

## BRIEFING

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JUNE 2019

# The surge of electric vehicles in United States cities

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This briefing analyzes 2018 electric vehicle market development in the United States and the policy factors that are driving it.

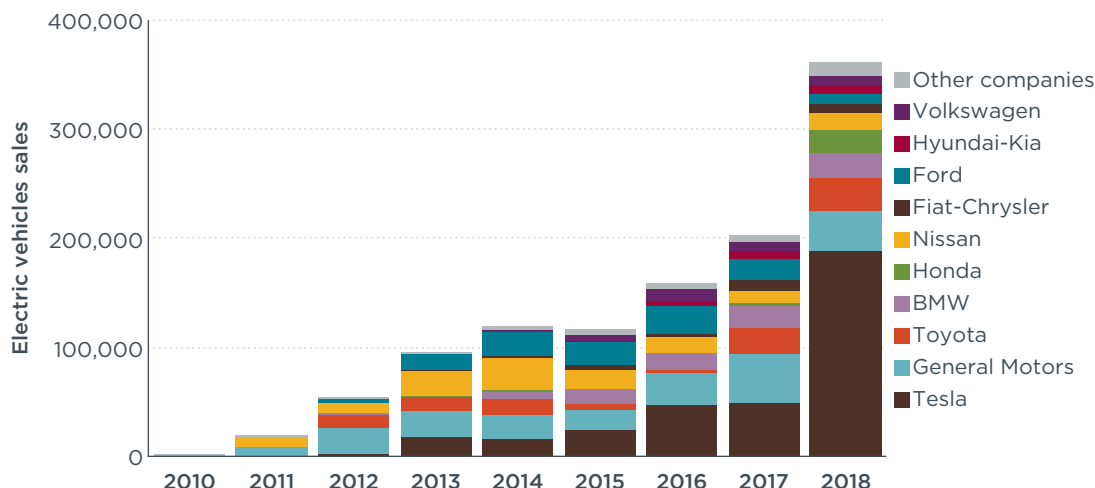
## INTRODUCTION

The global electric vehicle market continues to grow, with annual light-duty electric vehicle sales surpassing 2 million in 2018, an increase of approximately 70% from 2017. The United States, the third largest electric vehicle market, is a particularly rich laboratory for an analysis of what is driving this growth due to its local variation in electric vehicle adoption and policy action.

Figure 1 shows the total electric vehicle sales in the United States in 2018. The figure labels the ten companies with the most electric vehicle sales, which together accounted for 96% of the market in 2018.<sup>1</sup> The highest-selling model was the Tesla Model 3 with over 130,000 new sales. Several other models had 28,000 to 18,000 U.S. sales, including the Toyota Prius Prime, Tesla Model S, Tesla Model X, Honda Clarity, Chevrolet Bolt, and Chevrolet Volt. Overall, electric vehicle sales in the United States increased from approximately 200,000 in 2017 to more than 350,000 in 2018, with approximately 65% of these being fully battery electric vehicles (BEVs) and 35% plug-in hybrid electric vehicles (PHEVs). Tesla accounted for a large portion of this growth; The company more than tripled its U.S. sales in 2018, which was the first full calendar year of Model 3 production. Honda was also a big part of this growth, as Clarity sales increased from about 2,000 in 2017 to about 20,000 in 2018.

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1 EV-Volumes (EV Data Center, 2019), <http://www.ev-volumes.com/datacenter/>.



**Figure 1.** Automaker electric vehicle sales in the United States through 2018. (Vehicle sales data from EV-volumes, 2019)

Automakers continue to bring more electric models across more vehicle segments to the market at greater scale. New plug-in offerings such as the Jaguar I-Pace and Kia Niro were launched in the United States in late 2018, and additional all-electric models, like the Hyundai Kona, Audi e-tron, and next-generation Nissan Leaf, are launching in 2019. Technology advancements and reductions in battery costs are allowing automakers to bring lower-cost and longer-range models to market as demonstrated by recent improvements BMW has made in the i3 so that all 2019 vehicles come standard with a larger battery pack and longer range.

Government policy support at the state and local levels varies significantly across the United States. California and the other nine states that have adopted the Zero Emission Vehicle regulation, which requires increasing shares of electric vehicles through 2025, continue to implement a wide array of policies and are home to most electric vehicle sales. These policy actions, including consumer incentives, infrastructure deployment, information campaigns, and various local measures, help to overcome electric vehicle adoption barriers related to higher upfront costs, functional electric range and range anxiety, and the lack of awareness of the benefits of electric vehicles.

This briefing updates our annual U.S. electric vehicle market analysis of state and local actions to promote electric vehicles. Our most recent previous analysis<sup>2</sup> identified factors that are linked with higher electric vehicle uptake, including incentives, charging infrastructure, model availability, and access to high-occupancy vehicle lanes. This analysis covers the U.S. electric vehicle market in 2018, and incorporates new market data, policy implementation, and infrastructure developments to identify best practice policies, and major market trends. The analysis is primarily focused on the 50 most populous U.S. metropolitan areas,<sup>3</sup> which collectively accounted for 80% of the 2018 electric vehicle market and 55% percent of the nation’s population.

2 Peter Slowik and Nic Lutsey, *The continued transition to electric vehicles in U.S. cities*, (ICCT: Washington DC, 2018) <https://www.theicct.org/publications/continued-EV-transition-us-cities-2018>

3 U.S. Census Bureau, “Metropolitan and Micropolitan Statistical Area Population Totals: 2010-2018” (2019), <https://www.census.gov/data/datasets/time-series/demo/popest/2010s-total-metro-and-micro-statistical-areas.html?#>

## DATA COLLECTION ON ELECTRIC VEHICLE INFRASTRUCTURE, POLICY, AND UPTAKE

This section catalogues and summarizes key data on electric vehicle charging infrastructure, policy actions, and *uptake*, measured as the percentage of new light-duty vehicle registrations that are plug-in electric, including BEVs and PHEVs.<sup>4</sup> Policy data were collected for 43 unique state, city, and utility activities supporting electric vehicles across the 50 most populous metropolitan areas.

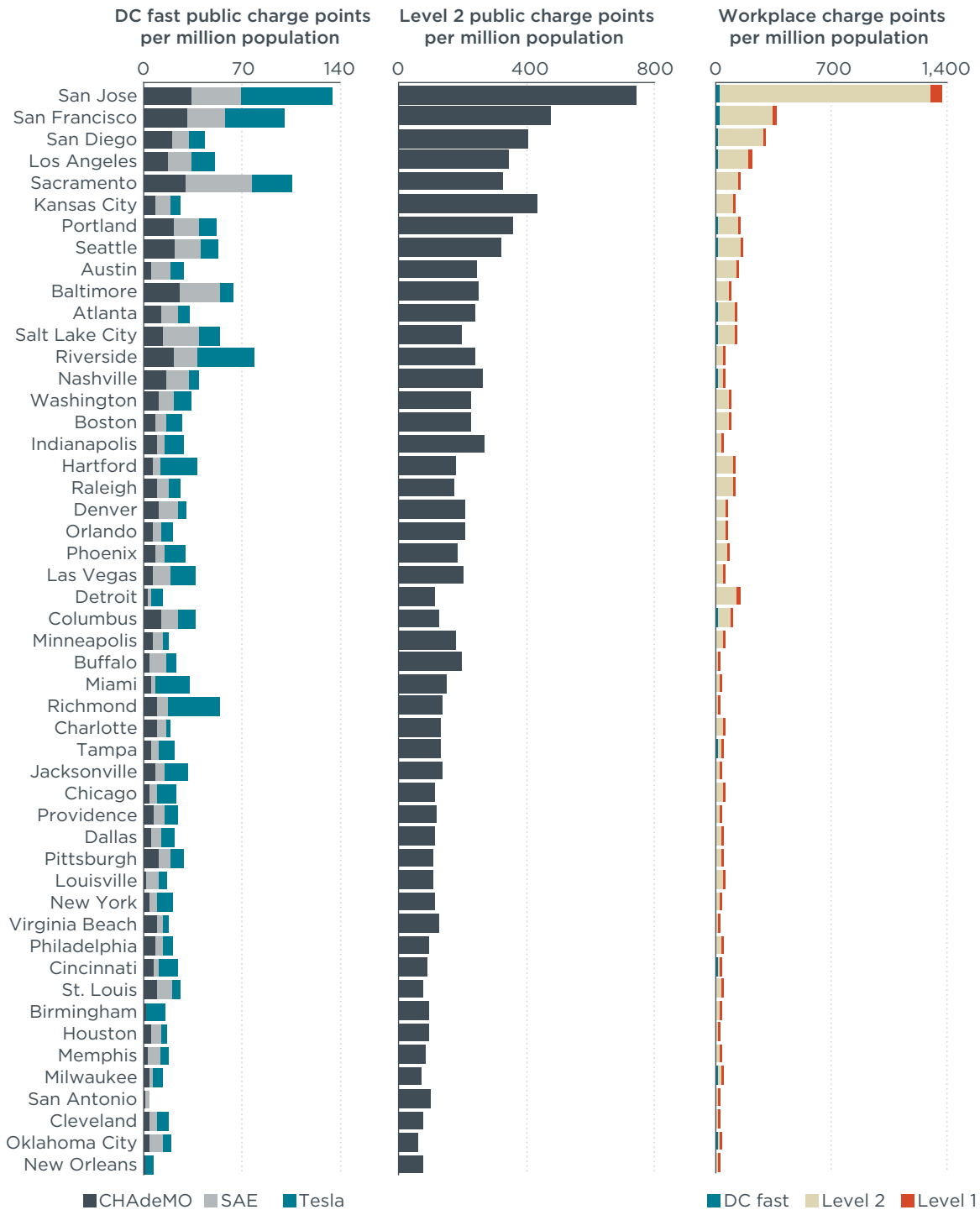
### CHARGING INFRASTRUCTURE

Charging infrastructure is critical to support electric vehicle market growth. Greater infrastructure deployment at home, the workplace, and public locations can increase driver confidence, extend range and driving functionality, and increase visibility and public awareness. Calculating charge points per capita for the 50 metropolitan areas studied allows for relative comparisons between locations.

Figure 2 shows the public direct current (DC) fast charging, public Level 2 charging, and workplace charging points per million population in the 50 most populous metropolitan areas. Locations with the most charging infrastructure have roughly 80-135 DC fast and 350-750 Level 2 charge points per million population. However, over half of the areas in Figure 2 had fewer than 27 DC fast and 175 Level 2 charge points per million population. Overall, the public charging infrastructure across the United States is comprised of 83% Level 2 and 17% DC fast charging points. The workplace charging infrastructure is comprised of 88% Level 2, with the rest being mix of DC fast and Level 1. Across the 50 areas studied, new charging installations installed in 2018 tended to have more chargers per location than previously, increasing by about 57% since 2015. This trend toward more chargers per location can help to lower the overall installation costs.

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<sup>4</sup> Charging data are from PlugShare (Charging infrastructure data, 2019), <https://www.plugshare.com/>. Registration data are from IHS Markit (New vehicle registration data, 2019), <https://ihsmarkit.com/>.



**Figure 2.** Public direct current fast charge points, public Level 2 charge points, and workplace charge points per million population in the 50 most populous U.S. metropolitan areas. (Charging infrastructure data are from PlugShare, 2019; population data are from U.S. Census Bureau, 2019.)

The top five metropolitan areas in Figure 2 had, on average, about six times the public charging infrastructure per capita of the bottom five areas. San Jose, with nearly 1,400 workplace charge points per million population, stands out as having far greater workplace charging points available than others. The markets with the next

highest workplace charging availability, at about 150-350 workplace charge points per million population, are Detroit, Los Angeles, Sacramento, San Diego, San Francisco, and Seattle. San Jose and Detroit are the only areas with more workplace than public charge points. The relationship between electric vehicle uptake and charging infrastructure is discussed below.

## **SUMMARY OF ELECTRIC VEHICLE SUPPORT ACTIVITIES**

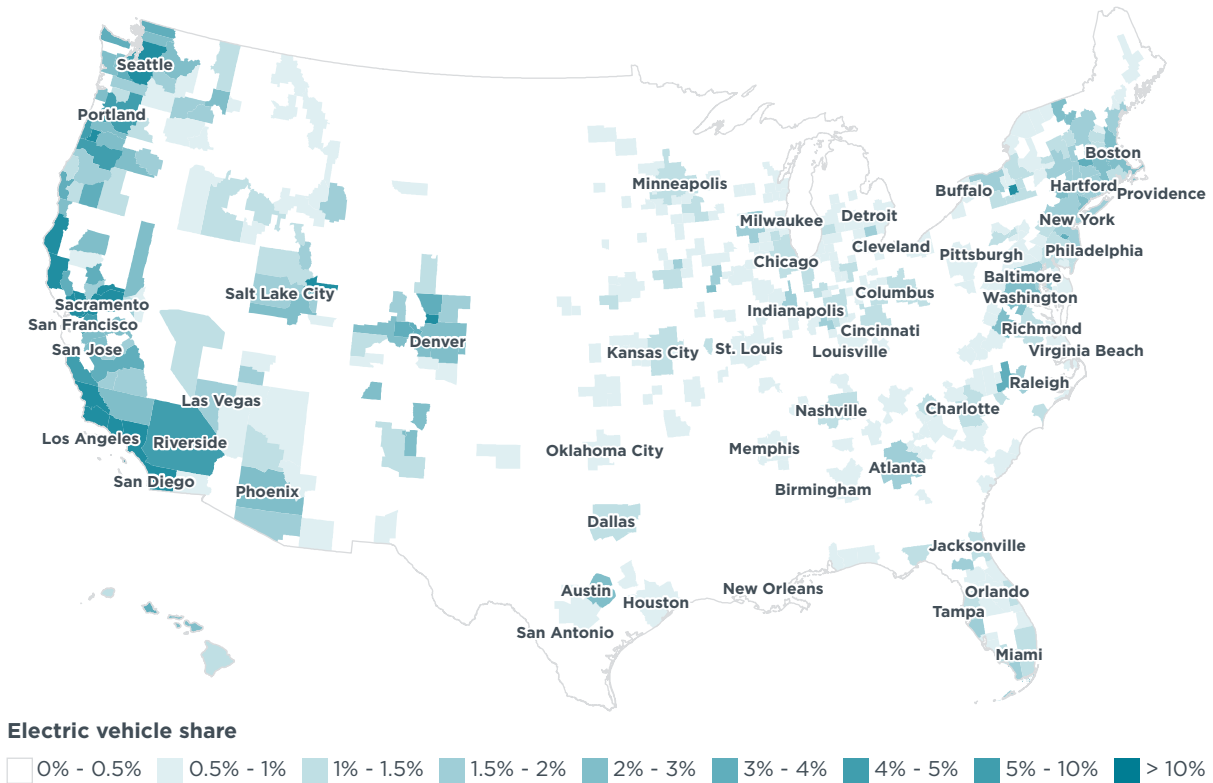
Table 2 summarizes the 43 unique electric vehicle policy actions implemented in the 50 locations studied, categorized by state, local, and utility action. The actions include those in place throughout the majority of 2018. The number of policy action per location varies greatly across the 50 areas. Five areas in California—Sacramento, San Francisco, Los Angeles, San Jose, San Diego—have undertaken the most actions, with 33 to 37 actions each. Other areas with 22 to 32 policy actions include Austin, Baltimore, Boston, Denver, New York, Portland, Riverside, and Seattle. Several areas adopted new policy actions from 2017 to 2018. Columbus, for example, doubled the number actions in place from 10 in 2017 to 20 in 2018 as the city and local utility company adopted several new programs including fiscal and non-fiscal support for residential and commercial charging stations, electric taxi deployment, and expanded consumer awareness and outreach programs. Pittsburgh and Portland each had several additional actions compared to 2017, including electric ride-hailing deployment, EV-ready building codes, and utility charging infrastructure promotion, and various consumer awareness and education programs.



### ELECTRIC VEHICLE UPTAKE

Electric vehicles accounted for 2.1% of light-duty vehicle registrations in 2018. The 50 metropolitan areas in our study are responsible for 80% of 2018 U.S. electric vehicle registrations, are 60% of the total light-duty vehicle market, and contain 55% of the U.S. population. The 50 metropolitan areas together have more than two-and-a-half times the electric vehicle uptake than the rest of the country, or 2.7% compared 1.0%.

Figure 3 shows electric vehicle share of new 2018 vehicle registrations across the more than 900 metropolitan statistical areas. The 50 most populous areas are labeled. Electric vehicle uptake tends to be highest in major metropolitan areas on the West Coast, followed by other hot spots in Colorado and the Northeast. California alone accounted for about half of the total U.S. electric vehicle market in 2018. San Jose had the highest share at about 21%, followed by a handful of other California cities, Seattle, and Portland at 4% to 13% market share. Los Angeles had the highest number of new electric vehicle registrations with nearly 60,000, followed by San Francisco, San Jose, New York, San Diego, and Seattle, with approximately 32,000 to 10,000 new registrations, respectively.



**Figure 3.** Electric vehicle share of new 2018 vehicle registrations by metropolitan area. (New vehicle registration data are from IHS Markit)

Several major changes occurred in the electric vehicle market from 2017 to 2018. Overall, new electric vehicle registrations increased approximately 72% from 2017 to 2018. Los Angeles, San Francisco, and San Jose saw the largest annual increases. Elsewhere, new electric vehicle registrations jumped by over three thousand units in Atlanta, Boston, Chicago, New York, Phoenix, Riverside, San Diego, Seattle, and

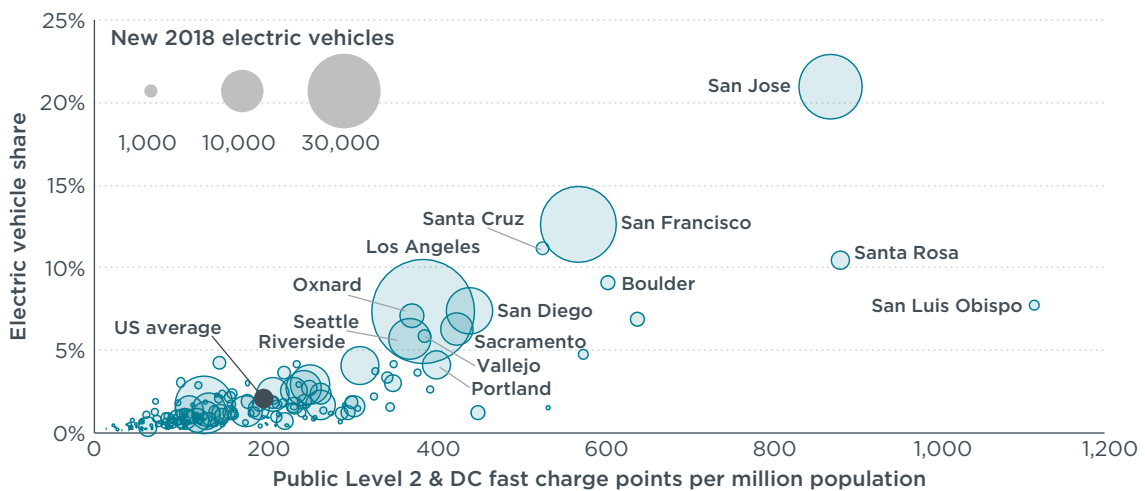
Washington, D.C. compared to 2017. Twenty of the 50 most popular metropolitan areas had an over 100% growth in electric vehicle registrations from 2017 to 2018. Atlanta and Phoenix stand out as having especially high year-over-year growth at 140% and over 5,000 new registrations in 2018. On the East coast, Baltimore and Boston saw above average growth in electric vehicle registrations of 87% and 97%, respectively. Many high-growth areas also had an increase in new model availability, local policy actions, and additional charging points. None of the 50 areas experienced a decrease in new electric vehicle registrations in 2018.

## ANALYSIS OF ELECTRIC VEHICLE MARKET DEVELOPMENT AND UNDERLYING FACTORS

This section evaluates the underlying factors that are supporting growth in the electric vehicle market. Specifically, electric vehicle uptake data is compared with public charging infrastructure, model availability, policy incentives, and promotion actions across the major markets.

### CHARGING INFRASTRUCTURE AND ELECTRIC VEHICLE UPTAKE

Using data from PlugShare<sup>5</sup>, public and workplace charging infrastructure across the 200 most populous metropolitan areas were analyzed in terms of charge points per million population in each area. Figure 4 plots the public Level 2 and DC fast charging infrastructure against electric vehicle share with bubble size shown as proportional to new 2018 electric vehicle registrations. The U.S. average, shown in the lower-left corner, is approximately 200 charge points per capita and about 2.1% uptake.



**Figure 4.** Electric vehicle share of new vehicles and public charge points per million population for the 200 most populous metropolitan areas. (New vehicle registration data are from IHS Markit; charging infrastructure data are from PlugShare)

The figure illustrates that areas with high uptake generally have greater public charging infrastructure availability. Of the 20 areas with the highest uptake, 19 had

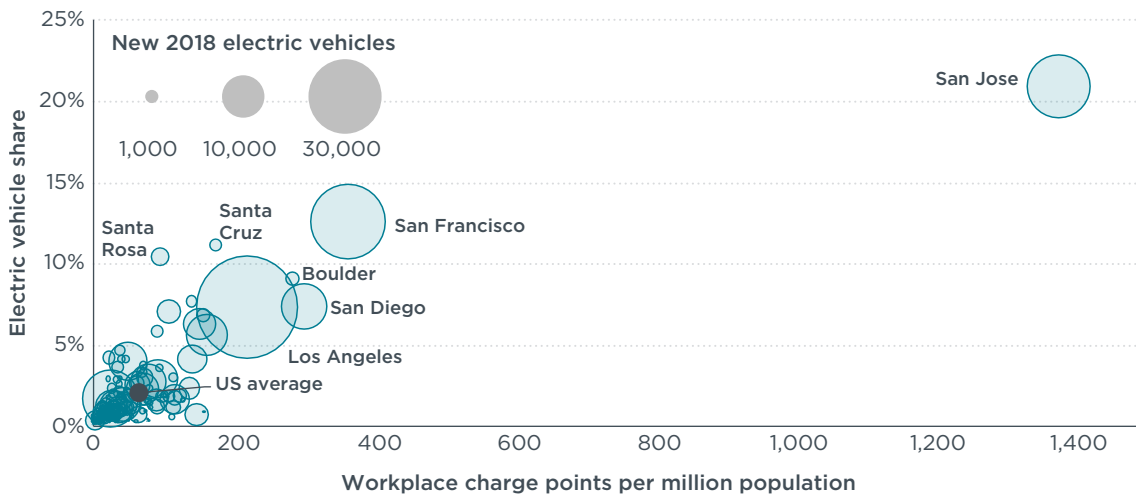
5 PlugShare (2019).



an above-average number of public charging points. The five areas with the highest uptake had about 2.5 to 4.5 times the average amount of public charging points. High-uptake markets, or those with 5% electric vehicle share, suggest a nominal benchmark of 400 public charge points per capita. Of the 20 areas with the most public charging infrastructure, 18 had above average uptake. Several areas with around 350-450 public charge points had about 4% to 7% electric vehicle uptake, including Fort Collins, Eugene, Portland, Seattle, Los Angeles, Oxnard, Sacramento, San Diego, and Vallejo. Other regional leaders with 2.4% to 2.9% electric vehicle shares, including Austin, Boston, Denver, and Washington, D.C., had about 250 to 275 public charge points per capita.

Developing electric vehicle markets continue to build out public charging infrastructure. From 2017 to 2018, the number of the major metropolitan areas with more than 200 public charge points per million population doubled from 34 to 64. However, half of the U.S. population lives in an area with fewer than 160 public charge points per million population, which is 60% below the leading benchmark of 400 public charge points per million.

Figure 5 illustrates the workplace charging infrastructure per capita across the 200 most populous areas. As above, charging infrastructure per million population is plotted against electric vehicle share, and the bubble sizes are proportional to new 2018 electric vehicle registrations. The U.S. average is shown at about 65 workplace charge points per million population.



**Figure 5.** Electric vehicle share of new vehicles and workplace charge points per million population for the 200 most populous metropolitan areas. (New vehicle registration data are from IHS Markit; charging infrastructure data are from PlugShare.)

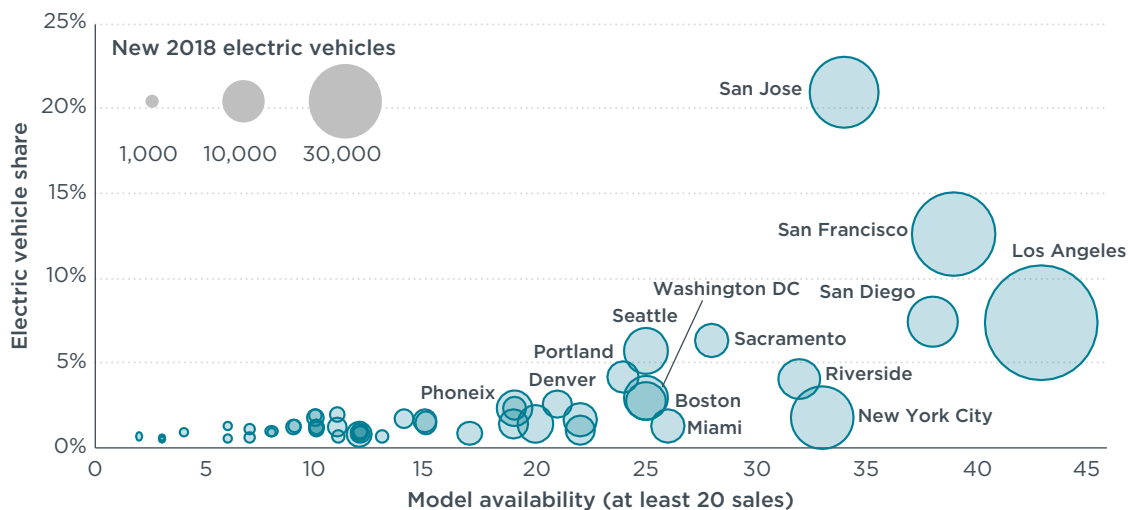
The figure shows that the areas with more workplace charging tend to have higher electric vehicle market shares. San Jose stands out in the top-right corner of the figure as having far more workplace charging and electric vehicle uptake than the others. Other areas including Boulder, Los Angeles, San Diego, and San Francisco had between 200 and 360 workplace charge points per million population. All 10 of the areas with highest electric vehicle uptake had above average workplace charging.

Of the 10 areas with the highest workplace charging points, nine had electric vehicle market shares of about 6% to about 21%, which is three to 10 times the U.S. average.

Of the 50 most populous areas analyzed, high uptake areas, including San Jose, San Francisco, and Los Angeles, had about 38-44 electric vehicles per each public charge point in 2018. Several other high-uptake areas, including Boston, Denver, Portland, Riverside, Sacramento, San Diego, Seattle, and Washington, D.C., had between 15-26 electric vehicles per public charge point. These areas each had 2018 electric vehicle market shares above 2.5%. The data affirm a previous finding that ratios of cumulative electric vehicles per public charge point in maturing markets increase over time as infrastructure reaches higher capacity and utilization.<sup>6</sup> The ratio of cumulative electric vehicles to public charge points increased by 13% on average from 2017 to 2018 in the 11 high-uptake areas listed above.

### MODEL AVAILABILITY AND ELECTRIC VEHICLE UPTAKE

Greater availability of electric models across more vehicle segments and in higher volume is a critical precursor to market growth. While the number of electric vehicle models for sale has expanded from just 5 in 2011 to more than 40 in 2018, model availability remains a barrier in many markets. Figure 6 compares the number of available models with electric vehicle market share across the 50 most populous areas. The circle size corresponds with the number of new electric vehicle registrations. Model availability is defined as the number of models that had at least 20 new registrations in 2018 to distinguish those that were widely available beyond a few select showrooms. The figure illustrates a general trend where areas with more models available tended to have higher shares. The five leading metropolitan areas by volume, representing over 40% of new electric vehicles in 2018, were also the top five in terms of model availability with 33 to 43 models.



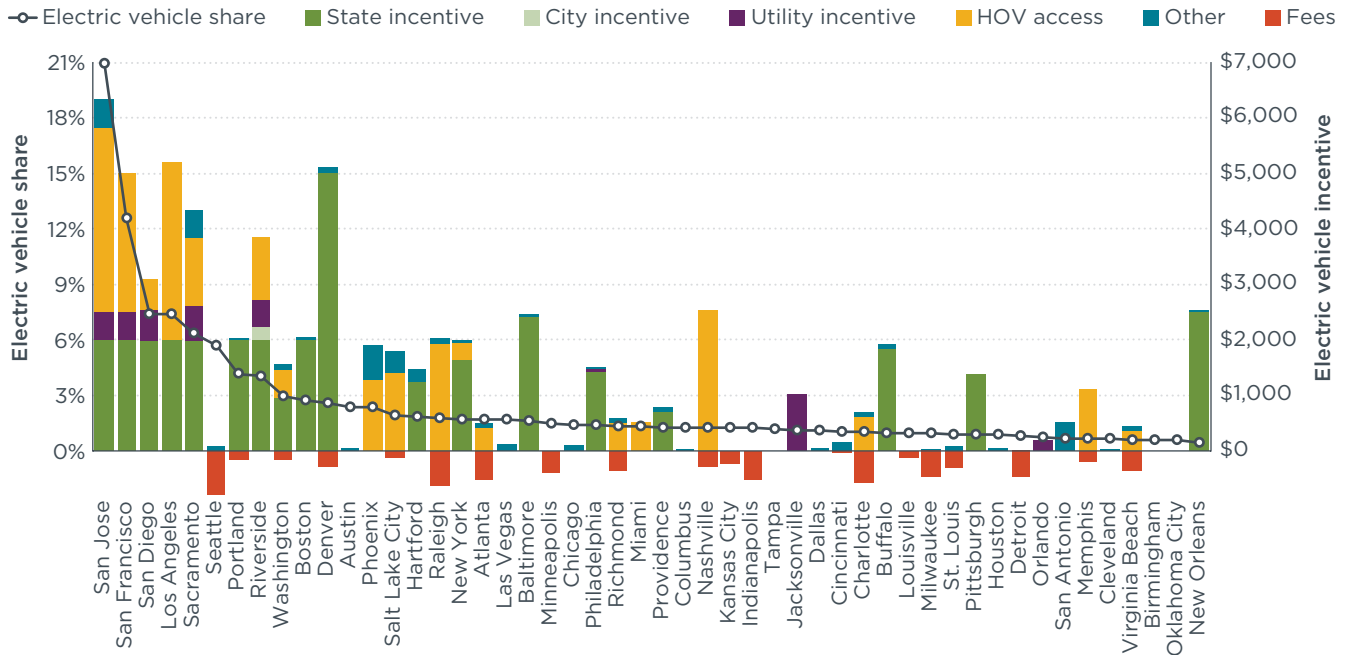
**Figure 6.** Electric vehicle share of new vehicles and model availability in the 50 most populous metropolitan areas. (New vehicle registration data are from IHS Markit.)

<sup>6</sup> Michael Nicholas, Dale Hall, and Nic Lutsey, *Quantifying the electric vehicle charging infrastructure gap across U.S. markets*, (ICCT: Washington DC, 2019), <https://www.theicct.org/publications/charging-gap-US>

In terms of electric vehicle share, all of the areas with above 4% uptake, or about twice the national average, had no fewer than 24 electric vehicle models available. Compared to 2017, 47 of the 50 most populous areas saw an increase in model availability. Thirteen of the 50 areas studied experienced an increase in availability of 5 or more models. Also, analyzing model availability across the 200 most populous metropolitan areas, we find that 80% of the areas still had no more than 10 electric vehicle models available. Approximately half of the population in 2018 was in an area with 14 or fewer models available in 2018.

### POLICY INCENTIVES AND ELECTRIC VEHICLE UPTAKE

Financial and nonfinancial incentives can greatly support early electric vehicle market growth by helping to overcome cost and convenience barriers. Figure 7 shows the estimated value of consumer incentives (bar, right axis) and electric vehicle share (line, left axis) in 2018 in the cities studied. The areas are ordered from left to right based on highest market share. The figure shows that, in many areas, strong consumer incentives coincide with high electric vehicle market shares. Most of the areas with high electric shares had substantial incentives, and many offered a mix of incentives. In California, electric vehicle drivers benefit from state and utility purchase incentives as well as high occupancy vehicle (HOV) lane access, and parking incentives are available in Sacramento and San Jose. Drivers in Denver receive substantial state purchase incentives, and incentives are also available in Connecticut, Maryland, New York, Oregon, and elsewhere. Drivers benefit from HOV access in areas such as Nashville, Phoenix, Raleigh, and Salt Lake City. Some states are instituting electric vehicle specific taxes or fees, resulting in a disincentive as shown by the red bar.

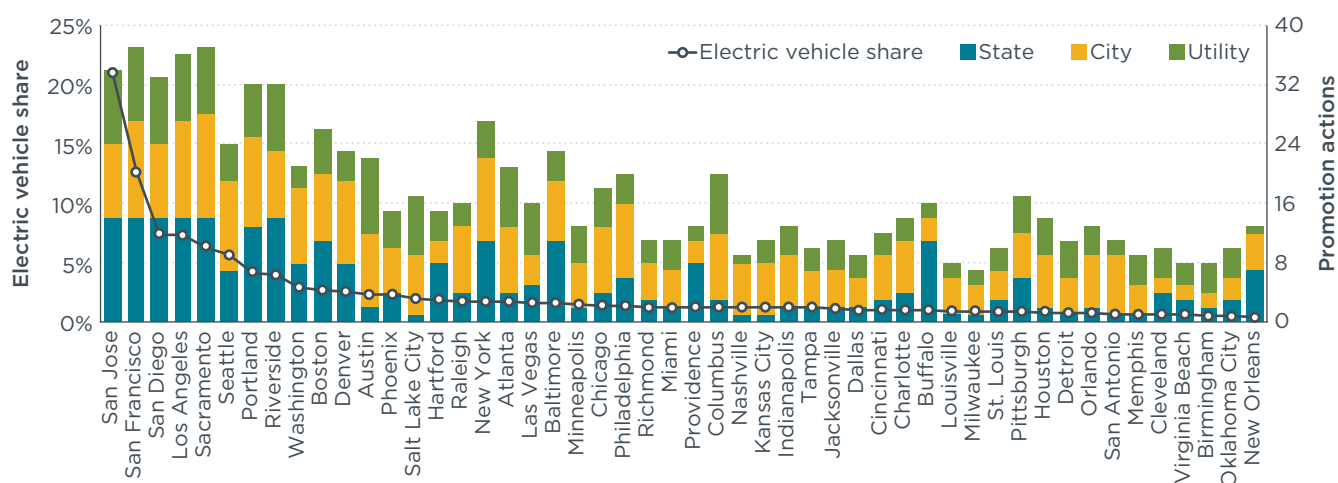


**Figure 7.** Electric vehicle share of new vehicles and available consumer incentives. (New vehicle registration data are from IHS Markit.)

Counterexamples of areas with low incentives and relatively high uptake tend to have several other promotion actions to support the market. In Seattle, electric vehicle buyers were previously eligible for a purchase tax credit worth about \$3,000, but the state-level program expired in May 2018 and thus is not shown. In Austin, as mentioned further below, drivers benefit from an array of other local promotion actions.

### PROMOTION ACTIONS AND ELECTRIC VEHICLE UPTAKE

A comprehensive package of state, city, and utility policy actions helps to overcome electric vehicle adoption barriers. Figure 8 plots the state, city, and utility promotion actions (bar, right axis) and electric vehicle share (line, left axis) in 2018 across the 50 areas, ordered from left to right based on highest market share. The figure shows a general trend where areas with the most policy actions tend to have the highest electric vehicle market shares. The 5 areas with the highest shares are in California and had 32 to 36 actions in 2018 with a healthy mix of state, city, and utility actions. Other leading markets, including Austin, Boston, Denver, Portland, Riverside, Seattle, and Washington, D.C., had 20 to 31 actions in place. Areas with the lowest uptake tended to have no more than 15 actions.

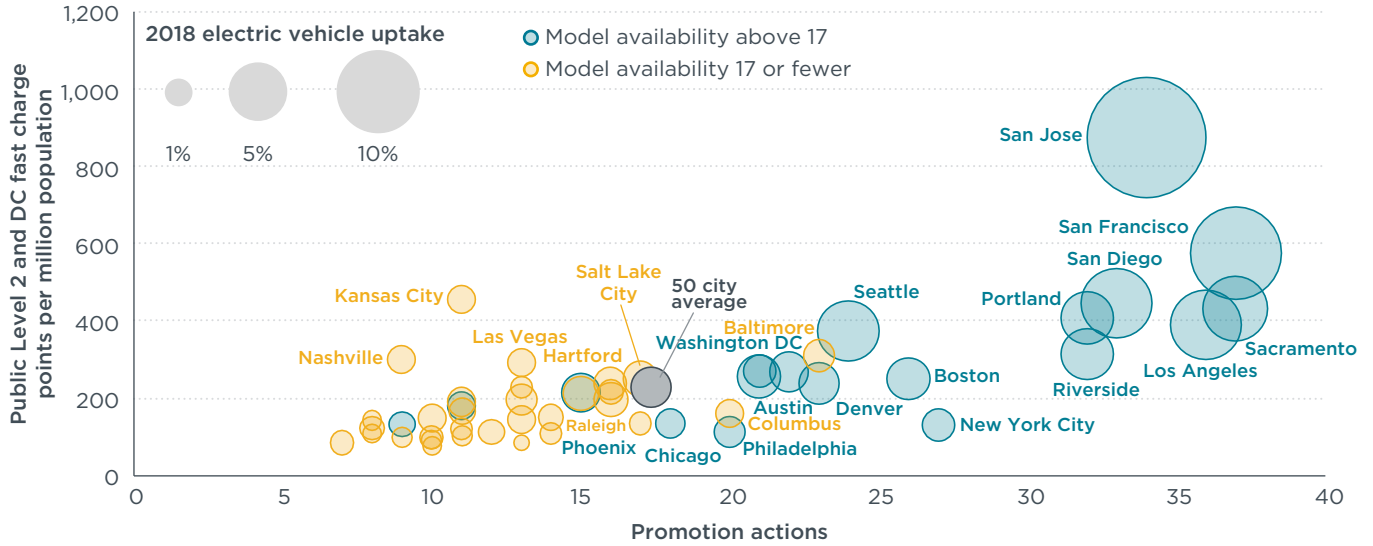


**Figure 8.** Electric vehicle share of new vehicles and promotion actions. (New vehicle registration data are from IHS Markit.)

The figure also reveals relative gaps in policy action. Austin and Columbus, for example, each have many city and utility actions, but support at the state level is lacking. State-level actions are also quite limited in Kentucky, Michigan, Minnesota, Missouri, Tennessee, Utah, and Wisconsin. Areas such as Buffalo, Hartford, and Providence have state-level support but few local and utility policies. Areas that could benefit from greater utility-level actions include Nashville, Raleigh, and Washington, D.C.

### COMPARISON OF 50 MAJOR METROPOLITAN AREAS

The potential relationship between the underlying factors associated with electric vehicle uptake can be further analyzed. Figure 9 illustrates how public charging infrastructure (vertical axis), promotion actions (horizontal axis), and model availability (circle color) relate to electric vehicle uptake (circle size). Overall, the areas with higher electric vehicle uptake tend to have more infrastructure, promotion actions, and models available.

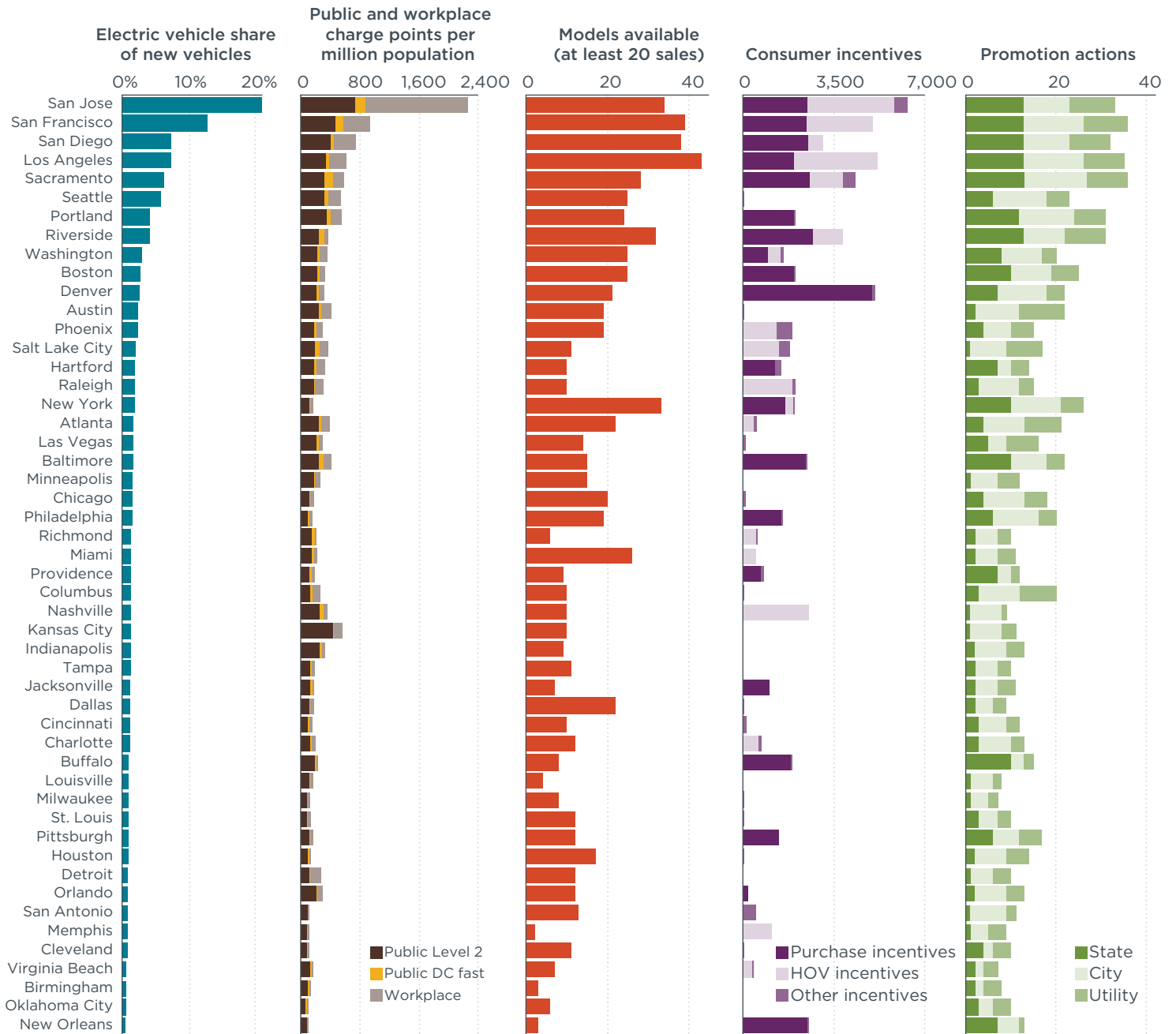


**Figure 9.** Public charge points, promotion actions, model availability, and electric vehicle uptake. (New vehicle registration data are from IHS Markit; charging infrastructure data are from PlugShare.)

Viewing Figure 9 as four quadrants around the 50-city average data point reveals relative gaps. Areas in the lower left quadrant (i.e., below 17 actions and below 200 chargers per million population) have relatively limited charging infrastructure, fewer promotion actions, and relatively low model availability. These areas tend to have less electric vehicle uptake than the U.S. average. In contrast, the largest circles, which represent the highest uptake and are clustered in the upper right quadrant, reflect high model availability, strong public charging infrastructure, and many promotion actions.

Several area clusters with about 2% uptake and shown in orange, including Hartford, Las Vegas, Raleigh, and Salt Lake City, would benefit from increased model availability, charging infrastructure deployment, and additional policy actions. Baltimore stands out as having above average infrastructure and promotion actions, but model availability appears to be lacking. Columbus, which is emerging as a regional leader in the Midwest, has above average policy actions but could benefit from greater model availability and infrastructure deployment. Kansas City and Nashville are poised for market growth with relatively high charging infrastructure per capita but the number of policy actions and model availability appear to be lacking.

Figure 10 compares electric vehicle uptake, public and workplace charging infrastructure, model availability, consumer incentives, and promotion actions across the 50 metropolitan areas. The areas are ordered from top to bottom based on highest 2018 electric vehicle market share. Overall, the areas with the highest uptake tended to have more charging infrastructure, more electric vehicle models available, consumer incentives, and promotion actions. The top 10 areas in terms of electric vehicle share largely overlap the top 10 areas for public charging infrastructure (8 of top 10), workplace charging infrastructure (7 of top 10), model availability (8 of top 10), incentives (7 of top 10), and promotion actions (9 of top 10).



**Figure 10.** 2018 electric vehicle uptake, charging infrastructure, model availability, incentives, and promotion actions in the 50 most populous U.S. metropolitan areas. (New vehicle registration data are from IHS Markit; charging infrastructure data are from PlugShare.)

There are also some counterexamples where variables do not visibly follow the trend with higher electric vehicle uptake. Regarding Seattle, Washington State’s purchase tax credit for electric vehicles expired in May 2018 (and has been reinstated, effective beginning August 2019) so is excluded from the data. Buffalo provides purchase incentives and strong state policy support yet has a relatively low electric vehicle market share. Model availability is also relatively limited in Baltimore, Buffalo, Hartford, Raleigh, and Salt Lake City.

Austin is emerging as a region-leading market with above average uptake, public and workplace charging infrastructure, and has an especially active utility supporting infrastructure deployment, fleet programs (e.g., electric vehicles in ride-hailing, car sharing, and municipal fleets), and public awareness campaigns. Austin and the other Texas markets would significantly benefit from state-level incentives. Texas offered just 2,000 electric vehicle rebates in 2018, or less than 0.2% of state vehicle sales. Other local markets with infrastructure and policy actions in place which would benefit from state-level incentives include Atlanta, Chicago, Columbus, Minneapolis, Las Vegas, and Salt Lake City.

## CONCLUSIONS

Electric vehicles surged into U.S. cities in 2018, supported by various government policy actions. These activities, including consumer fiscal incentives, charging infrastructure buildout, and other local policy promotions, help explain why the market is growing more quickly in some areas than others. The areas with the most underlying electric vehicle support are, on average experiencing the greatest growth. Our analysis leads us to the following four observations:

**States, cities, and utilities continue to develop comprehensive electric vehicle policy packages.** Various state and local authorities are reducing consumer purchase barriers with policy, incentives, infrastructure buildout, and awareness campaigns. States adopting California's ZEV regulations catalyze the market, expand model availability, and provide assurance for charging infrastructure investments. In 2019, Colorado is working toward the adoption of the ZEV regulation, and New Jersey and Washington State have signaled their commitment to electric vehicles by joining the International Zero-Emission Vehicle Alliance. Markets like Atlanta, Austin, Columbus, Denver, New York, Portland, Seattle, Washington, DC, and those in California continue to implement their own electric vehicle playbooks to help reach their emission-reduction goals.

**Greater diversity and availability of electric vehicle options is essential to continue growth.** The top five electric vehicle markets by volume, representing over 40% of all U.S. 2018 electric vehicle sales, each had at least 33 electric vehicle models available. However, across major U.S. markets, about half of the population has access to 14 or fewer electric models. According to the analysis, expanded model availability in more vehicle segments is key to continued market development. For example, the newly-available long-range Tesla Model 3 had approximately 130,000 sales in 2018, or half of all 2018 BEVs sales and greater than all U.S. electric vehicles sales in 2015.

**Consumer incentives remain important.** Electric vehicle prices have greatly decreased even as their electric ranges have increased. Yet, incentives remain important to reduce electric vehicles' upfront cost. Substantial consumer incentives, typically worth \$2,000 to \$5,000, were available through 2018 in nine of the 11 major metropolitan areas with the highest uptake. The exceptions are Seattle, where the state incentive expired in May 2018, and Washington, DC, where some drivers benefit from nearby Maryland's state incentive. Incentives like carpool lane access and preferential parking policies benefit electric vehicle drivers in Nashville, Phoenix, Raleigh, Salt Lake City, and many areas in California. As the federal \$7,500 electric vehicle tax credit begins to phase out for some manufacturers, continued state, city, and utility incentives will remain important.

**Electric vehicles and the charging infrastructure network grow in tandem.** Even as most charging occurs at home, greater electric vehicle market shares are typical where there is greater availability of public regular, public fast, and workplace charging infrastructure. Markets with high electric vehicle uptake have at least 400 public charge points per million people. By contrast, half of the U.S. population lives in markets with charging infrastructure at least 60% below this benchmark. In the top electric vehicle markets, about 10 to 25% of the available public charging is fast charging. The top electric vehicle markets also typically have at least 150 workplace charge points per million people, and San Jose, with the highest electric vehicle share in 2018, had about 9-times this value.

These examples demonstrate that state and local authorities are developing the necessary policy tools to overcome consumer barriers to electric vehicle adoption. Federal action to retain vehicle efficiency standards and the electric vehicle income tax credit would greatly support continued market growth, but lack of federal support would put more pressure on state and local authorities to develop stronger tools to reach their emission-reduction goals. The larger electric vehicle markets of Europe and China provide similarly rich laboratories for how the stronger market, policy, incentive, and infrastructure actions can further drive the market globally.<sup>7</sup> The more markets that act similarly to overcome the prevailing barriers, the quicker the global transition to a mainstream electric market will occur.

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<sup>7</sup> Dale Hall, Hongyang Cui, and Nic Lutsey, Electric vehicle capitals: Accelerating the global transition to electric drive, (ICCT: Washington DC, 2018), <https://www.theicct.org/publications/ev-capitals-of-the-world-2018>