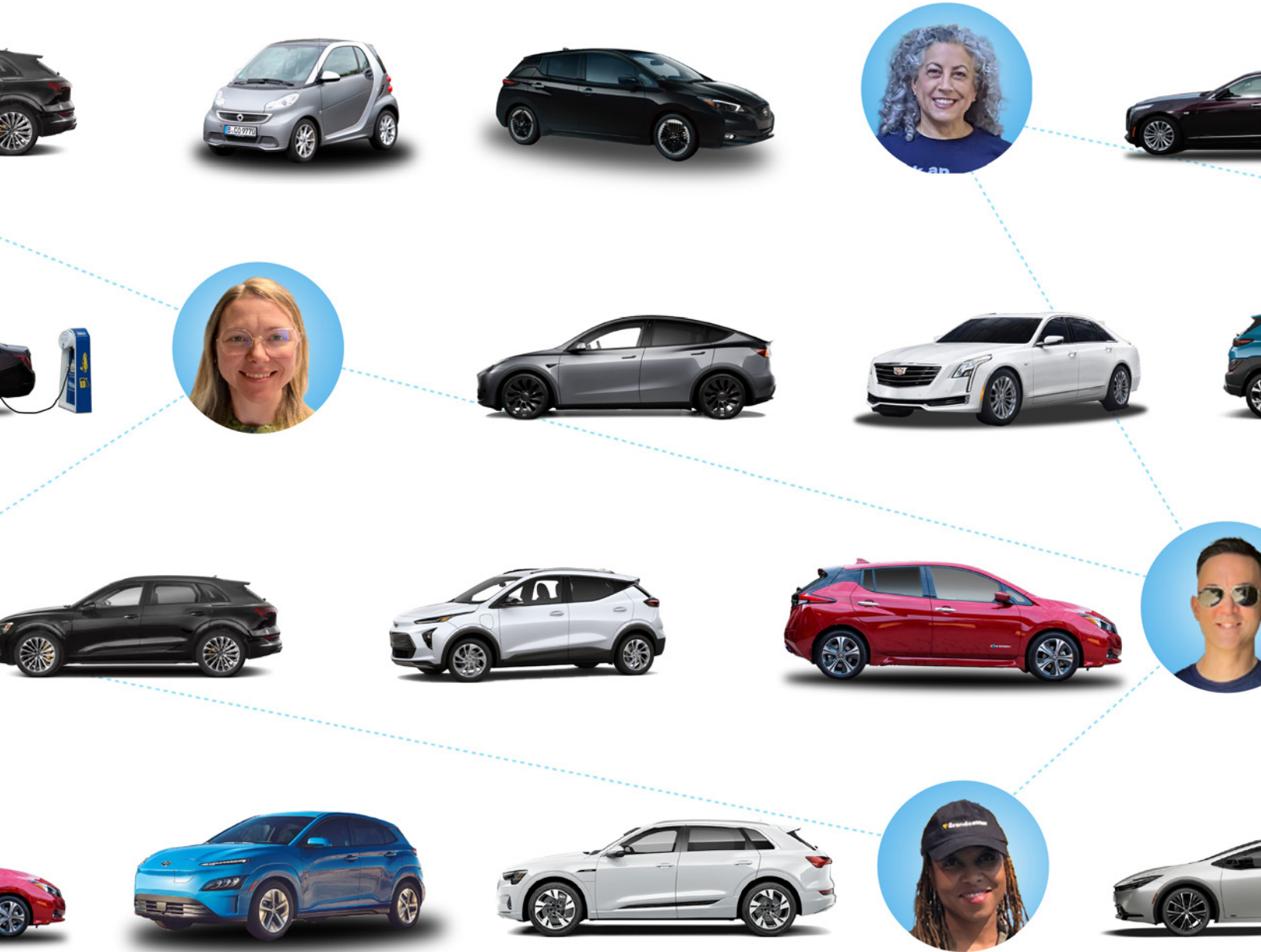


# Your Influence Matters: Peer Influence and EV Adoption



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**S&P Global**  
Mobility

**Yale University**

**NREL**  
NATIONAL RENEWABLE ENERGY LABORATORY

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**Plug-in nc**





**What leads people to make the decisions they do? This is the core question that hundreds of researchers have attempted to tackle over the past few decades. A key finding has emerged: people are influenced by their peers.**

Social influence has been demonstrated to affect decision making in the context of many technologies and actions. For example, there is powerful evidence that if your neighbors adopt solar panels, you are more likely to adopt solar panels too. Studies have shown a similar phenomenon for hybrid vehicles. It stands to follow that social influence also may be playing a role in the adoption of fully electric vehicles. Such social influence can lead to a contagion effect of the good kind; unlike a pandemic, this contagion can lead peers and neighbors to influence each other to adopt greener technologies.

This report presents exciting new evidence on electric vehicle (EV) adoption across the United States. It draws on rich data on EV registrations and ground-truths these findings with interviews of real EV owners. The report includes a fabulous set of maps that show clear clustering of EV adoption in different metropolitan areas. Such clustering is a common marker of peer influence, and is the pattern of adoption that one would expect if peer influence is a major factor, along with other important factors such as income, number of owner-occupied homes, and environmental preferences.

The analysis undertaken is a novel geospatial hot spot analysis – likely the first ever performed for electric vehicles. It uncovers the parts of cities that have the greatest clustering and concentration of EVs and shows the trends in this clustering over time. The findings are fascinating and in some cases unexpected, especially if you know some of these cities. I encourage readers to find the city they know the best, possibly even their own. The hot spot analysis is complemented by the stories of EV owners, which provides wonderful real-world context to the findings.

As we look to develop a cleaner society for both us and our children, it is important to develop a deeper understanding of what motivates people to take action to reduce their carbon footprint, including by adopting lower-emission vehicles. With insight into motivations, we can together design approaches that encourage more people to get involved in the much-needed transition to a greener and healthier world.



**Kenneth Gillingham**  
Yale School of the Environment



# Executive Summary

**Whether it's called peer pressure, social contagion, or the neighborhood effect, the phenomenon is clear: as social beings, humans have the ability to influence one another by their actions. In this report, Generation180 explores how peer influence is playing a key role in accelerating the adoption of electric vehicles (EVs) across the United States.**

A growing body of research shows that the behavior of peers has a significant impact on an individual's decision making around energy choices, from deciding to install solar panels to opting to buy an EV. Neighbors, friends, and coworkers have strong influence within a community and can change local behavior around any number of issues. In short, personal energy choices can be contagious. For example, several studies have demonstrated that the chance of an individual choosing to install solar panels on a residential roof increases as more panels are installed in that person's neighborhood or region.

This report, *Peer Influence and Electric Vehicle Adoption*, uses a detailed analysis of new electric vehicle registrations in 11 U.S. "designated market areas" (DMAs) to provide insight into the influence that individuals have on the increased local adoption of EVs. Researchers analyze "hot spot" data to assess changes in EV registrations over the five-year period from 2018 to 2022. The analysis was performed with insight from S&P Global Mobility and the National Renewable Energy Laboratory and is coupled with on-the-ground stories of EV owners.

Although peer influence is not the only factor behind the growth in hot spots of electric vehicle adoption, the results of our analysis indicate that peer influence is one of the most likely reasons for the clustering of neighboring ZIP codes with high EV registration rates. This report represents the first time that this type of cluster analysis has been conducted broadly across key U.S. markets to identify ZIP codes experiencing high EV registration per capita, while accounting for the neighborhood effect.



**Before I bought my EV, I bugged my friends relentlessly to convince me to buy one. They answered all my questions and helped make me more comfortable. I recognize the power of influencing other friends and family. Neighbors have asked me about my new EV, and I share information with work colleagues."**



**Chris Jewell**  
Virginia



Electric vehicles have grown in popularity across the country, with their market share almost doubling from just over 3% in 2021 to around 6% in 2022, and more than 1 million EVs are expected to be sold in 2023. In this report, the analysis of new vehicle registrations in selected areas indicates strong evidence of a peer effect on the growth in EV sales. Between 2018 and 2022, the national average change in EV retail share was 328%. Compared to the national average increase, 6 of the 11 DMAs experienced above average growth during this time, including Miami (571%), New York City (479%), Charlotte (476%), Philadelphia (426%), Austin (377%), and Los Angeles (357%). Five of the DMA's experienced lower growth: Washington, DC: (319%), Raleigh-Durham (316%), Atlanta (295%), Denver (253%), and Seattle (226%). Across all 11 DMAs, the analysis showed clustering (or hot spots) of higher than average EV growth for the DMA.

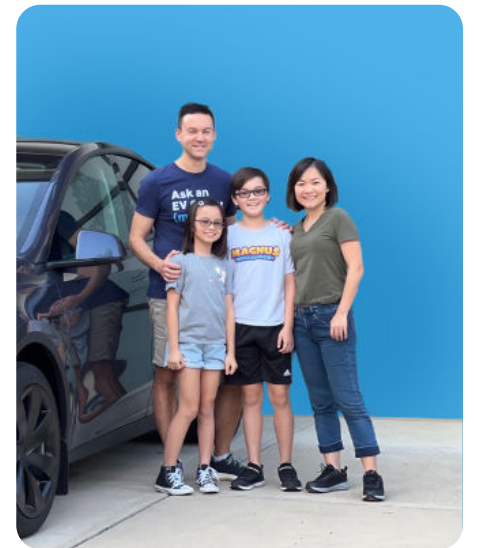
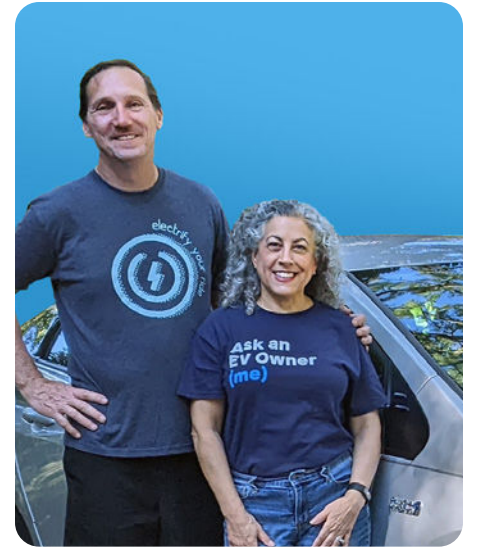
Additionally, interviews with individual EV owners from across the country – conducted to provide context to our hot spot data analysis – revealed a clear message: EV owners relied on and were inspired by other EV owners in their networks, whether it was neighbors, family members, or colleagues. Sentiments included: "There's no question that our neighbors put us on the path to electrification," and "Before I bought my EV, I bugged my friends relentlessly to convince me to buy one."

As governments, EV advocates, and the auto industry look to promote the uptake of electric vehicles, in part to support reductions in carbon emissions, this report provides an important indicator of ways to accelerate movement along the adoption curve. The ability to demonstrate the importance of individual action provides insights into the possible levers that advocates can use to support the wider electrification of transportation, including in communities that have not yet begun to benefit from this trend.

Although the report's findings point to the importance of the peer effect in driving EV adoption, a key limitation was the time frame studied. Factors related to the COVID-19 pandemic – such as a reduced vehicle supply, higher unemployment, and the ability to work from home – could impact the findings. In addition, although the analysis reveals the geographic evolution of hot and cold areas for EV registrations across ZIP codes, more granular data on household income, gender, and education are required to compare the relative impacts of peer influence versus wider demographic factors. Further research also is needed to test the peer effect across a broader diversity of regions, including rural areas.

This report clearly identifies geographic patterns for EV ownership, which can be useful to inform policy, identify specific barriers to adoption, help utility companies understand electricity demand, and support EV adoption strategies for advocates, manufacturers, and car dealers. With millions of financial incentives available over the coming decade through the U.S. Inflation Reduction Act, the country must ensure that all populations are able to benefit from EV uptake.

Individuals have an opportunity to invest in clean energy – and to encourage others to do so – just by talking about the changes they are making, answering questions from their peers, and inspiring action in others at the household and community levels. As we find ourselves in the "decisive decade" for climate action and emission reduction, the contributions of individuals should be considered more widely as a key pathway toward a clean energy future for all.



**There is no question that [our neighbors] definitely put us on the path to full electrification with the introduction to hybrid vehicles."**



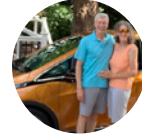
**Chuck Huber**  
Maryland

# Key Findings

The goal of this report is to demonstrate – through both analyses of new vehicle registration data and case studies of actual EV owners – that individuals and their influence on peers play a significant role in the wider adoption of electric vehicles. The analysis leverages “hot spot” analysis to indicate changes in EV registrations from 2018 to 2022. This is the first time that this type of cluster analysis has been conducted broadly across key U.S. markets to identify ZIP codes experiencing high EV retail registration per capita, while accounting for the neighborhood effect.

During the study period (2018–2022), this report shows that:

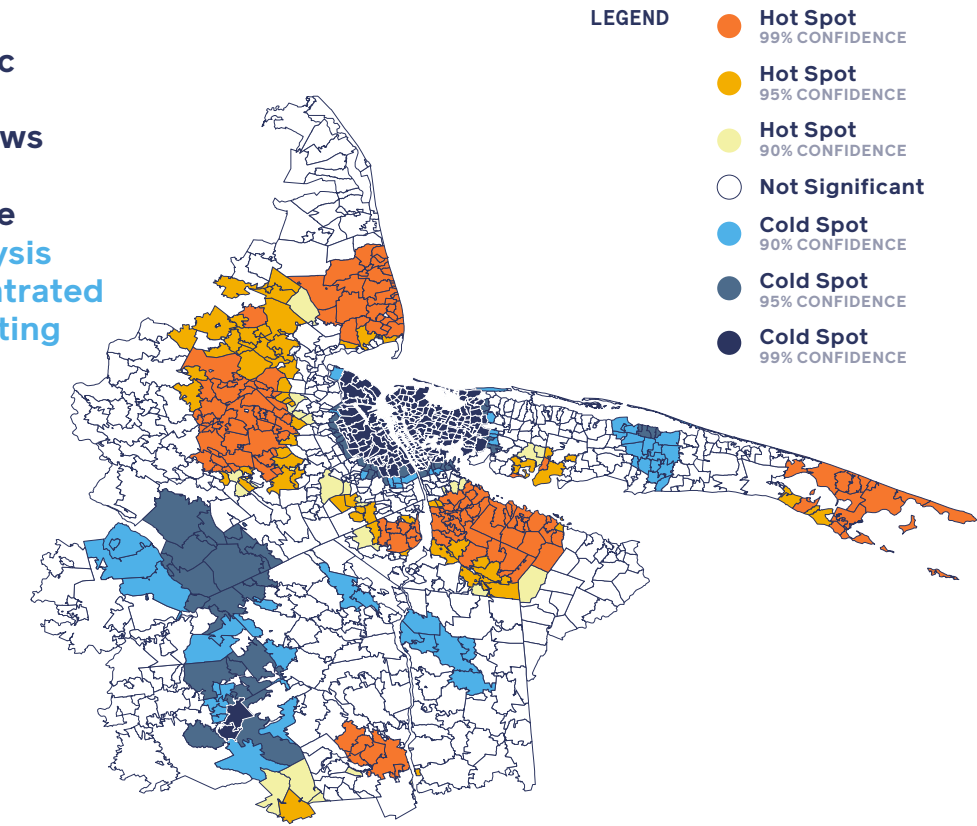
- Analyses of new vehicle registrations in 11 “designated market areas” (or DMAs) studied indicate strong evidence of a peer effect influence on the growth in EV sales.
- EV registrations experienced significant growth across all 11 DMAs.
- Compared to the national average of 328% growth, the following cities saw an:
  - Above national average growth: Miami: 571%, New York City 479%, Charlotte: 476%, Philadelphia: 426%, Austin: 377%, Los Angeles: 357%
  - Below national average growth: Washington, DC: 319%, Raleigh–Durham: 316%, Atlanta: 295%, Denver: 253%, Seattle: 226%.
- Some EV registration hot spots occurred in urban areas compared to outskirt/sub-urban regions. This suggests that the neighborhood effect may be more prevalent in densely populated urban areas than in non-urban areas.
- The New York City DMA provided the strongest example of the “neighborhood effect.” In 2018, the DMA had limited ZIP codes with high EV registration near Newark, NJ and Queens, NY; however, by 2022, more neighboring ZIP codes started to display high EV registration.
- Although peer influence is not the only factor behind the growth in “hot spots” of EV adoption in some of the DMAs, the results indicate that it is one of the most likely reasons for the clustering of neighboring ZIP codes with high EV registration rates.
- Potential applications: Cluster analysis patterns like those applied in this report can be used to inform regional policy planning, identify region-specific barriers, and help utility companies understand electricity demand in clusters of ZIP codes identified as EV hot spots and devise strategies.



## Driving Change How EV Owners Inspire Others:

Interviews with EV owners point to a peer effect trend showing that individual EV owners have a valuable role to play in both talking about their choice to buy an EV and demonstrating this action to their network.

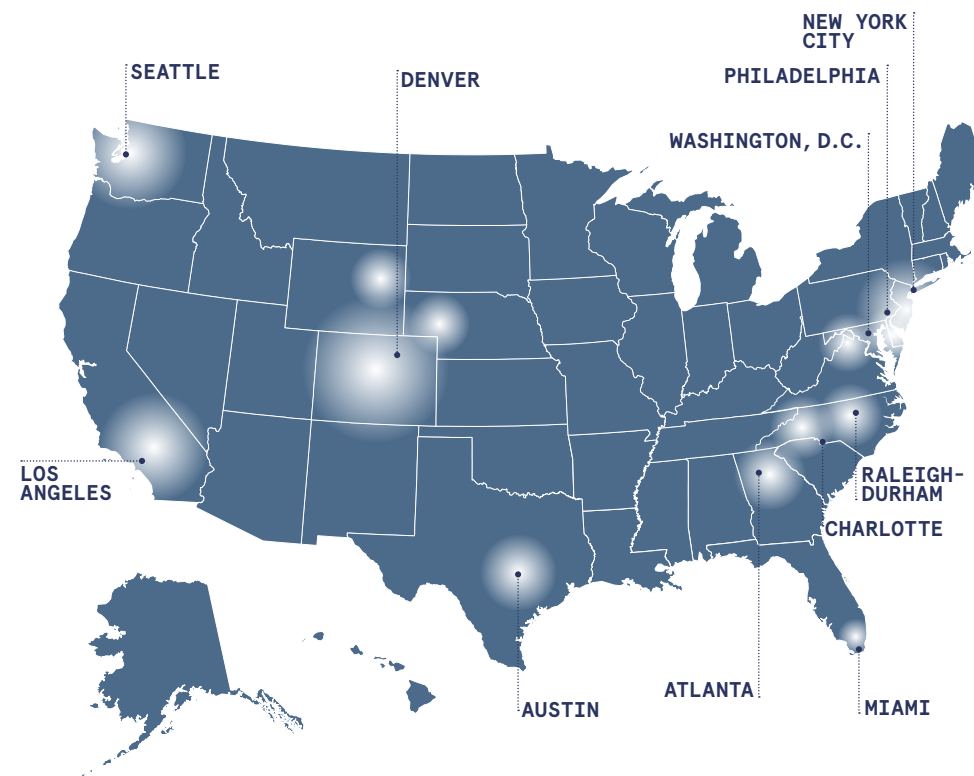
The analysis of new retail electric vehicle registrations over a five-year period (2018–2022) allows us to identify which ZIP codes in each DMA have the highest share of adoption. The “hot spot” analysis highlights a clustering of concentrated EV adoption in each DMA, indicating the neighborhood effect.



→ NEW YORK CITY PROVIDES A STRONG EXAMPLE OF PEER INFLUENCE AT WORK. SEE PAGE 32 TO LEARN MORE.

SOURCE: NREL, 2023

EV registrations experienced significant growth across all 11 DMAs.



EV share for the 11 selected DMAs and the U.S. overall 2018 AND 2022

	2018	2022
ATLANTA	1.5%	5.8%
AUSTIN	1.8%	8.4%
CHARLOTTE	0.8%	4.4%
DENVER	2.7%	9.4%
LOS ANGELES	3.9%	17.7%
MIAMI	1.0%	6.5%
NEW YORK CITY	1.0%	5.9%
PHILADELPHIA	1.0%	5.2%
RALEIGH-DURHAM	1.3%	5.5%
SEATTLE	4.2%	13.7%
WASHINGTON, D.C.	2.0%	8.3%
<b>UNITED STATES</b>	<b>1.4%</b>	<b>6.2%</b>

# About the Report

In this report, Generation180 explores how peer influence plays an important role in accelerating the adoption of electric vehicles across the United States.

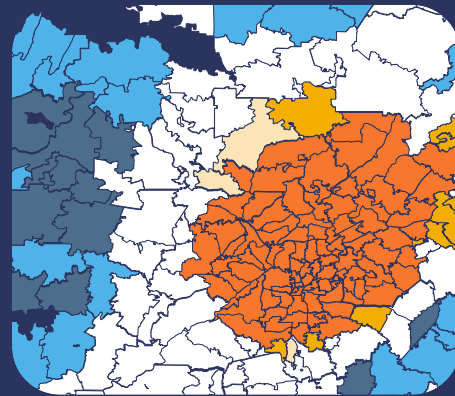
The report first defines the “peer effect” and its role in the uptake of clean energy solutions, including rooftop solar panels and EVs. It then provides background information on EV trends nationwide, summarizing existing data on EV sales and demographics and addressing common barriers to EV adoption, including among low-income consumers and communities of color. This is followed by a first-of-its-kind Generation180 study to understand the impact that peer influence has on EV adoption across the U.S.

Three key data sources are used to help understand this phenomenon:



## 1 S&P EV registration data

S&P Global Mobility supplied data on retail new vehicle registration and retail EV registration data by ZIP code in 11 “designated market areas” (DMAs) from 2018 to 2022.



## 2 A commissioned Generation180 analysis of the peer effect on EV adoption in specific U.S. markets.

Analysis of EV registration data at the ZIP code level indicates the potential presence of the peer (or “neighborhood”) effect. EV registration data was analyzed by the National Renewable Energy Laboratory (NREL) using geospatial hot spot analysis to identify clusters of ZIP codes that are experiencing high EV registration per capita. These results are featured in maps that correspond to each of the 11 DMAs for the years 2018 and 2022.



## 3 Stories from individual peer influencers who have played a role in accelerating EV adoption in their communities.

Generation180 worked with its nationwide network of EV owners (“EV Ambassadors”) to obtain first-hand accounts of their role in inspiring their peers to adopt EVs. These and other stories are profiled throughout the report. Interviews with EV owners indicate a strong likelihood of an individual’s ability to inspire others within a peer group to transition to an EV.

# Generation180’s EV Ambassadors: Championing Clean Energy Action

**It’s no secret that the most effective messengers and advocates for electric cars are EV owners themselves. To complement our quantitative data analysis, Generation180 surveyed our nationwide network of EV owners to obtain first-hand accounts of their role in inspiring their peers to adopt EVs. Our analysis also drew from interviews with EV owners from partner organizations.**

In line with Generation180’s mission to inspire and equip individuals to take action, our EV Ambassadors help drive awareness and adoption of electric transport in their neighborhoods, communities, and networks. As early adopters of electric vehicle technology, EV owners are trusted messengers who help spread the benefits of EVs, dispel myths, and accelerate the transition to clean energy. The energy and excitement that EV owners emanate about their vehicles is contagious. They are basically like sales people, but without the pressure.

Generation180 currently engages EV Ambassadors through our priority campaign Electrify Your Ride. Our Ambassadors extend the reach of our work. They stand out as experts in their field and community, engage their networks and neighbors, and inspire action in others. This results not only in immediate carbon reduction benefits, but also in new champions for clean energy policy and technologies. EV Ambassadors equip and mobilize others to take action, further building the network of new individuals taking steps to decarbonize their lives.

EV owners have a valuable role to play in both talking about their choice to buy an EV and demonstrating this action to their network – neighbors, colleagues, friends, and family. When Generation180 asked a recent panel of EV owners what they do to help influence others to drive electric, they said: offer to give people a test drive in my EV, encourage others to rent an EV for a couple of days to drive around town, or for a road trip, and demonstrate how much it costs to operate the vehicle. These advocates also encourage folks to download the PlugShare app, which shows EV charger locations nationwide, and to attend EV awareness and education events.

Generation180 EV owners are more likely to take additional clean energy actions in their home. In a survey of 500 Generation180 EV Owners in February 2023, of those who responded (120 people), 96% are taking other clean energy actions at the household level. Actions include using EnergyStar efficient appliances (78%), electric lawn equipment (66%), residential solar or community solar programs (59%), heat pumps for heating / air conditioning (52%), electric or induction stoves (48%), “other” (26%), and heat pump hot water heaters (21%). The “other” category includes geothermal, wind, solar hot water, weatherization, battery storage, heat pump clothes dryers, panel upgrades, and net zero homes.

**More than half of survey respondents have invested in solar and mention being able to charge their EV at home using 100% renewable energy as valuable and important.**

In conversations with our EV Ambassadors and our School Leaders in Clean Energy, a common theme is the mention of their individual choices and being on a clean energy journey where they have adopted multiple clean energy technologies and are looking ahead to what’s next. While some of these actions may not be as visible to others as solar panels and EVs, it is another area where individuals can talk about and demonstrate actions, answer questions, and influence their peers.



1 GENERATION180 AMBASSADORS ON AN "ASK AN EV OWNER" PANEL AT THE NEW YORK INTERNATIONAL AUTO SHOW, 2022.

# Role of Peer Influence in Clean Energy Adoption



**“Policies and programs that seek to promote low-carbon technologies may benefit from enlisting the help of peers who have already adopted them.”**



**Kenneth Gillingham**  
Yale School of the Environment <sup>01</sup>

## Individuals and communities play a critical role in making and driving the transition to clean energy.

A majority of Americans (71%) now believe that climate change is happening, and among this group 70% say it is necessary for individuals to make lifestyle changes to combat climate change.<sup>02</sup> Lifestyle change, in combination with broader policy and system changes, is critical to tackling the many global crises we face.<sup>03</sup>

What we do as individuals, and what we see other people around us doing, makes a difference. Research shows that the best predictor of climate action is whether a person believes that other people are already taking action.<sup>04</sup> It turns out that, for individuals, having an understanding that other people are doing something actually matters more than their own beliefs that they should take action.<sup>05</sup> In general, people are more likely to change their behavior, such as taking action on climate change, when they perceive this action to be common, normal, and expected.<sup>06</sup>

Behavioral science reveals that our social environment – what’s going on around us – can profoundly shape our behavior. Social visibility, peer pressure, and influencers can all speed the cultural adoption of new clean energy norms. The behavior of our peers has a significant influence on our own decision making about clean energy – whether it’s choosing to install solar on our homes or to buy an EV. In short, personal energy choices can be contagious.

## What Is Peer Influence?

Neighbors, friends, and coworkers have strong influence in a community and can change local behavior around any number of issues. This power to shape the actions of others within a community is called peer influence. Research on peer influence focuses on two main areas:



**Interpersonal communication and persuasion:** this can include observation of specific choices (such as, in the case of clean energy, seeing solar panels on a neighbor’s roof), word-of-mouth communication, and the influence of trusted community leaders.



**Normative social influence:** here, social norms are passively communicated as shared standards that constrain or guide the behavior of individuals within a group.<sup>07</sup> *Example: “I believe my neighbors are supportive of clean energy, an EV would show I fit in.”*

Peer influence is shown to have a bigger impact on the uptake of clean energy technology than factors such as glitzy advertising, expert knowledge, or even social media reviews.<sup>08</sup> Two key areas where this linkage is being explored are residential solar energy and electric vehicles (the focus of this report).

# Residential Solar Energy

**Peer influence plays out in the clean energy transition in a number of ways. A key example is the installation of residential solar panels.** Studies show that when someone is considering whether to install solar power, their home's proximity to other homes with solar is the most important factor in their decision – and is even more important than socio-economic and demographic factors.<sup>9</sup> This phenomenon is known as the “neighborhood effect.” However, as the distance from the nearest solar panel increases, and as the duration of time following the panels' installation increases, the strength of peer influence diminishes. This decline points to the power of proximity in both time and space.<sup>10</sup>

Through peer influence, residential solar adoption can spread naturally. For example, SolarCity, a solar panel installer, reports that in Fort Collins, Colorado, “69% of... installations came from referrals.”<sup>11</sup> Furthermore, according to a Yale study, “Adding one rooftop system on a block increased the average number of installations within a half-mile radius by 0.44.”<sup>12</sup> If we think about these numbers in the context of the entire country, the power of peer influence in the energy transition becomes quite significant.

The peer influence effect works in real life when someone walks out their front door and sees a solar panel on their neighbor's house. The act of just seeing someone living nearby with a solar panel is enough influence to push that individual to install their own panels.<sup>13</sup> A 2012 study calculated that in one California ZIP code, for each additional rooftop solar installation, the probability of another increased by 0.78 percentage points.<sup>14</sup>

When solar spreads through peer influence, it does so in a distinctly “wave-like centrifugal pattern.”<sup>15</sup> Solar peer influence occurs across all populations;<sup>16</sup> however, it is particularly strong in small- and medium-sized populations. Additionally, neighbors are influenced to install solar across all income levels.<sup>17</sup> Understanding the ins and outs of solar power, including the “soft costs” of adoption and financing mechanisms, is challenging. There are different tax credits to benefit from, installation issues crop up, and choosing a panel and installer takes a decent amount of specialized knowledge. This process is simplified when there is a neighbor right down the street to learn from.<sup>18</sup>

1 CADILLAC CTS PLUG-IN HYBRID



## Stan Bergkamp and Tim Williams

Maize, KS / Columbia, MO

2018 CADILLAC CTS PLUG-IN HYBRID

In 2016, Stan Bergkamp was surprised to see a huge gap on Generation180's map of schools with solar ([Brighter Futures Report](#)) that spanned from Kansas to Dallas, Texas. He wanted to change that and put his town on the map as the biggest solar array in the state of Kansas. As a physics teacher and farmer in Maize, KS, Stan knew the benefits of solar from installing it on his own ranch. He realized that his local school district could adopt clean, inexpensive solar for their schools to save money and teach students about the benefits of solar energy.

To get the solar array installed at his school, Stan hosted fundraising events that engaged current and former students, including sisters Katie and Lillie W. He also promised his students he would get a tattoo if they were successful in raising \$3000. In the end, Stan and students surpassed their goal and Stan got the tattoo a student had sketched of him and a solar array on his leg. In June of 2019, the 240kW system went online.

The Maize school going solar influenced both students, their families, and the community. Katie and Lillie contributed to the solar fundraiser along with their parents. In addition, they took their own steps at home. Katie has since purchased a Chevy Volt (PHEV) plug-in hybrid. Katie's dad, Tim, also transitioned to electric, buying a 2018 Cadillac CTS PHEV for “environmental reasons, to save on fuel, and because the tech is really cool.” Tim used it to commute 27 miles round trip to work and went a whole year without buying gas. He was also inspired to look into residential solar panels, which Tim and his wife Susie installed at their home in Columbia, MO. They combined federal tax credits with a local rebate to cover 15-20% of their system cost. In May 2023, their 25kw solar system was installed – which will charge their EV and cover 128% of their home electricity consumption.

Tim reflected, life is busy and it takes time to research the practicality and economics of a home solar system. “Stan making this a reality at Maize school district gave us the extra encouragement to do our homework and the extra motivation to support his efforts to act locally to make the world a better place.”

To take advantage of peer influence, research suggests that solar panels should be strategically introduced in otherwise solar-sparse areas to push an entire community toward widespread solar adoption.<sup>19</sup> Growth in shared and community-based solar thrives on large groups of people simultaneously and sequentially choosing solar. These group-oriented projects benefit greatly from the peer influence effect and are especially well-equipped to bring solar to lower-income areas, where peer influence is already strongest.<sup>20</sup>

Research has shown that it takes roughly 3.5% of a population to protest for a movement to be a success.<sup>21</sup> This same logic can be applied to the peer influence effect. If neighbors can influence neighbors to adopt clean energy until solar uptake reaches a critical threshold, the movement for the clean energy transition will find success. One by one, communities can be flipped to fully embrace solar, starting with just one neighbor.



1 DAVID'S HOME SOLAR AND EV



1 TOYOTA PRIUS / TOYOTA MEDIA SITE



## David Strevel

Raleigh, NC

TOYOTA PRIUS HYBRID,  
PRIUS PRIME PLUG-IN HYBRID,  
TESLA MODEL Y

**“Generating solar energy from the sun to power my home, my auto, and my church is doing all I can to reduce global warming while, also being financially attractive.”**

As an electrical engineer and a former high-tech invention manager for universities, David feels at home with EVs and new car technology. His curiosity was piqued when the Toyota Prius hybrid was first introduced in 2000, and did his research before ordering one in 2006. David drove the car for 10 years, getting 55 miles to the gallon, and found it to be reliable, efficient, and a good fit for his family. By 2017, David was ready to buy his first plug-in hybrid, the Prius Prime. Because the model wasn't available for sale in North Carolina, he ordered the car from a Maryland dealer and drove it home. David owned the Prime for three years and found it to be very reliable, getting 25-28 miles on the battery before switching to gas. It also allowed him to transport 10-foot pieces of wood or pipe from the lumber yard.

When Tesla came on the scene and established two offices in North Carolina, David took note. By 2020, he felt like the Tesla was proven, and he took five test drives with his wife and friends before purchasing his Model Y. About the same time, David became interested in residential solar and had a local solar contractor install panels on his home. He was able to take advantage of a net metering plan and a rebate program covering a quarter of the cost, offered by the local utility Duke Progress Energy. A Federal Investment Tax Credit covered another quarter of the cost.

David's goal was to generate 100% of his home electricity demand and also to provide for home-charging for the electric car. The net metering plan has reduced his monthly power bill to zero (except for small bills in December and January), and the Tesla runs on the solar-generated electricity, so David hasn't bought gas for three years. In around four years, when the savings will cover the initial cost of the solar installation, both the home and the car will be powered for free. David estimates that he's saving around \$2,000 a year by not buying gas for the car, plus around \$1,100 a year in avoided electricity for the house.

David regularly talks with friends and neighbors about both solar and his EV. Since he installed his own Level 2 charger, people have stopped by to ask about it, and he's helped several neighbors plan out similar electric installations and charging systems. Once, he helped his neighbors map out the charging stops they'd use when driving their kid to college in Michigan in their new EV. David was able to draw from his own EV driving and charging experience to share how easy the chargers were to use. He encourages folks to download the PlugShare app and to do their research in advance, noting that road trips are very doable with a little planning.



# Electric Vehicles

Similar evidence about the peer effect is emerging in the case of electric vehicle adoption and is explored in detail in this report. In the case of EVs, studies show that peer influence – especially through word-of-mouth communication – is one of the best ways to speed the EV revolution. The upshot is that current EV owners are among the top advocates for these low-maintenance, zero-tailpipe-emission vehicles.



## Personal Recommendations

A 2020 survey by [Autolist.com](#) found that personal recommendations from friends, family, or coworkers had the most influence on a person's vehicle purchase, with 52% of respondents saying that this had governed their buying choice.<sup>22</sup> "When someone in your immediate circle has a good or bad experience with anything, it makes you feel better about making the same decision," an Autolist analyst explained. "Because cars are such a huge purchase in our lives, word of mouth means that much more here."<sup>23</sup>

Steve Hanley, a self-proclaimed "ambassador for the electric vehicle lifestyle," noted that, as the first EV buyer in his area, he was able to dispel common misconceptions that his neighbors had about the Nissan Leaf, including its 200-mile-plus battery range.<sup>24</sup> "When I explain it is adequate for 90 percent of my driving needs and can go several days without recharging, they begin to see how an electric car could fit their needs as well," he said. Just driving around town helps break down the barriers to greater EV demand, Hanley explained, as "fear of the unknown subsidies and people become more receptive of the newfangled oddity in their midst."<sup>25</sup>



1 CHRIS JEWELL AND HIS WIFE RECENTLY PARTICIPATED IN AN ECOACTION ARLINGTON NEIGHBORHOOD EVENT WHERE THEY INVITED NEIGHBORS TO STOP BY THEIR HOME AND LEARN MORE ABOUT THEIR SOLAR, EV, AND SUSTAINABLE GARDENING EFFORTS.

TESLA MODEL Y / TESLA MEDIA SITE



**Chris Jewell**  
Arlington, VA  
TESLA MODEL Y

In September 2021, Chris signed Generation180's National Going Electric Pledge – committing to make his next vehicle an electric one. Chris already knew his next car would be an EV: "It wasn't a question of IF, it was WHEN." Around 18 months later, when the rebates under the Inflation Reduction Act took effect and vehicle prices fell, Chris ordered and took delivery of his first EV, a Tesla Model Y.

In 2019, Chris and his wife built a new home for their family of six (their two children as well as his in-laws). Four months after moving in, they went solar. Chris's family is climate aware, and it's important to them to make sustainable choices. The children attend a school that has rooftop solar, and the Jewells live in a county that holds Earth Day and other green community events where neighbors learn about one another's clean energy actions – from EVs to sustainable gardening to household electrification. When the family's solar panels ended up producing an energy surplus, it became obvious that they should get an EV: free charging, powered by the sun.

Before Chris bought his EV, he "bugged his Tesla-owning friends relentlessly" to convince him to buy one. "They answered all my questions and helped make me more comfortable." In the same way that Chris was influenced by his EV-owning friends and neighbors, he recognizes the power of influencing other friends and family. Neighbors have asked about his new EV, including the father of his daughter's best friend. Chris has also talked about his EV and shared the pledge with a work colleague who lives on the other side of Virginia.

Now that they generate solar and drive an EV, what's next for Chris and his family? A big goal is to further electrify their home. "Currently we use a portable induction cooktop instead of our gas range as much as possible, and when it's time to replace our gas furnace and hot water heater, we will do so with electric heat pump versions. For electricity, I love to be at net zero." Chris has been motivated to take climate action since he was younger, when he was sobered after seeing the films "An Inconvenient Truth" and "The 11th Hour."

Ambassadors like Chris who are demonstrating clean energy actions and talking about them with others demonstrate peer influence. Their community of friends and colleagues can talk to them directly about the energy-efficient decisions they made, why, and what their experience and cost savings are. Ambassadors build on Generation180's mission to inspire and equip others to take action.



## Word of Mouth

Automaker Tesla has been a perfect test case for the power of peer effects on car buyers. The company is notorious for avoiding traditional marketing and advertising, but it still outsells all other EV brands, in part because Tesla owners love to convert people they know into EV drivers.<sup>26</sup> In a study involving 5,000 purchasers of Tesla's all-electric Model 3 sedan, 99% of the participants were satisfied with the car and were willing to recommend it to friends and family.<sup>27</sup> In Hawaii, researchers found that for every 26 Tesla EVs sold in a ZIP code, the peer influence of just seeing the vehicles in the vicinity generated at least one additional Tesla sale.<sup>28</sup> "What we're seeing is that word of mouth is more than enough to drive our demand in excess of production," observed Tesla CEO Elon Musk.<sup>29</sup>

Largely because people have enjoyed their interactions with EV owners, more and more carmakers are capitalizing on word-of-mouth sales. At the 2019 Los Angeles Auto Show, the CEO of Mercedes-Benz USA said: "It's a question of experience. I think it's getting cars on the road and having people speak of their experience positively."<sup>30</sup> Similarly, GM's president has acknowledged that, "[w]ord-of-mouth will be critical" to increasing the demand for EVs.<sup>31</sup>

CHEVROLET BOLT / CHEVROLET MEDIA SITE



**Chuck and Beth Huber**  
Westminster, MD

CHEVROLET VOLT PLUG-IN HYBRID, CHEVROLET BOLT

**"There is no question that [our neighbors] definitely put us on the path to full electrification with the introduction to hybrid vehicles."**

In 2013, Chuck and Beth were in the market for a new car and were contemplating hybrid technology. Their neighbors, Paul and Claire, who drove a Toyota Prius and a Chevrolet Volt, suggested that they take the two cars for a test drive. That's all it took – Chuck and Beth wound up purchasing a plug-in hybrid Volt, which they loved and owned for about four years before buying a fully electric Chevrolet Bolt in 2017. Paul and Claire were a trusted source of information for the Hubers, and Beth also had access to EV charging at her place of work.

Beth was the main driver of their first EV, the Volt. She had the longest commute (around 52 miles round-trip), and was able to charge the car for free during the work day. The Volt was mostly a commuter vehicle, and although it had a 45-mile electric range with an eight-gallon reserve tank for gas, the Hubers almost never needed to gas it up. "We loved seeing how far we could get without having to put a tank of gas in it – at one point we traveled 8,500 miles before we had to refill.

In 2017, the Hubers added the all-electric Chevy Bolt to their life because Chuck was impressed with the vehicle's range (236 miles on a full charge). It was a smooth transition from a plug-in hybrid to a full EV. By this time, Chuck's workplace had also added charging stations. Although the chargers weren't free (he had to pay 10 cents per kilowatt-hour), the Bolt's range, plus home charging, meant he didn't need to use them often. Chuck learned which of his colleagues also drove EVs, and they quickly established a work email group to notify one another when they needed to charge their cars or when a charger was free.

A number of factors motivated the Hubers to drive electric. Initially, it was their neighbors and the fluctuating price of gas, but Chuck and Beth also wanted to reduce tailpipe emissions. Free charging at Beth's workplace was another key incentive. "We bought the smallest and most fuel-efficient vehicle that would meet our needs." The Hubers have been tremendously pleased with how low-maintenance their Bolt is. "It's been a great vehicle, and at 74,000 miles, we are not ready to part with it. It's our default vehicle – we drive it as much as possible."

Chuck and Beth have driven their Volt (and now Bolt) to family get-togethers, plugging in along the way and answering questions about the vehicles. In the last few years, Beth's nephew and brother-in-law have both become EV owners. Chuck also participates in Drive Electric Events, sharing his EV experience with others, and has presented to students in Paul's class on environmental sustainability. Chuck says he's most often asked about EV range – a question he's happy to answer, based on his own driving experience.



## Social Media Influence

Social media can be a powerful tool for peer influence. Despite its recent growth, the EV marketplace remains nascent, attracting only a small fraction of interest among auto consumers. However, it's a different story on X (formerly Twitter). Across the social media platform, early adopters of EVs are not only driving the EV conversation among "the converted," but they're making EVs more attractive to mainstream audiences. In a survey of X/Twitter users, 60% of respondents said they've seen tweets about EVs, and more than half of respondents reported that seeing more EV tweets in their feeds is making it easier to picture themselves driving one.<sup>32</sup>

The challenge remains of bridging the gap between a person's expressed interest in testing or buying an EV and their actual following through with the purchase. But as more models come on the market and as more people "know someone (or know someone who knows someone)" who has an EV, this will quickly change.<sup>33</sup> Researchers note that, in contrast to household solar, "the network effects for [plug-in hybrid EVs] are not confined to the residential location."<sup>34</sup> EVs are mobile, extending their visibility beyond the home to where one shops and works. Watching more of our neighbors zipping to work or to the grocery store in their clean energy vehicles – and talking to them about their experiences – will make more of us want to go electric.<sup>35</sup> And if you're already a proud EV owner, you're more valuable than you think: just keep singing the praises of your silent ride, and you may soon see all your neighbors plugging in.<sup>36</sup>



## Vince Bowers and Pamela Jacobson Bowers

Virginia Beach, VA

TOYOTA PRIUS PRIME PLUG-IN HYBRID

**"It's a modern vehicle with a lot of bells and whistles, low maintenance, and practically drives itself."**

Pamela started driving a Toyota Prius in 2006. In November 2022, she switched to a Prius Prime plug-in hybrid. Since the purchase of the Prime, she's driven just over 4,500 miles and has used only 30 gallons of gas. Pamela and Vince's ultimate goal is to switch to an all-electric vehicle. Pamela was motivated to drive electric after being raised in New York by a mom who taught her to be environmentally conscientious. Pamela is an avid recycler and is conscious of her carbon footprint, aiming to reduce her reliance on oil and other non-renewable resources.

As Virginia Beach residents, Pamela and Vince are increasingly aware of flooding and sea-level rise in their own backyard. Vince was a Navy pilot and admits he burned a lot of gas, which he was aware of at the time. He now works for Lynnhaven River Now, a non-profit environmental group focused on restoring and protecting clean waterways, and he volunteers with the Chesapeake Bay Foundation and the Virginia Conservation Network. Both Vince and Pamela "want to do their part to help Virginia become a more sustainable state."

After purchasing the Prius Prime, Pamela routinely posted on Facebook about how much she loved the EV, updating her network of friends and family on the vehicle's fuel efficiency (which averaged more than 174 miles a gallon before they took their first long road trip out of town). Shortly after Pamela bought her plug-in hybrid, her brother Paul totaled his car. A resident of Los Angeles, Paul is an actor and delivers for DoorDash on the side. Even before the accident, the siblings had been talking about Pamela's Prius and how charging works, so it didn't take much convincing for Paul to buy the same vehicle.

Pamela and Vince love how quiet their car is. Even though it's a hybrid, they don't use much gas – almost all their driving uses the electric-powered battery. "Gas mileage is the top thing that gets people to listen – it's eye opening," said Pamela. "Low maintenance is another catching point," said Vince. In addition to driving electric, the couple have replaced their stove with an electric model, invested in an electric chainsaw and grass trimmer, and plan to buy an electric lawnmower. "My EV purchase and home upgrades happened in succession. When I bought into the realities of climate change, I tried to do as much as I could all at once," said Vince.

TOYOTA PRIUS / TOYOTA MEDIA SITE



## Increasing Peer Influence

To increase peer influence around clean energy, it is important to invest in first movers and to grow ambassadors, networks, and communities of champions and messengers. For behaviors that seemingly have high upfront costs, such as installing solar panels or buying an EV, people may be more likely to follow suit when they've had an opportunity to talk with existing owners of those technologies. Research suggests that friends and family are often among "the most trusted sources of information," and that policies, financing options, and programs that seek to promote low-carbon technologies "may benefit from enlisting the help of peers who have already adopted them."<sup>37</sup>

Mobilizing people at the necessary scale and pace requires tested solutions and telling compelling stories about successful experiences with clean energy technologies – and painting a positive vision of a clean energy future. Rather than a story of austerity, sacrifice, or impending catastrophe, this story is about solutions, reinvention, innovation, and opportunity: the power of Americans coming together to create change.



HYUNDAI KONA / HYUNSAI MEDIA SITE



**Lisa Frank**  
Hyattsville, MD

HYUNDAI KONA

**"My EV has great range, so even though we're a one-car household, we can still do a lot of exploring. It's also a treat to drive, and tax credits for used EVs made it much more affordable for us."**

Lisa and her wife rely mainly on walking, biking, and public transportation to get around. In May 2023, they purchased their first car since 2016 – a used Hyundai Kona EV – because they wanted a clean energy car for short shopping trips and to run errands, and for slightly longer road trips to the mountains and coast. Lisa's motivation for going electric was "doing my part for the environment and our climate, plus not needing to buy gas. Simpler maintenance was another bonus." Currently, the couple is set up for Level 1 charging at home, and they access fast chargers in their neighborhood and during road trips.

The Kona was the cheapest of the EV options the couple considered, and they were able to use the \$4,000 tax credit available through the Inflation Reduction Act for purchases of used EVs. Before taking the leap, Lisa referenced Environment America's Used EV Buyers Guide and the relevant IRS guidance to make sure they were getting a qualifying EV and had the documentation needed for the rebate. The Kona has a range of more than 300 miles in some conditions, as well as good trunk space for a small SUV. However, finding the vehicle in their home state of Maryland was a challenge, so they ended up having their Kona shipped from a dealership in New Jersey (which ranks fifth in the U.S. for EV sales, and has provided state incentives to support EV adoption).

Lisa spends much of her day influencing others to go electric – both at work and among her peers. Through her job at Environment America, she collects and shares stories of members of Congress who drive EVs or have taken other steps to shift to a clean energy home. Elected officials have a large audience, and it's important for them to both hear from others who have taken these actions and to share their stories with their constituents.

Having heard about Lisa's experience, her parents are considering making their next car an EV, and she has helped advise and encourage them along the way. They live in Oregon and currently drive a 23-year old Toyota Camry for long distances and a hybrid Prius for their in-town and shorter trips. As her parents research the options, they're looking for a vehicle that can do longer trips. In July 2023, Lisa's parents came to Maryland for a visit that included a road trip to the beach, and while they liked the Kona, they were surprised by some of the charging challenges they encountered driving home from the trip.

**"If you talk about the future, people are more likely to feel hope, respond, and take action."**

**Naming the problem has its place, but selling the ending – the future we can achieve together – is where the change is likely to come."**

Harmony Labs<sup>38</sup>



LISA FRANK CHARGING AT THE HYATTSVILLE POLICE STATION, A FULL CHARGE FOR \$20 WHILE SHE HAS A MEETING AT A LOCAL COFFEE SHOP

# Trends in U.S. Electric Vehicle Sales



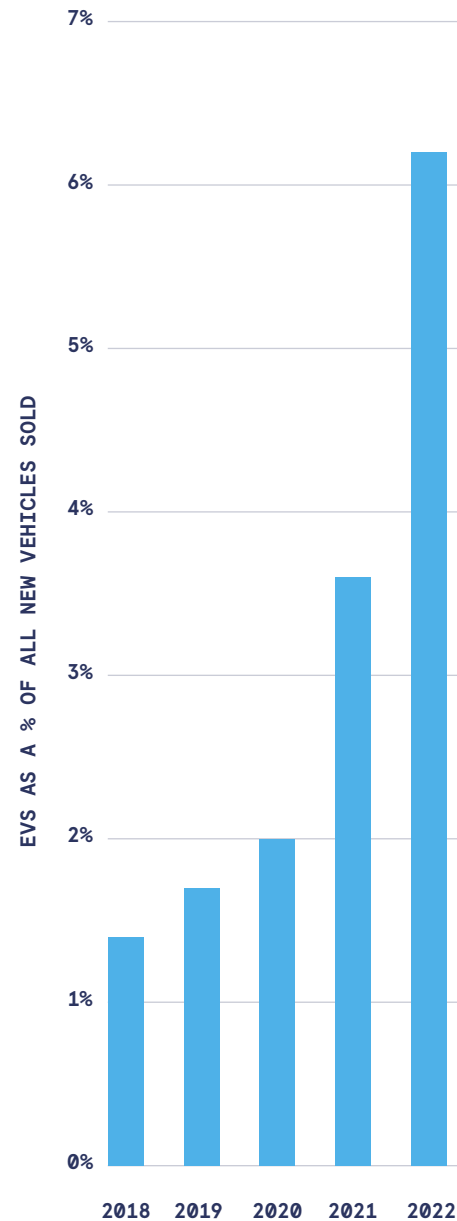
**Electric vehicles are having a moment.** According to the market research firm S&P Global Mobility, EV sales in the U.S. increased by two-thirds in 2022 to account for 6.2% of all new retail vehicles sold (SEE FIGURE 1).<sup>39</sup> This is up significantly from the 3.6% market share in 2021.<sup>40</sup> The recent growth in EVs is even more remarkable given that overall U.S. auto sales (of all vehicle types) fell 8% in 2022.<sup>41</sup>

Automakers sold a total of 807,180 fully electric vehicles nationwide in 2022.<sup>42</sup> Consumers looking to purchase an EV now have a wide range of options – not just plug-in hybrid sedans and hatchbacks, but also new, powerful electric truck and sport utility vehicle (SUV) models. More options are becoming available monthly, as the number of companies introducing their first EV offering continues to grow.<sup>43</sup>

Tesla still sells more than 6 out of every 10 EVs registered in the U.S.<sup>44</sup> But electric vehicle choice is expanding. In the first quarter of 2022, potential buyers had 34 EV models to choose from.<sup>45</sup> A year later, by early 2023, the number of choices had jumped to 42, and the EV options available on the market were expected to expand in every quarter of the year.<sup>46</sup>

Choice is an important factor in EV adoption, considering that consumers looking to buy a gas-powered vehicle in 2022 were able to select from around 625 different options.<sup>47</sup> In contrast, EV shopping can be challenging: a survey of more than 2,000 car shoppers in late 2022 found that only 3 out of 10 respondents were able to find an EV that “works for them,” based on price, vehicle type, and other factors.<sup>48</sup> The expansion in EV model choices over the next decade – projected to reach 151 options in 2025, and 327 by 2033 – is expected to meet a wider range of consumer needs and thus accelerate adoption.<sup>49</sup>

FIG. 1  
Electric Vehicle Sales as a Share of All New Vehicles Sold in the U.S. 2022



SOURCE: S&P GLOBAL MOBILITY, 2022

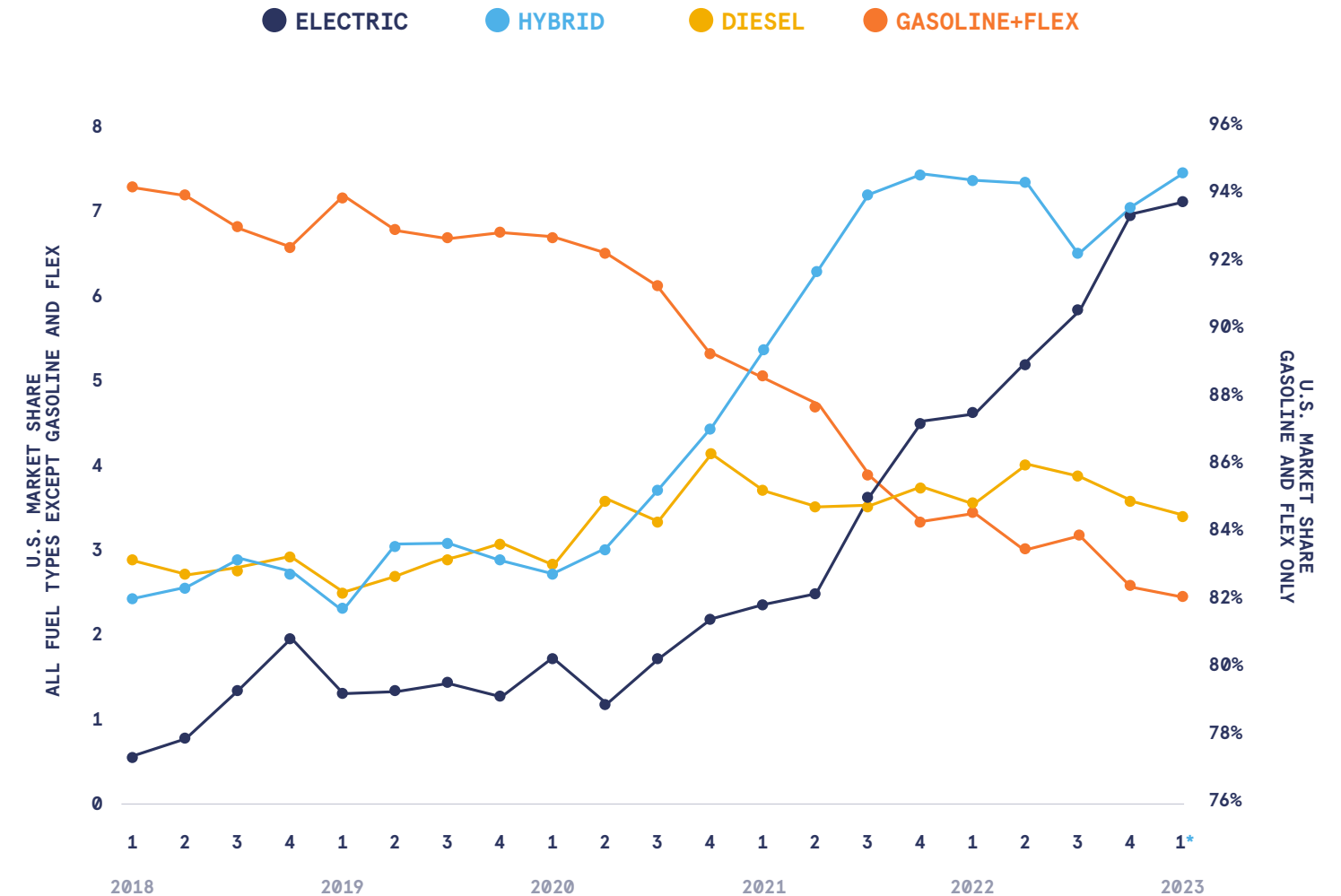
Although overall market shares of gasoline and flexible-fuel vehicles are falling, shares of hybrid electric and fully electric vehicles are rising noticeably (SEE FIGURE 2).<sup>50</sup> However, gas-powered transport still dominates the market by far. In the fourth quarter of 2022, gasoline and flex-fuel vehicles accounted for 82.5% of the total market share, while hybrids represented 7% and fully electric vehicles 6.9% (the rest were diesel-powered vehicles).<sup>51</sup>

Q4 2022

GASOLINE + FLEX	82.5%
HYBRID	7.0%
ELECTRIC	6.9%
DIESEL	3.6%

LOW-VOLUME FUEL TYPES WERE INCLUDED IN THE CALCULATION BUT EXCLUDED FROM THE CHART

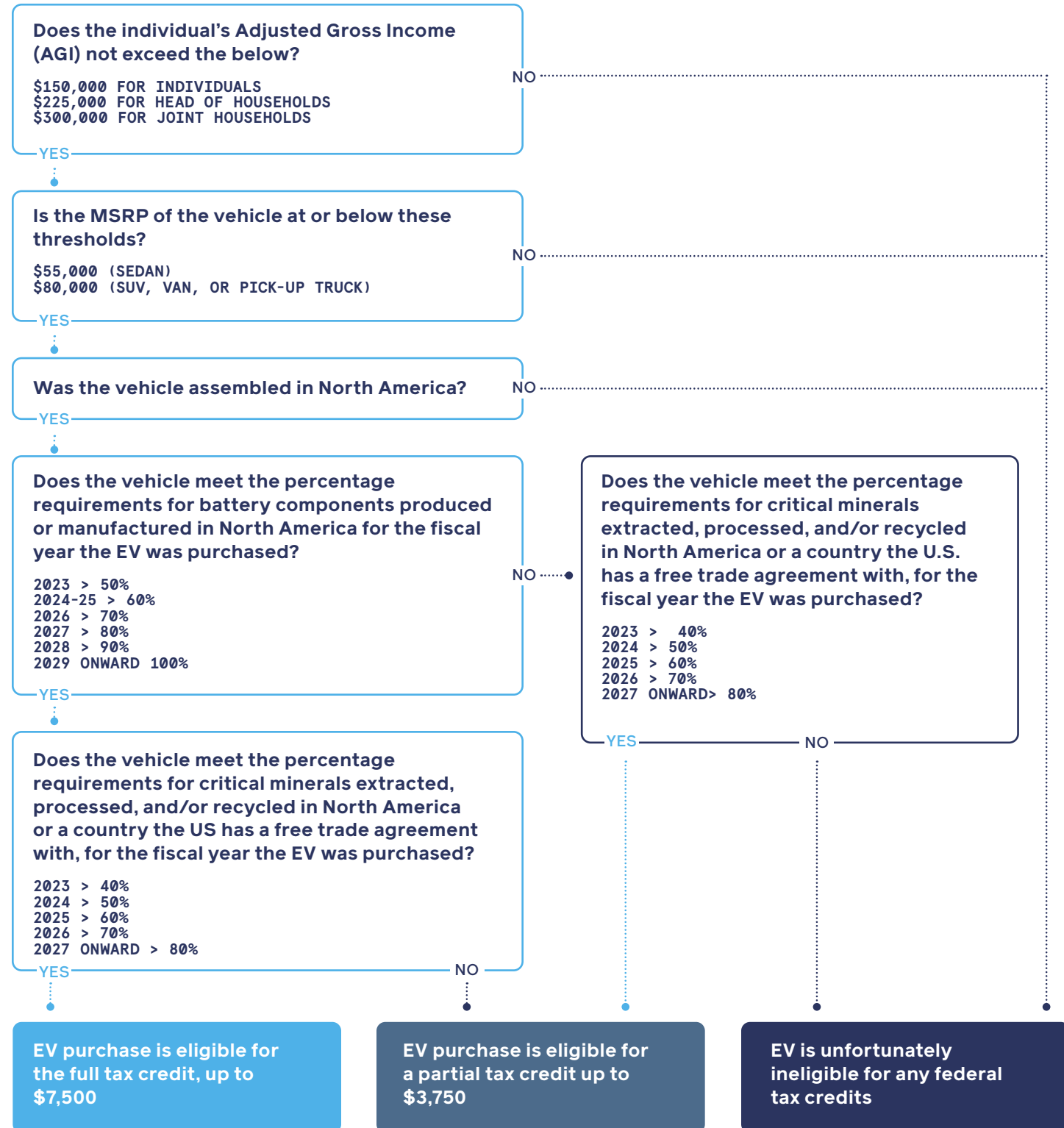
FIG. 2  
Fuel Type Market Share Total Industry by Quarter



SOURCE: S&P GLOBAL MOBILITY, 2022 / REGISTRATION TYPE: TOTAL \*Q1 2023 INCLUDES JAN AND FEB 2023 ONLY

**FIG. 3**  
**EV Tax Credits Demystified:**  
**A Clear Path to Savings**

**When purchasing a new electric vehicle, will it qualify for the full federal tax credit of up to \$7,500?**



Government incentives for purchases of both new and used electric vehicles are expected to have a dramatic impact on EV adoption (SEE FIGURE 3). For example, under the 2022 Inflation Reduction Act, U.S. consumers can receive a \$4,000 tax credit for purchasing a used EV sold for under \$25,000 and up to a \$7,500 tax credit for qualifying new vehicles.<sup>52</sup> Industry forecasters expect that the growth in EV sales will outpace growth in overall auto sales for the foreseeable future.<sup>53</sup>

Despite these trends, the rate of EV adoption varies widely by state and region. A handful of states dominate in EV registrations, including California, Florida, and Texas (SEE FIGURE 4).<sup>54</sup> Within these key states, it is possible to identify which specific geographic regions (or “designated market areas,” DMAs) are leading in EV adoption. As of mid-2023, less than 10 of U.S. DMAs were boasting double-digit EV market shares. Analysis of specific DMAs is provided starting on page 34.

**FIG. 4**  
**Electric Vehicle Registrations by State**  
 2022

Source: US, Dept. of Energy, Alternative Fuels Data Center, <https://afdc.energy.gov/data/10962>

Only all-electric vehicles; plug-in hybrid electric vehicles (PHEVs) not included. Updated July 2023



Starting in Jan. 2024, electric vehicle buyers will be able to receive purchase incentives at the point of sale (dealer) according to new guidance from the US Department of Treasury. Additionally, some States offer an additional purchase incentive making electric vehicles even more accessible.<sup>55</sup>

# Trends in Electric Vehicle Ownership: Demographics and Motivations

A variety of factors influence who is likely (or not) to purchase an electric vehicle in the U.S. Research indicates that EV owners are most likely to be middle-aged Caucasian men who are college graduates, earn more than \$100,000 annually, reside in urban areas, and own at least one other car.<sup>56</sup> In other words, most EV owners are older, have higher incomes, and live in cities.<sup>57</sup> While these demographics accurately represent the likeliest early EV owners, less-well-known factors also characterize EV adopters. For example, drivers who are confident that EV infrastructure will be swiftly built are more likely to purchase and drive an EV than those who are less confident.<sup>58</sup>

A Consumer Reports survey found that some groups of Americans are more likely than others to buy or lease an EV as their next vehicle. These include males, younger adults, those with a higher education, those with a higher household income, and residents of urban areas.<sup>59</sup> Another poll revealed that people living in the western U.S. and college graduates are more likely than their counterparts to report that they currently own an EV, are seriously considering buying one, or might buy one in the future.<sup>60</sup> This consumer alignment – where wealth seems to track toward clean energy and fuel savings – shows the importance of collaboration on solutions that allow for greater awareness and access for all. In a 2022 survey, when asked what factors would make them consider an EV, 33% of respondents cited the lower cost to charge an EV than to refuel a gas car, 31% cited the lower lifetime costs, and 28% cited the lower maintenance costs.<sup>61</sup>

Who isn't into EVs? So far, the majority of American buyers – although this is evolving rapidly. Overall, a survey reported that 76% of new-vehicle shoppers are “not ‘very likely’” to consider purchasing an EV, with the most frequently cited barriers being the upfront cost and concerns about charging infrastructure.<sup>62</sup> Based on one study, the population least likely to consider an EV is people born before 1965 (Boomers and the Silent Generation).<sup>63</sup> In another survey, 43% of U.S. adults said they might consider buying an EV in the future, but 41% unequivocally said they would not.<sup>64</sup>

In total, around 4% of Americans owned an EV in 2023, and another 12% were “seriously considering” purchasing one.<sup>65</sup> However, as the number of models on the market expands, and with the release of new electric pick-up truck options, EVs will increasingly appeal to a wider diversity of shoppers.<sup>66</sup> Generation Z (born between 1995 and 2004) is seen as “the future of the marketplace,” and as more Gen Zers mature into adulthood and start to buy cars of their own, this is likely to drive a large uptick in EV purchases.<sup>67</sup> Surveys already reveal that 69% of people aged 18-34 in the U.S. either currently own an EV or “might consider” purchasing one in the future.<sup>68</sup>

Acceptance of EVs is growing rapidly. In 2022, the share of shoppers who say they are “very likely” to consider an EV for their next purchase or lease climbed to 24%, four percentage points higher than a year prior.<sup>69</sup> A variety of changes in the coming years – from new generations growing up, to lowered EV costs, to federal funding for chargers – will aid the expansion of EVs across a greater and more diverse share of the population. In addition, as this report confirms, the peer effect will strengthen. As more people see their family, friends, and neighbors purchasing EVs, the more likely they will be to buy one too.

CHRIS MAXWELL FIRST BOUGHT A SMART FORTWO ELECTRIC DRIVE CABRIOLET IN 2016, NOW WITH 60K+ MILES ON IT.



# Addressing Barriers to Electric Vehicle Adoption

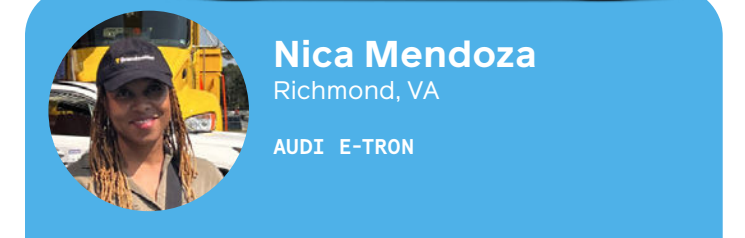
As with any new technology, electric vehicles still face barriers to their adoption. The most common concerns voiced by consumers considering an EV purchase include the upfront cost, the availability of the product, access to charging, range anxiety, and a lack of knowledge about the vehicle.

## Upfront Cost

The relatively higher upfront cost of an EV, as well as consumer perceptions of the costs, prevent many people from accessing the benefits of electrified transport. However, EVs have gradually become less expensive in recent years due to growing market competition, as more models are released.<sup>70</sup> Experts expect EVs to reach cost parity with gas-powered cars between 2024 and 2026.<sup>71</sup> Additionally, tax rebates and incentives offered to many qualifying new and used EV purchases through the Inflation Reduction Act will help reduce upfront costs and put EV costs more on par with gas-powered vehicles. Meanwhile, reductions in battery costs are making EVs more affordable by each model year.<sup>72</sup>

Despite their (currently) higher upfront costs, EVs save drivers money over the long run. A study by Consumer Reports found that EV owners spend half as much to repair and maintain their vehicle as owners of gas-powered vehicles.<sup>73</sup> The analysis found that, for the most popular EVs that sell for under \$50,000, drivers end up saving around 60% in fuel costs.<sup>74</sup> **Owning an EV can save typical drivers \$6,000 to \$12,000 over the vehicle's life time, compared to owning a comparable gas-powered vehicle.**<sup>75</sup> Federal tax credits linked to the Inflation Reduction Act can save consumers as much as \$1,100 in the first year of ownership.<sup>76</sup> No oil changes and fueling at home also reduce costs and some need for scheduled errands.

Individuals in low- to moderate-income communities in particular could benefit from EV technology. Often, these individuals spend a greater share of their income on transportation (and specifically on vehicle ownership) because they own older and less-efficient vehicles, with higher fuel and maintenance costs. Through the Inflation Reduction Act, the federal government is offering many new tax credits for more affordable EVs, both new and used. Car-dependent low-income communities have the most to gain from these potential cost savings.



**“I began going electric in 2017, I started with solar, then added a car. It benefits me and my family plus has an impact on the environment – [these actions] represent me.”**

Nica recently finished her master's degree in branding and experience design at Virginia Commonwealth University. Before that, she served in the U.S. Air Force, became a mom, completed a fine arts degree at Columbus State University, and worked for non-profits.

Before buying her Audi e-tron in 2022, Nica did a lot of online research and also spoke to other EV owners. She wanted to learn about range – getting from point A to point B – and to figure out which EV was the right fit for her and her family. She also looked into cost – not only the upfront cost of the EV, but also how owning the vehicle would affect her electric bill. Vehicle maintenance was a big factor as well. Ultimately, what drove Nica's decision to go electric was “finding alternative ways to live free from fossil fuels.” Nica's charges her Audi mainly at home, using electricity generated from solar panels she installed on her house.

At Generation180's Ask an EV Owner panel in 2022, Nica was able to connect with fellow EV owners and ask questions. She was inspired to join Generation180's EV Ambassador Network, where she can spread awareness and influence others to learn more about EVs, share this information with friends and family, and ultimately go electric.

## Product Availability

Despite the many benefits that EVs offer, availability issues can make it difficult for consumers to make the switch to electric. The availability of EV models at dealerships fluctuates, preventing many potential buyers from exploring and test-driving the options. Manufacturers determine the overall distribution of EVs nationwide, prioritizing states that have policies that support an EV market. These include, in particular, the 15 “zero emission vehicle” (ZEV) states that have adopted Clean Car Standards.<sup>77</sup>

A 2019 Sierra Club report found significant nationwide differences between ZEV and non-ZEV states in the overall inventory of EVs in stock.<sup>78</sup> Non-ZEV states had much less inventory, with more than 78% of the auto dealerships in those states having no EVs on their lots.<sup>79</sup> Individuals are nearly three times more likely to purchase an EV if they have even just ridden in one before.<sup>80</sup> Therefore, if a dealership has limited or no EVs available to test drive, a consumer is far less likely to make the switch to electric.



**Chris Maxwell**

Raleigh, NC

SMART FORTWO  
AUDI E-TRON  
PLUS ELECTRIC MOTORCYCLES

“Having grown up in the Southern Baptist church, I remember the saying ‘your actions always speak louder than your words’. For me, that also applies to driving electric.”

Chris grew up in a lower-middle-income family in Tennessee, with a background in diesel repair. As an adult driver, he was able to save money by getting 50 miles to the gallon on a single tank of diesel. In 2016, Chris was driving a converted biodiesel Volkswagen that qualified for a buy back, so he was in the market for a new vehicle. Around that time, his best friend Brad called him up to tell him he’d just bought an electric Nissan Leaf. Brad was a military spouse, living on the base in Fort Bragg, NC, and he was able to save money by being able to charge the car for free, helping his family’s budget go farther. When Brad visited Chris in his new Leaf, Chris didn’t think it was an attractive car, but he was sold on its acceleration and driving quality – as well as its \$10,000 price.

That April, when Chris started looking for another car, he was only commuting 12 miles a day round-trip. He was getting ready to buy a Leaf, but when he discovered the Smart fortwo electric car, he preferred its small size, which allowed for easy parking at NC State University, where he was taking classes. There weren’t any Smart cars in his area, so he purchased the vehicle in Maryland and drove it home from there. He and his partner initially used a regular 110-volt house outlet for charging but later upgraded to a 240-volt charger. They also added rooftop solar to their home to enable free charging, generated by the sun.

Chris and his partner now own a 2019 Hyundai Ioniq (124 mile range), a 2020 Audi e-tron, and two electric motorcycles. He’s put 20,000 to 40,000 miles a year on his cars (with lots of out of state travel) and has visited all 42 NC state parks with an electric vehicle or motorcycle. On a recent road trip to Texas, Chris used 24 Electrify America charging stations in seven different states. He says he spends time planning where he’ll charge for his road trips, and that charging stations can sometimes prove challenging and slow – but he’s always gotten where he needs to go.

Since Brad convinced Chris to go electric in 2016, Chris has sold a dozen or more people in his own circle on EVs. Being conservative with money himself, he’s found that cost savings is what grabs people’s attention and gets them to listen when he’s talking about EVs. He sees his friends spend \$200 in fuel, while he spends \$40 for the same trip. EVs are also very low maintenance – he takes his car in once a year for service and has only needed to replace filters and wiper blades. He’s never had to replace a battery and loves the quiet and regenerative braking that EVs offer. He’s also motivated by health concerns (he was asthmatic as a child) and will do anything he can to contribute to fewer bad air quality days.

Chris has participated in the EV Challenge at NC State, maintains a blog on his adventures ([Ecodweeb](#)), and is always sharing his experience driving EVs with his friends. He goes above and beyond to get his friends to drive EVs, taking them on test drives, finding the right car for their situation, and helping them with the purchase. Once, Chris was helping a fellow Audi driver he’d just met use Audi credits at a local charger, and the guy recognized Chris from one of the many videos he’d posted on Instagram about his car. The guy said, “hey, you’re ‘eco dweeb’ – you’re the reason I bought this car because you live in my area. Now that you’ve shown me how to make charging work, I’m not worried about my trip.”

— SMART FORTWO / ADOBESTOCK



## Charging Infrastructure

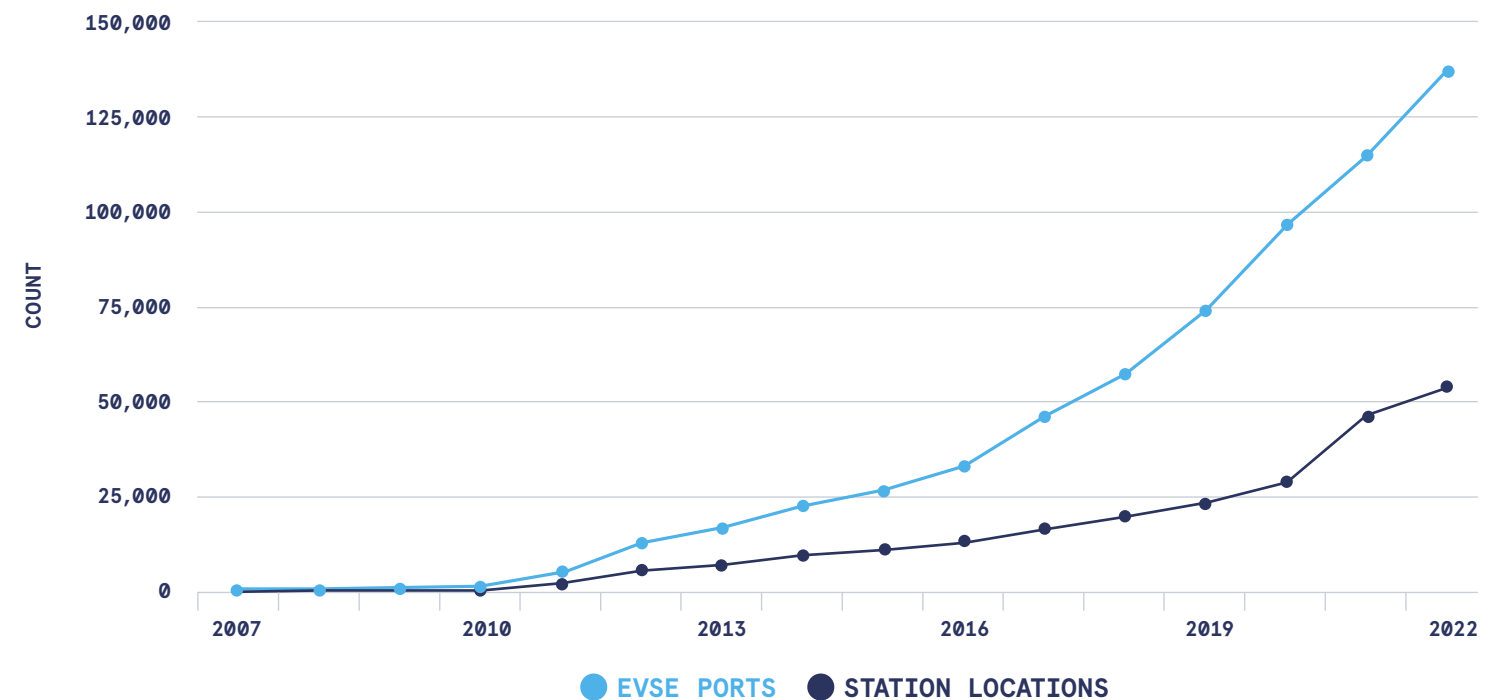
A lack of charging infrastructure has remained one of the top reasons why people are reluctant to buy an EV.<sup>81</sup> When surveyed by Consumer Reports, “charging logistics” was the number one barrier for 61% of respondents.<sup>82</sup> EV adoption would undoubtedly increase if more homes, workplaces, and public spaces had EV chargers. For instance, homeowners are more likely (27% of respondents) than renters (17%) to consider purchasing an EV.<sup>83</sup> Not only are homeowners more likely to be able to afford the initial upfront cost of the vehicle, but they are more likely to be able to install a charger on the premises.

Although the private sector is taking strides to expand the nationwide charging network, the government has much broader influence over, and access to, the charging system. As of 2023, more than 163,000 charge ports at 61,000 locations were available across all U.S. states (SEE FIGURE 5), with plans to add many more.<sup>84</sup> The federal government has enacted sweeping legislation to promote both public and private charging. The National Electric Vehicle Infrastructure (NEVI) Formula Program, created under the 2021 Bipartisan Infrastructure Law, will distribute \$5 billion from 2022 to 2026 to expand the nation’s network of EV chargers and infrastructure.<sup>85</sup>

Given the limited number of public fast chargers in the national network, both the public and private sectors need to be responsible for building it out. Having chargers every 50 miles on some highways will be a start. For greater charger visibility, additional programs will be needed for homeowner access (such as the \$1,000 tax credit) as well as community and workplace charging (such as the \$100,000 tax credit or utility funds).



**FIG. 5**  
**U.S. Public Electric Vehicle Charging Infrastructure**



SOURCE: ALTERNATE FUELS DATA CENTER, “U.S. PUBLIC ELECTRIC VEHICLE CHARGING INFRASTRUCTURE,” ALTERNATE FUELS DATA CENTER, APRIL 2023, [HTTPS://AFDC.ENERGY.GOV/DATA/10972](https://afdc.energy.gov/data/10972).

## Range Anxiety

The growing pains of robust charging networks, as well as misconceptions about the range and power of an EV, have led many consumers and drivers to feel an emotion called “range anxiety.” Potential EV owners are concerned about “running out of fuel” due to the gaps or lack of awareness of readily accessible charging stations. Two pieces of federal legislation – the Inflation Reduction Act and the 2021 Infrastructure Investment and Jobs Act – designate millions of dollars in programs, including large tax credits and \$7.5 billion in Department of Transportation funding to install 500,000 EV chargers nationwide by 2030.<sup>86</sup> The goal is to make charging convenient, affordable, reliable, and accessible to every American.

The average American drives just over 38 miles per day; this suggests that for nearly all daily travel needs, the driving ranges of EVs currently available on the market are more than sufficient (averaging 196–216 miles per charge).<sup>87</sup> Misconceptions regarding the range and power of EVs can be attributed to a lack of consumer awareness – a widespread challenge facing the EV transition.

**“Everyday suburban people can do it. It’s an everyday family car that is within reach. People pay the same amount for SUVs in my neighborhood. It’s in the realm of cost where I live.”**

**Helena Von Rueben**  
Midlothian, VA



**Helena von Rueden**

Midlothian, VA

CHEVROLET BOLT

In 2022, Helena became an electric vehicle owner, then quickly became a Generation180 EV Ambassador. Her decision to purchase an EV was influenced by multiple factors. During a sabbatical in Europe, she witnessed the availability and viability of electric transportation options, which sparked her interest. Upon returning to the U.S., she faced a long work commute – 300 miles a week for around 25 weeks a year – and needed to replace her existing vehicle.

Helena’s primary concern was EV range. However, she found a 2023 Chevrolet Bolt that offered the mileage she needed at a price point that worked. The high gas prices at the time motivated her to overcome any reservations she had about transitioning to an EV. Additionally, she felt guilty about driving a gas-powered car and wanted to reduce her environmental impact. With two young daughters, she is worried about what the world will look like in 50 years. “I do hope everything has gone electric by then, and also that the problems with mining the necessary minerals for these cars have been fixed.”

Helena enjoys talking about her EV experience. She describes the Bolt as feeling “like a spaceship and a toy,” which naturally generates curiosity among her friends. People often inquire about the tax incentives associated with EVs. She believes that cost is a significant factor that holds people back, even though EVs can be comparable in price to basic luxury cars. Her friends and neighbors are aware of her EV ownership and enjoy learning about her experience.

Helena has an interest in clean energy that extends beyond owning an EV. She has evaluated her home for solar power twice, although installing solar would be challenging due to numerous trees. However, she’s made other energy-efficient upgrades, such as replacing her windows and the existing heat pump. She’s noticed that people tend to switch to clean energy options when their current systems need replacement.

While Helena hasn’t yet influenced close friends and family, she enjoys talking about her EV experience and has had conversations with others about the pros and cons of driving electric. Becoming a Generation180 Ambassador was driven by her personal concerns about climate change, her desire to learn more about electrifying transportation, and her belief that everyday people can adopt EVs. She is actively involved in spreading awareness in her community and wishes to make this information more accessible to others.



CHEVROLET  
BOLT /  
CHEVROLET  
MEDIA SITE



**Robbi Walls**

Charlotte, NC

NISSAN LEAF (LEASED)  
CHEVROLET BOLT

**“I am an ambassador for Plug-In NC. I attend events, where I often bring my car and talk about EVs.”**

Robbi began exploring electric mobility in 2015, when her friend Valerie introduced her to the benefits of electric cars. Valerie’s excitement and satisfaction with her newly purchased Nissan Leaf sparked Robbi’s interest, and she became intrigued by the idea of driving an EV herself. After test-driving Valerie’s Leaf to experience it first-hand, and asking a lot of questions, Robbi leased her own Leaf for three years, which opened her eyes to the world of electric driving. She was especially impressed by the lack of maintenance compared to a traditional gas-powered vehicle, with no oil changes or belt replacements.

In February 2020, Robbi began leasing a Chevy Bolt, which she eventually came to own. With the Bolt’s extended range, she was able to travel up to 250 miles or more on a single charge, which granted her newfound freedom and flexibility to drive from Charlotte to the beach without experiencing range anxiety. While Robbi continued to embrace her electric driving experience, her friend Valerie faced challenges due to a deteriorating battery and a frustrating customer service experience, ultimately opting to use a hybrid vehicle instead. Robbi remains dedicated to advocating for EVs, and she hopes to help Valerie overcome her negative experience (noting that “it can happen with any vehicle type”) and rekindle her interest in EVs.

Robbi is involved with local sustainability organizations and is an ambassador for Plug-in NC, providing her with a platform to engage in meaningful discussions about clean energy and EVs. By participating in events and showcasing her own EV, she actively bridges the gap between discussing clean energy topics and inspiring others to take action. Robbi has also installed solar panels on her house and participated in a city-wide tour conducted by Solar United Neighbors. A retiree from Duke Energy, she is familiar with the benefits of energy rebates and incentives and used them to upgrade a pool pump and HVAC unit to more efficient alternatives. Robbi’s journey highlights the importance of fostering positive experiences



NISSAN LEAF /  
NISSAN MEDIA  
SITE

## Consumer Awareness

Lack of awareness about EVs and their benefits remains a significant barrier to broader and speedier EV adoption. According to J.D. Power’s U.S. Electric Vehicle Consideration Study, 30% of people who said they would not purchase an EV attributed their reluctance to “a lack of information” about the vehicles. The survey also noted that “firsthand experience with EVs plays an important role in purchase consideration.”<sup>89</sup> Ultimately, an EV-informed consumer is more likely to consider an EV. To promote adoption, automakers need to increase their efforts to educate shoppers about EVs and their benefits.

Despite the need for better information, automakers continue to struggle with EV consumer awareness and understanding. For example, a 2021 study alarmingly found that 69% of EV shoppers were unsure if Chevrolet even made an EV, even though the wide-selling all-electric Bolt model was first launched in late 2016, and the Volt was introduced in 2010.<sup>90</sup> Similarly, 63% of EV shoppers were unsure if Nissan offered an EV, despite the Nissan Leaf being on the U.S. market for more than a decade.<sup>91</sup> Even more remarkably, 17% of EV shoppers were unsure if Tesla, an all-electric manufacturer, offered an EV.<sup>92</sup> Providing more EV options at dealerships, and generally improving the visibility of the vehicles, would lead to greater awareness among consumers – and thus to higher EV adoption rates.



ROBBI AND HER HUSBAND WITH THEIR BOLT 1

# Ensuring Equity in Electric Vehicle Adoption

If electric vehicles are to make significant inroads in U.S. auto sales – and thereby make a dent in carbon emissions – then the benefits of EVs need to be available to all segments of the population. Currently, the distribution and adoption of EVs is inequitable, with much lower sales among low- and middle-income communities and communities of color.<sup>93</sup> This is the case even though EVs help to address important environmental health concerns that disproportionately impact these communities, including air quality and noise pollution, in addition to EVs having lower lifetime and operating costs.

Ensuring equity in EV adoption requires actions ranging from improving the EV selection at car dealerships to thoughtfully distributing charging stations, including in rural and underserved areas and rental communities.<sup>94</sup> Another key challenge is ensuring that extra and additional rebates offered for EV purchases are equitable. A 2022 report on equitable EV rebates summarized many of the barriers to learning about and accessing EVs, through the lens of rebates.<sup>95</sup> Among the main findings are:

- The high price of EVs is a major barrier for low-income communities, and many state rebates currently do not offer a large-enough amount to make the vehicles affordable.
- Lower-income, less-incorporated, or rural areas often do not have access to dealerships that can support their state's EV rebate, and dealers typically have a smaller inventory of EV options for sale.
- Small and minority-owned businesses may not have a large-enough vehicle fleet to meet certain requirements to be able to take advantage of incentives to electrify their fleet.
- Businesses may not have enough capital to pay for the upfront cost of fleet electrification, compared to competitors that may be better positioned financially and have the administrative knowledge of how to take on the added complexity of electrifying their fleet.

A variety of groups are working to advance shifts in this space by helping under-resourced community-based organizations, municipalities, businesses, and others with electrifying their infrastructure and fleets. These include [ChargerHelp](#), [EVNoire](#), and the many BIPOC / environmental justice community-based organizations

**“Peer influence can and must play a huge role in ensuring more equity in EV adoption. When people see EV owners who look like them, live in their neighborhood, or have similar driving habits, they take them seriously.”**



**Isa Gaillard**  
Greenlining Institute, TEEM  
Community of Practice Co-Lead

associated with the U.S. Environmental Protection Agency's [Thriving Communities Technical Assistance Centers](#).

Groups such as [JitneyEV](#) and [CleanAireNC](#) are working to change the narrative by securing neighborhood-level clean transportation and infrastructure wins, and elevating the well-being of the environmental justice community in this “just transition.” In Illinois, great progress has been made on the [state policy level](#) in ensuring that the benefits of electrification are intersectional and meet the real needs of grassroots communities. Warehouse Workers for Justice and the Respiratory Health Association (along with other partners) have a campaign focused on electrifying medium- and heavy-duty transportation in 12 “Dirty Dozen” counties that are in the top 9% of polluted counties nationwide.

In general, there is a growing need for equity-focused entities such as transportation demand management groups that manage first- and last-mile and active electric mobility options for disadvantaged communities – such as [Northeast Transportation Connections \(NETC\)](#) in Colorado. Although many major cities have such groups, they often are not equity focused. There is an opportunity for policy advocates to partner with and activate more local- and neighborhood-level transport demand management groups, Safe Routes to Schools Programs, transit, and other local/regional entities that provide mobility services for goods and people.

Chicago's [Community Charging](#) offers a great example of how to harness equitable, affordable, and even wealth-generating opportunities in the public EV charging space. The non-profit organization is focused on building accessible, community-based Level 2 smart charging options for city neighborhoods (especially those considered “charging deserts”) by leveraging existing infrastructure, community hosts, and the sharing economy.

## EV Demonstration Events

Demonstration events that cover a diversity of vehicle owners nationwide include [Drive Electric Earth Day](#) and [National Drive Electric Week](#). The national Drive Electric Earth Day campaign shares information about EVs throughout the month of April, with the perspective that EVs are not only better for the environment, but also more fun to drive, more convenient to fuel, and less expensive to operate than gasoline vehicles. Individuals can participate in related events to test-drive vehicles and experience driving electric. National Drive Electric Week, held annually in late September, is a nationwide celebration to raise awareness of the many benefits of all-electric and plug-in hybrid cars, trucks, motorcycles, and more.



## Toward Equitable Electric Transportation (TEEM)

Generation180 is a participant in the Toward Equitable Electric Transportation (TEEM) Community of Practice, a collaborative initiative between Forth and the Greenlining Institute that is committed to advancing equity in EV ownership and use. TEEM is a multi-year effort focused on advancing racial equity, electric transportation, and climate change goals. It is made up of more than 30 grassroots and environmental organizations, with cohorts in Colorado, Illinois, Michigan, North Carolina, and Virginia.

TEEM programs to advance equitable electric mobility include carsharing, access to charging at workplaces and in multi-unit dwellings, and influencing state and national policy. One of the group's biggest successes has been advancing equity within the State of Michigan's 2023-2024 transportation budget. A summary of TEEM's advocacy and outcomes is available [here](#). Additional programs by TEEM and Forth to expand accessibility to drivers who have traditionally faced the greatest barriers to electrification include Community Carsharing, Rideshare and Gig Drivers, and a Mobile Showcase.



## U.S. Department of Energy Programs

Generation180 and the National Renewable Energy Laboratory are stakeholders in the U.S. Department of Energy's program, which includes 75 regional community groups or “Clean Cities coalitions” working to support the nation's energy and economic security by building partnerships to advance affordable domestic transportation fuels, energy-efficient mobility systems, and other fuel-saving technologies and practices. Clean Cities coalitions are helping to improve equitable access to clean transportation by engaging with local communities to co-develop projects and solutions that meet on-the-ground needs. Coalition activities advance energy and environmental justice goals and benefit underserved and overburdened communities in various ways, including through vehicle electrification.

At the national level, the Department of Energy's Vehicle Technologies Office provides unbiased and objective resources and information to help transportation stakeholders evaluate options and achieve goals around alternative fuels, advanced vehicles, mobility solutions, and other fuel-saving strategies.



# Generation180's Peer Influence Study

As interest in electric vehicles grows across the United States, many of the areas that have the largest market shares of EVs also have experienced the greatest growth in EV sales.<sup>96</sup> To explore this phenomenon further, we conducted a two-stage data analysis on EV registrations over time across zip codes in major metropolitan areas. The aim was to identify whether there is a "neighborhood effect" in EV adoption, where growth or clusters of EV adoption might occur (reflecting on the ability of an individual to inspire others within their geographic area to transition to an EV).

## Methodology

### Data on New Vehicle Registrations

To assess EV growth over time across various U.S. metropolitan areas, we selected 11 "designated market areas" (DMAs) for more detailed analysis:

- Atlanta, GA
- Austin, TX
- Charlotte, NC
- Denver, CO
- Los Angeles, CA
- Miami, FL
- New York City, NY
- Philadelphia, PA
- Raleigh-Durham, NC
- Seattle, WA
- Washington, D.C.

For each of the DMAs, we wanted to assess EV growth over time in neighboring ZIP codes, to understand if growth in one ZIP code led to growth in surrounding ZIP codes (as evidence of a neighborhood effect). To do this, we solicited data from the research and analysis firm S&P Global Mobility on three main trends: new EV retail registrations by ZIP code, the share of EVs in overall retail registrations, and the change in the EV retail share over time. The data on EV volumes and shares were compiled monthly from new vehicle registrations in all 50 U.S. states for the years 2018 to 2022.

EV retail registrations reflect all electric vehicle registrations associated with individuals, excluding fleet customers. The EV retail share is the percent of all vehicle registrations in a ZIP code that were EVs. It is calculated as the number of EVs registered in a ZIP code in a single year as a share of the total number of vehicles registered in that ZIP code that year. EV retail share growth is the change in the EV retail share from 2018 to 2022.

### Hot Spot Analysis of the Selected DMAs

Leveraging the data on EV registrations from S&P Global Mobility, we commissioned experts from the National Renewable Energy Laboratory to conduct a "hot spot" analysis to illuminate trends in EV sales over time at the ZIP code level in the 11 DMAs. The objective was to identify ZIP codes with a high concentration of EV registrations per capita and to visualize the shift in patterns during the selected years from 2018 to 2022.

The study used a spatial clustering approach to identify regions or locations that have high concentrations of EV registrations per capita, with the aim of illuminating underlying trends and reasons for the pattern characteristics.<sup>97</sup> This method has been applied in multiple domains, including studying the location of illicit drug activities, identifying clusters of traffic crashes and crimes, and examining the geography of disease outbreak and transmission.<sup>98</sup>

A hot spot analysis uses statistical analysis to define areas that have a higher concentration of events compared to the expected number, given a random distribution of events.<sup>99</sup> Since hot spot areas are statistically significant, this results in an end visualization that is less subjective. The designation of an area as being a "hot spot" is therefore expressed in terms of statistical confidence.<sup>100</sup>

We undertook the hot spot analysis based on the Getis-Ord-Gi\* statistic (z-score). The method works by comparing the number of events (in this case, EV registrations per capita) in a target feature with its neighboring features.<sup>101</sup> The z-scores were calculated for each ZIP code to indicate the strength of spatial dependence between a ZIP code and its neighbors

with regard to the concentration of EV registrations per capita. In other words, the z-score value discerns neighborhoods/areas with clusters of EV registrations per capita.

The Getis-Ord-Gi\* statistic (z-score) was calculated using ArcGIS ESRI software and given by the following equation:

$$Gi^*(d) = \frac{\sum_{j=1}^n w_{ij} x_j - \bar{X} \sum_{j=1}^n w_{ij}}{\sqrt{\frac{[n \sum_{j=1}^n w_{ij}^2 - (\sum_{j=1}^n w_{ij})^2]}{n-1}}}$$

where  $x_j$  is the variable of interest at ZIP code  $j$  (i.e., electric vehicle registration per capita);  $w_{ij}$  is the spatial weight between target ZIP code  $i$  and neighboring ZIP code  $j$ ; and  $n$  is the total number of ZIP codes. Euclidean method was used to calculate the distance between ZIP code centroids.

**A larger (and positive) z-score value signals the presence of a "hot spot" (where the intensity of clustering of high values is greater), whereas a smaller (and negative) z-score value indicates the presence of a cold spot.** In this context, a hot spot means that a high frequency of EV registrations per capita is expected at a ZIP code, after accounting for spatial dependence among neighboring ZIP codes.

The results were then analyzed to determine the extent of a neighborhood peer effect on EV registrations across the 11 selected DMAs.

#### DMA MAPS EXPLAINED

#### Hot Spot

Hot spots, in orange, represent regions with high EV registration per capita. They are clusters of ZIP codes that are surrounded by other ZIP codes with high EV registrations relative to other ZIP codes in the DMA.



#### Cold Spot

In contrast, ZIP codes with blue demonstrate target ZIP codes with lower EV registration per capita that are surrounded by other low EV registration ZIP codes relative to other ZIP codes in the DMA.



#### Not Significant

ZIP codes without color do not show significant EV registration numbers in relation to the neighboring ZIP codes during the time of the study.



#### Gradient Levels

Dark versus light colors on the maps do not indicate more or less growth. The darker the color, the more statistically significant the hot spot is. Dark orange is 99% confidence, yellow is 90% confidence. All orange areas have higher EV registrations per capita and have neighboring ZIP codes with higher EV registrations relative to the rest of the ZIP codes in that DMA.

#### Cold doesn't mean no growth.

Cold spots, represented in blue, do not mean no growth in EV retail registrations. Compared to 2018, most DMAs in 2022 show significant growth. Blue clusters indicate low values of EV registration per capita surrounded by other ZIP codes with low values relative to other ZIP codes in that DMA. Cold spots can help inform region-specific policies to increase EV registration in these areas.

# Findings

The data from S&P Global Mobility indicated that all of the 11 selected DMAs experienced significant growth in EV registrations from 2018 to 2022. Some of the DMAs experienced 2-3x growth in their EV shares compared to the national average, whereas other DMAs experienced less growth. (SEE TABLE 1).

**TABLE 1**  
**Percentage growth in EV retail registrations from 2018-2022 in the 11 selected DMAs (and US overall) 2018-2022**

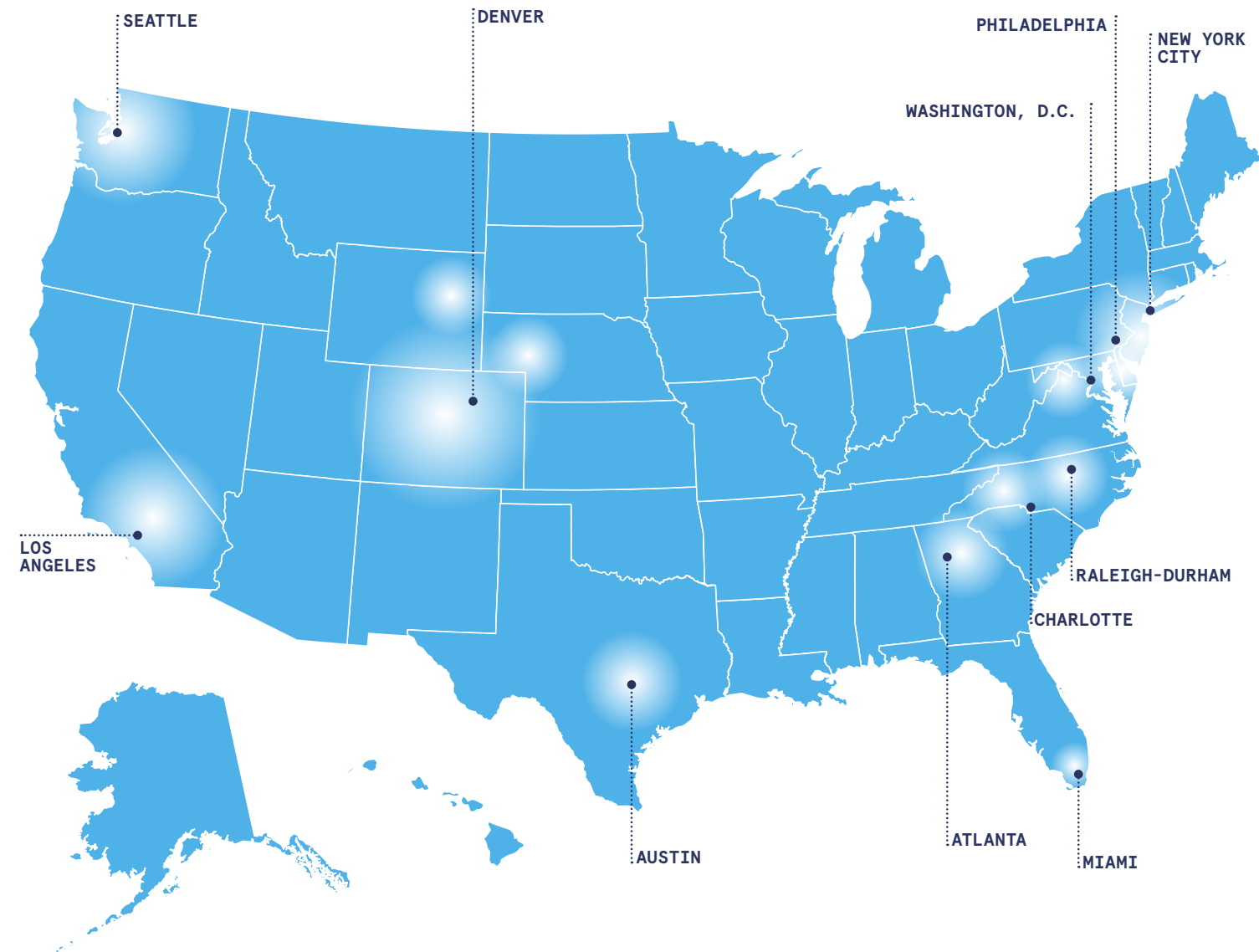
	2018	2019	2020	2021	2022	EV SHARE PERCENTAGE CHANGE, 2018-2022
ATLANTA	1.5%	1.4%	1.7%	3.2%	5.8%	295%
AUSTIN	1.8%	2.4%	2.4%	4.6%	8.4%	377%
CHARLOTTE	0.8%	1.0%	1.2%	2.5%	4.4%	476%
DENVER	2.7%	3.4%	4.0%	5.9%	9.4%	253%
LOS ANGELES	3.9%	4.8%	6.0%	10.1%	17.7%	357%
MIAMI	1.0%	1.4%	1.9%	3.7%	6.5%	571%
NEW YORK CITY	1.0%	1.2%	2.2%	3.6%	5.9%	479%
PHILADELPHIA	1.0%	1.1%	1.8%	3.0%	5.2%	426%
RALEIGH-DURHAM	1.3%	1.5%	1.7%	3.2%	5.5%	316%
SEATTLE	4.2%	5.0%	5.7%	8.4%	13.7%	226%
WASHINGTON, D.C.	2.0%	2.4%	2.7%	4.9%	8.3%	319%
UNITED STATES	1.4%	1.7%	2.0%	3.6%	6.2%	328%

## What explains this growth?

Through the hot spot analysis, we were able to test the hypothesis that, given the proximity of growth in neighboring ZIP codes that have existing strong EV shares, the peer effect is highly probable. The hot spot analysis results show a variety of trends in the concentration of EV registrations across the 11 DMAs from 2018 to 2022. The results, summarized by each DMA, are provided on the following pages.

SOURCE:  
 S&P GLOBAL MOBILITY, 2022

## Designated Market Areas from Across the U.S. selected for the study



# Analysis of Results

The transition to electric vehicles is accelerating. S&P Global Mobility estimates that by 2030, more than 40% of new passenger vehicles sold in the U.S. will be EVs. But despite the rapidly growing product choices, the industry as a whole must continue to address the concerns of prospective EV owners. A potential key driver in accelerating the adoption of EVs and mitigating barriers to their uptake is current owners of EVs.



## The Shifting Landscape of EV Adoption: Signs of neighborhood effect

The New York City DMA provided perhaps the most explicit example of peer influence, or the “neighborhood effect,” which has been shown to play an important role in the adoption of EVs.<sup>102</sup> In 2018, the DMA had limited ZIP codes with high EV registration toward Newark, NJ and Queens, NY; however, by 2022, more neighboring ZIP codes started to display high EV registration. The New York City DMA also saw a growth in cold spots in the northeast region.

Two other DMAs saw similar mixed trends. In Philadelphia, there was a shift in the cluster of hot spots from 2018 to 2022. Similar observations were made for cold spot clusters. In Atlanta, the concentration of ZIP codes with high EV registrations did not change dramatically; however, there was a significant increase in cold spots in the suburbs/outskirts of the DMA.

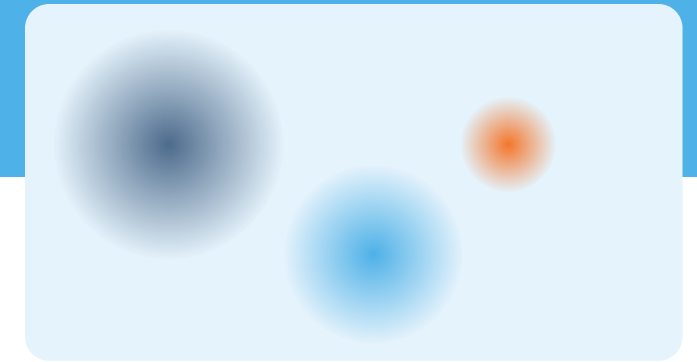
## Increased hot spots in urban areas

Clusters of hot spots increasingly grew in the central or urban regions of the DMAs, while the outskirts/suburban regions experienced increases in cold spots. In Charlotte, there was a clear increase in ZIP codes with high EV registrations from 2018 to 2022, but this was confined to the urban region. Washington, D.C. likewise saw a slight increase in EV registrations in its urban region but otherwise similar clustering in 2018 and in 2022. Similarly, the Denver DMA experienced an increase in hot spots in the urban/ex-urban region.

This suggests that the neighborhood effect may be more prevalent in densely populated urban areas than in non-urban areas. A 2022 California study found that, for plug-in EVs, in communities that have low initial penetration (commonly non-urban areas), the lack of a neighborhood effect may delay the spread of the vehicles, even when prices fall and market supplies grow.<sup>103</sup>

**The study notes that the presence of neighborhood and workplace effects impacts the effectiveness of EV policies. Thus, even in regions with high incentives for EVs but low exposure to the technology (such as rural areas), initiatives such as awareness campaigns and infrastructure support may be necessary to foster network effects.**

S&P Global Mobility’s data on new vehicle registrations in 11 selected DMAs provided the insights necessary to assess the importance of existing EV households as catalysts for more widespread EV adoption. According to S&P Global Mobility, analysis of EV registration data at the ZIP code level indicates potential presence of the neighborhood effect, highlighting the important role that individual households and their influence on their peers plays in the wider adoption of EVs.



## The need for targeted policies in low-adoption areas

In Los Angeles, there was barely any shift in the clustering patterns of hot and cold spots for EV registrations. Rather, there were widely spread regions of high EV registrations per capita in the southwest and low EV registrations in the northeast. Austin and Raleigh-Durham experienced barely any shift in hot and cold spots for EV registrations over the study period, whereas Seattle experienced a decline in both hot and cold spots. This suggests that region-specific initiatives targeted at residents of these low-adoption ZIP codes may prove to be beneficial in spurring EV adoption. This concept is corroborated by a 2020 study that finds that “policy champions” are needed at the local/town level to spur clean energy engagement.<sup>104</sup>

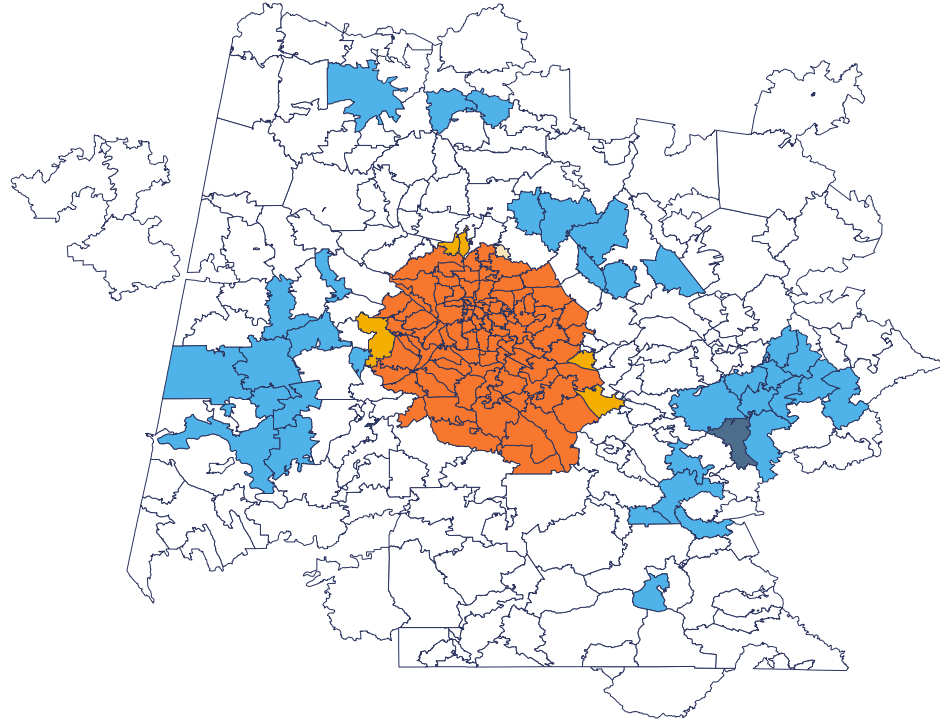
## Further applications

The maps developed for this analysis may be used to design region-specific policies, to identify region-specific barriers that may be leading to a decrease in EV registrations, and to help utility companies predict electricity demand in hot spot areas. Future work could focus on understanding the underlying reasons explaining the formation of hot and cold spots in selected DMAs.

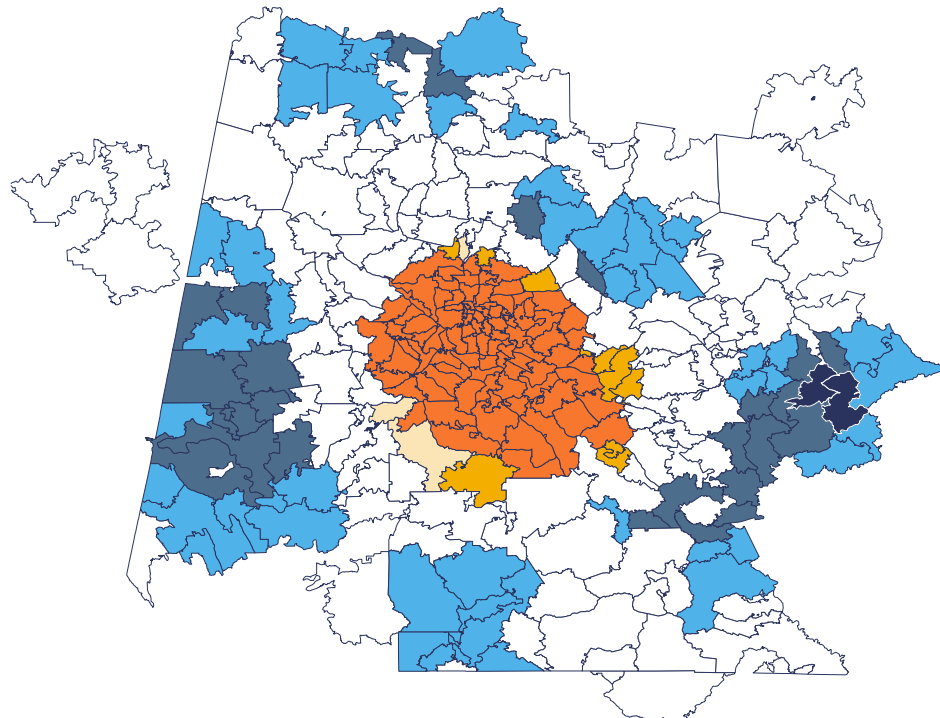
## Atlanta

In Atlanta, the concentration of high-registration ZIP codes did not see a dramatic change in the clustering of hot spots. However, Atlanta experienced an increase in cold spots in the outskirts of the DMA.

2018



2022



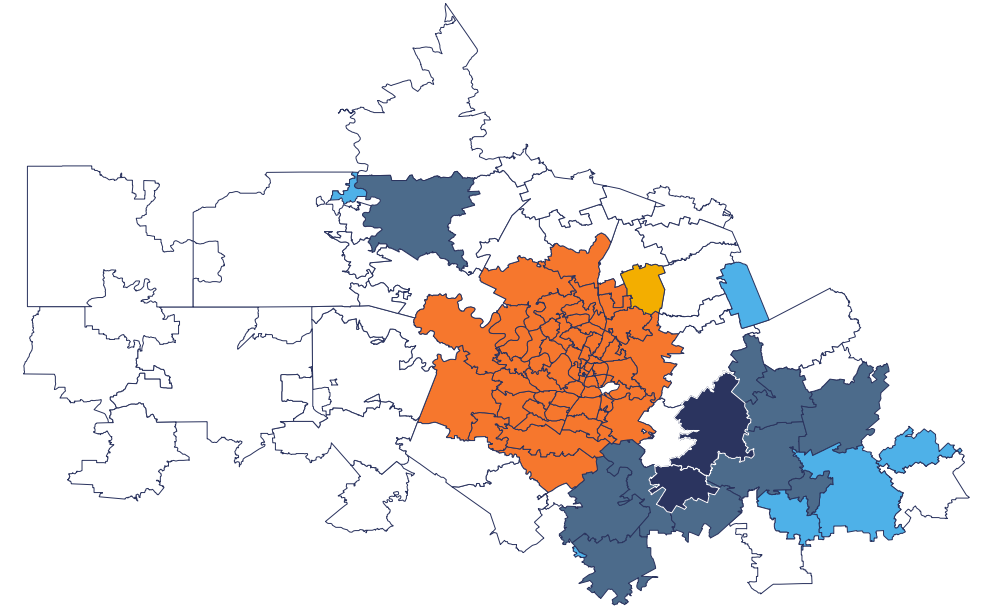
LEGEND

- Hot Spot  
99% CONFIDENCE
- Hot Spot  
95% CONFIDENCE
- Hot Spot  
90% CONFIDENCE
- Not Significant
- Cold Spot  
90% CONFIDENCE
- Cold Spot  
95% CONFIDENCE
- Cold Spot  
99% CONFIDENCE

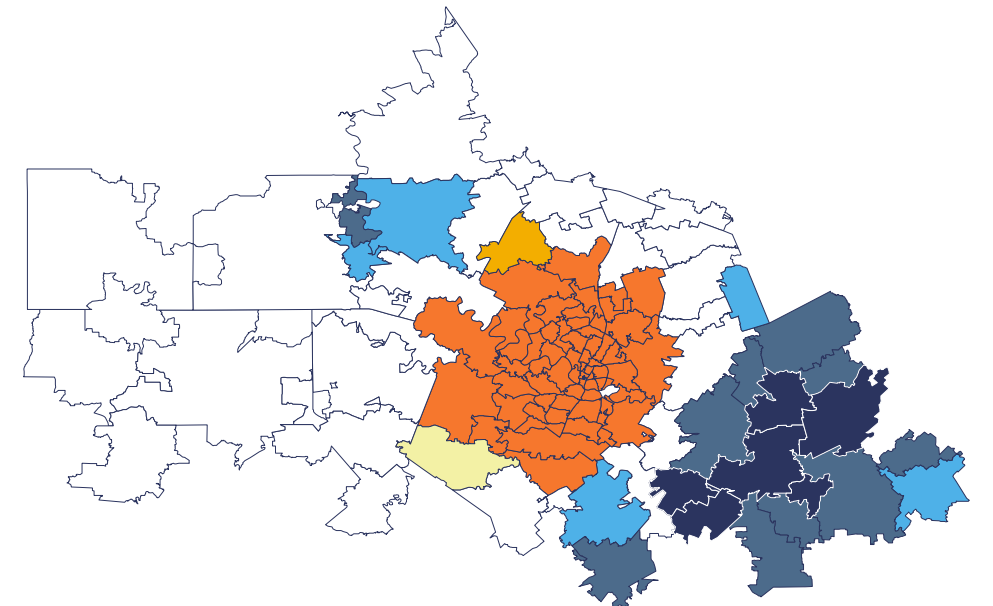
## Austin

In Austin, there was only a minor shift in the hot and cold spots for EV registrations between 2018 and 2022. This indicates a continued concentration of EV adoption in specific ZIP codes.

2018



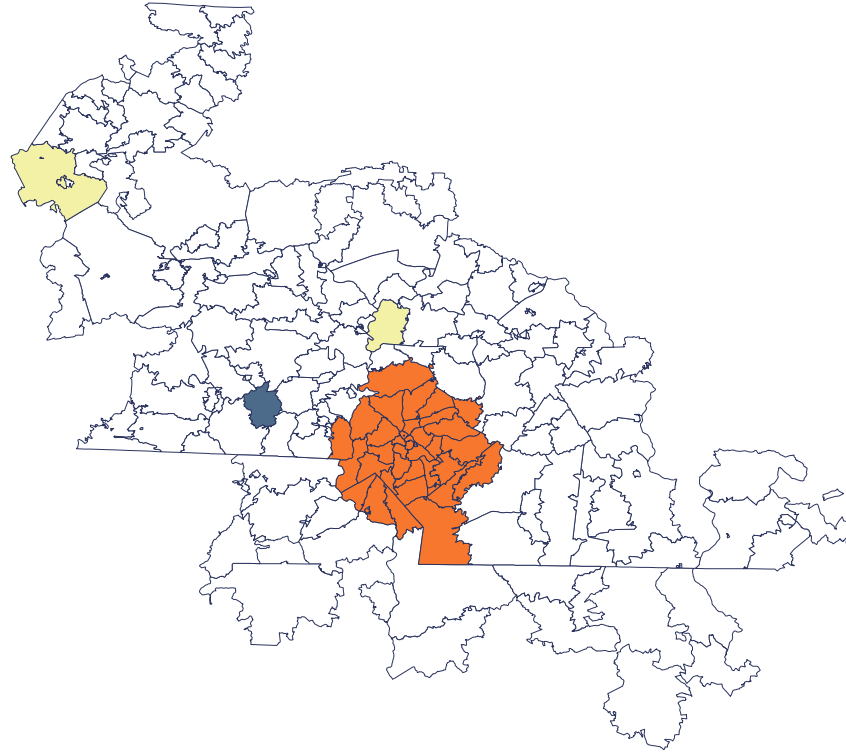
2022



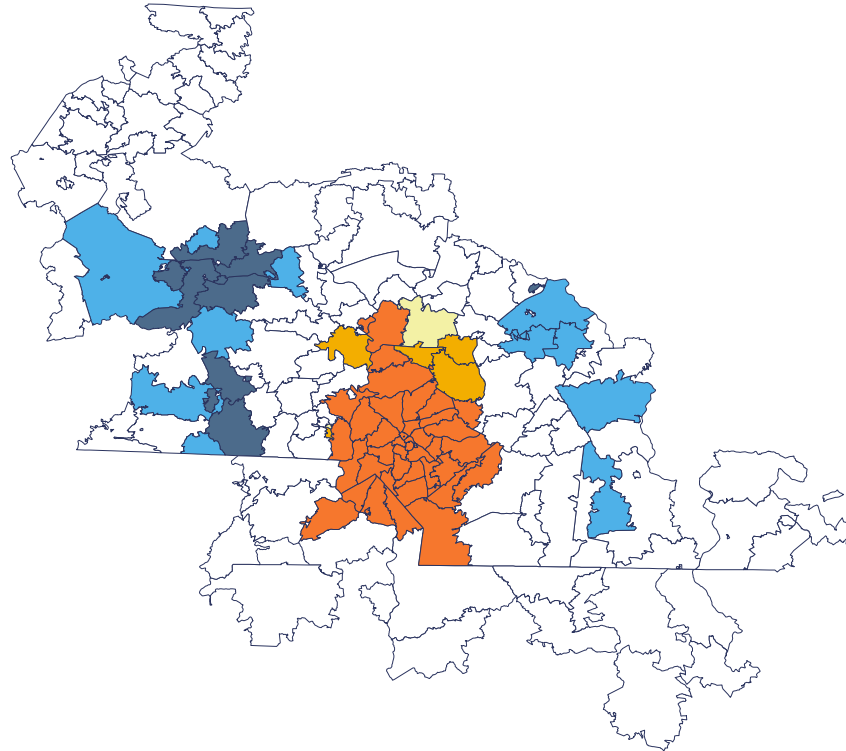
## Charlotte

In Charlotte, there was a clear increase in hot spot ZIP codes for EV registrations from 2018 to 2022. The growth was confined to the urban region, however.

2018



2022



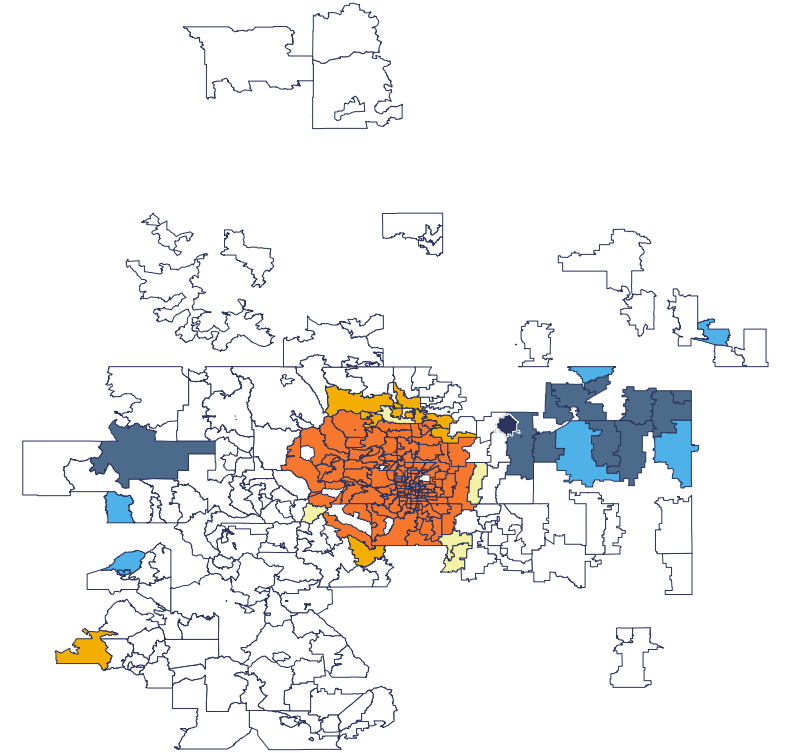
LEGEND

- **Hot Spot**  
99% CONFIDENCE
- **Hot Spot**  
95% CONFIDENCE
- **Hot Spot**  
90% CONFIDENCE
- Not Significant**
- **Cold Spot**  
90% CONFIDENCE
- **Cold Spot**  
95% CONFIDENCE
- **Cold Spot**  
99% CONFIDENCE

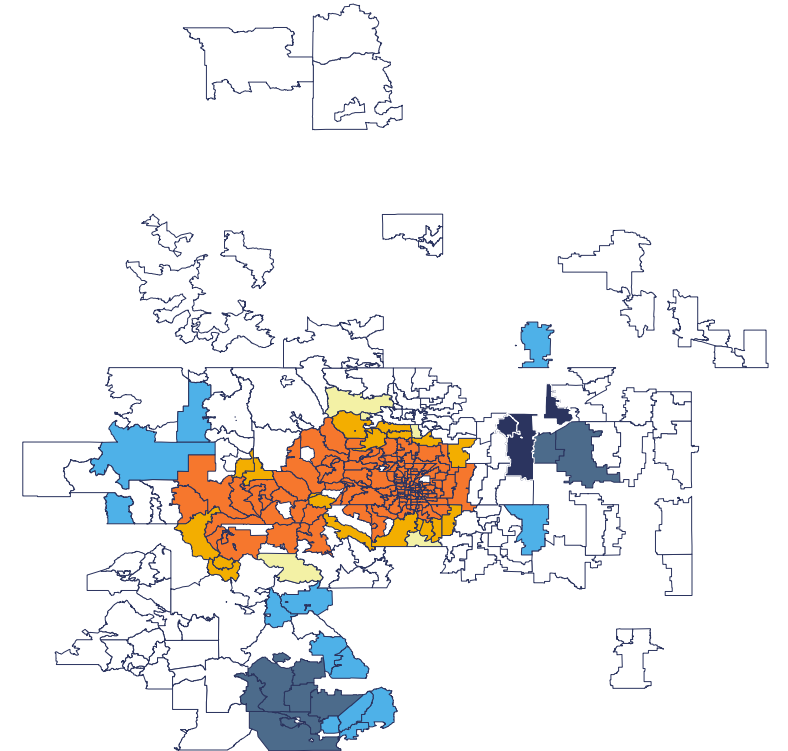
## Denver

Denver experienced an increase in hot spots for EV registrations in the urban/ex-urban region. This pattern may suggest that the neighborhood effect is more prevalent in densely populated urban areas and less prevalent in non-urban areas.

2018



2022

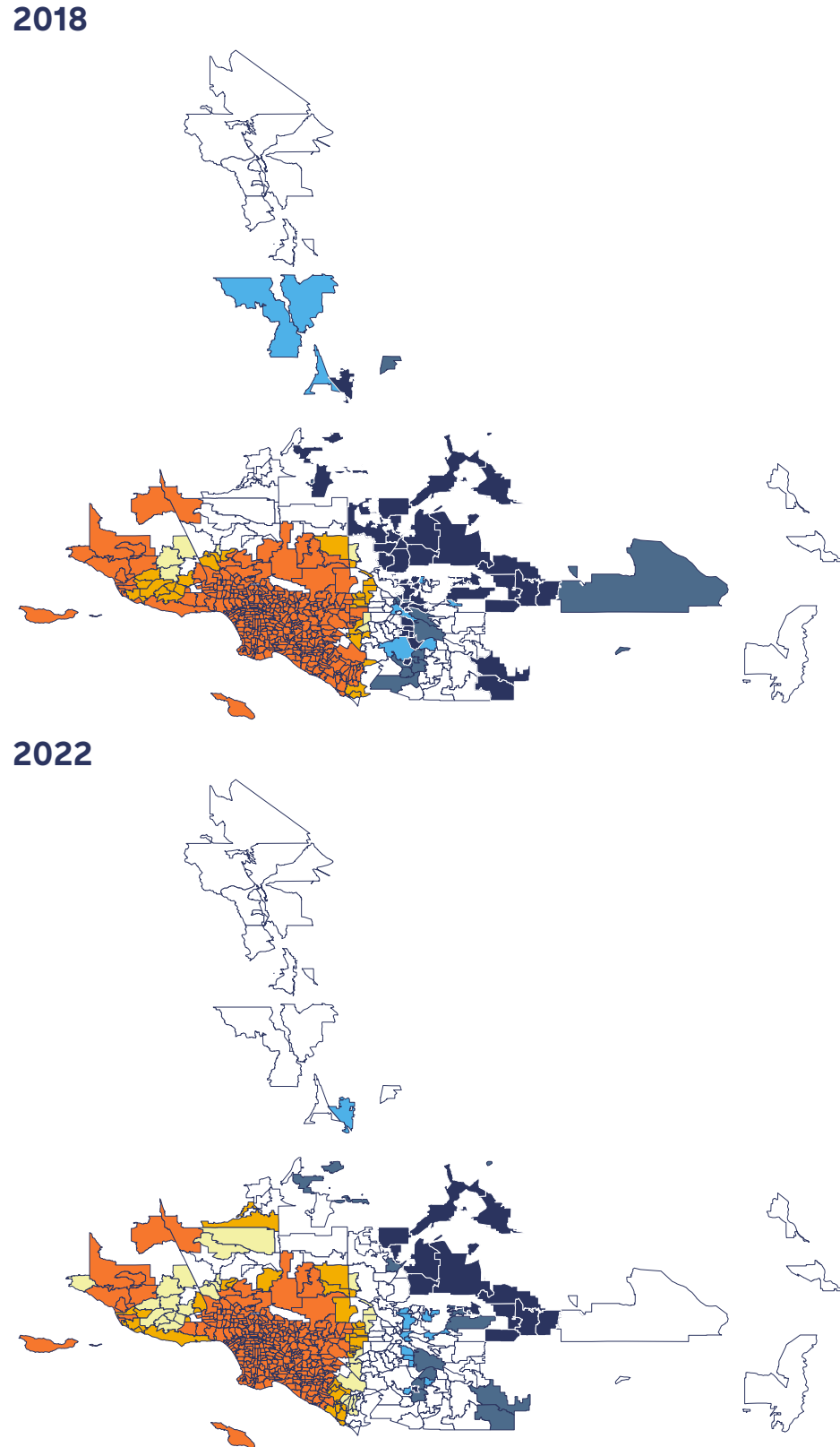


## Los Angeles

In Los Angeles, there were limited changes in the clustering patterns of hot and cold spots for EV registrations. Rather, the results showed widely spread regions of high EV registration per capita in the southwest and low EV registration in the northeast.

LEGEND

- Hot Spot**  
99% CONFIDENCE
- Hot Spot**  
95% CONFIDENCE
- Hot Spot**  
90% CONFIDENCE
- Not Significant**
- Cold Spot**  
90% CONFIDENCE
- Cold Spot**  
95% CONFIDENCE
- Cold Spot**  
99% CONFIDENCE

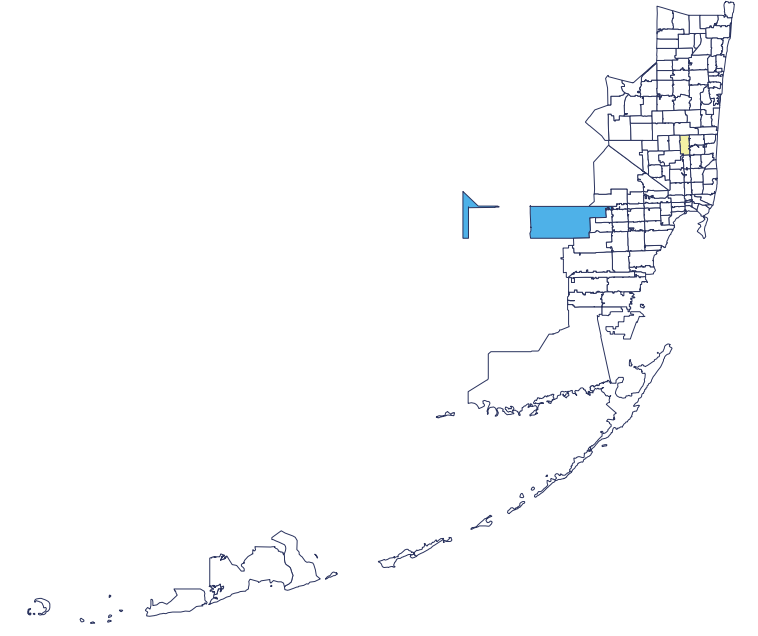


SOURCE: NREL, 2023

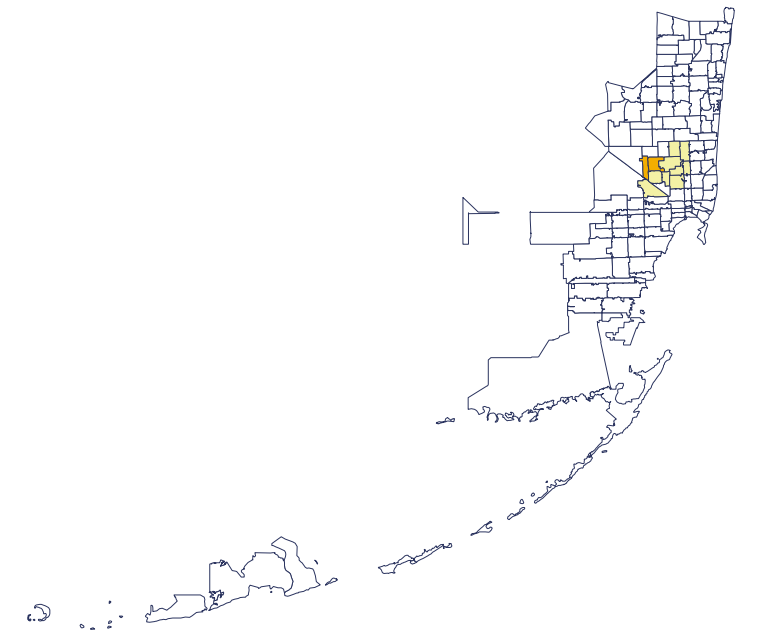
## Miami

In Miami, EV registrations in the ZIP codes in the northern region grew during the period 2018-2022.

2018



2022



SOURCE: NREL, 2023

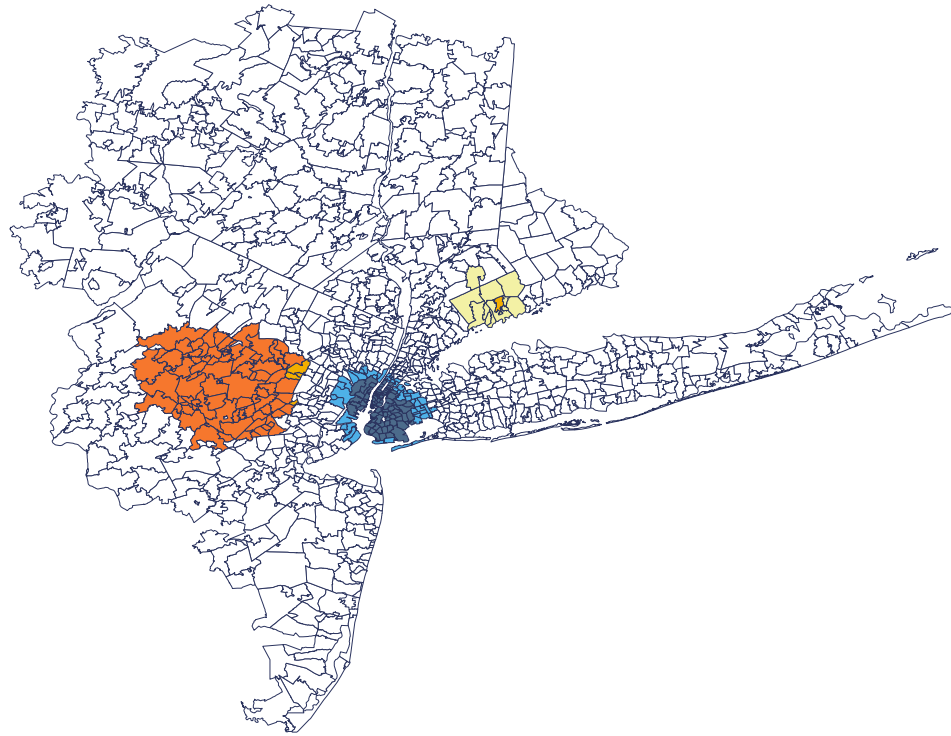
## New York City

New York City shows perhaps the most explicit example of the neighborhood effect. In 2018, there were limited ZIP codes with high EV registration toward Newark, NJ, and Queens, NY; however, by 2022, more neighboring ZIP codes started to display high EV registration. The DMA also saw a growth in cold spots in the northeast region.

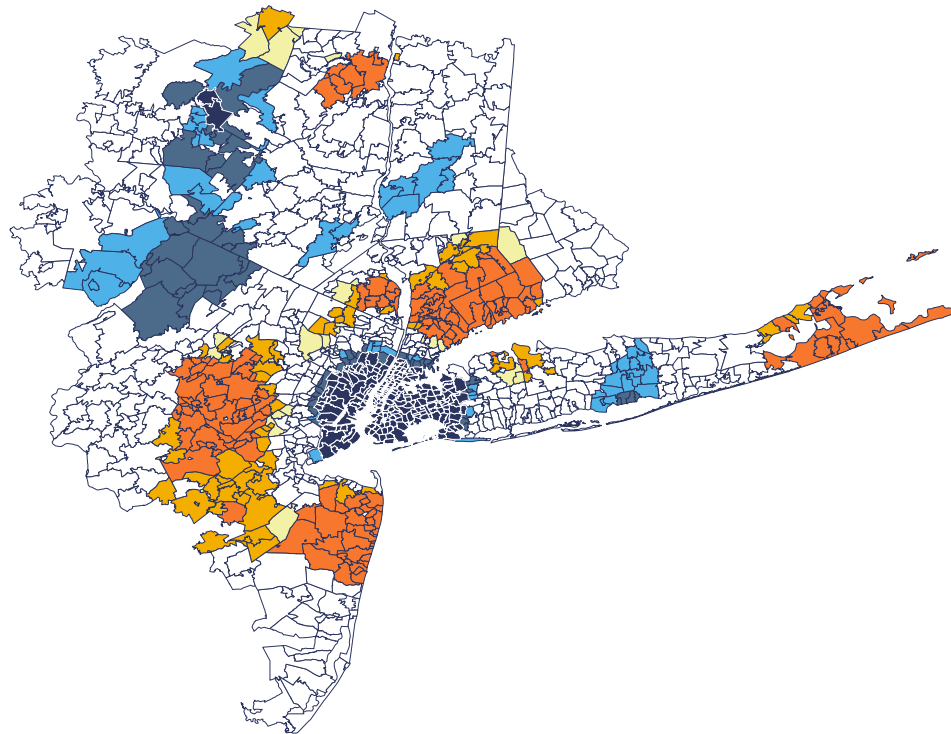
LEGEND

- Hot Spot**  
99% CONFIDENCE
- Hot Spot**  
95% CONFIDENCE
- Hot Spot**  
90% CONFIDENCE
- Not Significant**
- Cold Spot**  
90% CONFIDENCE
- Cold Spot**  
95% CONFIDENCE
- Cold Spot**  
99% CONFIDENCE

2018



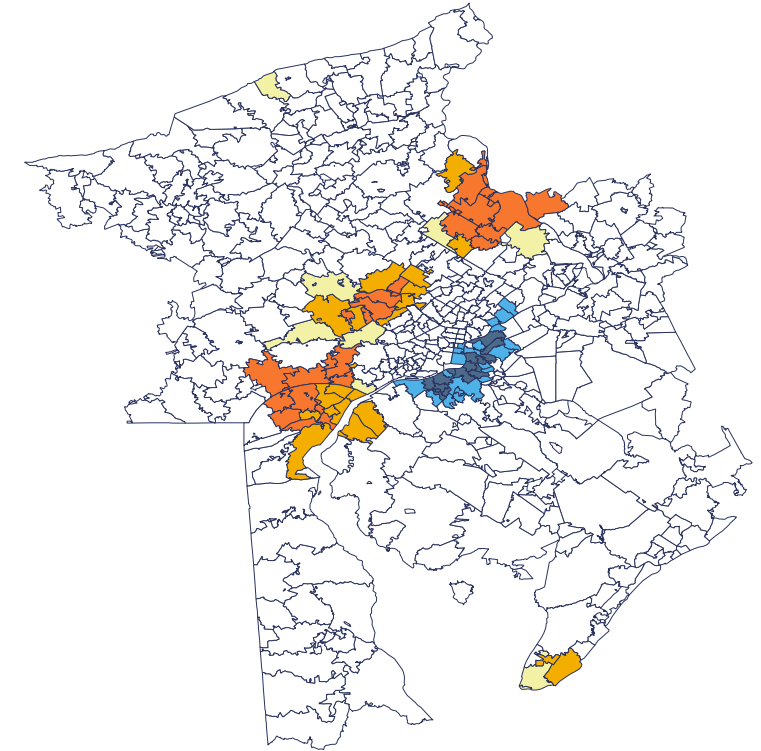
2022



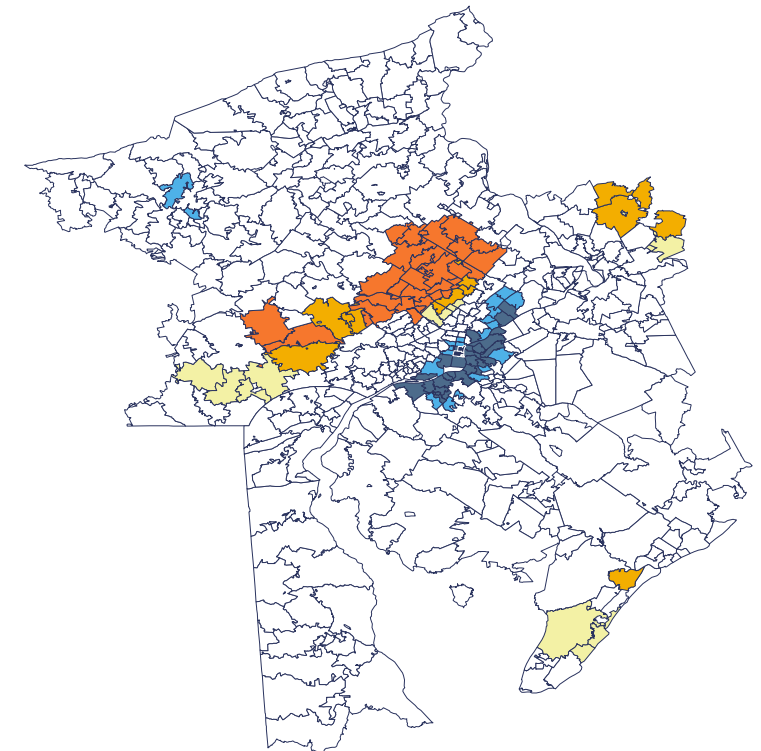
## Philadelphia

In Philadelphia, there was a shift in the cluster of hot spots of EV registrations from 2018 to 2022. Similar observations were made for cold spot clusters. As in the New York City DMA, Philadelphia showed mixed trends.

2018



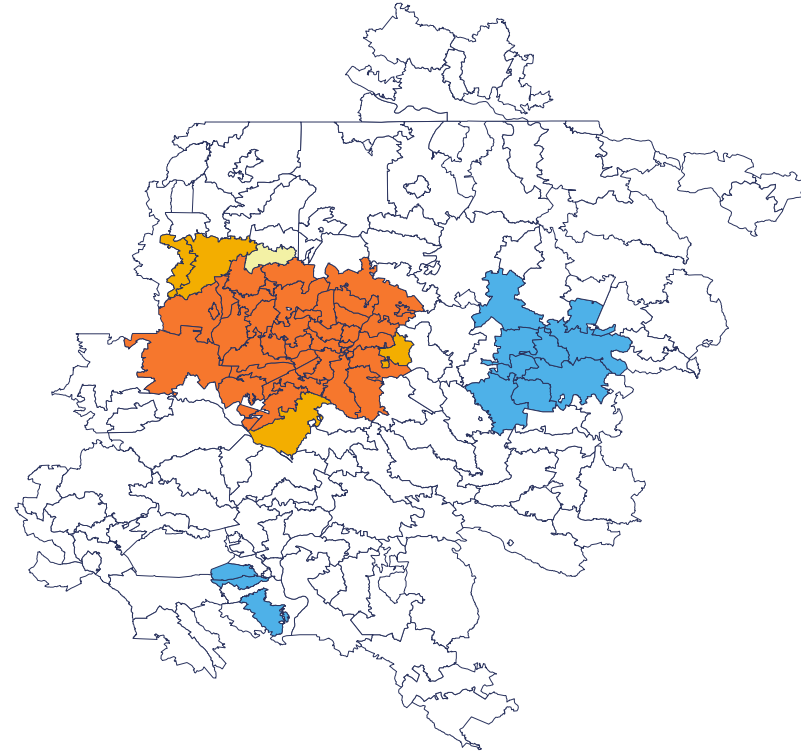
2022



## Raleigh-Durham

Raleigh-Durham experienced only a minor shift in hot and cold spots for EV registrations between 2018 and 2022.

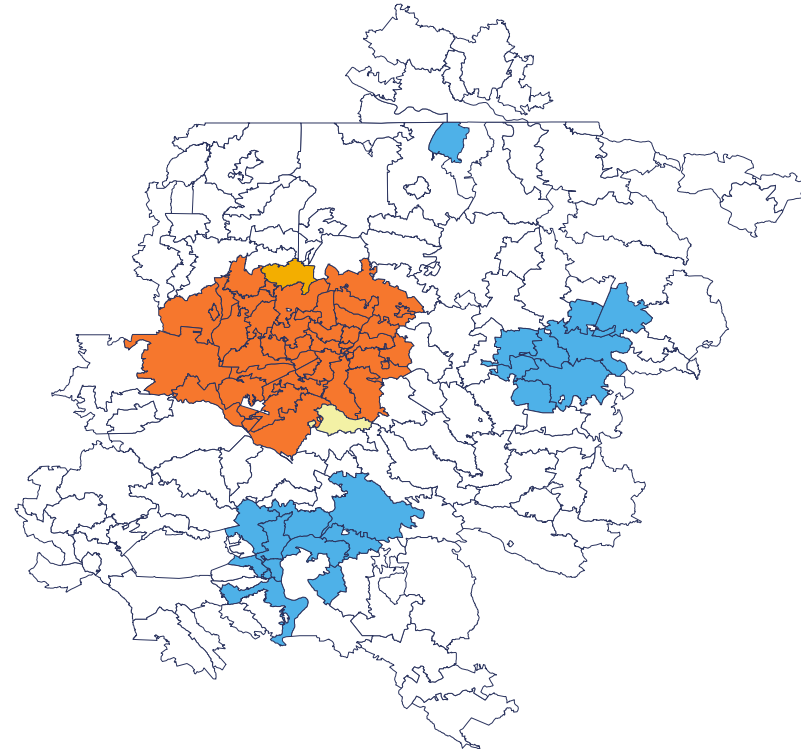
2018



LEGEND

- Hot Spot  
99% CONFIDENCE
- Hot Spot  
95% CONFIDENCE
- Hot Spot  
90% CONFIDENCE
- Not Significant
- Cold Spot  
90% CONFIDENCE
- Cold Spot  
95% CONFIDENCE
- Cold Spot  
99% CONFIDENCE

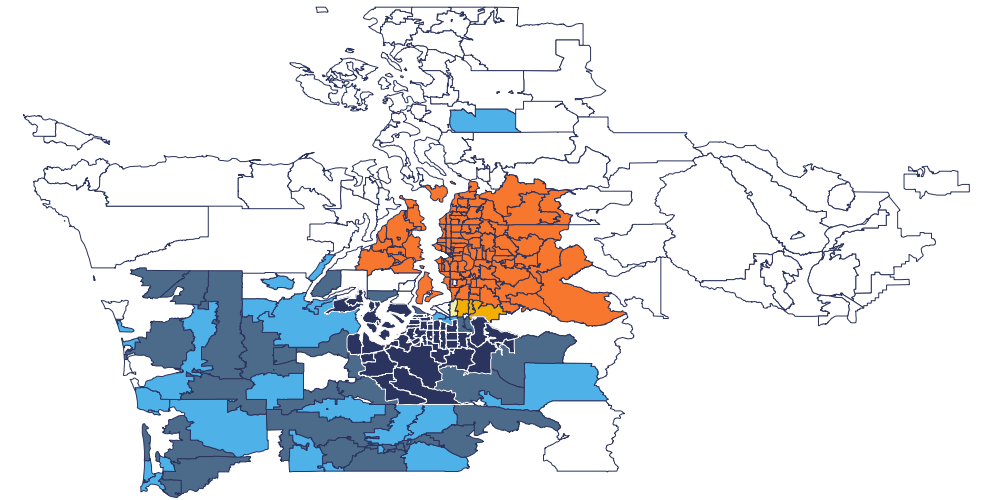
2022



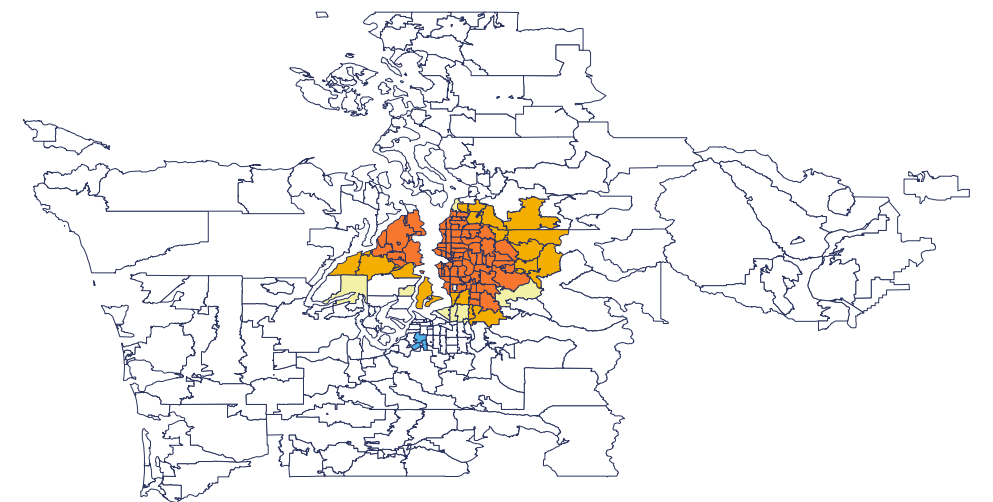
## Seattle

Seattle was the only DMA among the 11 selected that experienced a decline in hot spots and cold spots for EV registrations over the study period. More analysis is needed to understand the decline in hot-spots and cold-spots.

2018



2022

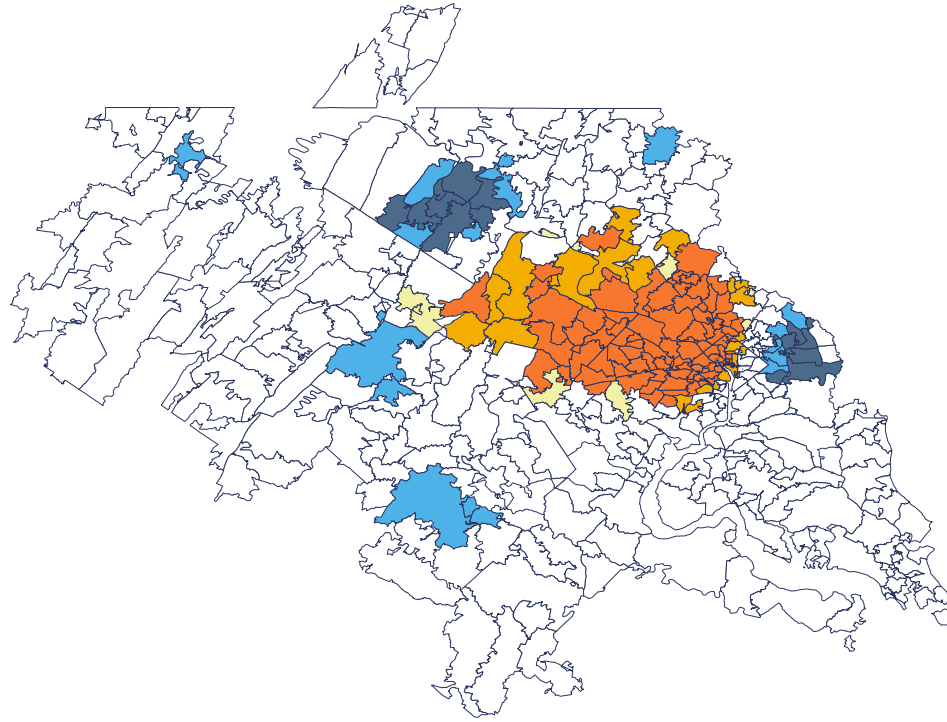




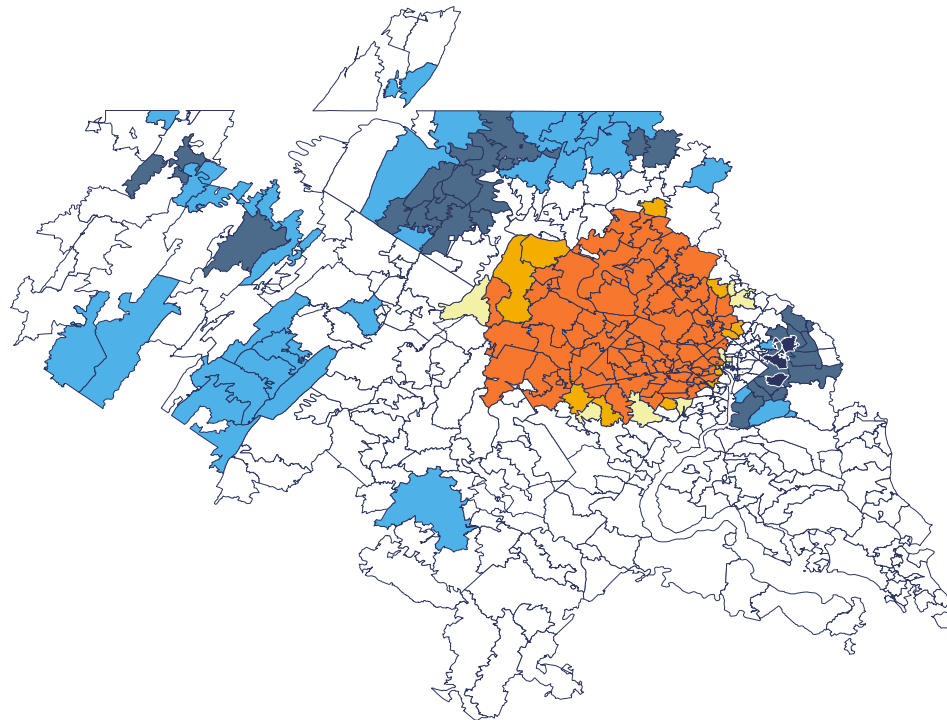
## Washington, D.C.

Washington, D.C., likewise saw a slight increase in EV registrations in its urban region but otherwise similar clustering in 2018 and in 2022. This pattern may suggest that the neighborhood effect is more prevalent in densely populated urban areas and less prevalent in non-urban areas.

2018



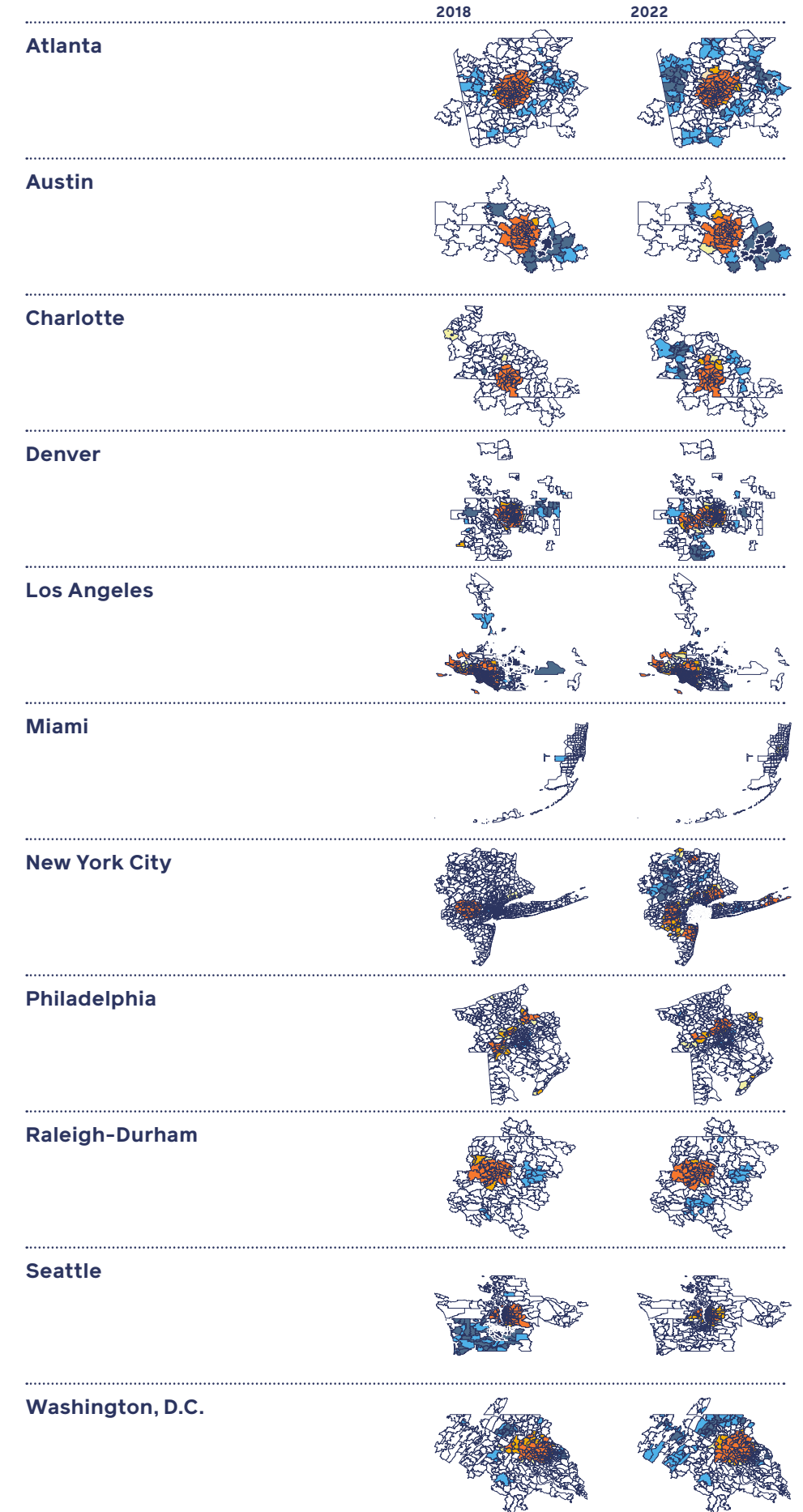
2022



LEGEND

- **Hot Spot**  
99% CONFIDENCE
- **Hot Spot**  
95% CONFIDENCE
- **Hot Spot**  
90% CONFIDENCE
- Not Significant**
- **Cold Spot**  
90% CONFIDENCE
- **Cold Spot**  
95% CONFIDENCE
- **Cold Spot**  
99% CONFIDENCE

## All DMA Locations



# Recommendations: Key Pathways to Activate EV Ambassadors

Given the importance of the peer effect in influencing EV adoption, Generation180 recommends that policymakers, EV Ambassadors, and other promoters of electric transportation take the following actions to stimulate EV uptake across the U.S.



## Word of mouth

**Work with existing EV owners and customers to share the opportunities and benefits of purchasing an EV, especially through word of mouth.**

Nearly half of Americans (46%) are unaware of the incentives available to purchase an EV. However, 53% say that tax rebates or discounts at the time of purchase would encourage them to do so. Many consumers can save thousands of dollars on the price of an EV with existing federal, state, and local incentives, such as power utility incentives. This suggests that incentives – and concerted efforts to make Americans aware that they exist – are important policy tools to help spur a transition to clean transportation.

## Interaction

**Provide greater opportunities for people to be exposed to EVs and to interact with and test drive them.**

Americans who have experience with EVs are more likely to be interested in purchasing one.<sup>105</sup> However, in a 2022 survey only 7% of Americans had driven one in the past 12 months.<sup>106</sup> Meanwhile, 20% of respondents who said they would “definitely” buy or lease an EV as their next vehicle had driven one during that period.<sup>107</sup>

## Bundling

**In communications, bundle the benefits of clean energy solutions to demonstrate their larger combined benefit.**

Is the adoption of EVs and solar panels interdependent, or independent? Interviews with clean energy adopters coupled with findings from literature indicate that the adoption behavior for both of these technologies is interconnected and is greatly influenced by attitudes (such as technology awareness), values, and personality traits.<sup>108</sup> Findings from studies suggest that bundled incentives/subsidies that drive the adoption of both EVs and solar should be explored.<sup>109</sup> The results highlight the need to consider energy-efficient technology adoption behavior for transport and buildings in a single integrated structure.<sup>110</sup>



## About the Project Team and Contributors

### Generation180 **Generation180**

Generation180 is a national non-profit organization working to inspire and equip individuals to take action on clean energy. At Generation180, we are reframing the narrative around energy and equipping people to take meaningful action in their homes and communities. We envision a 180-degree shift in our energy sources – from fossil fuels to clean energy – driven by a 180-degree shift in people's perception of their role in making it happen – from apathy to agency, from despondency to determination, from hopeless to hopeful. A world powered by wind, water, and sun is not only possible – it's already happening. We have both the technology and the expertise.

[generation180.org](https://generation180.org)



### **Electrify Your Ride**

Generation180's national Electrify Your Ride campaign is accelerating the transition to electric vehicles (EVs) by building awareness, transforming EV owners into advocates, and breaking down barriers to make EVs more accessible. We host educational events, partner with regional and national influencers, and tap local owners to become EV ambassadors within their communities. Whether you're just learning about EVs or you're looking to help spread the word, Generation180 can help you find ways to plug in. Visit our website to learn more and join thousands of Americans who have pledged to make their next car electric.

[generation180.org/electrify-your-ride](https://generation180.org/electrify-your-ride)



### **National Renewable Energy Laboratory (NREL)**

The National Renewable Energy Laboratory (NREL) is the U.S. Department of Energy's primary national laboratory for renewable energy and energy efficiency research and development. NREL is operated for DOE by the Alliance for Sustainable Energy LLC. Support for this work was provided through DOE's Clean Energy to Communities Expert Match program. The views expressed in the report do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the report for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

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### **Pacific Northwest National Laboratory (PNNL)**

Pacific Northwest National Laboratory (PNNL) advances the frontiers of knowledge, taking on some of the world's greatest science and technology challenges. Our research lays a foundation for innovations that advance sustainable energy through decarbonization and energy storage and enhance national security through nuclear materials and threat analyses. PNNL collaborates with academia in fundamental research and with industry to transition technologies to market. Whether our researchers are unlocking the mysteries of Earth's climate, helping modernize the U.S. electric power grid, or safeguarding ports around the world from nuclear smuggling, we accept great challenges for one purpose: to create a world that is safer, cleaner, more prosperous, and more secure.

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### **S&P Global Mobility**

At S&P Global Mobility, we provide invaluable insights derived from unmatched automotive data, enabling our customers to anticipate change and make decisions with conviction. Our expertise helps them to optimize their businesses, reach the right consumers, and shape the future of mobility. We open the door to automotive innovation, revealing the buying patterns of today and helping customers plan for the emerging technologies of tomorrow. S&P Global Mobility is a division of S&P Global (NYSE: SPGI). S&P Global is the world's foremost provider of credit ratings, benchmarks, analytics and workflow solutions in the global capital, commodity, and automotive markets. With every one of our offerings, we help many of the world's leading organizations navigate the economic landscape so they can plan for tomorrow, today.

[spglobal.com/mobility](https://spglobal.com/mobility)

### **Yale University Kenneth Gillingham**

Kenneth is Professor of Economics and Senior Associate Dean of Academic Affairs at the Yale School of the Environment. In 2015-2016, he served as the Senior Economist for Energy and the Environment at the White House Council of Economic Advisers. As an energy and environmental economist, his research examines the adoption of new energy technologies, energy efficiency, quantitative policy and program analysis, and climate change policy. He serves as Associate Editor at the Review of Economics & Statistics and is on the Editorial Board at the Energy Journal. His research has been funded by the National Science Foundation, the U.S. Department of Energy, the U.S. Environmental Protection Agency, and several foundations. Prior to joining Yale, Kenneth was a Fulbright Fellow in New Zealand and a Fellow for Energy and the Environment at the White House Council of Economic Advisers. He also worked at Resources for the Future and at Pacific Northwest National Laboratory. He received his Ph.D. and M.S. degrees from Stanford University and his A.B. from Dartmouth College.

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