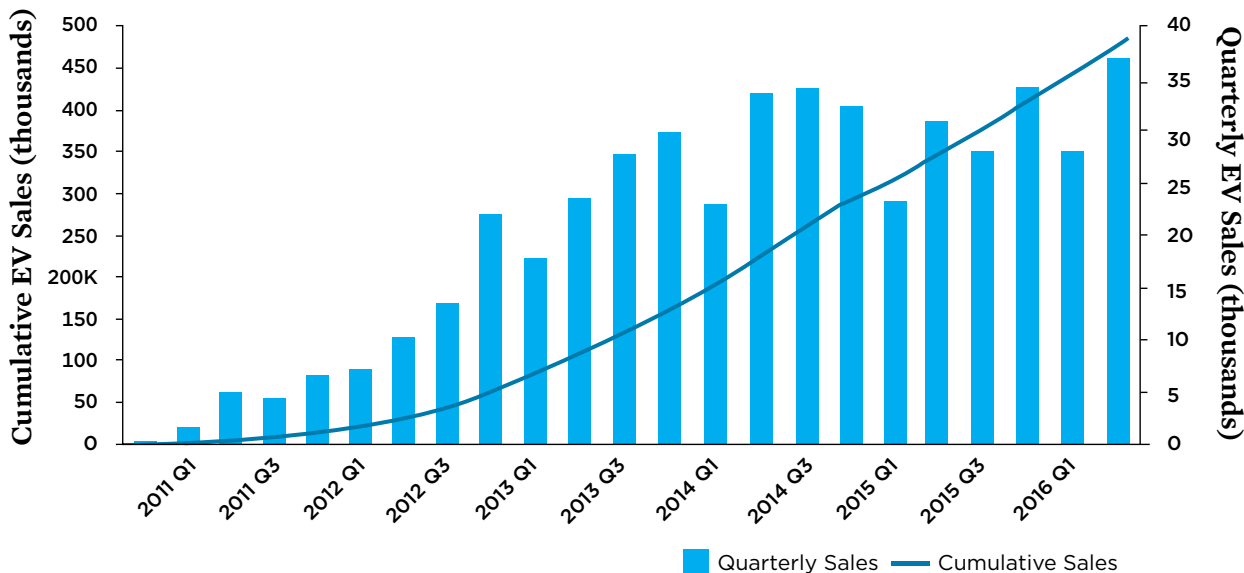
Battery Electric Vehicles (BEVs)

BEVs forgo liquid fuels entirely, operating exclusively on electricity. Battery-powered electric cars usually have larger storage batteries than PHEVs. Many BEVs allow 80 miles of driving on a single charge, Tesla BEVs have ranges in excess of 200 miles, and other manufacturers are planning vehicles with ranges of 200 miles or more. The best-selling examples of BEVs are the Nissan LEAF and the Tesla Model S.

Fuel-Cell Electric Vehicles (FCEVs)

FCEVs store hydrogen on board and use it in a fuel cell to produce electricity. The only exhaust is water vapor, so like BEVs, these vehicles produce no tailpipe pollution. FCEVs share many of the components of PHEVs, such as an electric motor, storage batteries, and regenerative braking (braking that can recharge the batteries). Because manufacturers are just beginning early-stage production of FCEVs and almost exclusively for sales in California, this report does not address such vehicles.

FIGURE 1. US Electric Vehicle Sales Are Increasing and Nearing Half a Million Cumulative Sales



Cumulative EV sales in the United States are nearing 500,000 with steady sales over the last two years.

SOURCE: INSIDEEVS.COM.

available, and not all EVs are available in all parts of the country. Some are only effectively available in a handful of states. That said, sales data do give insight into the attractiveness and customer acceptance of EVs.

EVs Sales and Availability in the United States

Before 2010, very few EVs were available in the United States. The current wave of commercially available EVs began with the launch of the Nissan LEAF and Chevrolet Volt at the end of 2010. Since then, other manufacturers have followed suit, with over 20 models now available in the United States.

Automakers vary greatly in their efforts to develop EVs and make them available. The Tesla Model S, Chevrolet Volt, and Nissan LEAF make up over half of the EVs sold to date, partly because those models have been on the market for longer. However, other EV models are sold only in a handful of states or have had limited availability at dealerships.

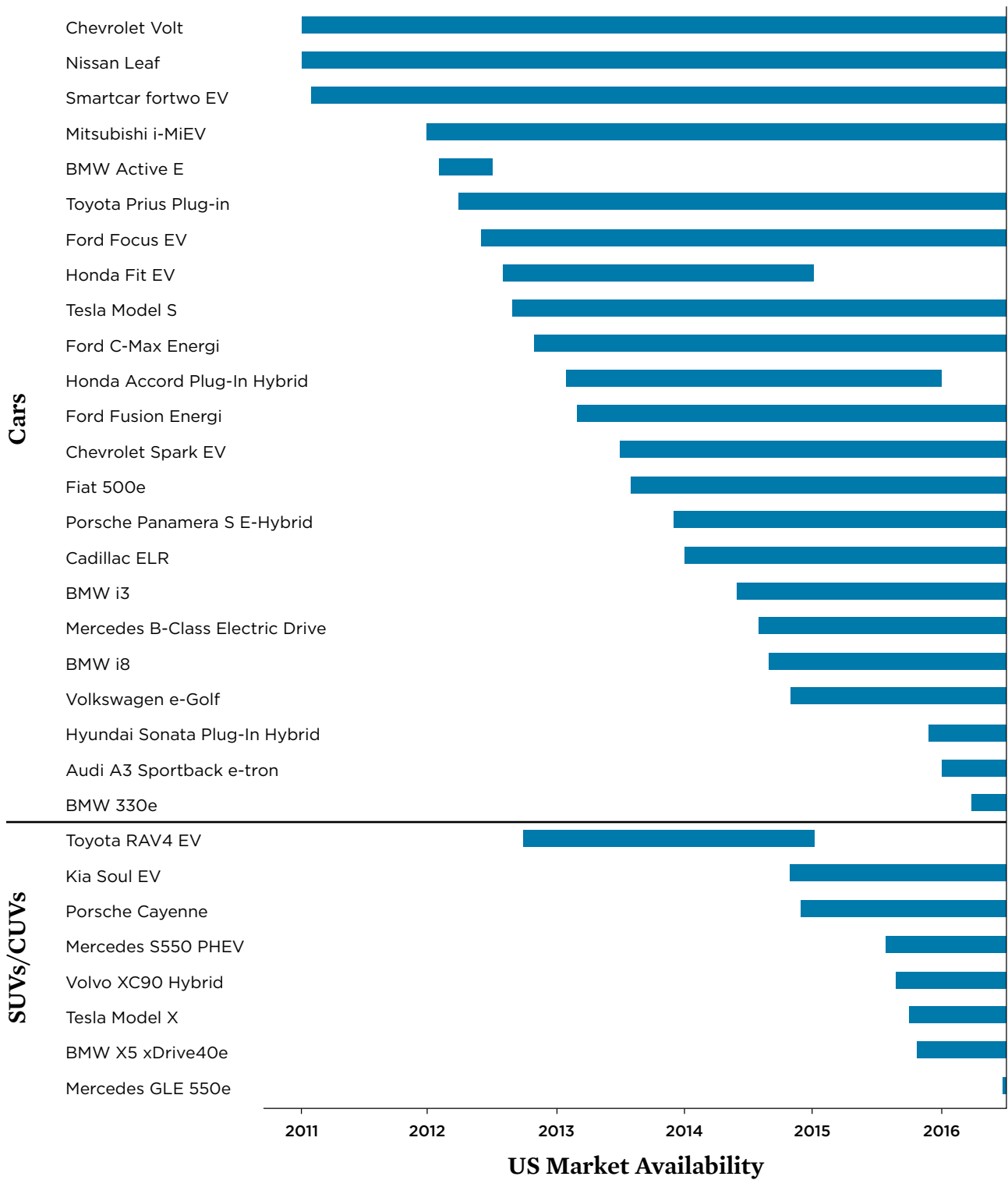
Overall, sales have been steady for the last two years, with an average of 120,000 EVs sold each year. However, sales figures alone do not reveal the impact of model introductions and product cycles. With the top six EVs comprising 79 percent of EVs sold, changes to even one model have a noticeable impact on the entire sector. For example, Toyota began phasing out the Prius Plug-in in 2015, while Nissan and Chevrolet

were changing their main EV models. These factors led to a significant slowing in sales of those models. However, the rest of the EV market grew over the same period, in part as new models became available. Overall, the two trends cancelled each other out, with the product cycles of existing models masking increased interest in new EVs.

The picture may change with the entry of a number of new EVs into the US market over the last year. Additionally, several high-profile EV models are slated to go on sale in 2016 and 2017, including the Tesla Model 3 and the Chevrolet Bolt. Diversity in both the types of EV (cars and SUVs) and the number of manufacturers should lead to a market in which EV sales are more broadly distributed and less susceptible to the success or failure of individual models.

Consumers outside California have fewer choices in EV models, and they have fewer opportunities to find or test drive them at local dealerships.

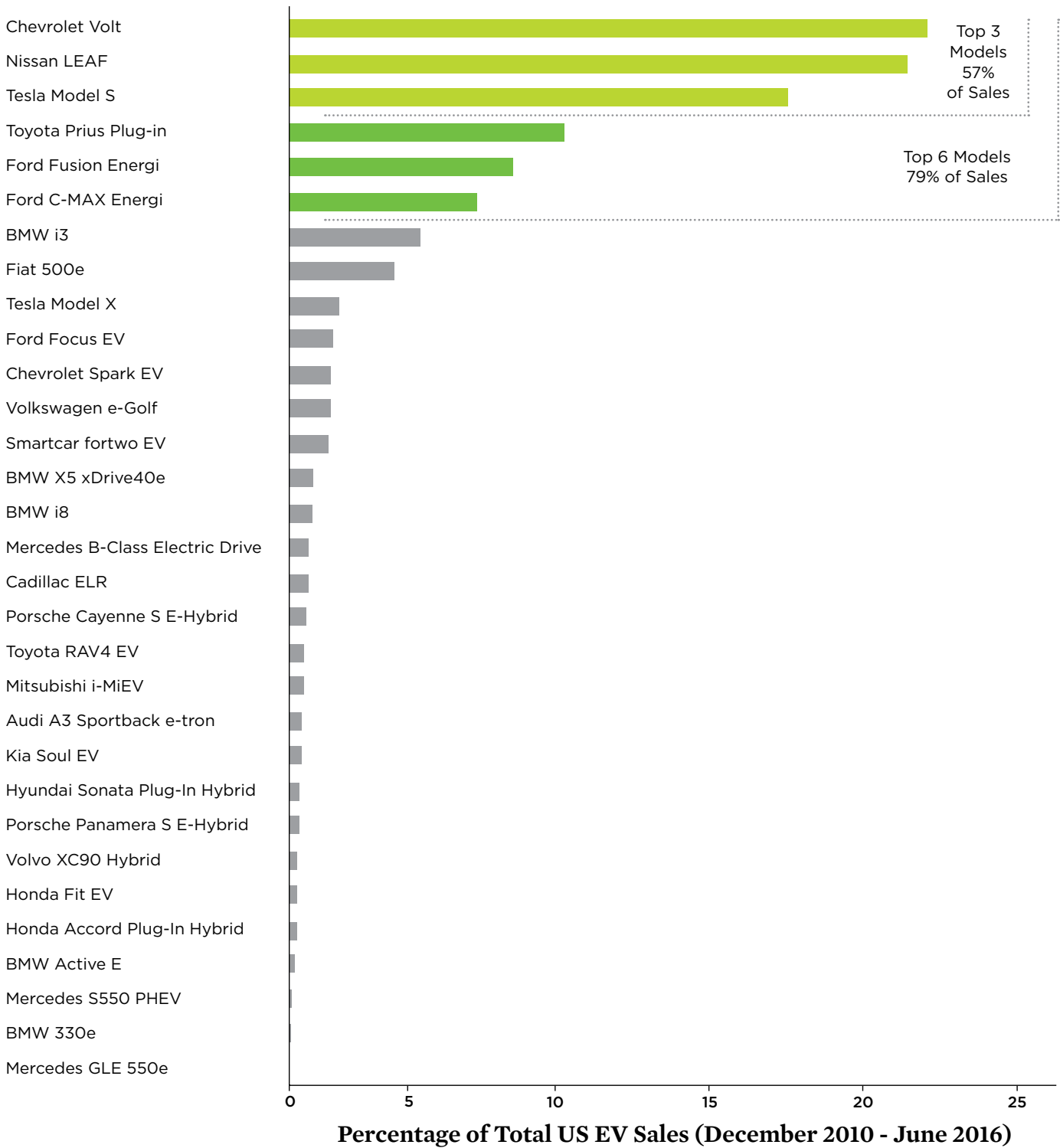
FIGURE 2. Availability Timing for Electric Vehicles in the United States



Twenty-six EV models are available for sale in one or more states, although many have been available only since 2013. Most models of EVs are cars, but sports utility vehicle (SUVs) and crossover utility vehicles (CUVs) are becoming available.

SOURCE: INSIDEEVS.COM.

FIGURE 3. Only Six Models Comprise Almost 80 Percent of US EV Sales to Date



While 20+ models of EVs are or have been sold in the United States, the three top-selling EVs make up 57 percent of all EV sales; the top six represent 79 percent of sales.

SOURCE: INSIDEEVS.COM.

Leaders and Laggards in EV Sales

Total EV sales are an important measure of the overall market success of electric vehicles. Beyond that, the percentage of each automaker's EV sales compared with overall vehicle sales is a telling measure of its efforts to offer and market EVs. Model availability, looking at both the development of EVs and the ability of consumers to find EVs, is also important in determining the commitment of a manufacturer to EV technology.

Examining the proportion of sales that are EVs reveals that some automakers are making significant efforts to sell these vehicles across the United States, but others are not. In 2015, US EV sales were 0.7 percent of total new vehicle sales (0.5 percent excluding Tesla). BMW led major automakers by selling EVs at a rate nearly five times the overall industry average (see Figure 4). Nissan, Volkswagen, and Daimler had above-average rates of EV sales nationally, while Ford and GM were close to the average. Fiat Chrysler, Toyota, and Hyundai/Kia ranked far below average, and Honda sold fewer than 100 EVs in 2015 despite selling a total of over 1.5 million vehicles in the United States.

Another important factor for EV sales at the levels of both automaker and brand is the availability of even one EV model.

BOX 2.

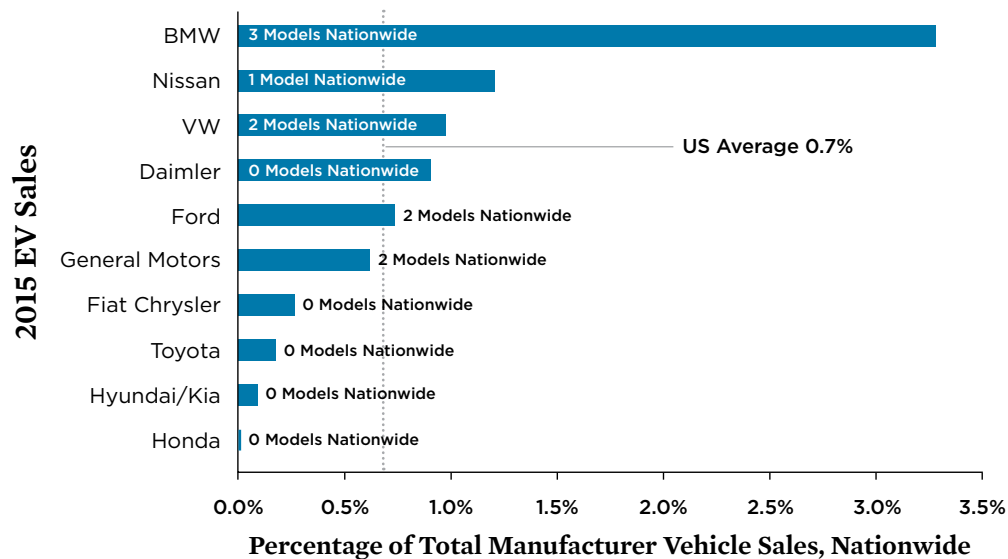
Measuring Tesla's Availability and Effort

This report, assessing the efforts of major automakers to develop EVs and make them available, excludes Tesla Motors from the availability metrics such as the geographic availability of new EVs and dealership availability.

Tesla produces only electric vehicles, so its commitment to developing and selling electric vehicles is clear. Tesla is also unique in its production and dealership models. It builds cars to order and owns its showrooms. Therefore, the availability of Tesla's EVs does not depend on the availability of vehicles at dealerships. (Franchise laws affect the company's ability to open stores in some states.)

Many brands sold by the major automakers make no EVs available to consumers. For example, Chrysler, Lexus, Dodge, and Acura have never offered an EV. Because car buyers cannot buy vehicles that are not offered, the unavailability of EV models in many brands reduces the overall rate of EV sales.

FIGURE 4. Automakers That Make EVs Available Nationwide Have Higher Sales



Automakers that offered more EV models and made them available across the United States sold a higher percentage of such vehicles. BMW was the clear leader among major manufacturers, while Fiat Chrysler, Toyota, Hyundai/Kia, and Honda were far behind in both EV sales and model availability.

Note: Available Nationally = Registrations in 40+ states

SOURCES: INSIDEEVS.COM, WARDAUTO.

EV Sales in California

California's EV market, accounting for roughly half of all current EV sales in the United States, is an important indicator of automakers' efforts to sell EVs. The state's regulatory requirements—including the Zero Emission Vehicle (ZEV) program—and other policy measures—such as EV rebates, an EV charging infrastructure, and access to carpool lanes for EV drivers—have provided incentives for automakers to deploy EVs to California. Automakers have responded with strategic decisions to concentrate their EV deployment efforts in the state.

The Zero Emission Vehicle Program

California's ZEV program is accelerating the move to electric vehicles. This important policy, which the California Air Resources Board initially adopted in 1990, has been modified several times, most recently in 2012 (CARB 2014). Its goal is to ensure that automakers develop and market EVs, enabling the state to meet its goals for improving air quality and reducing climate-changing emissions.

Since 1990, nine other states have adopted the ZEV program: Oregon, New York, New Jersey, Maine, Connecticut, Maryland, Vermont, Rhode Island, and Massachusetts. These ZEV states are sometimes referred to as the "177 states," after the section in the federal Clean Air Act that grants states the authority to adopt California's vehicle standards, which are significantly more stringent than the federal standards.

Only the ZEV states explicitly require automakers to sell electric vehicles, and these are where automakers have directed their EV sales efforts, particularly California.³ Portions of our analysis also concentrate on the ZEV states (and

particularly California) because their sales and availability results, compared with results for all states, better indicate the potential to sell EVs across the United States.

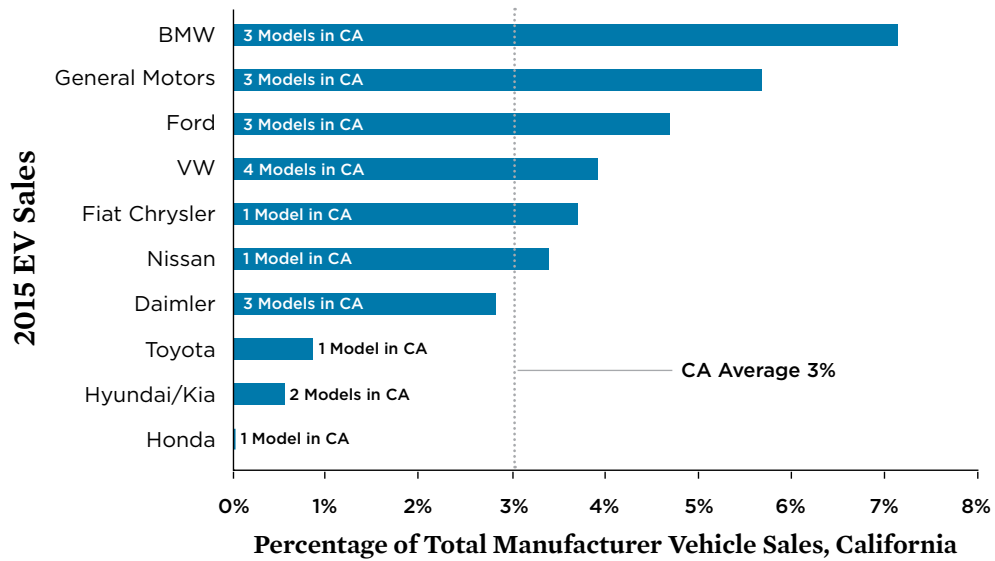
In addition to sales data, data were collected to assess the ability of consumers to find EVs at dealerships in California and the other ZEV states. Inventory data were collected on the number of EVs and comparable gasoline models from a popular automotive website, Edmunds.com (see Appendix A). While this dataset does not reflect every vehicle in the search area, it is representative of the vehicle availability a car buyer would experience when searching online.

California Sales

In 2015, EV sales in California, including Tesla sales, comprised 3 percent of the total sales of new passenger vehicles in the state, a significantly higher percentage than for the nation. BMW was the leader among major automakers, with EVs representing 7.1 percent of the company's California sales (see Figure 5, p. 14). When considering only BMW-branded vehicles (that is, excluding Mini), the percentage rises to 8.3 percent (see Figure 6, p. 16). GM and Ford EV sales in the state were also significantly above average. As in the national sales statistics, Toyota, Hyundai/Kia, and Honda sold EVs at a markedly lower rate than their competitors. Fiat Chrysler is slightly above average in California despite a much lower rate at the national level. This is because the Fiat 500e BEV is available only in California and Oregon and because the electric-powered 500e sales are higher than those for the gasoline-powered Fiat 500 in California.

3 Until 2018, it is possible for automakers to comply with the ZEV regulation solely with EV sales in California.

FIGURE 5. BMW and General Motors Lead in California with More Than 5% of New Car Sales EVs



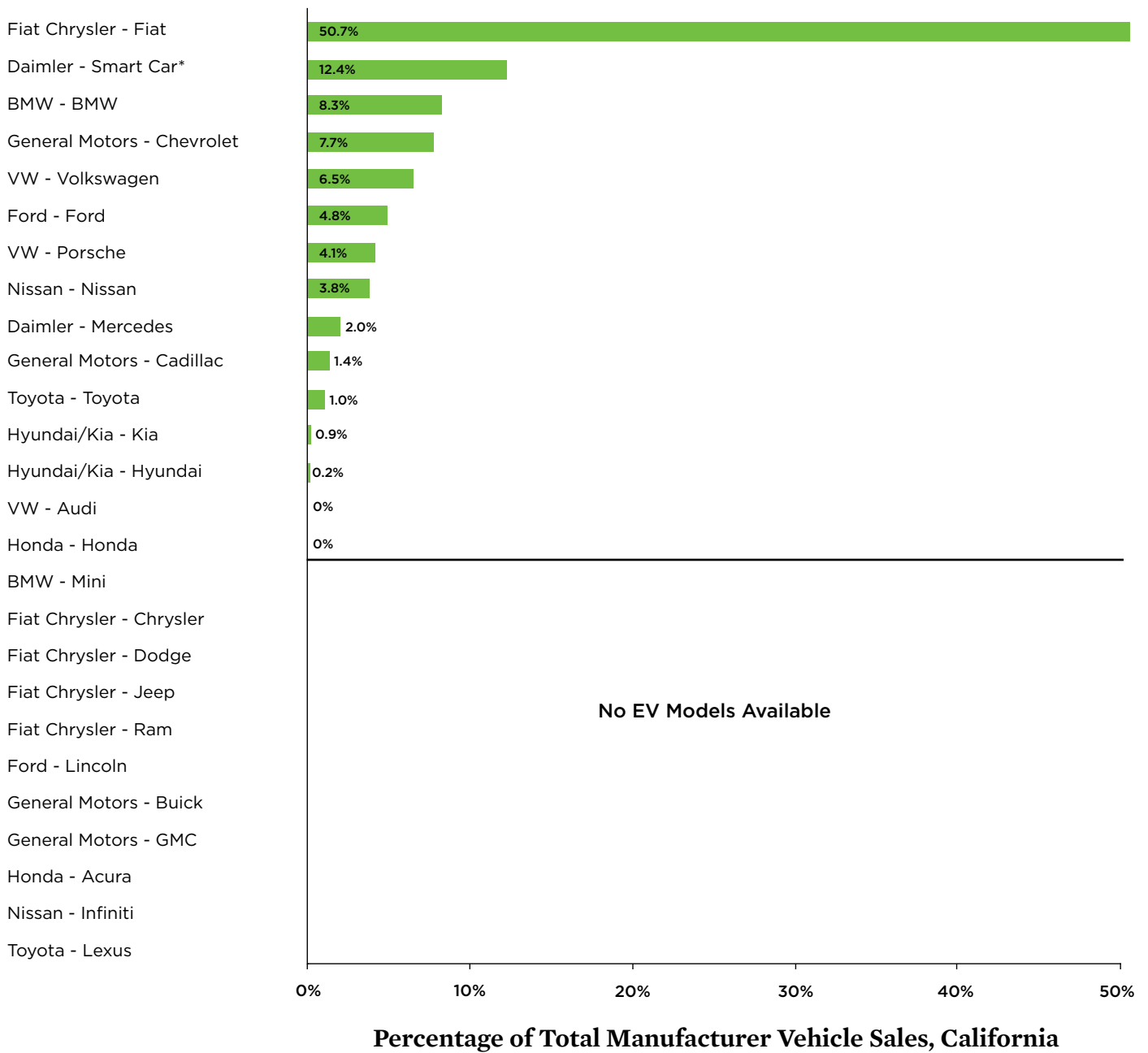
BMW and General Motors led in California, with EVs representing more than 5 percent of all of their sales. Honda and Toyota sold few EVs in California because they stopped selling plug-in vehicles during 2015.

SOURCES: IHS AUTOMOTIVE, CALIFORNIA NEW CAR DEALERS ASSOCIATION'S CALIFORNIA AUTO OUTLOOK.



California's Zero Emission Vehicle Policy has led to greater EV model choice and higher sales in California as compared to the rest of the United States. Over twenty EV models were available in California in 2015.

FIGURE 6. Fiat Far Outpaced Other Brands of EVs in California in 2015

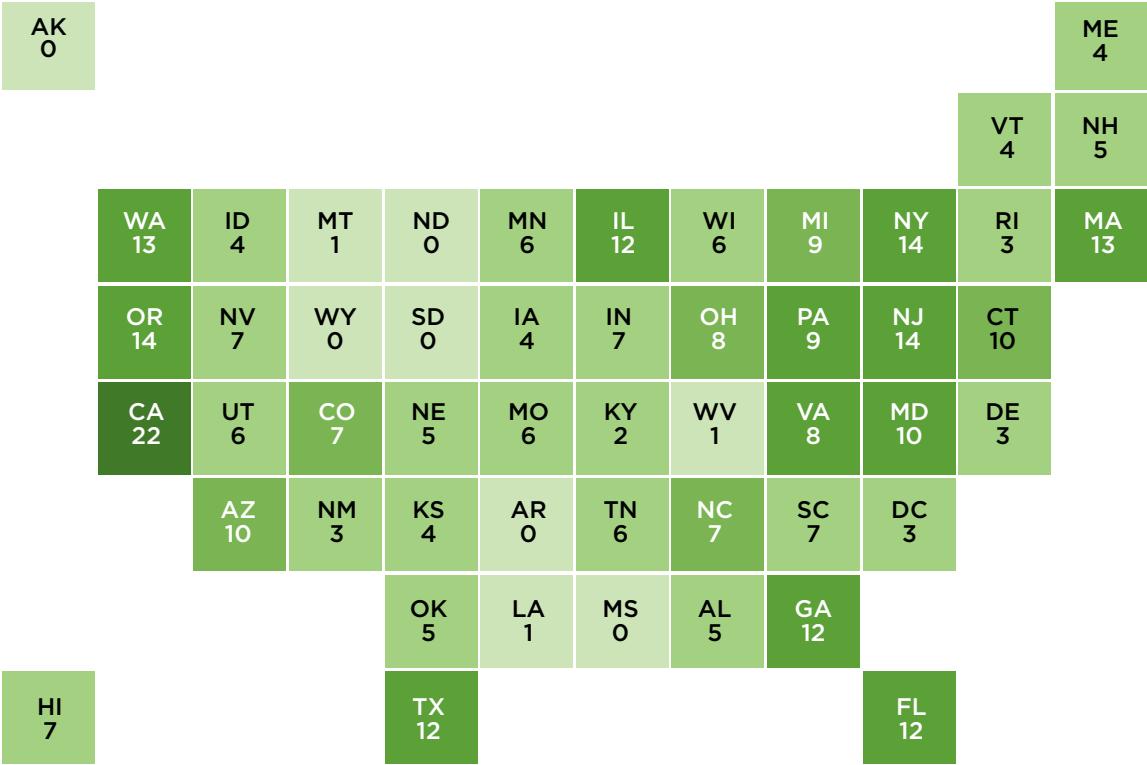


Many brands made no EVs available, which reduced sales percentages by manufacturer.

* Estimated (see Appendix, p. 35)

SOURCES: IHS AUTOMOTIVE, CALIFORNIA NEW CAR DEALERS ASSOCIATION'S CALIFORNIA AUTO OUTLOOK.

FIGURE 7. Many More EV Models Are Available in California



California buyers bought 22 different EV models in 2015. No other state had more than 14 different EV models purchased. A minimum of 20 vehicle registrations is required to qualify as sold in the state.

SOURCE: IHS AUTOMOTIVE.

California’s EV market, accounting for roughly half of all current EV sales in the United States, is an important indicator of automakers’ efforts to sell EVs.

State-Level Availability of EV Models

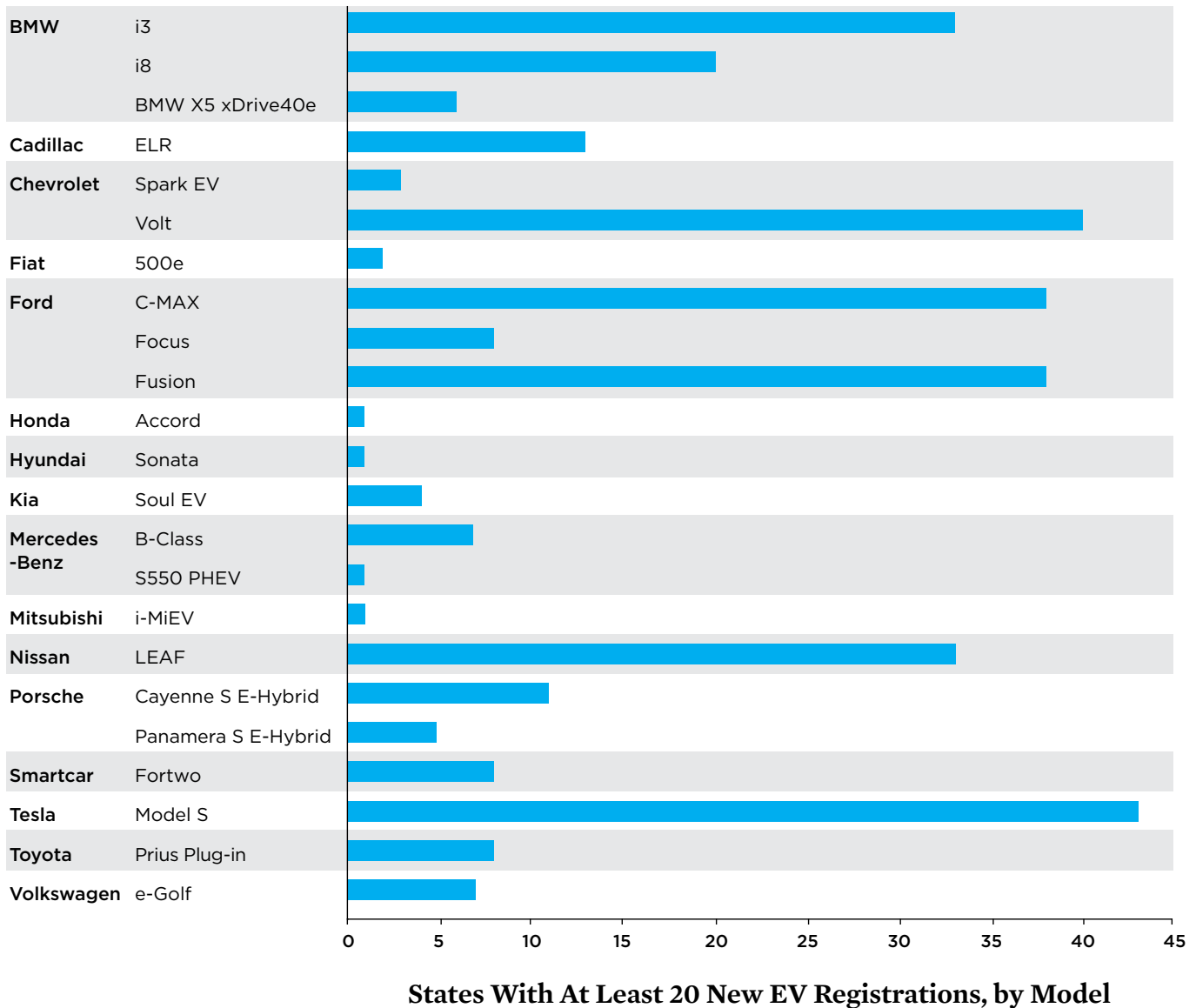
Sales are limited at the national level in part because some automakers sell EVs in a limited geographic area. Some manufacturers sell EVs in only a handful of states, often California plus some of the other ZEV states. Only five EV models

recorded sales in all 50 states during 2015. Some models were only sold in a few states: the Fiat 500e (two states), Kia Soul EV (ten states), and Chevrolet Spark EV (three states). Overall, California car buyers could choose from 22 EV models in 2015, but buyers in the rest of the country had 14 models or fewer available (see Figures 7 and 8).

Availability of EVs at Dealerships

In a recent survey, 86 percent of drivers said they would not buy a new car without being able to test drive it (UCS 2016b). In fact, while automakers may advertise the availability of certain EV models in certain markets or the whole country, the reality of being able to take a test drive varies significantly. For example, over 2,800 EVs were available on average in the San Francisco–Oakland Bay Area, compared with just over 300 in Boston, MA. Not only are more EVs available near Oakland, there are many more EVs relative to the total number of vehicles in the metropolitan area (see Figure 9, p. 18).

FIGURE 8. Only Six EV Models Were Available in More Than Thirty States in 2015

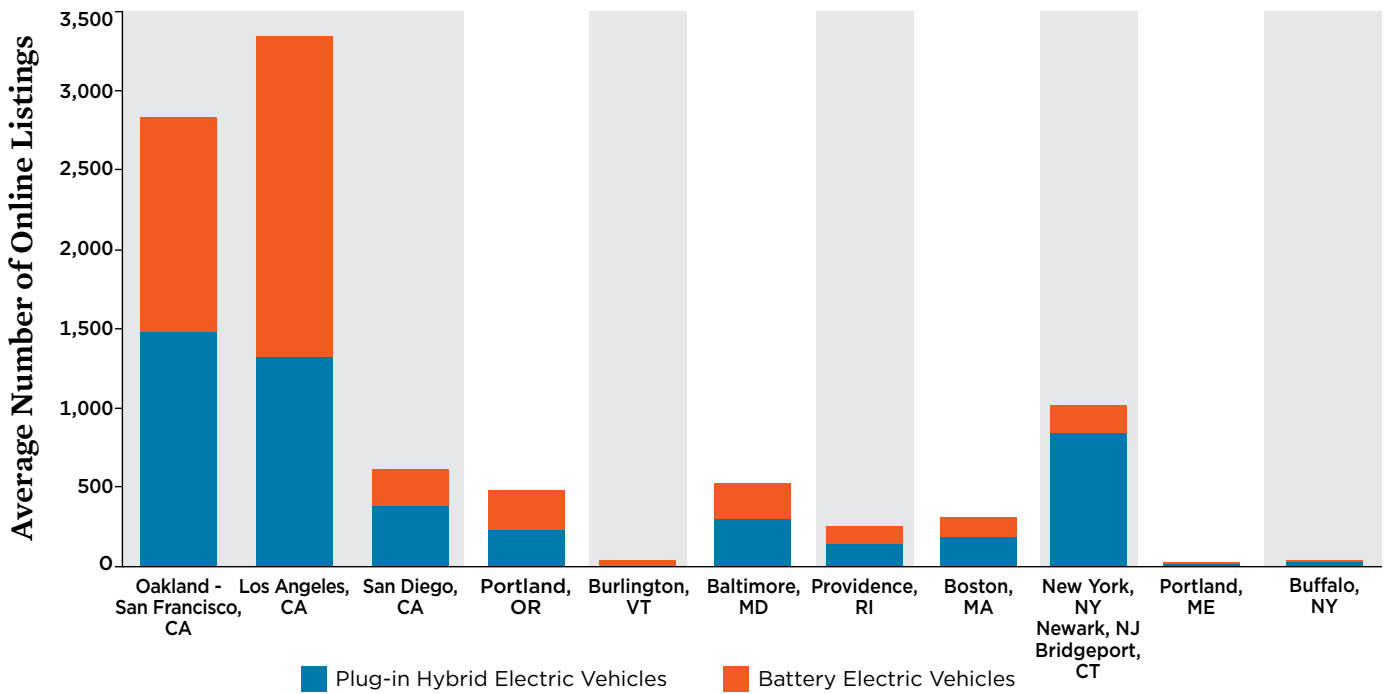


Consumers registered only two vehicle models in at least 40 states and only seven in at least 20 states in 2015.

SOURCE: IHS AUTOMOTIVE.

Sales are limited at the national level because some automakers sell EVs in a limited geographic area.

FIGURE 9. The Availability of EVs in Selected Metropolitan Areas, January-June 2016



City	Unique EV Listings per 1 Million Vehicles	EV Availability (Relative to Oakland - San Francisco)	Average EVs Listed for Sale	Proportion of Dealers offering an EV*
Oakland - San Francisco, CA	1,718	100%	2,822	93%
Los Angeles, CA	783	46%	3,323	97%
San Diego, CA	567	33%	614	89%
Portland, OR	558	32%	490	85%
Burlington, VT	551	32%	47	44%
Baltimore, MD	507	30%	524	66%
Providence, RI	417	24%	259	61%
Boston, MA	179	10%	317	61%
New York, NY - Newark, NJ - Bridgeport, CT**	137	8%	1,022	66%
Portland, ME	132	8%	28	53%
Buffalo, NY	81	5%	38	39%

Significantly fewer EVs are available outside California, both in terms of the absolute number of vehicles and their relative availability.

* Excluding Honda and Toyota, which do not currently offer a plug-in EV.

** Because the search radii for these cities overlap, the analysis combined EV and availability metrics.

Ranking the Companies on EV Progress

The UCS analysis compared the major 11 automakers currently selling EVs in the United States. The analysis also ranked these companies, plus two smaller-volume companies not profiled, Volvo and Mitsubishi, on four criteria:

- Total EV sales, December 2010-June 2016;
- 2015 EV sales;
- EV sales as a percentage of the company's 2015 new-vehicle sales for the United States; and
- EV sales as a percentage of the company's 2015 new-vehicle sales in California.



energy.gov/Creative Commons (Flickr)

California's Zero Emission Vehicle requirement has spurred many automakers to focus their EV efforts there, neglecting prospective EV buyers in the rest of the United States.

BMW (BMW and Mini brands)

BMW entered the EV market in 2011 with a short-lived experiment, the BMW ActiveE. While the ActiveE did not result in significant sales, it gave BMW valuable experience in building EVs. In 2014, BMW began selling the i3, a vehicle that was designed from the start as an EV. Available in both BEV and PHEV versions, the i3 is a top-selling EV model in the United States.

BMW takes a two-pronged approach to developing EV models. Via its “BMW i” sub-brand, the company sells distinctive EVs like the i3 and i8. At the same time, it makes plug-in hybrid versions of popular gasoline models like the X5 SUV and 3-series sedan. BMW says it will develop plug-in versions of all core vehicle models (Boston 2016).

Perhaps because of this strategy, BMW leads major car manufacturers in US sales of EVs compared with sales of gasoline and diesel models. Plug-in vehicles represent 3.3 percent of US BMWs (including the Mini brand) and 7.1 percent of BMW-made cars sold in California. Considering only BMW-branded vehicles, 1 in 12 (8.3 percent) sold in California in 2015 can be plugged in. The latest EV to come from BMW is the 330e sedan, a plug-in hybrid variant of the 3-series car. The 3-series is BMW’s best-selling model, so this vehicle could continue to increase the proportion of EVs sold at BMW dealers (BMW 2016). Also, the 3-series and X5

TABLE 1. BMW

		Rank
EV Models Available	4	
2010–Present EV Sales	27,715	6th
2015 EV Sales	14,181	5th
2015 US Sales Proportion	3.3%	2nd
2015 CA Sales Proportion	7.1%	2nd

combined represent over 40 percent of total BMW sales, so a significant fraction of BMW shoppers have plug-in options to choose from.⁴

EV PROGRESS

BMW is an industry leader in vehicle electrification, with EVs representing the highest proportion of all US sales among traditional automakers. Tesla is the only company with a higher proportion. If BMW maintains its commitment to electrification, it may set the pace for luxury automakers for the foreseeable future. However, it will face competition from Tesla as the latter brings the Model 3 to market, especially if BMW fails to develop a long-range BEV model.

BMW leads major car manufacturers in US sales of EVs compared with sales of gasoline and diesel models.

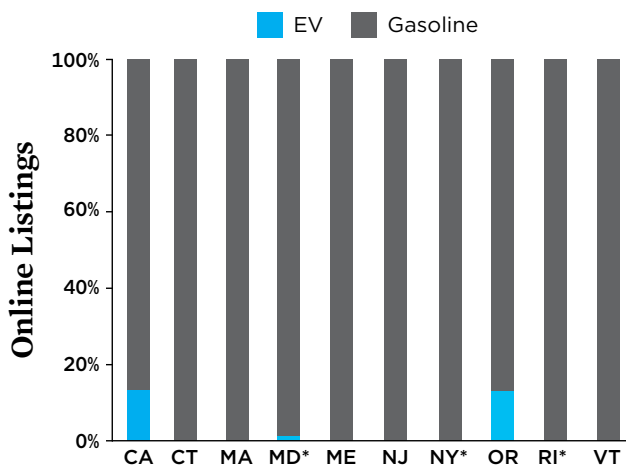
⁴ BMW has also promoted the use of sustainable manufacturing for electric cars. For example, the company uses renewable power for carbon-fiber production and incorporates recycled materials into the i3 plug-in vehicle (BMW n.d.).

Daimler (Mercedes-Benz and Smart brands)

Daimler, the parent company for Mercedes-Benz and Smart, has two main EV models, the Mercedes B-class BEV and the Smart fortwo BEV. While the Smart fortwo is available in most states surveyed, the Mercedes B-class BEV is not (see Figure 10). Our inventory search found only four states with any availability, including a single vehicle in Rhode Island. Mercedes has offered another EV, the S550 PHEV, in very small volumes, with fewer than 200 vehicles total sold in the United States as of April 2016.

Sales volumes of the B-class BEV by state match the availability patterns. Oregon and California were the only states studied to have a number of B-class vehicles listed online for sale. Over 85 percent of all B-class sales in the United States were to buyers in those two states.

FIGURE 10. Listings of Mercedes B-class EVs vs. the Similar-size GLA-class Gasoline Vehicle



Only California and Oregon have significant proportions of Mercedes B-class EVs listed for sale compared with a similar-size gasoline vehicle, the Mercedes-Benz GLA-class.

*Mercedes B-class EV listings were less than 2%.

TABLE 2. Daimler

		Rank
EV Models Available	4	
2010–Present EV Sales	8,923	9th
2015 EV Sales	3,411	9th
2015 US Sales Proportion	0.9%	5th
2015 CA Sales Proportion	2.8%	8th

EV PROGRESS

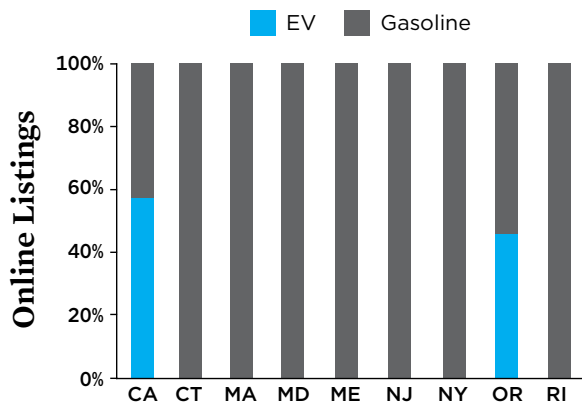
Daimler has lagged behind its German rivals BMW and VW in bringing EVs to the US market. While Daimler has two BEVs and one PHEV on the market, it sells very few of these models and their availability is low. A Mercedes-Benz PHEV SUV is slated to go on sale in the United States in fall 2016, which could signal a shift toward greater electrification throughout its fleet. Recently, Daimler pledged to offer all its vehicles with an electric-drive option, although that may include non-plug-in hybrids, and not all will be available in the United States (Daimler n.d.). It would be a change for the better if Daimler follows through with its electrification plans.

Daimler pledged to offer all its vehicles with an electric-drive option, but that may include non-plug-in hybrids, and not all will be available in the United States.

Fiat Chrysler (Fiat, Jeep, Chrysler, Dodge, and Ram brands)

Fiat Chrysler brands include Chrysler, Dodge, Fiat, Jeep, and Ram. Only Fiat offers an EV, the Fiat 500e, and that only in Oregon and California. However, in those two states, the electric Fiat 500e is available in higher numbers than the conventional, gasoline-powered Fiat 500 (Figure 11). This balance carries over to sales: over 50 percent of Fiat sales in California are electric drive, the highest percentage for any brand except Tesla. However, because Fiat is only one Fiat Chrysler brand out of five and the 500e has limited geographic availability, Fiat Chrysler’s overall US sales proportion of EVs is below average.

FIGURE 11. Listings of the Fiat 500 vs. 500e



The plug-in version of the Fiat 500 is sold only in Oregon and California, but it is available in about equal numbers to the gasoline version in those two states.

TABLE 3. Fiat Chrysler

		Rank
EV Models Available	1	
2010–Present EV Sales	15,853	7th
2015 EV Sales	6,194	6th
2015 US Sales Proportion	0.3%	8th
2015 CA Sales Proportion	3.7%	6th

EV PROGRESS

At the CEO level, Fiat Chrysler has been a vocal opponent of EVs. CEO Sergio Marchionne famously has asked customers not to buy the Fiat 500e and said that selling EVs is “masochistic” (Beech 2014; Loveday 2013). Additionally, Fiat Chrysler offers its lone plug-in in just two states. Few US car buyers can choose an electric car from Fiat Chrysler.

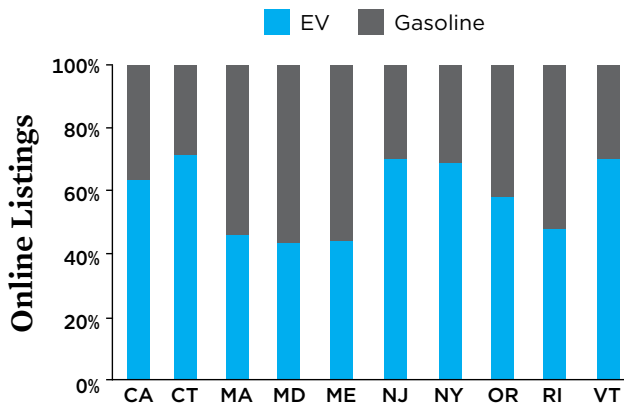
Despite this anti-EV rhetoric, the company had shown progress on EVs and plans to release the first plug-in minivan, the Chrysler Pacifica PHEV, in late 2016 (Vijayenthiran 2016). Traditionally, Fiat Chrysler has focused sales on pickup trucks and SUVs, so to make a meaningful effort toward electrification, it will need to go much further and develop a strategy to incorporate electric drive into its more popular vehicle lines.

Fiat Chrysler offers its lone plug-in in just two states.

Ford (Ford and Lincoln brands)

Ford makes three EV models available in the United States. All are electric-drive-enabled versions of vehicles available as gasoline cars, and all are within the main Ford brand. The two plug-in hybrid models—Fusion and C-MAX—are the most successful in terms of sales, helped in part by their widespread availability outside California. In contrast, the Focus EV has very limited availability outside California, with no more than five vehicles listed for sale online per state, according to the Web-based inventory search (see Figures 12 and 13).

FIGURE 12. Listings of the C-MAX Energi (PHEV) vs. the Gasoline-only C-MAX



In six of the ten states, more plug-in version models than gasoline versions are listed for sale.

Ford is in the middle of the pack for developing and promoting EVs and has not developed distinct, EV-only products.

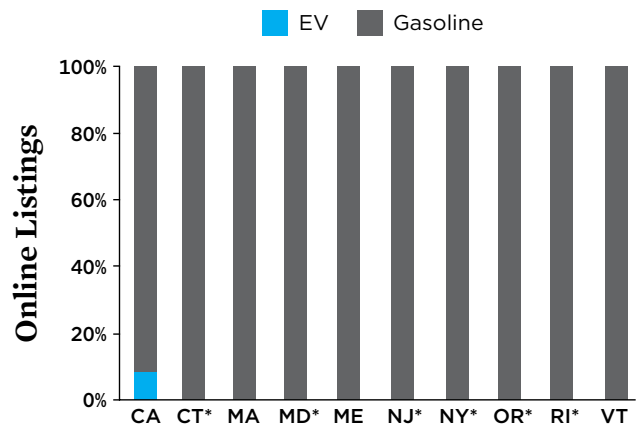
TABLE 4. Ford

		Rank
EV Models Available	3	
2010–Present EV Sales	69,814	4th
2015 EV Sales	18,923	3rd
2015 US Sales Proportion	0.7%	6th
2015 CA Sales Proportion	4.7%	4th

EV PROGRESS

Ford is in the middle of the pack for developing and promoting EVs. Unlike GM, Nissan, and BMW, the company has not developed distinct, EV-only products. However, its Fusion and C-MAX PHEVs have sold well in California and the other ZEV states. Ford’s decision to develop a long-range BEV seems in part motivated by the strong interest in the Tesla Model 3 and, to a lesser degree, the Chevrolet Bolt. Perhaps continued success by other EV leaders will push Ford to accelerate its EV plans.

FIGURE 13. Listings of the Focus EV vs. the Gasoline Focus



The EV version is effectively available only in California. About 9 percent of Focus models listed in California are EVs.

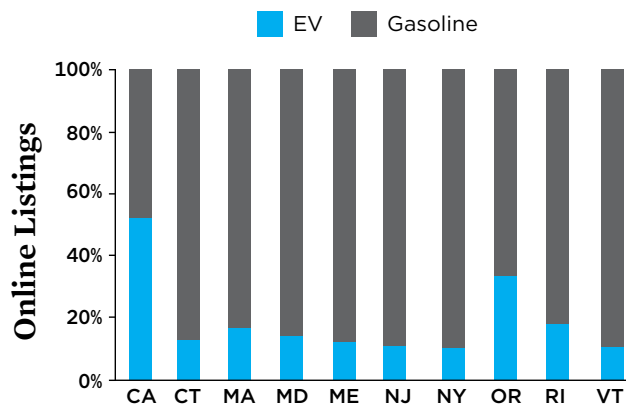
* Ford Focus EV listings were less than 1%

General Motors (GM) (Chevrolet, Cadillac, Buick, and GMC brands)

General Motors was one of the first major automakers to bring an EV to market, the Chevrolet Volt. This plug-in hybrid is also among the top three EVs for US sales, and GM recently redesigned it to achieve over 50 miles of electric range. In addition, GM is slated to bring to market the first moderately priced BEV with a range of over 200 miles. Selling for about \$30,000 after a federal tax credit, its release is scheduled for late 2016 (Chevrolet n.d.). In sales percentage, GM trails only BMW in California: over 5 percent of all GM vehicles sold in the state are electric vehicles.

Availability of the Volt was constrained in California and nationwide at the start of 2016 due to a changeover from first- to second-generation vehicles. Availability of GM's other EV, the small Chevrolet Spark EV, was even more limited: it was only available in California, Oregon, and Maryland, with California accounting for over 80 percent of sales (see Figure 14). Volt sales were higher in California as well but less concentrated than those of the Spark: under 60 percent of Volt sales were in California.

FIGURE 14. Listing of the Volt vs. the Cruze



Availability of the Volt EV is much higher in California and Oregon than elsewhere in the United States.

GM publicly supports EVs, calling them more than a means to comply with regulations.

TABLE 5. General Motors

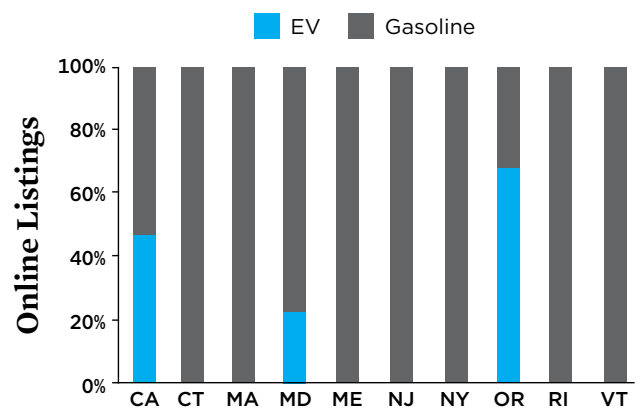
		Rank
EV Models Available	3	
2010–Present EV Sales	107,507	1st
2015 EV Sales	19,046	2nd
2015 US Sales Proportion	0.6%	7th
2015 CA Sales Proportion	5.7%	3rd

GM has made public statements supporting EVs, calling them more than a means to comply with regulations. Speaking about the new Bolt, CEO Mary Barra said, “You can look at the car, and you can buy it just because you love the car as well as the fact that it has a 200-mile electric range. This wasn’t a compliance play” (Gross 2016).

EV PROGRESS

General Motors is a leader in the development of EVs. Its Volt PHEV was the first major plug-in hybrid to go on sale in the United States, and the redesigned second-generation Volt is best-in-class for electric range. GM’s Spark EV has been less successful, but the introduction of the Bolt should make GM a leader in the market for lower-cost BEVs. GM is an EV market leader but could improve by offering more EV brands, models, and types.

FIGURE 15. Listings of the Chevrolet Spark vs. the Spark EV



Chevrolet offers the Spark EV in only three states but at levels comparable to the gasoline version in those states.

Honda (Honda and Acura brands)

Honda ranks last among major automakers in bringing electric vehicles to market in the United States. It is the only major carmaker unlikely to have a plug-in EV available in 2016. In past years, Honda sold electric-drive variants of the Fit and Accord models, albeit at very low levels. However, Honda discontinued the Fit EV despite a waiting list of customers wanting to lease it (Ingram 2014).⁵ The Accord PHEV garnered critical praise (*U.S. News and World Report* n.d.), but Honda cancelled the car in 2015 after selling only about 1,000 in three years, and the vehicle was very hard to locate. Ford released its Fusion PHEV around the same time as Honda released the Accord PHEV, and the vehicles are similar in terms of suggested retail price, size, and vehicle type (although the Accord has a lower electric range) (Berman 2013). However, Ford has sold over 30,000 Fusion PHEVs (see Figure 16).

Honda has said it is interested in EVs and recently announced a desire to have partially or fully electric cars make up two-thirds of global sales by 2030 (Kubota 2016). However, Honda does not plan to sell new plug-in EVs in the United States until 2017 at the earliest (Voelcker 2016a).

Honda has been a proponent of researching and developing fuel-cell electric vehicles, and that focus may be delaying its development of plug-in electric vehicles. However, even for fuel-cell vehicles, Honda has been slow in following its early demonstration of the Honda Clarity, and it now lags competitors Toyota and Hyundai, which have launched fuel-cell EVs in California.

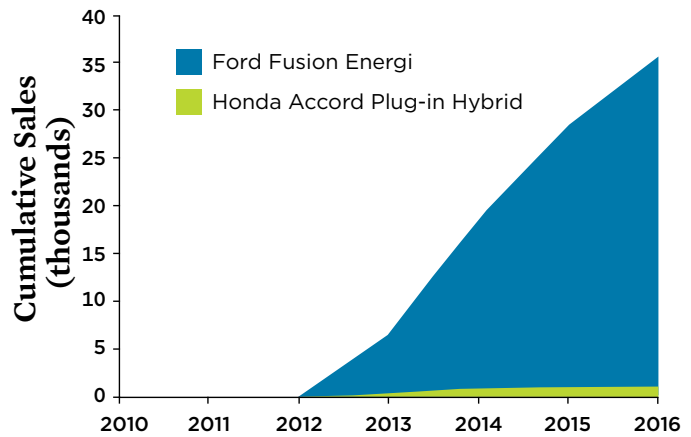
EV PROGRESS

Honda ranks last among manufacturers on many EV metrics, despite the development of a plug-in version of its most popular US model, the Accord. Honda has taken a strategy of minimal compliance with ZEV regulations, and while new plug-in models may be available in a year or two, Honda would have to markedly change its approach to supplying, marketing, and promoting EVs in order to move out of the bottom tier of EV makers. Additionally, Honda is starting behind other automakers in terms of the number of models available and the size of its EV customer base, requiring extra effort if it is to move on par with its competitors.

TABLE 6. Honda

		Rank
EV Models Available	0	
2010–Present EV Sales	2,097	12th
2015 EV Sales	64	13th
2015 US Sales Proportion	0.0%	13th
2015 CA Sales Proportion	0.0%	12th

FIGURE 16. Sales of Honda Accord PHEV and Ford Fusion PHEV



Although the vehicles are similar, the Ford Fusion Energi PHEV outsells the Honda Accord PHEV by over 30-fold.

SOURCE: INSIDEEVS.COM.

Honda discontinued the Fit EV despite a waiting list of customers wanting to lease it.

⁵ Vehicles were not available for purchase.

Hyundai Motor Group (Hyundai, Kia, and Genesis brands)

The Korean automakers Hyundai and Kia, both part of the Hyundai conglomerate, began selling EVs in the United States in 2014. They offer the Kia Soul EV BEV and a plug-in hybrid version of the Hyundai Sonata sedan. Both models are sold in low volumes. The Kia Soul EV is mainly available in California, with a little availability in nine states and only at select dealers within those states. Both the Soul and Sonata plug-ins have higher availability in California and Oregon (see Figure 17).

Hyundai and Kia have plans to produce more EVs for 2017: the Ioniq BEV and PHEV and the Kia Niro PHEV (Capparella 2016; Halvorson 2016).

EV PROGRESS

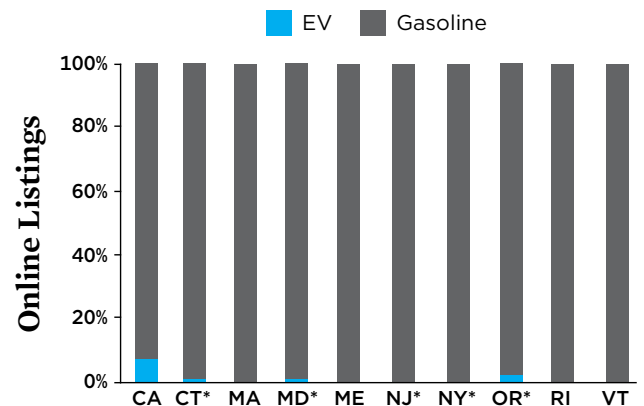
The Hyundai conglomerate sold few EVs before 2016. The introduction of the Sonata PHEV may lead to an uptick in EV sales, but the company will need to make more progress to move out of the bottom group. In a promising sign, Hyundai has announced plans to expand its EV lineup with dedicated EV models. It has launched a fuel-cell vehicle in California and should be able to leverage the electric-drive R&D learning to help design its new plug-in EVs.

In a promising sign, Hyundai has plans to expand its EV lineup with dedicated EV models.

TABLE 7. Hyundai Motor Group

		Rank
EV Models Available	2	
2010–Present EV Sales	3,507	10th
2015 EV Sales	1,534	10th
2015 US Sales Proportion	0.1%	11th
2015 CA Sales Proportion	0.5%	10th

FIGURE 17. Listings of the Kia Soul EV vs. Gasoline Kia Soul



California and Oregon are the only states with meaningful availability of the Kia Soul EV.

* Kia Soul EV listings were less than 3%.

Nissan (Nissan and Infiniti brands)

Nissan was the first major car company to sell a BEV in the United States. The Nissan LEAF is one of the most popular EVs in the country in terms of total sales, just behind the Chevrolet Volt. The Nissan LEAF is sold in many states, although availability (as indicated by online inventory) is much higher in California and Oregon than in most of the ZEV states in the Northeast (see Figure 18).

Nissan has been a public supporter of EV technologies, with CEO Carlos Ghosn recently saying, “I can bet you’ll see a major shift toward electric cars. Look at Detroit. A lot of carmakers, if not hostile, were at least neutral or skeptical, and they’re all coming with electric cars and saying they’ll invest in them. It’s not an easy shift, but I don’t see how we can skip this one” (Bigelow 2016).

While Nissan has not announced specifics on any new EVs, it is expected that the EV pioneer will bring a longer-range BEV to market within the next few years (Hanley 2015). However, Nissan has indicated that it will not produce an EV for its Infiniti luxury brand in the near future (Edelstein 2015).

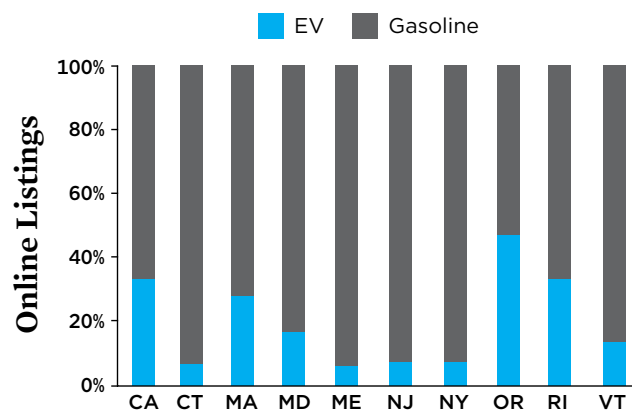
EV PROGRESS

Along with General Motors, Nissan was an early EV leader, with the Nissan LEAF BEV. Nissan is number two in total EV sales since 2010, despite selling only the one EV model. It has been an advocate for electric vehicles and aggressively promoted the LEAF. However, the most recent edition of the LEAF has sold more slowly, likely due to increased competition from newer EVs and the anticipation of 200-mile BEVs like the Chevrolet Bolt. To regain a leadership position among EV carmakers, Nissan will need to innovate and bring new EV models to market.

TABLE 8. Nissan

		Rank
EV Models Available	1	
2010–Present EV Sales	95,402	2nd
2015 EV Sales	17,269	4th
2015 US Sales Proportion	1.2%	3rd
2015 CA Sales Proportion	3.4%	7th

FIGURE 18. Listings of the Nissan LEAF (EV) vs. the Nissan Versa

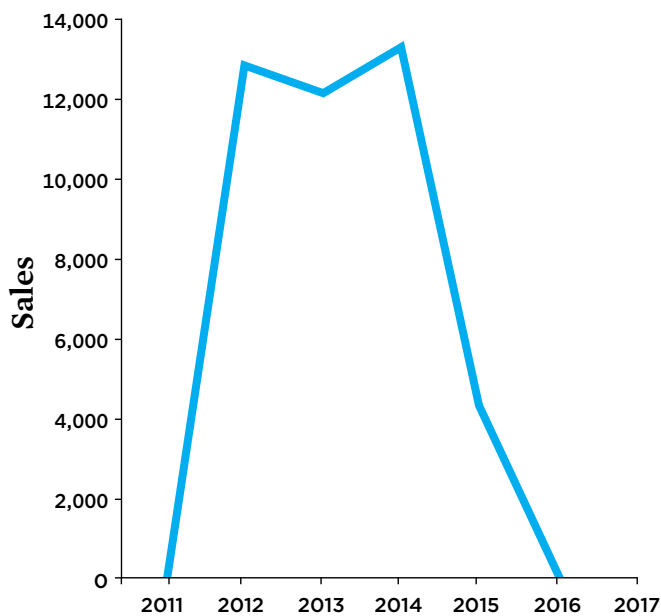


Availability of the LEAF is higher in Oregon, California, Rhode Island, and Massachusetts.

Toyota (Toyota and Lexus brands)

Toyota does not currently market a plug-in EV. In past years, the company offered a battery electric version of its RAV4 SUV and a plug-in hybrid variant of the popular Prius hatchback. The RAV4, the product of a now discontinued partnership with Tesla Motors, had limited availability. The Prius Plug-in has also been discontinued, although Toyota has announced that a new Prius Prime plug-in will be available in late 2016. During the year-long gap between the discontinued Prius Plug-in and the start of Prius Prime sales, buyers of the popular fuel-efficient car will not be able to choose a plug-in EV option (see Figure 19).

FIGURE 19. US Prius Plug-in Sales



The EV was a popular plug-in choice, but Toyota took it off the market after three and a half years.

SOURCE: INSIDEEVS.COM.

TABLE 9. Toyota

		Rank
EV Models Available	0	
2010–Present EV Sales	44,676	5th
2015 EV Sales	4,191	8th
2015 US Sales Proportion	0.2%	9th
2015 CA Sales Proportion	0.8%	9th

EV PROGRESS

With the now discontinued Prius Plug-in, Toyota had one of the top-selling PHEV models. However, the car had the smallest electric range of any PHEV and required the use of the gasoline engine in many normal driving situations, regardless of the battery charge. Toyota will bring a new PHEV (Prius Prime) to market at the end of 2016, and it is also investing in fuel-cell vehicles that share many electric-drive systems with plug-in vehicles. But the company needs to increase the number and types of electric vehicle it makes to catch up with other carmakers. In particular, offering a plug-in version of its popular hybrid vehicles like the Camry, Highlander, and RAV4 could help Toyota catch up to the EV leaders.

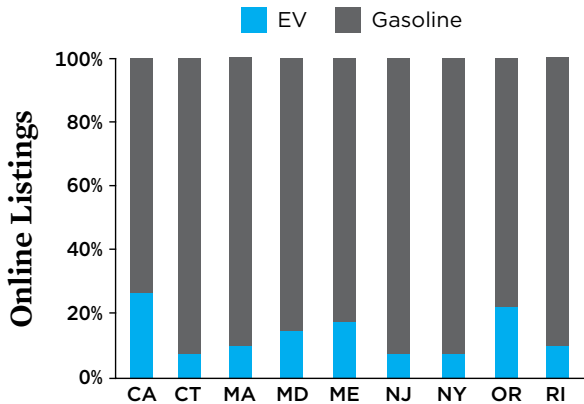
During the year-long gap between the discontinued Prius Plug-in and the start of Prius Prime sales, buyers will have no Toyota plug-in EV option.

VW (Volkswagen, Audi, and Porsche brands)

The VW group offers several PHEV models and one BEV, the Volkswagen e-Golf. VW offers the e-Golf and Audi A3 e-tron in multiple states, including the Northeast ZEV states, and at levels comparable to California (see Figures 20 and 21). As a result, VW ranks fourth in terms of the proportion of EV sales across the United States.

The VW group has received much negative attention due to the scandal involving emissions from its diesel cars. As part of its recovery, VW has suggested that it will move more rapidly to develop plug-in vehicles to reduce emissions (Golson 2015). In the United States, VW's Audi brand has announced plans for an aggressive shift to electric vehicles. Audi USA CEO Scott Keogh announced at the 2015 Los Angeles Auto Show that the carmaker plans to have electric cars make up 25 percent of US sales by 2025 (Audi USA 2015). In addition, Audi pledged at its 2016 annual meeting to release one EV every year, starting in 2018 (Vijayenthiran 2016a).

FIGURE 20. Listings of the VW e-Golf vs. the Gasoline-only VW Golf

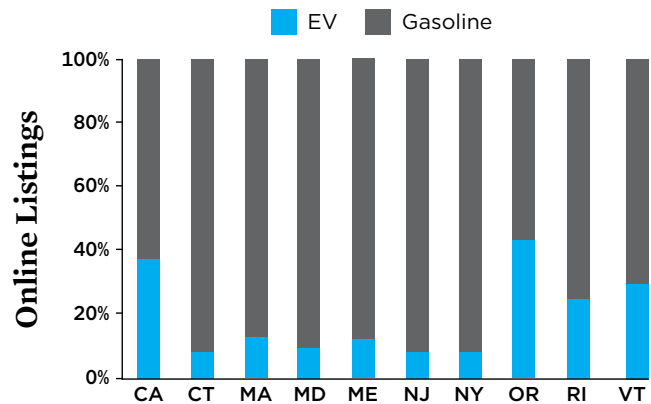


The availability of the e-Golf in California and Oregon is over twice its availability in many of the other ZEV states. However, the e-Golf, unlike many other BEVs, is available in all ZEV states.

TABLE 10. VW

		Rank
EV Models Available	4	
2010–Present EV Sales	11,902	8th
2015 EV Sales	5,791	7th
2015 US Sales Proportion	1.0%	4th
2015 CA Sales Proportion	3.9%	5th

FIGURE 21. Listings of the Audi A3 e-tron vs. the Gasoline-only A3



The plug-in hybrid version of the Audi A3 is more common in California and Oregon than in the other states evaluated.

EV PROGRESS

VW's total EV sales in the United States are lower than those of other major auto companies. However, EVs make up a growing proportion of VW sales, due to the introduction of new EV models. If VW can continue to increase the number of EV models its brands sell, it could join the top tier of EV makers. Such changes may also be a business necessity, both to rehabilitate VW's environmental image and to prevent losing Audi and Porsche sales to high-performance EVs like Tesla's Model S and Model X.

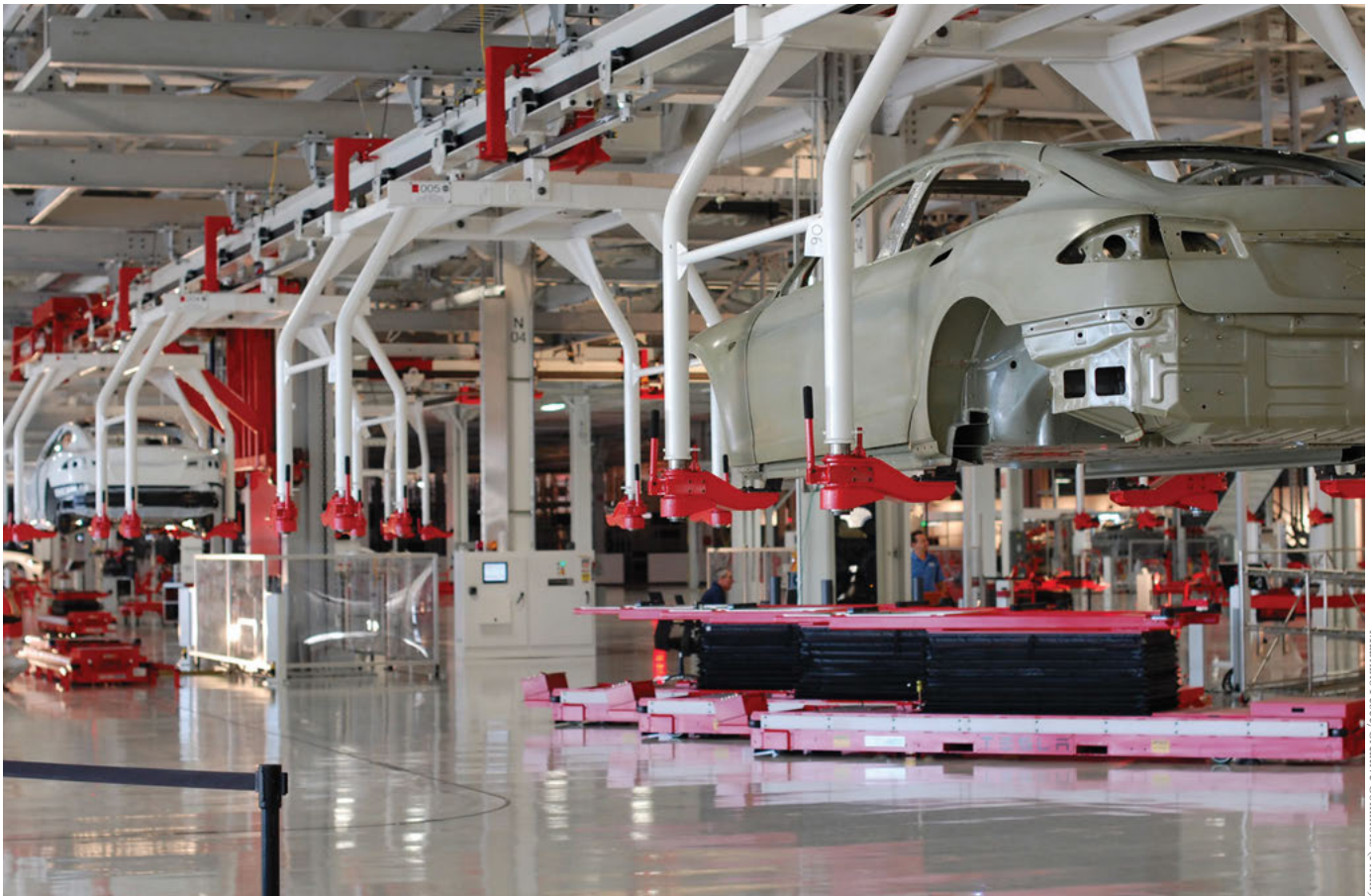
Tesla Motors

Tesla is unique. It sells only EVs, so 100 percent of its vehicle sales are electric drive. It also uses a direct-sales model: with most vehicles built to order, the availability metrics applied to other automakers do not apply. Tesla will sell cars to buyers in all 50 states, although state regulations against direct automaker sales limit the locations where it can operate retail stores (Voelker 2015).

Almost all of Tesla's sales have been for the Model S sedan. With the recent release of the Model X SUV, Tesla should be able to accelerate its sales of EVs. In addition, the announcement of a lower-priced EV, the Model 3, spurred close to 400,000 preorders worldwide. While not all of those preorders are from prospective US buyers, Tesla could become the clear leader in US EV sales if it converts even half of the reservations to actual sales.

TABLE 11. Tesla Motors

		Rank
EV Models Available	2	
2010–Present EV sales	84,329	3rd
2015 EV Sales	25,914	1st
2015 US Sales Proportion	100%	1st
2015 CA Sales Proportion	100%	1st



Maurizio Pese/Creative Commons (Flickr)

Since Tesla sells only EVs, it ranks highest in proportion of product line devoted to EVs.

Summary and Conclusion

Market Evaluation

While leading automakers make their EVs available fairly widely, all automakers could improve the availability of EVs and the number of models available at dealerships. According to vehicle data across major metropolitan areas in the states covered by the ZEV program, Californians have by far the most models to choose from and the most EVs available at local dealerships. Many EV models are either not available in the eastern ZEV states or are available in small quantities.

The fact that few EV models are truly available nationwide lessens the ability of consumers to choose from a variety of types of vehicle—let alone to know about their existence. While many factors (such as consumer interest, dealer interest, and local incentives) affect the availability of EVs, the lack of EVs outside California to test drive and purchase hinders sales.

Automaker Evaluation

LEADERS

- **BMW** is the leading traditional automaker as measured by the proportion of its sales that derive from EVs. It offers both PHEV versions of popular gasoline models and purpose-built EVs, both of which are effective strategies for growing plug-in vehicle sales.
- **General Motors** and **Nissan** have the highest overall sales of EVs and a national strategy, but they must keep innovating to retain their lead.

- **Tesla** is one of the best-selling EV makers and will increase its lead if it releases the Model 3 and fulfills current reservations.

LAGGARDS

- **Toyota**, the largest automaker in the world, previously sold significant volumes of its plug-in Prius. However, it does not currently sell a plug-in vehicle in the United States and will not sell the second-generation plug-in Prius until later in 2016. Toyota brought the Mirai fuel-cell vehicle to the United States in 2015, but it expects low-volume sales for the foreseeable future.
- **Hyundai** and **Kia** have few EV sales at this time, although that could change with promised new models like the Ioniq series. Hyundai brought the first mass-production, fuel-cell vehicle to the United States (the Hyundai Tucson FCEV), but it has only leased the car and in low volumes.
- **Honda** has made minimal efforts to build or sell EVs. It has announced new plug-in and fuel-cell models to be released over the next few years, but it is not clear how

All automakers could improve the availability of EVs and the number of models available at dealerships.

much effort the company will invest in selling its next generation of EVs.

- **Fiat Chrysler** has sold the Fiat 500e, its lone EV, well in California and Oregon, but it has no plans to offer the car elsewhere.

Conclusion

The US passenger vehicle market has begun a transition from gasoline and diesel to electricity, but the start of the EV market has been uneven, with some automakers showing much more success than others in designing and selling EVs. Some automakers have positioned themselves as early leaders: upgraded or second-generation EVs—including the Chevrolet Volt, Nissan LEAF, and Tesla Model X—are already on the market. Other automakers are just bringing models to market or have made limited numbers of vehicles available.

For car buyers, this mixed picture in terms of automaker investment and leadership translates into fewer choices of

EVs than of gasoline-powered vehicles. In California, where many automakers have concentrated their efforts, consumers have significantly more options for plug-in vehicles, both in the number of vehicles available and the number of different models.

While many factors influence EV sales, new-car buyers cannot choose vehicles that are not available for purchase. To raise the nationwide adoption of EVs significantly, car buyers across the United States need more of the plug-in vehicle options that are available in California.

The success of some companies in making EVs a significant and growing proportion of their sales, especially in California, shows that electric-vehicle technology will be an increasingly important part of the automobile market. It also demonstrates that policies like the ZEV program are workable and effective in encouraging the growth of the EV market. To meet our air-quality and climate goals, the United States should continue policies that encourage companies to design and sell EVs through incentives and regulations.

While many factors influence EV sales, new-car buyers cannot choose vehicles that are not available for purchase.

[REFERENCES]

All URLs accessed on June 12, 2016.

- Audi USA. 2015. Audi declares at least 25% of US sales will come from electric vehicles by 2025. Press release, November 18. Online at: www.audiusa.com/newsroom/news/press-releases/2015/11/audi-at-least-25-percent-u-s-sales-to-come-from-electric-2025.
- Beech, E. 2014. Fiat Chrysler CEO: Please don't buy Fiat 500e electric car. *Reuters*, May 21. Online at www.reuters.com/article/chrysler-ceo-evs-idUSL1N0071MS20140521, accessed June 25, 2016.
- Berman, B. 2013. Aiming for the hybrid's sweet spot. *New York Times*, June 7. Online at: www.nytimes.com/2013/06/09/automobiles/autoreviews/aiming-for-the-hybrids-sweet-spot.html.
- Bigelow, P. 2016. Carlos Ghosn remains bullish on Nissan Leaf and electric cars. *Autoblog*, January 14. Online at: www.autoblog.com/2016/01/14/carlos-ghosn-nissan-leaf-electric-cars.
- BMW of North America. 2016. BMW Group U.S. reports December and 2015 sales. Press release, January 5. Online at www.prnewswire.com/news-releases/bmw-group-us-reports-december-and-2015-sales-300199606.html.
- BMW. No date. Emission free into the future. Online at: www.bmw.com/com/en/insights/corporation/bmw/sustainability.html.
- Boston, W. 2016. The future is electric for BMW. *Wall Street Journal*, March 16. Online at: www.wsj.com/articles/the-future-is-electric-for-bmw-1458142897 (subscription required).
- California Air Resource Board (CARB). 2014. Zero-emission vehicle legal and regulatory activities and background. October 27. Online at: www.arb.ca.gov/msprog/zevprog/zevregs/zevregs.htm.
- Capparella, J. 2016. Electric invasion: Hyundai Ioniq Hybrid & EV on sale late 2016, plug-in arrives spring 2017. *Car and Driver*, March 24. Online at: <http://blog.caranddriver.com/electric-invasion-hyundai-ioniq-hybrid-ev-on-sale-late-2016-plug-in-arrives-spring-2017>.
- Chevrolet. No date. Chevrolet Bolt EV. Online at: www.chevrolet.com/bolt-ev-electric-vehicle.html, accessed June 25, 2016.
- Daimler. No date. Daimler invests massively in green powertrain technologies: All Mercedes-Benz model series will be electrified. Press release. Online at: <http://media.daimler.com/marsMediaSite/en/instance/ko/Daimler-invests-massively-in-green-powertrain-technologies-A.xhtml?oid=11108480>.
- Edelstein, S. 2015. Infiniti sees no demand for luxury electric cars before 2020. *Green Car Reports*, October 8. Online at: www.greencarreports.com/news/1100386_infiniti-sees-no-demand-for-luxury-electric-cars-before-2020.
- Electric Drive Transportation Association (EDTA). No date. Electric drive sales dashboard. Online at <http://electricdrive.org/index.php?ht=d/sp/i/20952/pid/20952>.
- Fehrenbacher, K. 2016. Tesla's Model 3 reservations rise to almost 400,000. *Fortune*, April 15. Online at fortune.com/2016/04/15/tesla-model-3-reservations-400000.
- Golson, J. 2015. VW plans to recover from its scandal by going electric. *Wired*, October 13. Online at: www.wired.com/2015/10/vw-plans-to-recover-from-its-scandal-by-going-electric.
- Greenblatt, J. B. Modeling California policy impacts on greenhouse gas emissions. *Energy Policy* 78 (2015): 158-172.
- Gross, D. 2016. GM may have just changed the game for electric cars. *Slate*, January 11. Online at: www.slate.com/blogs/moneybox/2016/01/11/gm-ceo-mary-barra-explains-what-the-chevy-bolt-means-for-electric-cars.html.
- Halvorson, B. 2016. 2017 Kia Niro hybrid SUV: Are electric, AWD versions in the works? *Green Car Reports*, March 29. Online at: www.greencarreports.com/news/1103122_2017-kia-niro-hybrid-suv-are-ev-or-awd-versions-in-the-works/page-2.
- Hanley, S. 2015. 2018 Nissan LEAF will have 200 mile range. *GAS2*, November 3. Online at: <http://gas2.org/2015/11/03/2018-nissan-leaf-will-have-200-mile-range>.
- Ingram, A. 2014. 2014 Honda Fit EV: Model year ends early as last cars are built. *Green Car Reports*, February 25. Online at: www.greencarreports.com/news/1090533_2014-honda-fit-ev-model-year-ends-early-as-last-cars-are-built.
- Kubota, Y. 2016. Honda CEO shifts focus to electric vehicles. *Wall Street Journal*, February 25. Online at: www.wsj.com/articles/honda-ceo-shifts-focus-to-electric-vehicles-1456307220 (subscription required).
- Loveday, E. 2013. Fiat-Chrysler CEO Marchionne says embracing only electric vehicles would be like "masochism in the extreme." *InsideEVs.com*. Online at: <http://insideevs.com/fit-chrysler-ceo-marchionne-says-embracing-only-electric-vehicles-would-be-like-masochism-in-the-extreme>, accessed June 25, 2016.
- Taylor, E. 2016. Carmakers eye twin-track product cycle to keep pace with technology. *Automotive News*, March 2. Online at www.autonews.com/article/20160302/OEM04/160309947/carmakers-eye-twin-track-product-cycle-to-keep-pace-with-technology, accessed June 25, 2016.
- Union of Concerned Scientists (UCS). 2016. Northeast drivers want electric cars. Online at: www.ucsusa.org/clean-vehicles/electric-vehicles/northeast-electric-cars.
- Union of Concerned Scientists (UCS). 2016a. Fueling a clean transportation future. Online at: www.ucsusa.org/clean-vehicles/clean-fuels/transportation-fuels-future.

- Union of Concerned Scientists and Consumers Union. May 2016b. Electric vehicle survey methodology and assumptions. Online at: www.ucsusa.org/sites/default/files/attach/2016/05/Electric-Vehicle-Survey-Methodology.pdf.
- U.S. Department of Transportation, Bureau of Transportation Statistics (USDOT). No date. Average age of automobiles and trucks in operation in the United States. Online at: www.rita.dot.gov/bts/sites/rita.dot.gov/bts/files/publications/national_transportation_statistics/html/table_01_26.html_mfd.
- U.S. News & World Report. No date. 2014 Honda Accord Plug-in. Best Cars. Online at: http://usnews.rankingsandreviews.com/cars-trucks/Honda_Accord-Plug-in.
- Vijayenthiran, V. 2016. 2017 Chrysler Pacific Hybrid: Plug-in minivan offers 30 miles of electric range. *Green Car Reports*, January 11. Online at: www.greencarreports.com/news/1101815_2017-chrysler-pacifica-hybrid-plug-in-minivan-offers-30-miles-of-electric-range.
- Vijayenthiran, V. 2016a. Audi CEO pledges one electric (or electrified) car each year. *Christian Science Monitor*, May 13. Online at: www.csmonitor.com/Business/In-Gear/2016/0513/Audi-CEO-pledges-one-electric-or-electrified-car-each-year.
- Voelcker, J. 2016. Ford CEO Mark Fields confirms 200-mile electric car coming (updated). *Green Car Reports*, May 10. Online at: www.greencarreports.com/news/1103673_ford-ceo-mark-fields-confirms-200-mile-electric-car-coming.
- Voelcker, J. 2016a. 2018 Honda Clarity electric versions: First details, including 40-plus-mile range for plug-in hybrid. *Green Car Reports*, April 21. Online at: www.greencarreports.com/news/1103535_2018-honda-clarity-electric-versions-first-details-including-40-plus-mile-range-for-plug-in-hybrid.
- Voelcker, J. 2015. Where can Tesla legally sell cars directly to you? *Green Car Reports*, April 22. Online at: www.greencarreports.com/news/1095337_where-can-tesla-legally-sell-cars-directly-to-you-state-by-state-map.
- WardsAuto. 2016. U.S. light vehicle sales, December 2015. Online at <http://wardsauto.com/datasheet/us-light-vehicle-sales-december-2015> (subscription required).
- Williams, J.H., B. Haley, F. Kahr, J. Moore, A.D. Jones, M.S. Torn, and H. McJeon. 2014. Pathways to deep decarbonization in the United States. *Energy + Environmental Economics*. Online at https://ethree.com/publications/index_US2050.php.

[APPENDIX]

Data Collection and Sources

Sales Volume and Sales Proportion

Data on total US EV sales were adapted from InsideEVs.com “EV Sales Scorecard.” Data on US and California EV sales were purchased from IHS Automotive.

2015 California total light-duty-vehicle sales by manufacturer were reported by the California New Car Dealership

Association’s quarterly publication *California Auto Outlook*, available at www.cncda.org/Auto_Outlook.asp. Data for California sales of Daimler’s Smart brand were unavailable. Total 2015 California smart sales were estimated to be 8,200 based on the relative availability of electric and gasoline Smart models.

Total sales of US light-duty vehicles by manufacturer were obtained from WardsAuto’s subscription service.

TABLE A-1. EV Brands and Models Surveyed

Parent	Brand	Electric Model	Gasoline Model(s)
BMW	BMW	i3	2-series ⁶
BMW	BMW	X5 xDrive40e	X5
Daimler	Mercedes	B-class Electric Drive	GLA-class ⁷
Daimler	Smart	fortwo EV	fortwo
Fiat Chrysler	Fiat	500e	500
Ford	Ford	C-MAX Energi	C-MAX (hybrid)
Ford	Ford	Focus EV	Focus
Ford	Ford	Fusion Energi	Fusion and Fusion Hybrid
General Motors	Cadillac	ELR	N/A ⁸
General Motors	Chevrolet	Spark EV	Spark
General Motors	Chevrolet	Volt	Cruze and Cruze Limited
Honda	Honda	Accord Plug-In Hybrid	Accord
Hyundai/Kia	Hyundai	Sonata Plug-In Hybrid	Sonata and Sonata Hybrid
Hyundai/Kia	Kia	Soul EV	Soul
Mitsubishi	Mitsubishi	i-MiEV	N/A ⁸
Nissan	Nissan	Leaf	Versa
Toyota	Toyota	Prius Plug-in	Prius
Volvo	Volvo	XC90 Hybrid	XC90
VW	Audi	A3 Sportback e-tron	A3
VW	Volkswagen	e-Golf	Golf

⁶ The 2-series was used as the gasoline counterpart to the i3 based on vehicle size, but they are imperfect analogues.

⁷ The GLA was used as the gasoline counterpart to the B-class Electric Drive based on vehicle size, but they are imperfect analogues.

⁸ Gasoline model availability not analyzed for this vehicle

Vehicle Availability

Inventory data for EVs and selected similar gasoline models were gathered from Edmunds.com twice per week. For each model and city, an inventory search was completed using a 50-mile radius from a ZIP code in the city center. For each vehicle, the vehicle identification number and vehicle location were collected. Not all dealerships make their inventory available on *Edmunds.com*, but searching for both an electric model and a corresponding gasoline model yields the relative availability of EVs in the area. Also, while the number of EVs found is not necessarily equal to the total number of EVs in the area, it does reveal the number of options shown to a prospective car buyer on a popular automotive website and therefore is a metric of perceived vehicle availability.

Vehicle Availability Data

For more comprehensive data on the availability of EVs versus comparable gasoline vehicles, please visit www.ucsusa.org/EVavailability.

TABLE A-2. Metropolitan Areas in this Study

State	City	ZIP Center of 50-mile Radius Search
California	Oakland	94607
California	Los Angeles	90012
California	San Diego	92101
Connecticut	Bridgeport	06604
Maine	Portland	04102
Maryland	Baltimore	21202
Massachusetts	Boston	02114
New Jersey	Newark	07102
New York	Buffalo	14202
New York	New York	10018
Oregon	Portland	97204
Rhode Island	Providence	02903
Vermont	Burlington	05401

Electrifying the Vehicle Market

Evaluating Automaker Leaders and Laggards in the United States

Car buyers cannot buy cars that are not available and the lack of availability in many markets will slow the transition from petroleum to electricity.

The auto industry is changing, with electric cars providing a new and better alternative to conventional gasoline and diesel vehicles. However, some automakers lag in bringing electric vehicles to market, especially outside of California. Car buyers cannot buy cars that are not available, and the lack of availability of EVs in many markets will slow the transition from petroleum to electricity.

BMW, General Motors, Nissan, and Tesla are doing better at making electric options available. Toyota, Hyundai/Kia, Fiat

Chrysler, and Honda are lagging behind in their efforts to build and sell EVs.

Consumers have more ability to buy EVs in California, where automakers offer more models and consumers can find more of these vehicles at local dealerships. Thanks to availability and strong state policies, California accounts for roughly half of U.S. EV sales. However, even in states that have adopted California's policies, many EV models are not offered at all or they are difficult to find.

**Union of
Concerned Scientists**

FIND THIS DOCUMENT ONLINE: www.ucsusa.org/EVavailability

The Union of Concerned Scientists puts rigorous, independent science to work to solve our planet's most pressing problems. Joining with citizens across the country, we combine technical analysis and effective advocacy to create innovative, practical solutions for a healthy, safe, and sustainable future.

NATIONAL HEADQUARTERS

Two Brattle Square
Cambridge, MA 02138-3780
Phone: (617) 547-5552
Fax: (617) 864-9405

WASHINGTON, DC, OFFICE

1825 K St. NW, Suite 800
Washington, DC 20006-1232
Phone: (202) 223-6133
Fax: (202) 223-6162

WEST COAST OFFICE

500 12th St., Suite 340
Oakland, CA 94607-4087
Phone: (510) 843-1872
Fax: (510) 843-3785

MIDWEST OFFICE

One N. LaSalle St., Suite 1904
Chicago, IL 60602-4064
Phone: (312) 578-1750
Fax: (312) 578-1751