



Satisfied Drivers, Optimistic Intenders

How the EV market can continue to thrive, fix pain points, and evolve for the next generation of drivers

A report on Plug In America's national survey of Americans driving or considering an electric vehicle

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EXECUTIVE SUMMARY

Plug In America is the voice of the EV driver; while there are several groups who perform surveys of EV drivers, Plug In America's membership includes EV drivers with years or even decades of experience with the vehicles. In September–October 2020, Plug In America surveyed over 3,500 electric vehicle (EV) owners and over 800 individuals interested in purchasing an EV.¹ We have, in the past, surveyed our membership to understand charging habits, battery performance, and other aspects of EV driving. The intent of this survey was to understand the current state of EV driving and consideration in the United States, in particular:

- What are the primary motivations for drivers and those considering EVs?
- What are the most valuable sources of information available to EV customers?
- What is the quality of the current EV buying experience for customers?
- Are EV owners content? Why and why not?
- Where do prospective EV owners converge and diverge from existing owners?

The overall picture is one of satisfied EV owners, with 96% intending to purchase an EV as their next vehicle. The primary motivation for EV owners to purchase the vehicle was the environment and air quality, with approximately 60% indicating this was a "most important" consideration, twice the rate of a cluster of secondary factors including cost savings, interest in cutting edge technology, energy independence, and fun of driving. A majority of respondents (over 75%) expressed a preference for charging from renewable energy, increasing the environmental benefits of EVs even further.

Owners were satisfied with the information they were able to obtain when investigating EV purchasing, with 85% indicating satisfaction with finding the information they needed to buy or lease an EV, particularly with EV-specific websites like PlugStar.com, rated as the most valuable source of EV information. However, owners were not completely satisfied with the experience they received at dealerships, with only 15% considering the salesperson "very high" in knowledge, and only 40% considering them highly knowledgeable. While EV owners intend to continue EV ownership, they voice frustration with public charging infrastructure, with approximately half having experienced problems with public charging.

¹See "Survey Methodology and Response Summary" for more detail

<p>96%</p> <p>96% of EV owners are likely to purchase an EV as their next vehicle</p>	<p>85%</p> <p>85% of owners were satisfied with finding the information they needed to buy/ lease an EV</p>	<p>15%</p> <p>Only 15% of EV owners rated dealership salesperson knowledge as "very high." Only 40% rated as "high" or better</p>	<p>54%</p> <p>54% of owners reported experiencing problems with public charging, with broken chargers being the most common issue</p>
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Those who do not currently own an EV but are considering purchasing one within the next 12 months share some similarities with current owners, but there are stark differences. Similar to current EV owners, these "intenders" are primarily motivated by environmental and clean air impacts to purchase the vehicle, but they express less strong feelings overall, particularly less concern with the cutting edge technology and the fun of driving. They also find EV-specific websites to be the most valuable source of information on EVs, but are more likely to rely on friends and family than current owners. These intenders are somewhat different demographically as well. They tended to be younger, less likely to earn over \$100,000 per year and less likely to live in a single family home, though that is still the dominant home type, with ~80% of respondents.

The following report explores these findings in more detail, and also provides insight regarding what can be done to encourage further growth in the adoption of EVs. These results indicate that there must be greater investment in public charging infrastructure with a focus on reliability, and that a better dealership experience is essential as the market continues to evolve from innovators (the ones who adopt a technology even before the "early adopters"), who may have been more tolerant of market shortcomings for ideological reasons.

Overall, the report paints an encouraging picture of EV adoption. As a significant motivating factor in EV adoption is improving air quality, we recommend that this benefit be kept in mind when developing state incentives. Incentives for EVs support a public good (cleaner air and a more liveable climate).

Improving the dealership experience is a key area of Plug In America expertise, which the report shows is an important area to continue to expand our work. We encourage regions and states to implement dealership engagement programs such as PlugStar, which supports, trains, and certifies dealers to sell EVs. This program has proven results in improving customer satisfaction and dealer success in regions where it is implemented.

¹See "Survey Methodology and Response Summary" for more detail

Respondents frequently mentioned the problem of nonfunctional public chargers. Plug In America recommends that grant programs for publicly-funded EVSE include requirements for reliability (including redundancy, uptime requirements, and maintenance requirements).

Overall, the picture is encouraging, with EV drivers very satisfied with their vehicles. While there are some issues in need of attention, such as dealership knowledge and public charging reliability, policymakers and industry stakeholders have developed promising solutions to these concerns.

THE STATE OF EV OWNERSHIP

MOTIVATION AND INFORMATION

Understanding what motivates EV drivers and where they found value in their EV-buying experience can help refine new offerings and move the market forward.

The motivating factor for current EV owners in purchasing the vehicle is crystal clear—the environment and air quality. Over 60% indicate this was a “most important” consideration, almost twice the rate of the next highest factors including the fun of driving, energy independence, cost savings, and interest in cutting edge technology. Convenience and style were the least likely to be rated as most important. Figure 1 displays the proportion of owners who indicated that a factor was “most important” to them when it came to considering the purchase of an EV.

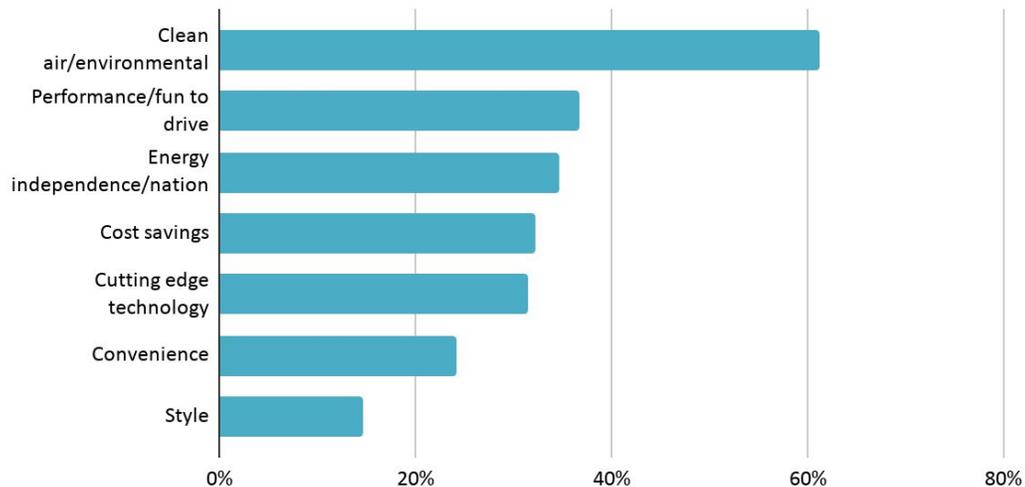


Figure 1: Percentage of EV owners indicating a factor is a “Most Important” purchase consideration

The strong desire for environmental protection also manifests in a preference for charging EVs with renewable energy to achieve even greater emission reductions, as seen in Figure 2.¹

¹ The vast majority of the country (92%) lives in regions where an EV provides at least a 50% greenhouse gas emission reduction compared to a gasoline vehicle (<https://blog.ucsusa.org/dave-reichmuth/are-electric-vehicles-really-better-for-the-climate-yes-heres-why>) even when charged with grid electricity. This benefit can be increased further by purchasing ‘green power’ to charge the EV.

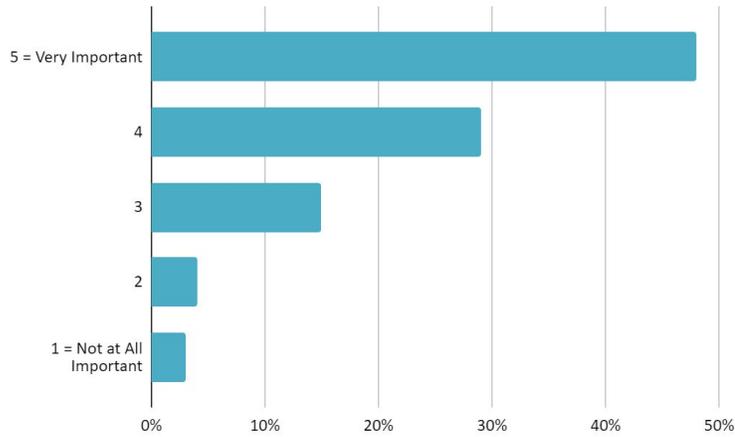


Figure 2: Responses to "How important is it that the electricity used in an EV come from renewable energy?", where 1 is "Not at all Important" and 5 is "Very Important"

Economic factors were also significant considerations when deciding to purchase an EV; Figure 3 indicates the most influential of these.

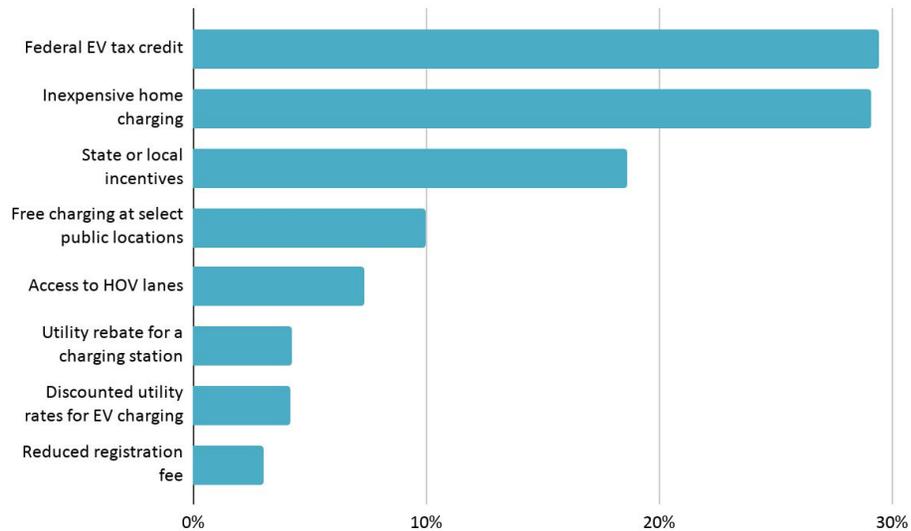


Figure 3: Percentage of EV owners indicating a factor is "Most Influential" on their purchase decision

The federal tax credit (for vehicles that are eligible for it) is a significantly higher factor in the purchase decision than state or local incentives. Plug In America is working to ensure that this tax credit is available to more drivers for a longer period of time. Access to low-cost home charging is also a significant economic factor in EV adoption, nearly

equal to the federal tax credit in the prevalence of a “most influential” rating and far ahead of any other factor influencing the purchase decision.

In addition to motivation for purchasing the vehicle, owners were surveyed regarding the value of varying sources of EV information in making that purchase decision. A similar dominance exists regarding information sources deemed “most valuable,” with EV-specific websites receiving this rating for over 40% of owners, with items like ride-and-drive events, automakers and online/print news articles garnering rates of 15%–25%. Plug In America and its national and local partners conduct hundreds of ride-and-drive events across the country during Drive Electric Earth Day and National Drive Electric Week. Most surprisingly, friends and family were only cited as key resources by 12% of owners, a potential indicator that this survey sample was heavily composed of the earliest adopters. Figure 4 displays the proportion of owners who indicated that an information source was “most valuable” to them:

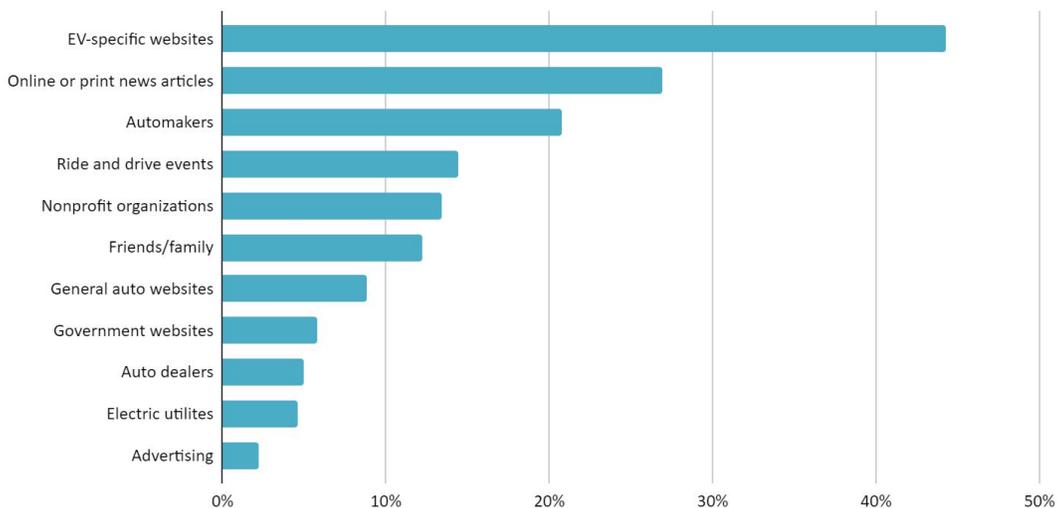


Figure 4: Percentage of EV owners indicating an information source is “Most Valuable” to them

Continuing analysis of what motivates EV buyers, and what they consider the most valuable and trusted information source will be critical to creating and maintaining further momentum in the retail space. It is likely that value systems will continue to evolve as electric vehicles continue to become more mainstream, appealing to new demographics, and the nature of information access continues to change.

Electric utilities were not highly cited as sources of information on electric vehicles, likely because such entities are only now becoming involved in significant education

and outreach efforts.² Many states allow—in fact require—electric utilities to provide information to their customers about energy-efficient technologies such as high-efficiency air conditioners or water heaters. It is less common for utilities to promote EVs, even though these are a highly-efficient technology that can reduce greenhouse gas emissions and place downward pressure on electricity rates. Therefore, in future polling, we hope to see more EV owners consider electric utilities a valuable source of information. As EV-specific websites were recognized as a valuable source of information, we note that Plug In America has developed white-labeled utility-specific versions of its PlugStar site to assist utilities in EV education and outreach.

It is also notable that advertising for EVs is virtually nonexistent as a source of information in the survey responses. While some high-profile commercials for EVs have aired during events such as the Super Bowl, these isolated advertisements do not represent the sort of sustained campaign that drives vehicle sales.

We do note that our survey sample is not representative of a cross-section of the *entire* potential car-buying public; it is biased towards “innovators” in the framework outlined by Everett Rogers (as seen in Figure 5). Later adopters may prefer different information sources. However, because these labels describe a continuum, and not discrete categories, the next wave of adopters will be fairly similar in most regards to those that have already purchased EVs.

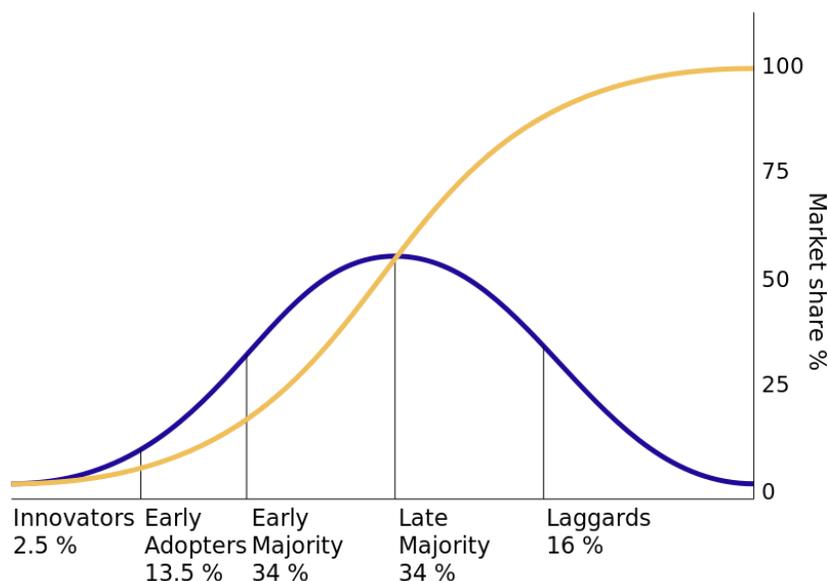


Figure 5: Innovation Diffusion curve. Based on Rogers, E. (1962) *Diffusion of innovations*. Free Press, London, NY, USA.

² For more information on utility education and outreach programs, see the Plug In America white paper, *The Missing Piece on Meeting Transportation Electrification Goals: Utility Education and Outreach Programs*, at <https://pluginamerica.org/wp-content/uploads/2020/12/EO-White-Paper.pdf>

THE CONSUMER EXPERIENCE—PURCHASING AND OWNERSHIP

The EV market is full of satisfied owners, with 96% intending to purchase an EV as their next vehicle. All-electric vehicles were more common in our survey; 83% of EV owners had at least one all-electric, while 26% had at least one plug-in hybrid vehicle. A full 30% of EV owners did not have a conventional internal combustion engine vehicle in their household.

EV owners were less satisfied with the purchasing experience. Only 15% of customers who shopped at a dealership rated the knowledge of the salesperson about EVs as “very high.” While manufacturers do provide informative model-specific training to dealerships, Plug In America has found that dealers often need more tools to answer questions about the entire EV ecosystem—including aspects such as charging infrastructure, rebates, and policies. Figure 6 displays the proportion of survey responses by rating of salesperson EV knowledge.

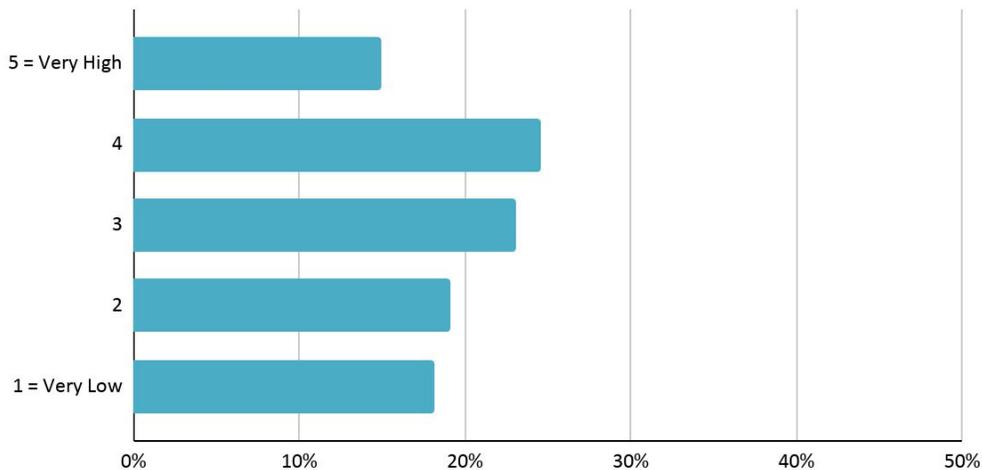


Figure 6: Ratings of salesperson EV knowledge for owners who shopped at dealerships

While overall satisfaction with EV ownership is displayed in the intent to remain an EV owner, the process is not without its frustrations. While over 90% of EV owners charge at home daily or weekly, as shown in Figure 7, the majority also charge in public, to mixed results.

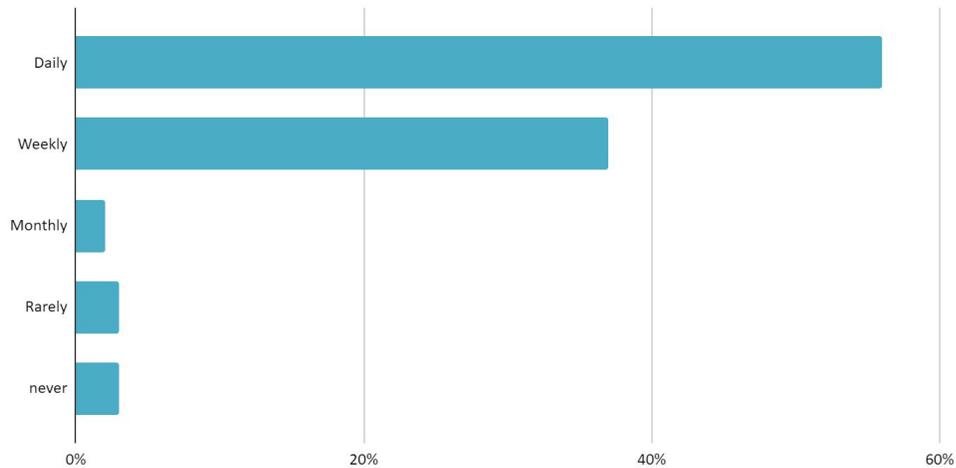


Figure 7: Frequency of home-charging among EV owners

Workplace charging was frequently utilized by EV owners who have such charging available to them. Roughly a quarter of such respondents reported using it daily, and nearly another quarter reported using it weekly, as seen in Figure 8.

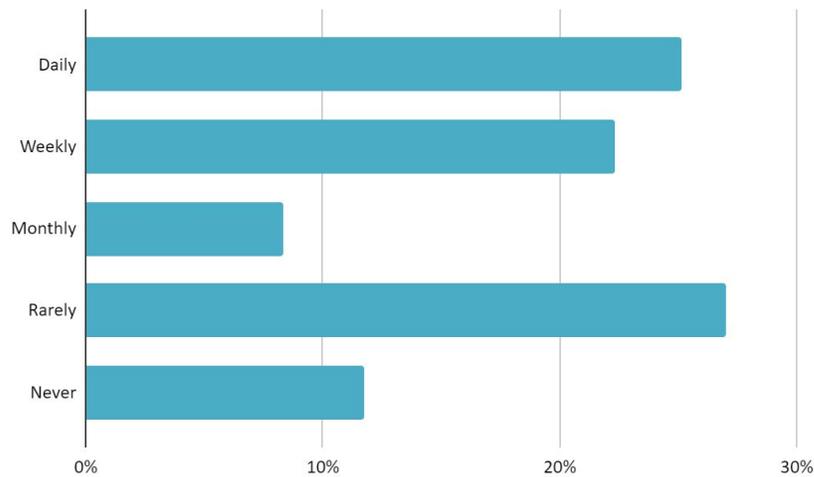


Figure 8: Frequency of workplace charging among EV owners with access to it

Over 50% of drivers have experienced problems with public charging. These problems were more prevalent in those who drove non-Tesla EVs; Tesla drivers have access to a charging network that differs in several key respects from other networks. The most common problem reported was public chargers being nonfunctional. At best, this is a nuisance or inconvenience. At worst, an EV driver could be stranded. Negative

experiences caused by non-functional charging stations would adversely affect the EV market.

Many public chargers are funded through grant programs. Such programs can impose reliability requirements on stations receiving funding; these may include requirements for redundancy (multiple chargers at a given charging location), uptime (establishing a minimum percent of the hours in year that each charger must be functional), and maintenance and repair (stipulating a time to initiate repairs from the notification of a charger being nonfunctional).³ Additionally, some state programs offer grants for replacement of existing charging stations, which will be increasingly necessary as early generations of electric vehicle supply equipment (EVSE) reach the end of their service life. Another specific concern that respondents noted was charging stations being blocked by internal combustion engine (ICE) vehicles, colloquially referred to as "ICE-ing." Numerous jurisdictions have passed laws to prohibit non-charging vehicles from parking in charging spots, although anecdotal evidence suggests that enforcement of such laws is uneven.

Dealer education is a key to accelerating EV adoption. Plug In America's PlugStar program provides dealers with the knowledge and tools to sell EVs, and connected interested EV buyers with trained and certified EV dealers. The average customer satisfaction rating of PlugStar dealers is 4.6 out of 5 stars, compared to 3.5 out of 5 stars for non-PlugStar dealers, with customers of PlugStar dealers twice as likely to give the top rating in customer satisfaction with the purchase experience. Anecdotal evidence suggests that many auto dealerships have had increased turnover due to the COVID-19 pandemic and will need to rebuild their EV expertise as business returns to normal. Also during the current pandemic, dealers are working hard to sustain business as usual and innovate to maintain vehicle sales. This is the perfect time to expand EV dealer support—when they need it the most.

³ The Northeast States for Coordinated Air Use Management (NESCAUM) recommends that charging supported with public funds be required to maintain a 99% uptime (for DCFC), that there should be multiple chargers at each site to provide redundancy (whether DCFC or level 2), and that any necessary repair efforts should be initiated within 24 hours of a notice of malfunction. See <http://www.nescaum.org/documents/model-contract-provisions-for-public-evse-5-24-19.pdf/download>.

EV “INTENDERS” —THE NEXT WAVE OF OWNERSHIP

CONVERGENCE AND DIVERGENCE

Those who do not currently own an EV but are considering purchasing one within the next 12 months share some similarities with current owners, but there are stark differences. Similar to current EV owners, these “intenders” are motivated by environmental and clean air impacts, but they express less concern with the cutting edge technology and the fun of driving (the latter possibly due to lack of experience driving EVs). Figure 9 compares the proportion of intenders who indicated that a factor was “most important” to them when considering the purchase of an EV to that of owners.

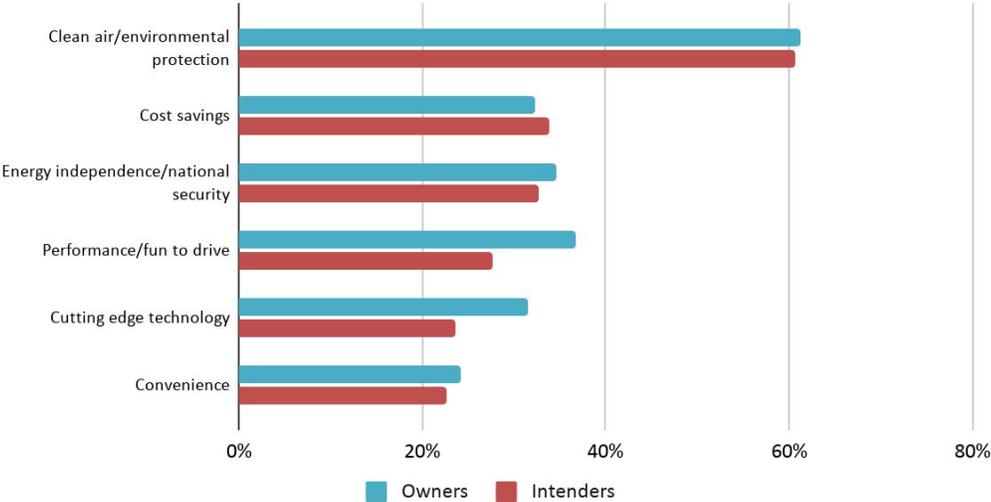


Figure 9: Percentage of respondents indicating a factor is a “Most Important” purchase consideration

Intenders also find EV-specific websites to be the most valuable source of information on EVs, but are more likely to rely on ride-and-drive events, non-profits, friends and family, and general auto websites, generally lower sources of information, than current owners. Figure 10 compares the proportion of intenders who indicated that an information source was “most valuable” to them, vs EV owners.

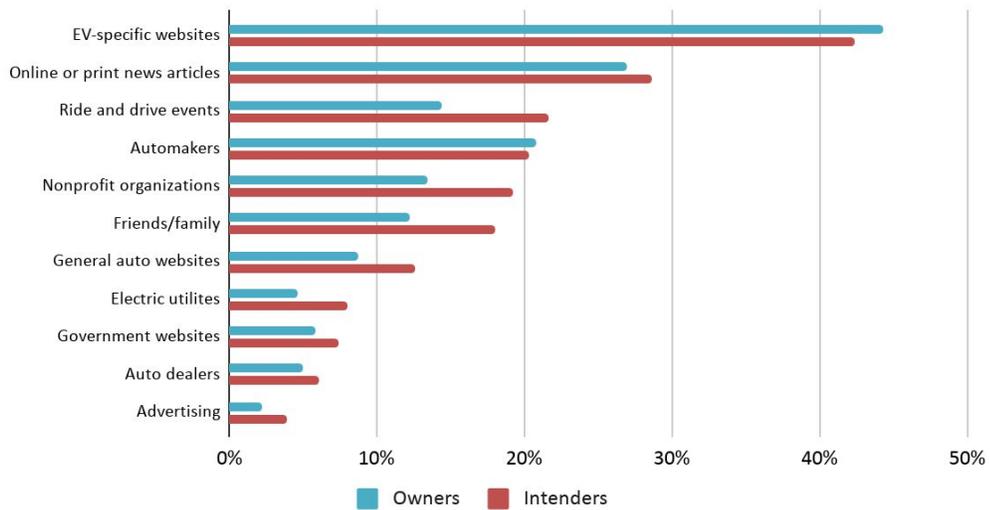


Figure 10: Percentage of respondents indicating an information source is "Most Valuable"

The demographics of population groups also offer cases of similarity and divergence. Intenders are younger, less likely to earn over \$100,000 per year and less likely to live in a single family home, though that is still the dominant home type, with ~80% of respondents. While divergence exists, the groupings are more similar than different. Figures 11–13 display demographic makeups of the two response groups.

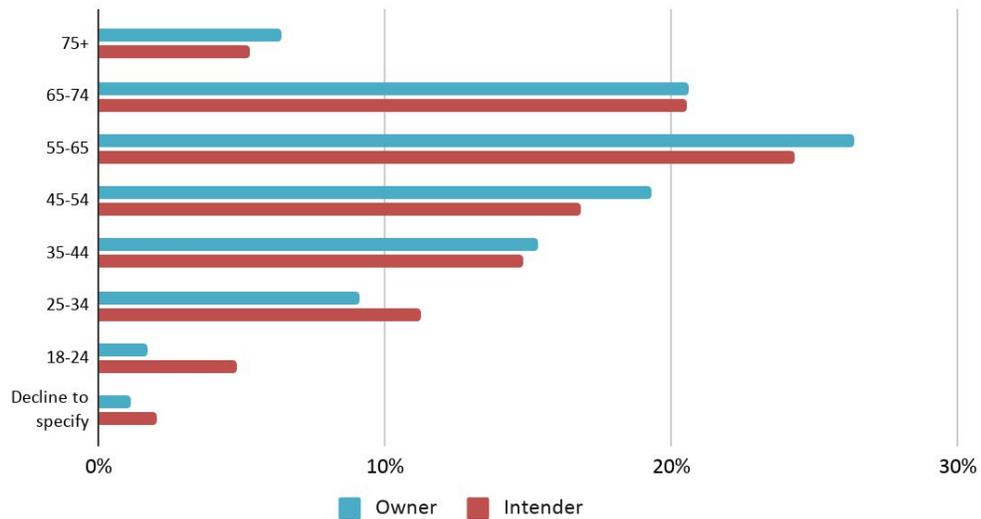


Figure 11: Age distribution of respondents

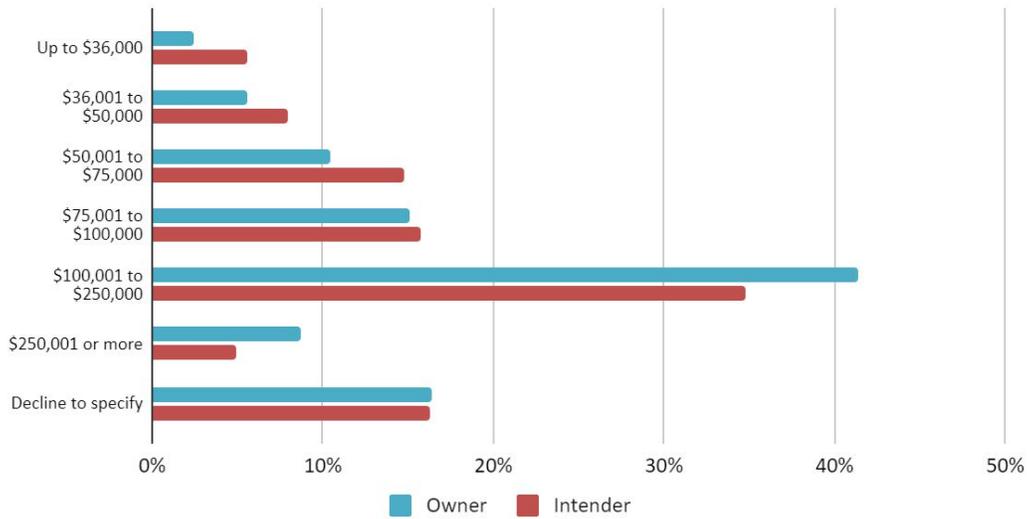


Figure 12: Income distribution of respondents

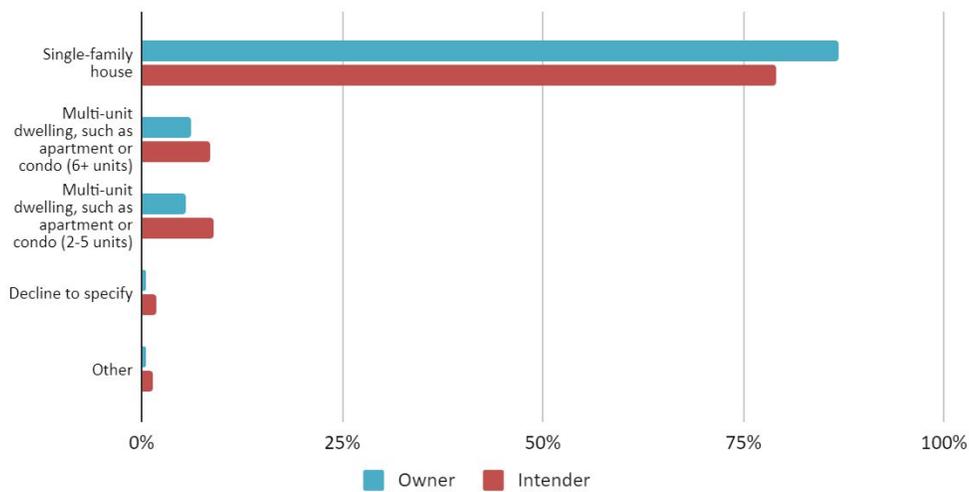


Figure 13: Dwelling distribution of respondents

There are relatively few used EVs on the market, so the profile of EV buyers does skew higher-income, corresponding to the new-car buyer demographic in general. About 20% of respondents did report buying their EV used, not an insignificant amount—however, in the U.S., about two thirds of vehicle sales are used cars and trucks. The used EV proportion will increase as more used EVs come onto the market. As that occurs, buyers of used EVs should be supported with credible and reliable information on vehicle performance and battery condition.⁴

⁴ Plug In America has developed a *Used Electric Vehicle Buyer's Guide*, available online at <https://pluginamerica.org/why-go-plug-in/used-electric-vehicles/>.

Single-family homes with garages offer a lower-cost charging solution than do most multi-unit dwellings. Access to low-cost home charging was one of the most significant economic factors in EV adoption, so it is not surprising that single-family home residents dominate our demographics. Apartments and condominiums may have a garage or parking lot with dedicated parking spaces, or a parking lot with non-dedicated spaces, or may not have parking at all (requiring residents to rely on street parking). Installing charging infrastructure for such buildings does carry a higher capital cost, especially if done as a retrofit where trenching through concrete or asphalt is required. The cost of EV charging is much less if addressed during building construction. Building codes to require new construction to have a significant fraction of "EV-ready" parking spots will enable greater adoption of EVs by residents of multi-unit dwellings.

CONCLUSIONS & FURTHER RESEARCH

EV owners are overall very positive about their experience, with 96% intending to purchase an EV as their next vehicle. EV owners recognize that the vehicles provide a public benefit in improving air quality and reducing greenhouse gas emissions, and this is an important motivating factor in EV adoption.

The vast majority charge at home, but workplace charging is also commonly used by those who have access to it. This is a convenient solution for many EV drivers, including those without access to home charging, and is relatively low-cost for the workplace.

Our survey respondents do reflect an "innovator" profile, with relatively few relying on friends and family for their information about EVs—instead, the innovators are likely the ones *telling* their friends and family about EVs, and bringing their vehicles to ride-and-drive events. These innovators may be willing to endure a few more inconveniences than the next wave of EV drivers, so it is important to listen to their concerns and proactively address them. The "considerers," while also well on the early side of the adoption curve, express a greater consideration for the information provided through ride-and-drives such as those held by Plug In America and partners during National Drive Electric Week and Drive Electric Earth Day.

Drivers noted that dealership knowledge is lacking; Plug In America's PlugStar program can resolve this. In addition, customer-facing websites (also a component of PlugStar) were cited as the most valuable information sources.

Drivers noted that public charging stations are often unreliable. Robust requirements for grant programs can ensure reliability (redundancy, uptime requirements, and maintenance requirements). Additionally, implementation and enforcement of laws to prohibit non-charging vehicles from blocking charging stations will be increasingly important as the EV market develops.

Their demographics of our respondents implicitly indicate a gap in multi-unit dwelling charging availability; building codes, grant programs, and focused work with multi-unit dwelling properties can help overcome this obstacle.

Plug In America looks forward to helping resolve the remaining barriers to EV adoption, and looks forward to learning more about EV drivers with future surveys. In particular, we will look for signs of progress on the dealership experience, the public charging experience, and the availability of charging for multi-unit dwellings. We stand ready to provide consumer education through PlugStar and our ride-and-drive events, and look forward to working with utilities and other partners in these efforts.

AUTHORS AND ACKNOWLEDGMENTS

ABOUT PLUG IN AMERICA

Plug In America is a non-profit, supporter-driven advocacy group. Our mission is to drive change to accelerate the shift to plug-in vehicles powered by clean, affordable, domestic electricity to reduce our nation's dependence on petroleum, improve air quality and reduce greenhouse gas emissions. Plug In America helps consumers, policy-makers, auto manufacturers and others to understand the powerful benefits of driving electric by providing practical, objective EV information.

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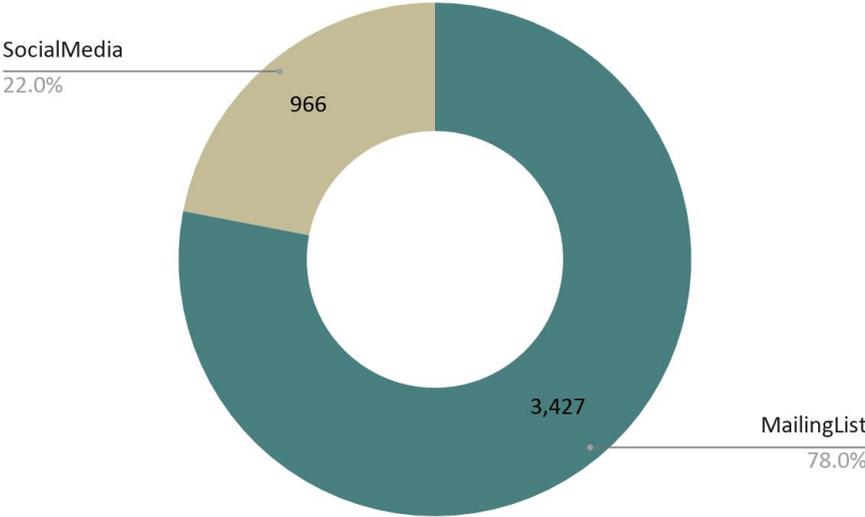
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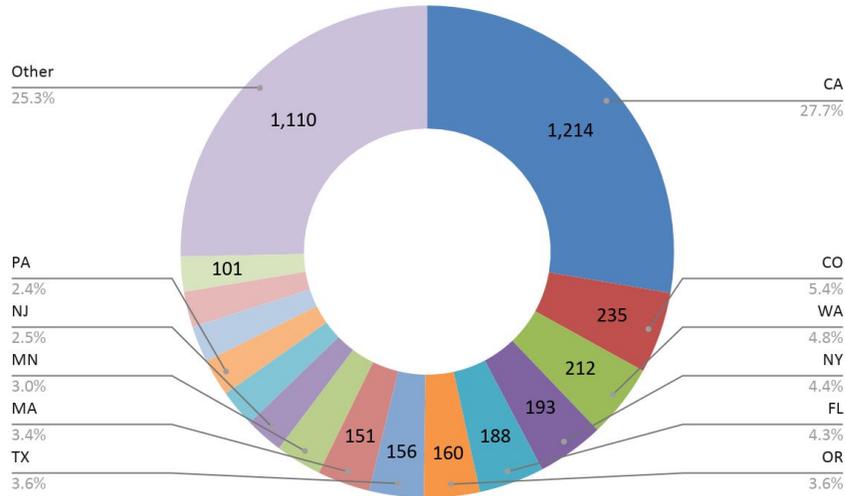
SURVEY METHODOLOGY AND RESPONSE SUMMARY

Plug In America surveyed over 4,000 EV owners and those considering purchasing EVs in October 2020. The survey was promoted in the Plug In America e-mail subscriber list four times between September 15 and October 13, 2020 and advertised on social media between September 14 and October 23, 2020. In both cases, respondents were offered an opportunity to win a \$500 gift card. Below is a summary of data by source, including sample sizes.

Responses By Data Source



Responses By State



Responses By Data Source, Response Type, and Charging Behavior

