



Plug-In Electric Vehicle Showcases: Consumer Experience and Acceptance

Mark Singer

National Renewable Energy Laboratory

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All judgments in the final analytic methodologies and interpretations are the responsibility of the author.

List of Acronyms

AEV	all-electric vehicle
DOE	U.S. Department of Energy
EVOLVE	Electric Vehicle Opportunities: Learning, eVents, Experience
NREL	National Renewable Energy Laboratory
PEV	plug-in electric vehicle
PHEV	plug-in hybrid electric vehicle

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Introduction

In 2016, the U.S. Department of Energy’s (DOE) Office of Energy Efficiency and Renewable Energy’s Vehicle Technologies Office announced three projects¹ to develop, manage, and host plug-in electric vehicle (PEV) showcases to demonstrate available technologies and provide a hands-on consumer experience at conveniently located, brand-neutral settings. The events varied from long-term stationary storefront settings to one- or two-day events at a variety of regional venues. Attendees could interact with the technology through ride-and-drives and longer-term test drives. The events began in the spring of 2017 and continued through 2019.

Three regions were represented by the projects (Figure 1).

- The **Midwest** region was the focus of the American Lung Association’s effort titled the Midwest (EVOLVE) Electric Vehicle Opportunities: Learning, eEvents, Experience project as a partnership with eight Midwestern Clean Cities coalitions across seven states: Illinois, Indiana, Michigan, Minnesota, North Dakota, Ohio, and Wisconsin (Midwest EVOLVE; Clean Cities).
- The **Pacific Northwest** region was covered by Forth events in Oregon and Washington (Forth).
- The **Northeast** region was covered by Plug In America events held in Connecticut, Massachusetts, Rhode Island, and Vermont (Plug In America).



Figure 1: Plug-in electric vehicle showcase geographies

Note: The awardee Plug In America is based in Los Angeles, but showcases were held in the Northeast. Source: Clean Cities

¹ DOE. 2016. “FY 2016 Vehicle Technologies Office Program-Wide Funding Opportunity Announcement Number Selections DE-FOA-0001384.” <https://www.energy.gov/sites/prod/files/2016/08/f33/FY%2016%20VT%20Program-Wide%20Selection%20Table.pdf>

The projects conducted online surveys of their participants, consistent across all events, to understand their sentiments toward PEVs and whether exposure to the technology increases the likelihood of a PEV purchase. The primary surveys were conducted immediately before and after the events. Questions covered topics including level of interest in PEVs, PEV attributes affecting interest, and respondent’s current vehicle habits. A follow-up questionnaire conducted months after the event was designed to capture how sentiments may have changed and whether the respondent took any further action toward purchasing a PEV. Respondents on average took seven minutes to complete the pre-drive survey, six minutes for the post-drive survey, and four minutes for the follow-up survey. This report summarizes results of over 9,000 responses collected through the pre-, post-, and follow-up questionnaires through September 2019. The report sections cover the following:

- Section 1: summary of key national level findings.
- Section 2: summary of regional differences in respondent views.
- Section 3: respondents’ existing vehicle behaviors and views of PEVs.
- Section 4: shifts in respondents’ views of PEVs from the pre- to post-drive surveys.
- Section 5: variations in expectations to consider PEVs by respondent attributes.
- Section 6: follow-up survey views of PEVs and PEV owner behaviors.

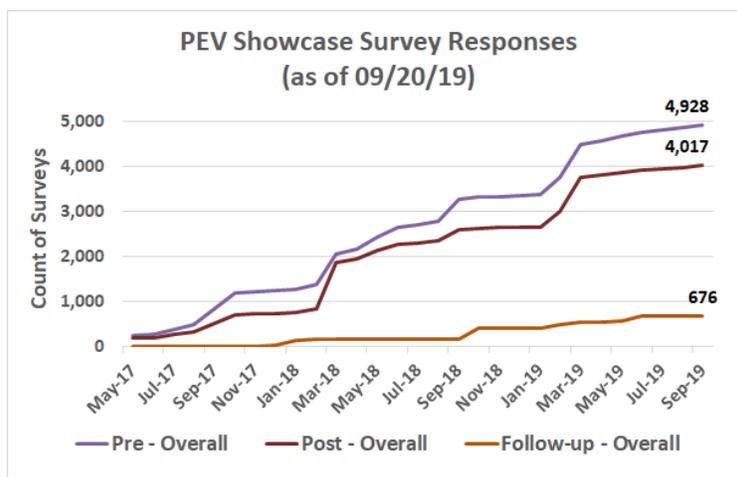


Figure 2: Survey totals

Surveys investigated views for two primary PEV technologies: all-electric vehicles (AEVs)—which are powered only by electric motors—and plug-in hybrid electric vehicles (PHEVs)—which are powered by electric motors but also have internal combustion engines using petroleum fuel. The specific survey language referred to AEVs as “pure electric vehicles” to make a clear distinction from PHEVs.

Participants did not all complete both the pre- and post-drive surveys, despite the event coordinators’ best efforts. Respondents provided email addresses in their responses that allow the

results to be linked across the pre- and post-drive surveys. The differing survey response totals and reduced number that can be linked across the surveys showed many respondents did not complete the surveys. Additionally, respondents did not always complete all questions in the surveys they began. For the purposes of this report, data was generally included when available. Additionally, only the most recent response from a specific respondent email address was included in the analysis. For all these reasons, sample sizes vary across the different summaries presented and are noted in each view.

1 Key Findings of Plug-in Electric Vehicle Surveys

The following findings are from a series of online surveys of PEV showcase event participants from 2017 to 2019. Note that sample sizes vary by topic and are detailed in later sections.

Before the events, participants reported the following:

- Respondents with firsthand exposure to PEVs were more likely to at least expect to consider a PEV (PHEV 70% and AEV 72%) than those with no prior exposure (PHEV 49% and AEV 44%)
- Respondents that regularly passed charging stations were more likely to at least expect to consider a PEV (PHEV 66% and AEV 69%) than those not aware of charging stations (PHEV 52% and AEV 47%)
- Respondents able to park near an existing electrical outlet were more likely to at least expect to consider a PEV (PHEV 66% and AEV 69%) than those not able to park near an outlet (PHEV 57% and AEV 50%).
- Respondents were more likely to agree that PHEVs, in comparison to AEVs, were as good or better than gasoline vehicles (72% for PHEVs compared to 62% for AEVs)
- Similar percentages of respondents at least expected to consider purchasing a PHEV (62%) or an AEV (63%)
- Prior firsthand exposure to PEVs, as defined by owning, having sat in, or having driven a PEV, was reported by 44% of respondents
- Neighbors with a PEV were reported by 24% of respondents and 36% had previously seen PEV advertisements
- In terms of charging stations awareness, 28% of respondents passed charging stations regularly, 26% had workplace charging stations, and 41% saw charging stations at stores
- The ability to park near an existing outlet at home was reported by 58% of respondents.

When the sample is reduced to only those who answered questions both before and after events, respondents displayed the following shifts:

- More were likely after events (86%) than before events (73%) to agree PHEVs were as good or better than traditional gasoline vehicles
- More were likely after events (77%) than before events (61%) to agree AEVs were as good or better than traditional gasoline vehicles
- More were likely after (73%) than before events (62%) to expect to consider a PHEV
- More were likely after (75%) than before events (62%) to expect to consider an AEV.

2 Summary of Regional Findings

The following summaries detail the prominent findings for the respondent group from each region. The conclusions are not expected to be indicative of the general public in each region as it is not known how representative the event attendees are of the region.

2.1 Pacific Northwest Respondent Findings

Pacific Northwest respondents were more interested in acquiring AEVs than other respondents. These respondents came to the events with higher percentages believing PEVs are as good or better than traditional gasoline vehicles than respondents from other regions. While a higher percentage agreed PHEVs were as good or better than traditional gasoline vehicles, a higher percentage expected to at least consider acquiring an AEV over a PHEV. In addition, a higher percentage of Pacific Northwest respondents were not planning to consider a PHEV (and were only planning to consider an AEV) compared to the other regions.

Response findings show that Pacific Northwest respondents:

- Were most likely to have attended a showcase at a retail outlet (32% compared to 1% for the Midwest and Northeast)
- Were more likely to consider purchasing a used vehicle (37% compared to 28% for the Midwest and 24% for the Northeast)
- Had shorter daily commutes, with a median daily commute of 15 miles (compared to 20 miles for the Midwest and Northeast respondents)
- Drive fewer annual miles, with a median of 10,000 miles (compared to 12,000 miles for the Midwest and Northeast respondents)
- Were more likely before the event to say PEVs were as good or better than gasoline vehicles than other regions (83% for PHEVs and 78% for AEVs)
- Were more likely before the event to expect to at least consider an AEV (82%) than a PHEV (63%), and had the highest percentage of all regions not planning to consider a PHEV (25%)
- Had the highest overall exposure to PEVs prior to the event and were particularly likely to have a neighbor with a PEV (38%, compared to 24% overall)
- Were most aware of charging stations they pass regularly (44%, compared to 28% overall) and at stores (56%, compared to 41% overall)
- Were most likely able to charge at home at an existing outlet (66%, compared to 58% overall)
- Valued environmental impact at the highest rate (69%, compared to 53% overall).

2.2 Midwest Respondent Findings

Midwest respondents overwhelmingly attended public events rather than workplace events or showcases at retail outlets and came to these events with the lowest levels of PEV exposure and awareness of public charging stations. These rates were similar to Northeast respondents, while being much lower than Pacific Northwest respondents. Midwest respondents were more likely to be interested in PHEVs than AEVs.

Response findings show that Midwest respondents:

- Were most likely to attend a public event (73%) compared to the Pacific Northwest (45%) and the Northeast (36%)
- Were less likely to consider leasing a new vehicle (12%) compared to the Pacific Northwest (21%) and the Northeast (20%)
- Were more likely to use their vehicle for towing (23%) compared to the Pacific Northwest (12%) and the Northeast (13%)
- Have a median daily commute of 20 miles and a median annual mileage of 12,000 miles, which is the same as Northeast respondents and longer than Pacific Northwest respondents
- Were much less likely than Pacific Northwest respondents and slightly less likely than Northeast respondents before the event to say PHEVs were better than traditional gasoline vehicles (48%, compared to 70% for the Pacific Northwest and 54% for the Northeast)
- Were much less likely than Pacific Northwest respondents and slightly less likely than Northeast respondents before the event to say AEVs were better than traditional gasoline vehicles (39%, compared to 66% for the Pacific Northwest and 43% for the Northeast)
- Were less likely than other region respondents before the event to at least expect to consider a PHEV (60% compared to 63% for the Pacific Northwest and 66% for the Northeast)
- Were less likely than other respondents before the event to at least expect to consider an AEV (56%, compared to 82% for the Pacific Northwest and 64% for the Northeast)
- Had the lowest exposure to PEVs prior to the events, though similar to Northeast respondents, with the greatest difference in exposure being having driven a PEV (19%, compared to 25% for Northeast respondents) and being aware of tax credits (33%, compared to 38% for Northeast respondents)
- Were least aware of any public charging stations overall (63%, compared to 84% for Pacific Northwest and 77% for Northeast)

- Were more likely to cite fuel costs (56%) than environmental impacts (47%) as a primary reason for considering a PEV, unlike other regions.

2.3 Northeast Respondent Findings

Northeast respondents were more likely than others to attend a workplace event rather than a general public event or a showcase at a retail outlet. These respondents were particularly aware of workplace charging stations and valued workplace charging while considering a PEV. Like other regions, these respondents were more likely to believe PHEVs than AEVs were as good or better than traditional gasoline vehicles, but only slightly favored PHEVs over AEVs in their expectation to consider purchasing them.

Response findings show that Northeast respondents:

- Were most likely to attend an event held at a workplace (50%, compared to 11% for the Midwest and 10% for the Pacific Northwest)
- Were least likely to consider buying a used vehicle (24%, compared to 28% for the Midwest and 37% for the Pacific Northwest)
- Have a median daily commute of 20 miles and a median annual mileage of 12,000 miles, which is the same as Midwest respondents and longer than Pacific Northwest respondents
- Were less likely than Pacific Northwest and slightly more likely than Midwest respondents before the event to say PHEVs were as good or better than gasoline vehicles (71%, compared to 83% for the Pacific Northwest and 70% for the Midwest)
- Were less likely than Pacific Northwest and slightly more likely than Midwest respondents before the event to say AEVs were as good or better than traditional gasoline vehicles (60%, compared to 78% for the Pacific Northwest and 57% for the Midwest)
- Were more likely than other respondents before the event to at least expect to consider a PHEV (66%, compared to 63% for the Pacific Northwest and 60% for the Midwest)
- Were more likely than Midwest respondents and less likely than Pacific Northwest respondents before the event to at least expect to consider an AEV (64%, compared to 82% for the Pacific Northwest and 56% for the Midwest)
- Had similar, but higher exposure than Midwest respondents to PEVs prior to the events, with the greatest difference in exposure being having driven a PEV (25%, compared to 19% for Midwest respondents) and being aware of tax credits (38%, compared to 33% for Midwest respondents)
- Were most aware of workplace charging stations overall (43%, compared to 29% for the Pacific Northwest and 19% for the Midwest)
- Were most likely to cite the ability to charge at work as a top consideration for a PEV purchase (16%, compared to 4% for the Pacific Northwest and 9% for the Midwest).

3 Pre-Drive Views

Pre-drive questionnaires were designed to capture the incoming sentiments of participants towards PEVs. These sentiments included how participants compare PEVs to traditional gasoline vehicles and their expectations for purchasing PEVs. Additionally, participants were asked about their current exposure to PEVs and their current vehicle purchasing and driving habits. In several instances the results were compared to those of a study conducted by the National Renewable Energy Laboratory (NREL) in February 2017 of U.S. households (Singer 2017). This study was conducted near the beginning of the PEV showcase events in the spring of 2017 and contained questions with wording similar to those of some in the showcase surveys. The results of the 2017 national study are noted in results of this study to provide a benchmark for how the event participants’ sentiments compare to U.S. households overall.

3.1 Event Types

Events were classified by type, including events open to the public, events hosted at a participant’s workplace, events at a retail outlet (termed a “showcase”), events held by a fleet, and other (Figure 3). Most event respondents (62%) were from Midwest events. Pacific Northwest and Northeast events each were represented by 19% of respondents overall. The most common event type was a public event, and 60% of respondents reported attending one. Midwest events were particularly dominated by public events at 73% of respondents. Pacific Northwest event respondents reported the highest percentage attending a showcase event (32%) of all three groups. The largest percentage of Northeast participants (50%) attended workplace events.

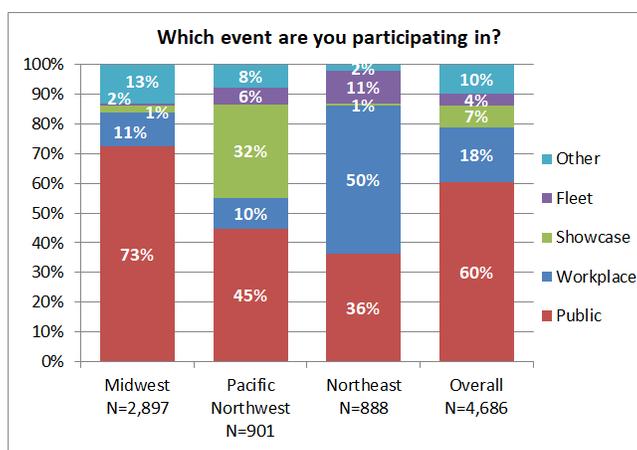


Figure 3: Showcase event types

3.2 Acquisition Preferences

Participants were asked about their expectations for how they would acquire their next vehicle (Figure 4). Consistent across all the events, about half of respondents were considering buying a new vehicle. The second most likely acquisition was buying a used vehicle. Midwest respondents were less likely to consider leasing a new vehicle (12%) than Pacific Northwest or Northeast respondents (21% and 20%, respectively). Pacific Northwest respondents were more likely to consider buying a used vehicle (37%) than the overall rate of 29%. Overall, 24% of respondents were not considering buying or leasing a vehicle. The potential effects of acquisition preferences on willingness to purchase PEVs are investigated in Section 5.

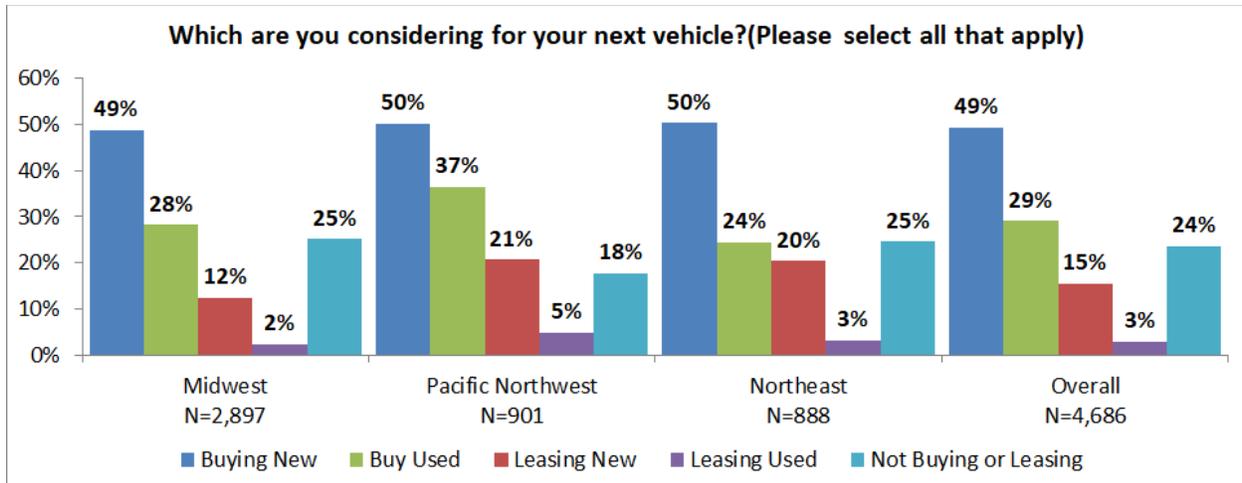


Figure 4: Acquisition preferences

3.3 Vehicle Ownership and Usage Behaviors

Participants were asked about their current vehicle ownership and usage behaviors (Figure 5). Overall, 74% of respondents reported owning two or more vehicles. Pacific Northwest respondents were most likely to own one or fewer vehicles (35%). Respondents generally owned more vehicles than national-level census data reported in 2014 (U.S. Census Bureau 2017). The potential effects of household vehicle ownership on willingness to purchase PEVs are investigated in Section 5.

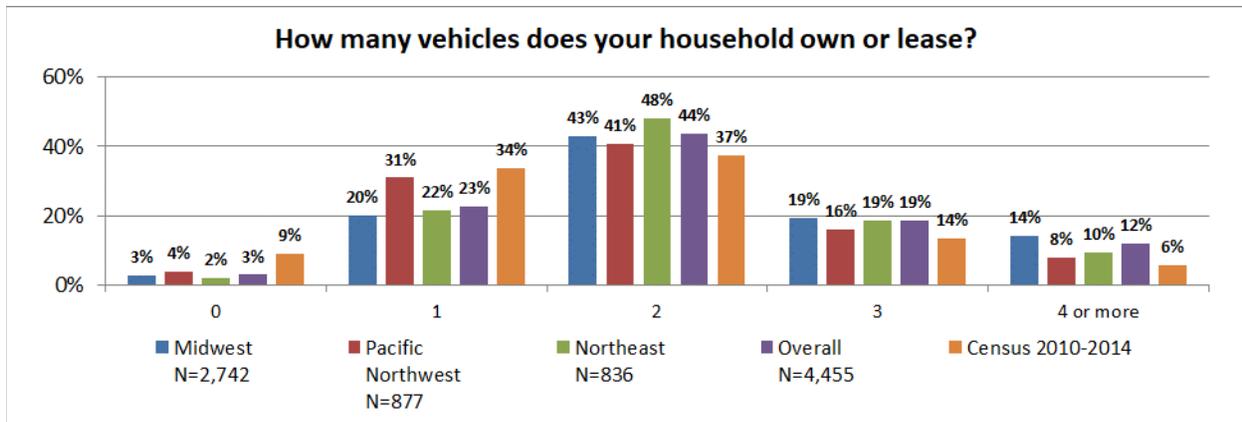


Figure 5: Household vehicles

Source: U.S. Census Bureau 2017

A significant percentage of respondents (19%) reported using their vehicles for towing (Figure 6). Midwest respondents had the highest percentage (23%) reporting towing needs.

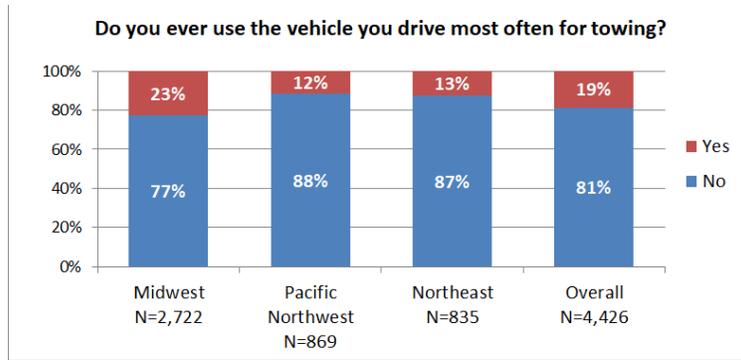


Figure 6: Towing requirements

Participants reported how far they drive in a typical daily commute as well as their annual mileage (Figure 7). The median daily one-way commute was 20 miles across the respondents, except for Pacific Northwest respondents, which reported a shorter 15-mile median commute.

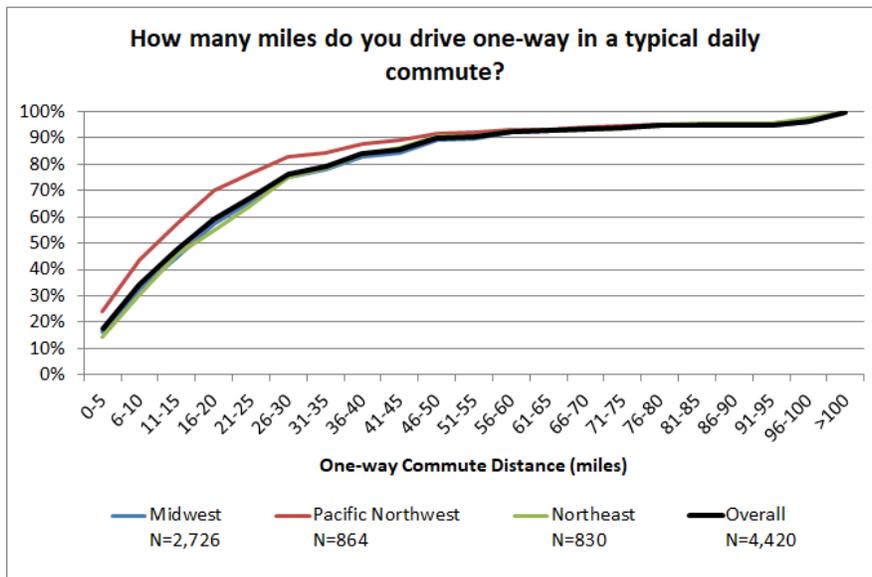


Figure 7: One-way commute distance

Pacific Northwest respondents also drive less annually, with a 10,000-mile median mileage compared to a median 12,000 miles for the other regions (Figure 8). Northeast respondents have fewer very low-mileage drivers (0–2,000 miles) than respondents overall.

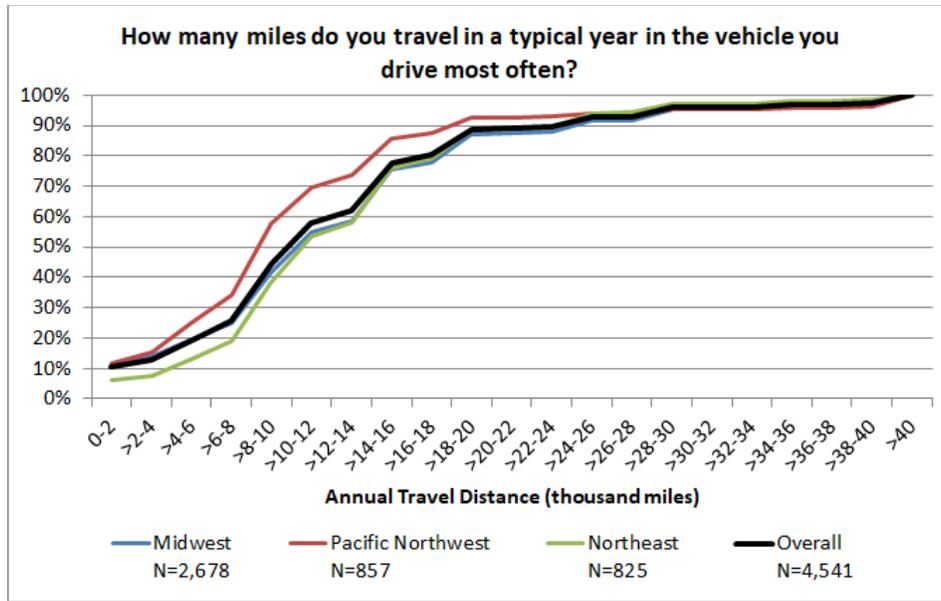


Figure 8: Annual vehicle miles

3.4 Existing PEV Sentiments

The primary sentiments captured indicate how respondents compare PEVs to traditional gasoline vehicles and whether they expect to consider a PEV for their next purchase or lease. Respondents were asked separately about PHEVs and AEVs.

Overall, 72% of respondents felt PHEVs are as good or better than gasoline vehicles (Figure 9). This rate is much higher than the 46% that responded similarly to the 2017 national survey of U.S. households (Singer 2017) and shows participants were more favorable to PEVs than the broad U.S. public was in the months prior to the events. Pacific Northwest respondents showed particularly high acceptance of PEVs, with 70% believing PHEVs are better than gasoline vehicles.

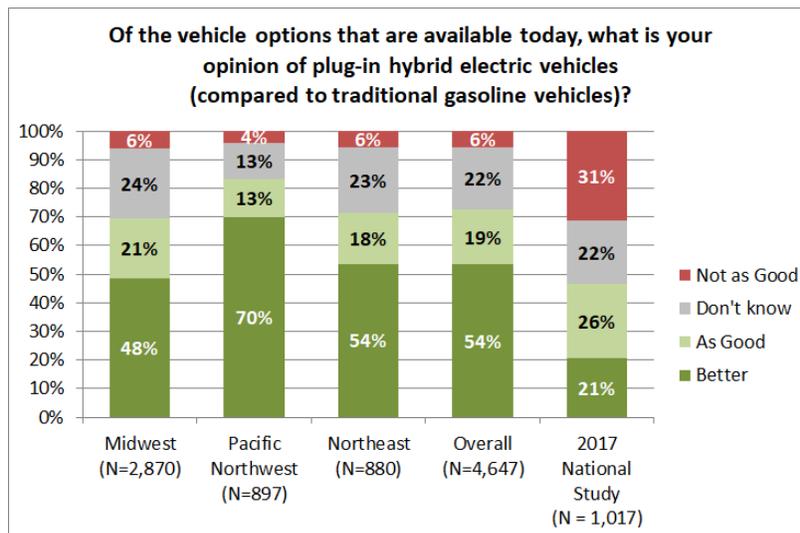


Figure 9: Pre-drive PHEV acceptance

Similarly, a higher percentage of participants (62%) viewed AEVs to be as good or better than traditional gasoline vehicles than the percentage of the general public (46%) in the 2017 national study (Figure 10). According to this metric, respondents reported a higher acceptance of PHEVs (72%) than AEVs (62%). Pacific Northwest respondents showed the greatest level of acceptance of AEVs, with 78% believing them to be as good or better than traditional gasoline vehicles.

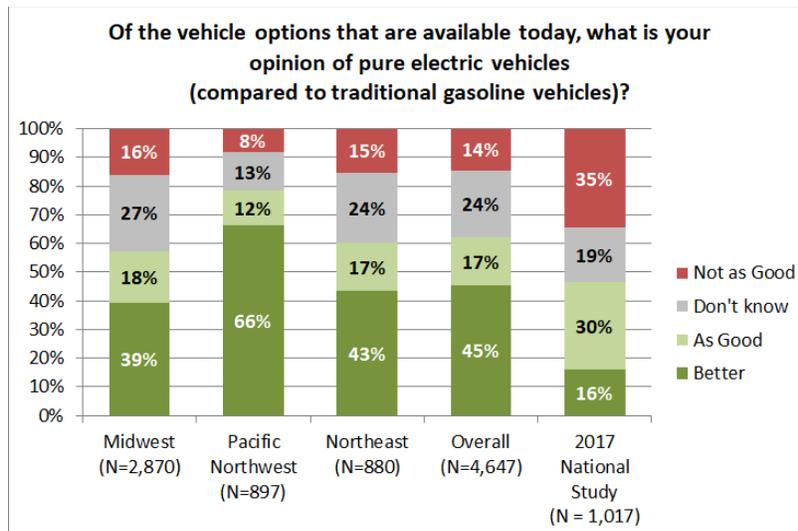


Figure 10: Pre-drive AEV acceptance

Respondents who expected to make a future vehicle acquisition—76% stated they would buy or lease a new or used vehicle in Section 3.2—were asked about the likelihood they would acquire a PEV. When respondents were asked whether they would consider a PHEV for their next purchase or lease (Figure 11), 62% said they expect to consider purchasing, expect to purchase, or will purchase a PHEV. This is much higher than the 24% of U.S. households that stated they would at least expect to consider purchasing a PHEV in the 2017 survey. However, this is not a direct comparison as the national study did not exclude those not planning to acquire a vehicle from the question.

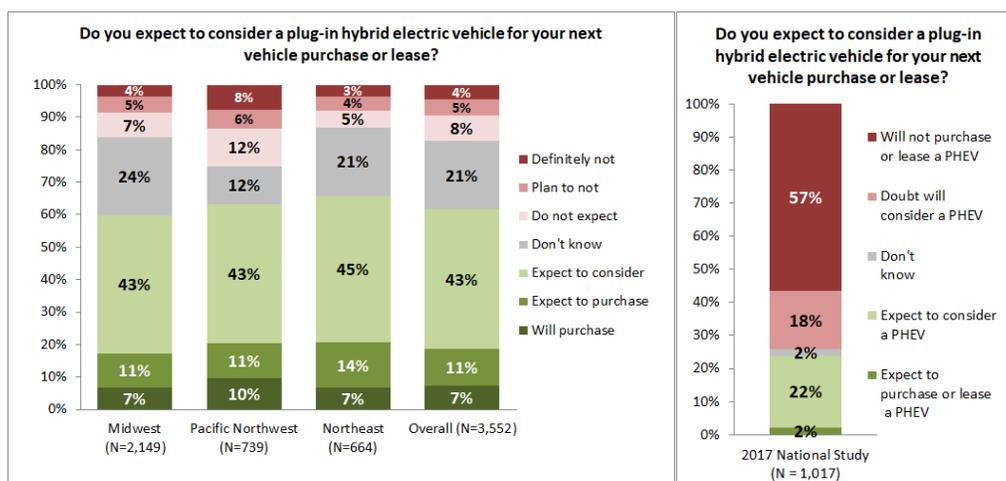


Figure 11: Pre-drive PHEV willingness to acquire

Like the case with PHEVs, most respondents (63%) stated they expect to at least consider purchasing an AEV (Figure 12). This is again higher than the 21% of respondents in the 2017 national study stating they expected to at least consider an AEV. Pacific Northwest respondents showed a preference for considering purchasing an AEV (82%) compared to a PHEV (63%). Midwest respondents were more likely to consider purchasing a PHEV (60%) compared to an AEV (56%). Northeast respondents were more evenly interested in the two technologies, with 66% expecting to at least consider a PHEV and 64% expecting the same for an AEV.

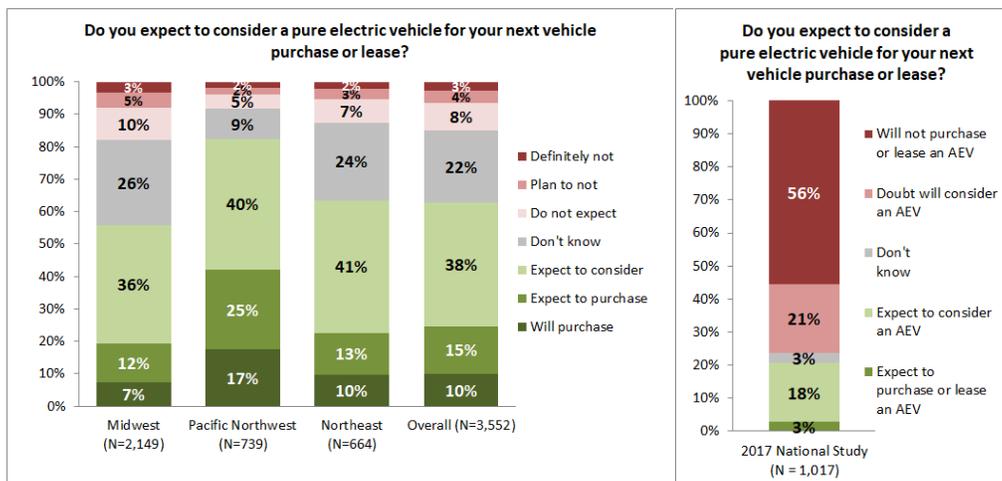


Figure 12: Pre-drive AEV willingness to acquire

3.5 Prior Exposure and Ability to Charge

Respondents were asked whether they had been previously exposed to PEVs (Figure 13). The most common type of exposure was seeing PEVs in parking lots, with 44% reporting this exposure. Seeing advertisements for PEVs was second (36%) and having heard of tax incentives was third (34%). Similar percentages of respondents had sat in a PEV (26%), had a neighbor with a PEV (24%), or driven a PEV (22%). A small percentage (9%) reported already owning a PEV. Firsthand exposure to PEVs, as defined by owning, having sat in, or having driven a PEV was higher in each category than the results of the 2017 national survey. Overall, 44% of respondents reported prior firsthand exposure to PEVs. The exposure level for Pacific Northwest respondents was consistently higher than other regions. The potential effects of prior PEV exposure on willingness to purchase PEVs are investigated in Section 5.

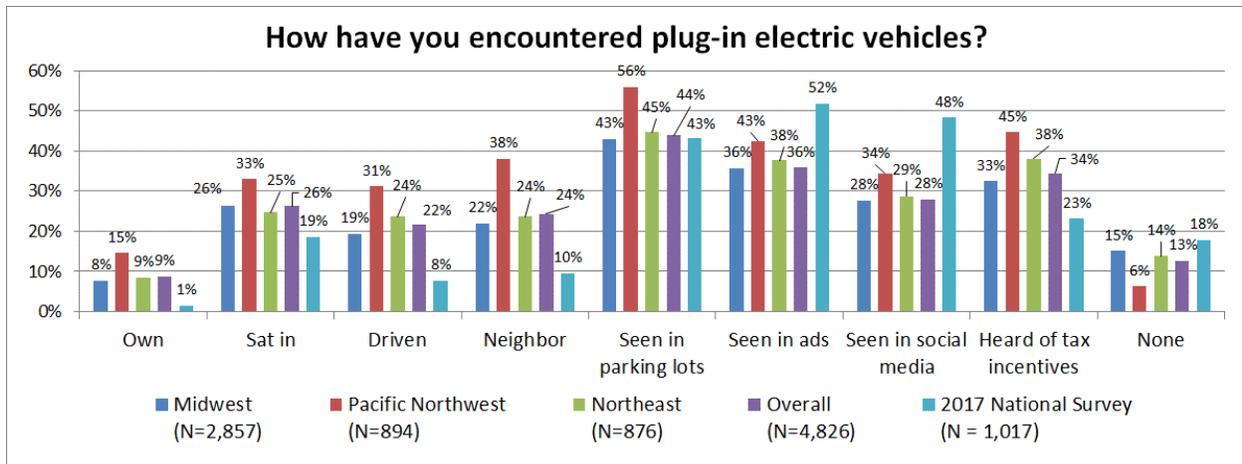


Figure 13: PEV exposure

Respondents were more aware of PEV charging stations than the respondents of the 2017 national study (Figure 14). The most common awareness of charging stations was that of those at stores and places regularly visited (41%). Midwest respondents were the least aware of charging stations, with only 63% reporting being aware of any charging stations along their typical drive. Pacific Northwest respondents were most aware of charging stations at 84%. Northeast respondents were particularly aware of workplace charging stations (43%). The potential effects of charging station awareness on willingness to purchase PEVs are investigated in Section 5.

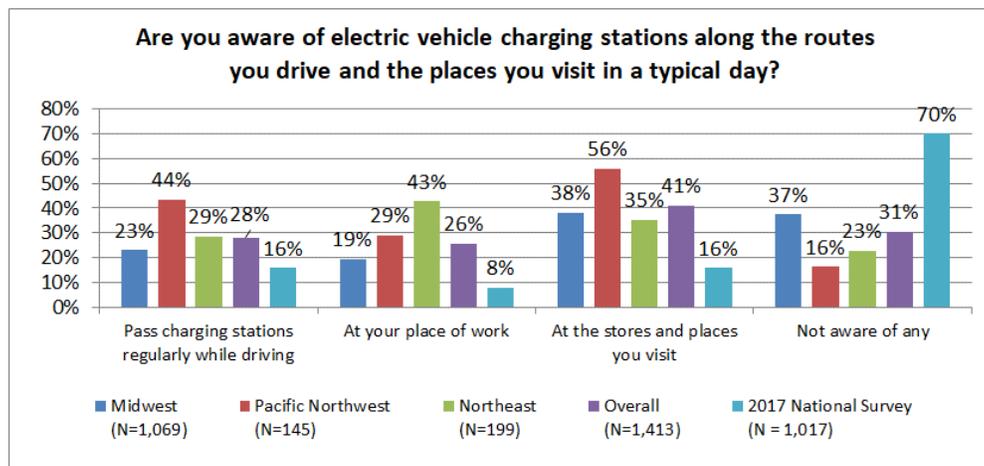


Figure 14: PEV charging station awareness

A majority (58%) of respondents believed they were able to park a vehicle near an existing electrical outlet at or near their home (Figure 15). A large minority (23%) were unsure if they could. Pacific Northwest respondents reported the highest percentage of respondents able to plug in at home (66%). The potential effects of the ability to charge at home on willingness to purchase PEVs are investigated in Section 5.

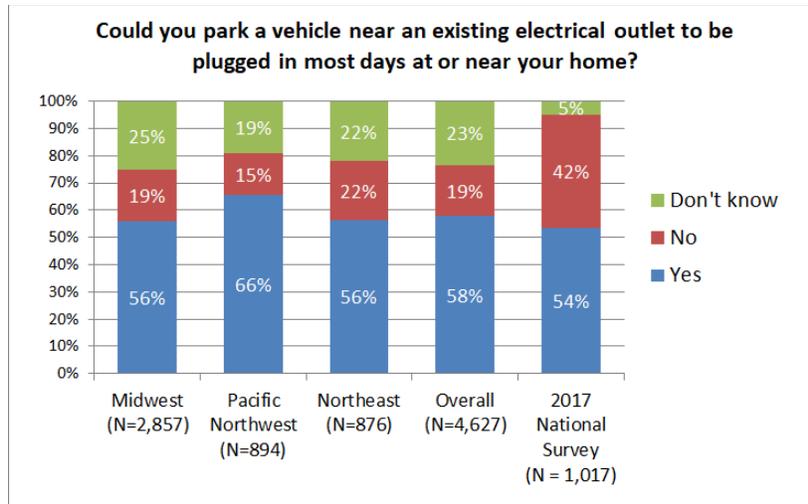


Figure 15: Ability to charge at home

3.6 Reasons for Considering

The top reasons for considering PEVs (Figure 16) were fuel costs (54%) and environmental impact (53%). A second tier of reasons included maintenance costs (26%), electric vehicle tax incentives (24%), driving range of the battery (22%), and charging at home (20%). The top reasons to consider were generally consistent across the different regions. Pacific Northwest respondents reported a higher interest in environmental impacts of the vehicles (69%) compared to respondents overall (53%). Northeast respondents reported an increased interest in charging at work (16%) compared to respondents overall (9%). This aligns with Northeast events more likely to have been held at workplaces, as reported in Section 3.1.

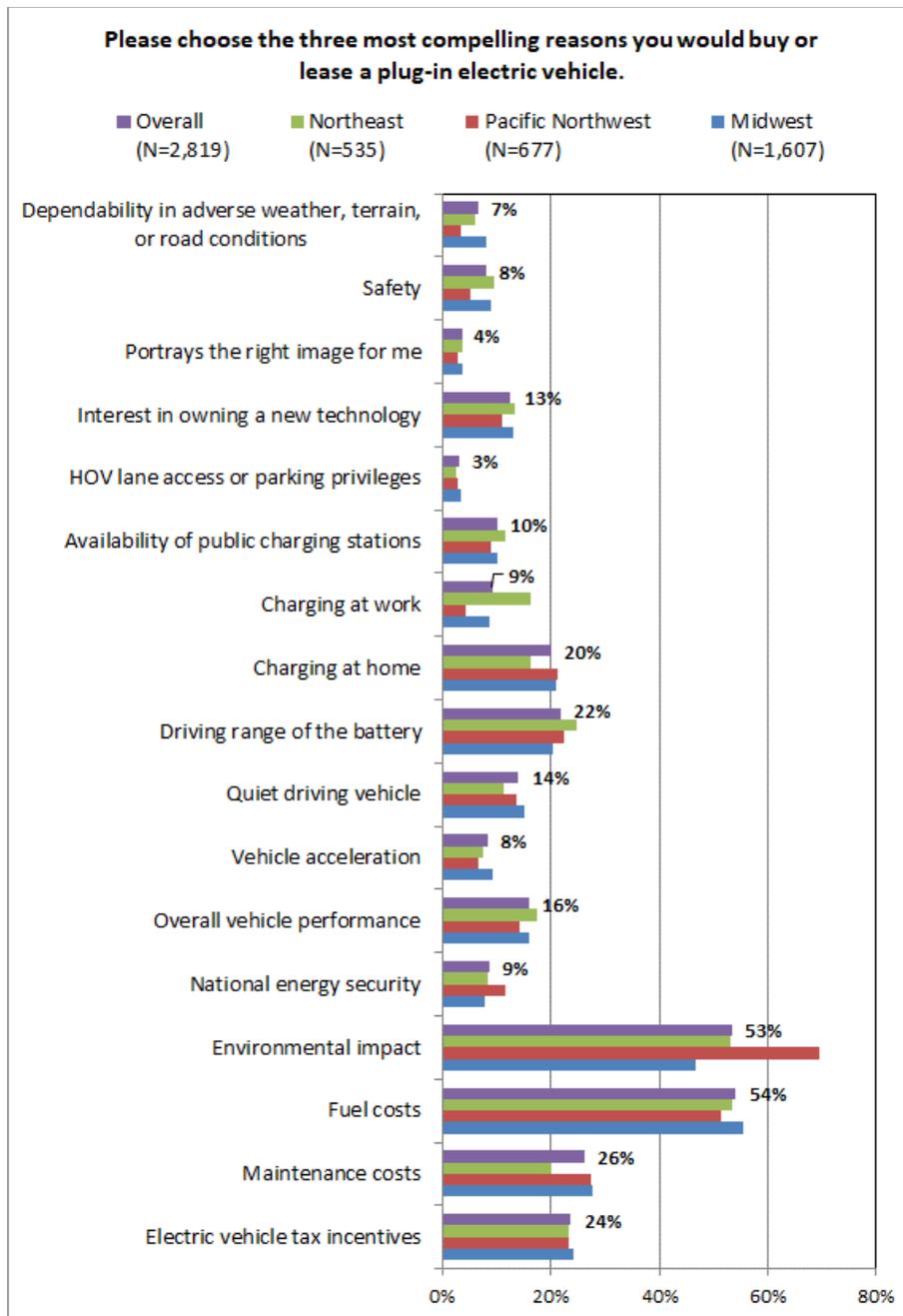


Figure 16: Reasons to consider a PEV

3.7 Reasons for Not Considering

The top reasons for not considering PEVs (Figure 17) included the driving range of the battery (52%) and vehicle cost (42%). A second tier of reasons to not consider PEVs included availability of public charging stations (33%), how long the battery will last (33%), ability to charge away from home (30%), and the length of time to charge the vehicle (27%). These top reasons were generally consistent across the different regions. Pacific Northwest respondents were more likely to be concerned about vehicle cost (58%) compared to respondents overall (42%), less likely to be concerned about public charging availability (19%) compared to

respondents overall (33%), and more likely to be concerned about how long the battery would last (39%) compared to respondents overall (33%).

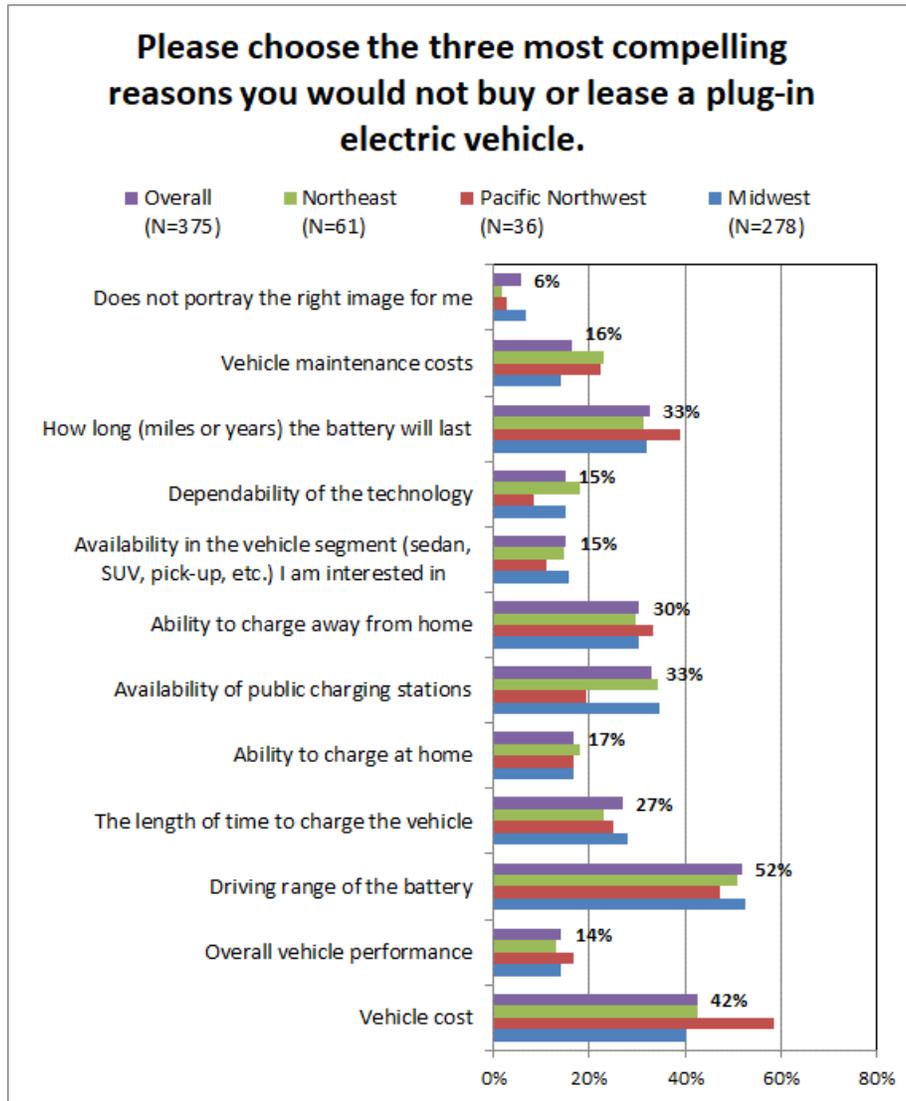


Figure 17: Reasons to not consider a PEV

3.8 Pre-Drive Required Battery Range

Respondents provided the battery range they would require of an AEV to consider purchasing one (Figure 18). The median range was 200 miles across all events. This range was less than the median 300-mile required range of U.S. households in the 2017 national study. Pacific Northwest respondents had the same 200-mile median range as other events, but fewer Pacific Northwest respondents required higher mileages.

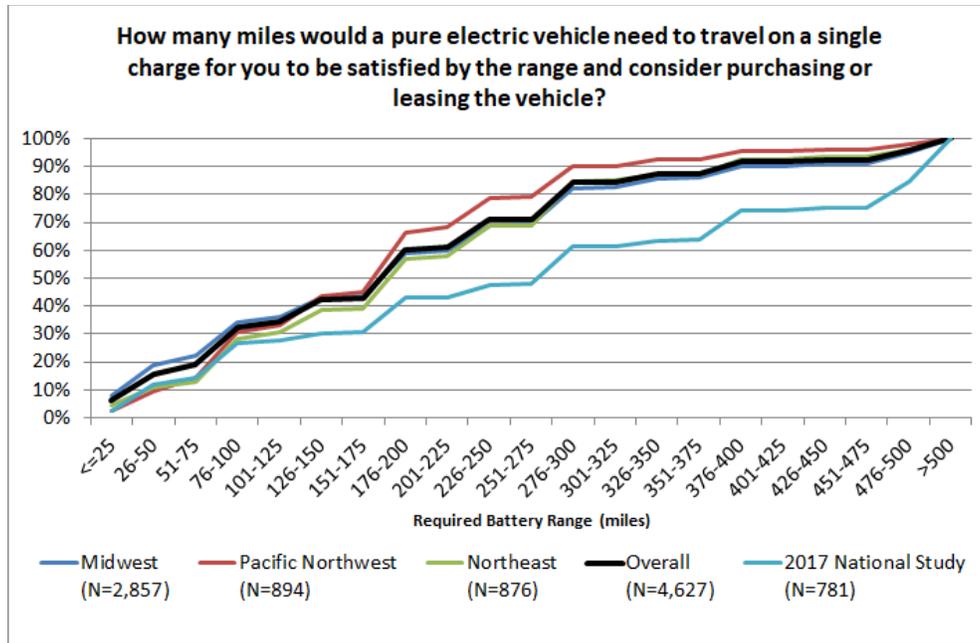


Figure 18: Pre-drive required battery range

4 Post-Drive Views

Participants completed post-drive questionnaires immediately following the events. The post-drive questionnaire asked respondents about the type of vehicle they drove and then repeated the questions from the pre-drive questionnaire regarding how they compare PEVs to traditional gasoline vehicles and whether they plan to consider purchasing a PEV. Comparing the responses from the pre-drive to the post-drive questionnaires provides a measure of the impact of the events. This section compares results from the pre- and post-drive events by limiting the responses to the set that could be linked based on email addresses provided by respondents.

4.1 Vehicle Type Tested

When asked which technology participants tested (Figure 19), participants reported more often testing an AEV (48%) than a PHEV (40%). Pacific Northwest respondents had the highest percentage of respondents having tested an AEV (79%). Midwest respondents were the most likely to have tested a PHEV (49%). The potential effects of the vehicle type tested on willingness to purchase PEVs are investigated in Section 5.

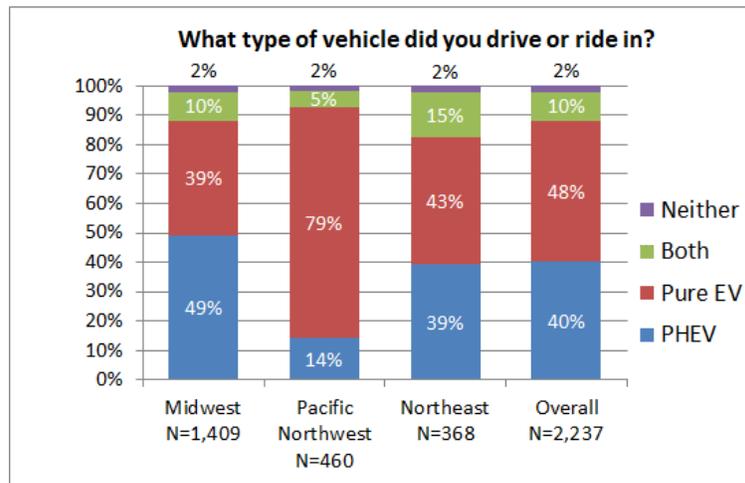


Figure 19: Technology type tested

4.2 Expecting to Buy or Lease

Respondents were asked about whether they expected to buy or lease a vehicle in the future (Figure 20). Those that answered that they did expect to acquire a vehicle were later asked whether they would consider a PEV. Overall, 74% of respondents expected to lease or buy a vehicle. Pacific Northwest respondents were most likely to expect to buy or lease (88%). While Midwest respondents were least likely to expect to buy or lease (69%).

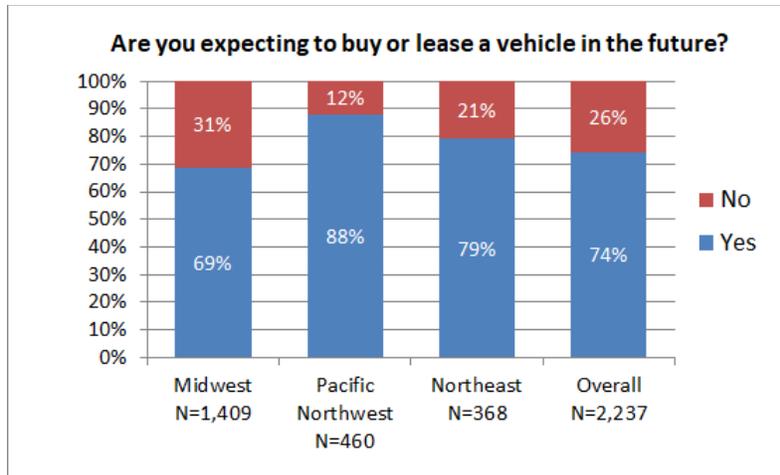


Figure 20: Post-drive expectation to acquire a vehicle

4.3 Post-Drive Acceptance

Respondents reported an increased level of acceptance of PEVs after events, as captured by their comparisons of PEVs to traditional gasoline vehicles (Figure 21). Respondents were more likely to say that PHEVs were as good or better than traditional gasoline vehicles. The percentage agreeing that PHEVs were as good or better than traditional gasoline vehicles rose from 73% to 86%. Respondents were also more likely to accept AEVs, as the percentage believing they were as good or better than traditional gasoline vehicles rose from 61% to 77%.

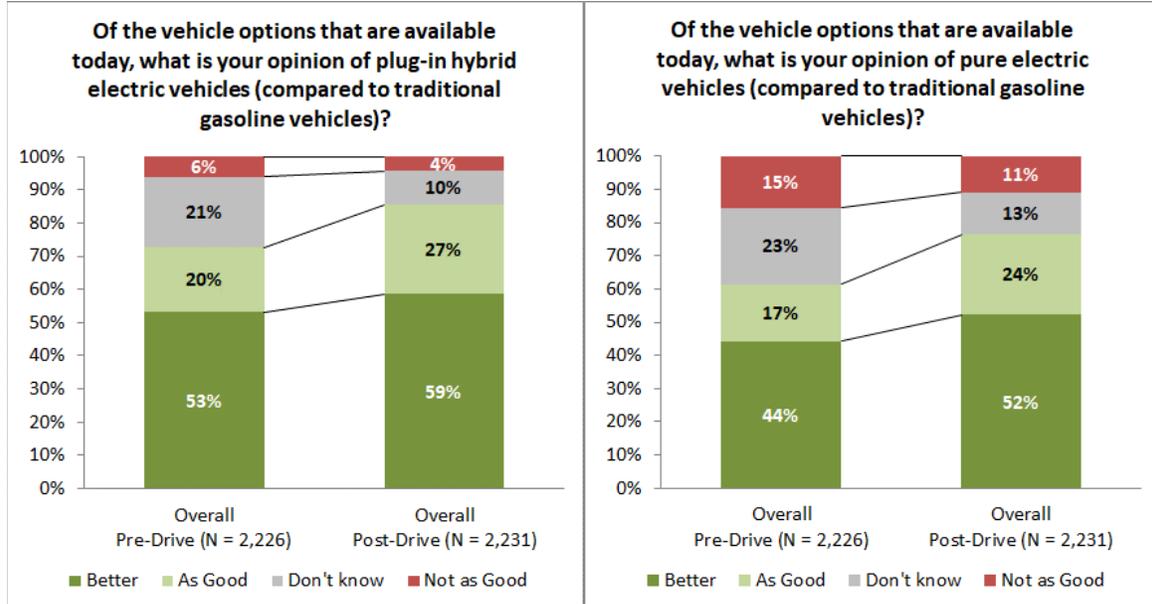


Figure 21: Post-drive PEV acceptance

Respondents reported they would be more likely to at least expect to consider purchasing a PEV after the events (Figure 22). The likelihood that a respondent would at least expect to consider a PHEV rose from 62% to 73%. Similarly, the likelihood that a respondent would at least expect to consider an AEV rose from 62% to 75%.

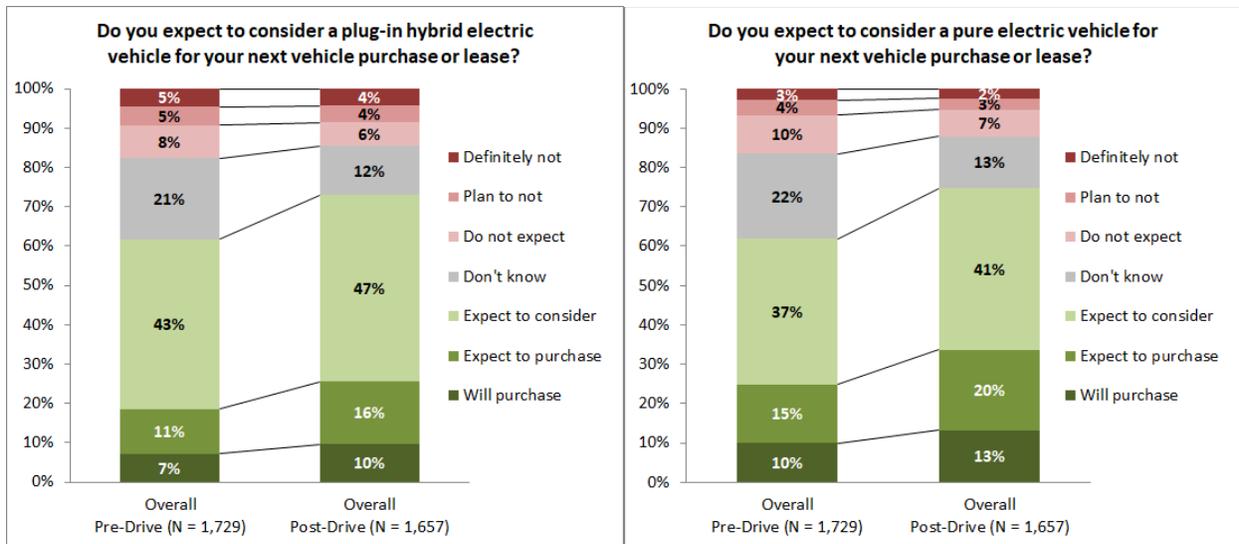


Figure 22: Post-drive PEV willingness to acquire

4.4 Post-Drive Reasons for Considering

Respondents did not report large shifts in their reasons for considering PEVs (Figure 23). Environmental impact and fuel costs remained the top reasons. The reason with the largest increase (5%) was overall vehicle performance, followed by availability of public charging with an increase of 4% (rounding) and quiet driving vehicle with an increase of 3%.

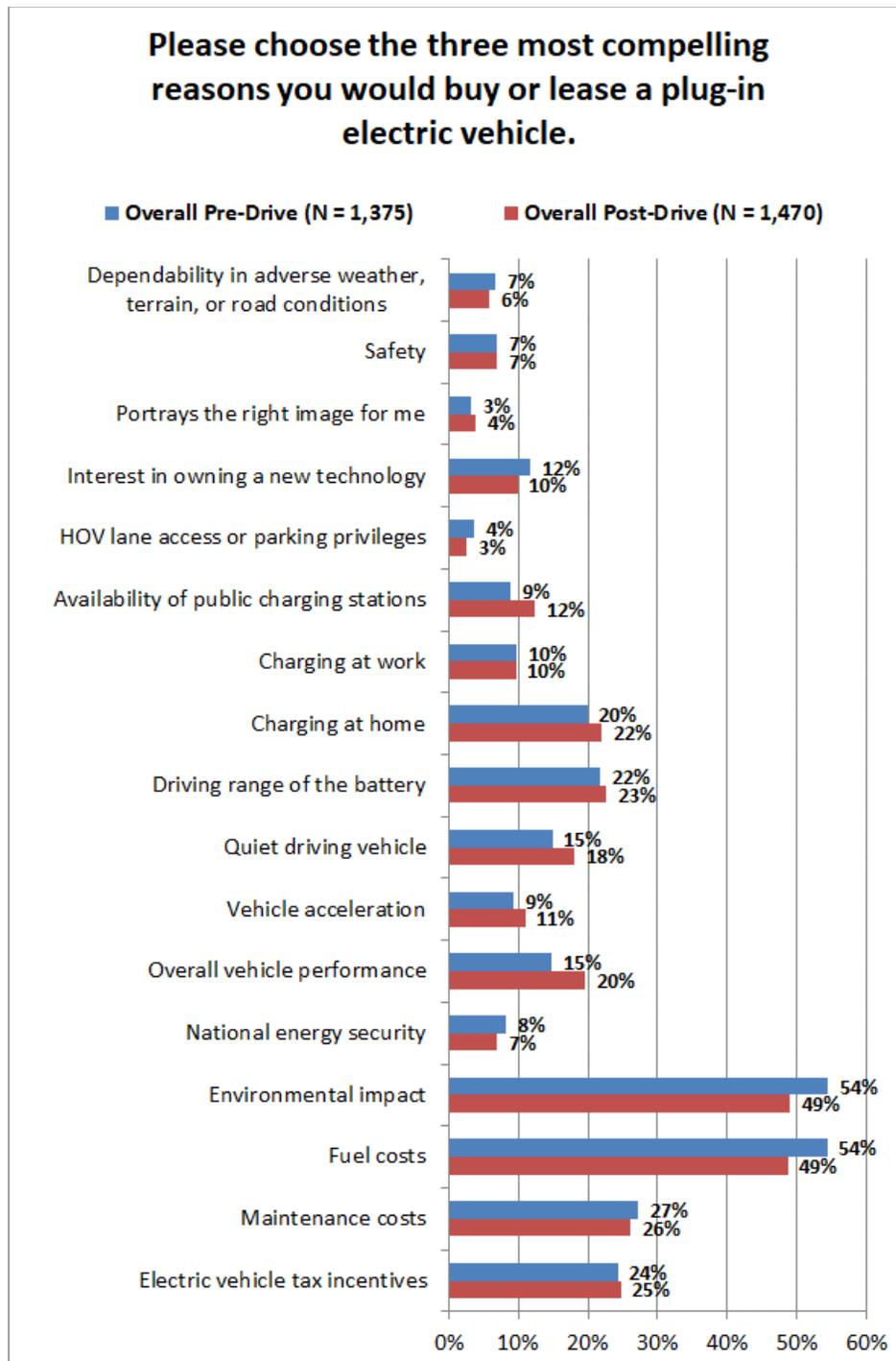


Figure 23: Post-drive reasons to consider a PEV

4.5 Post-Drive Reasons for Not Considering

There was a relatively small number of respondents that provided reasons for not considering PEVs (Figure 24). The reason with the largest shift was availability of public charging stations, which dropped by 15% as a reason to not consider a PEV. This could signal that the events addressed these respondents' concerns about public charging. The ability to charge at home

decreased by 5%. Reasons that were at least 5% more likely to be reported as a concern included overall vehicle performance (7% increase), the length of time to charge the vehicle (6% increase), vehicle cost (5%), and the availability of PEVs in the vehicle segment of choice (5%). The driving range of the battery (56%) and vehicle cost (47%) remained the most often cited concerns.

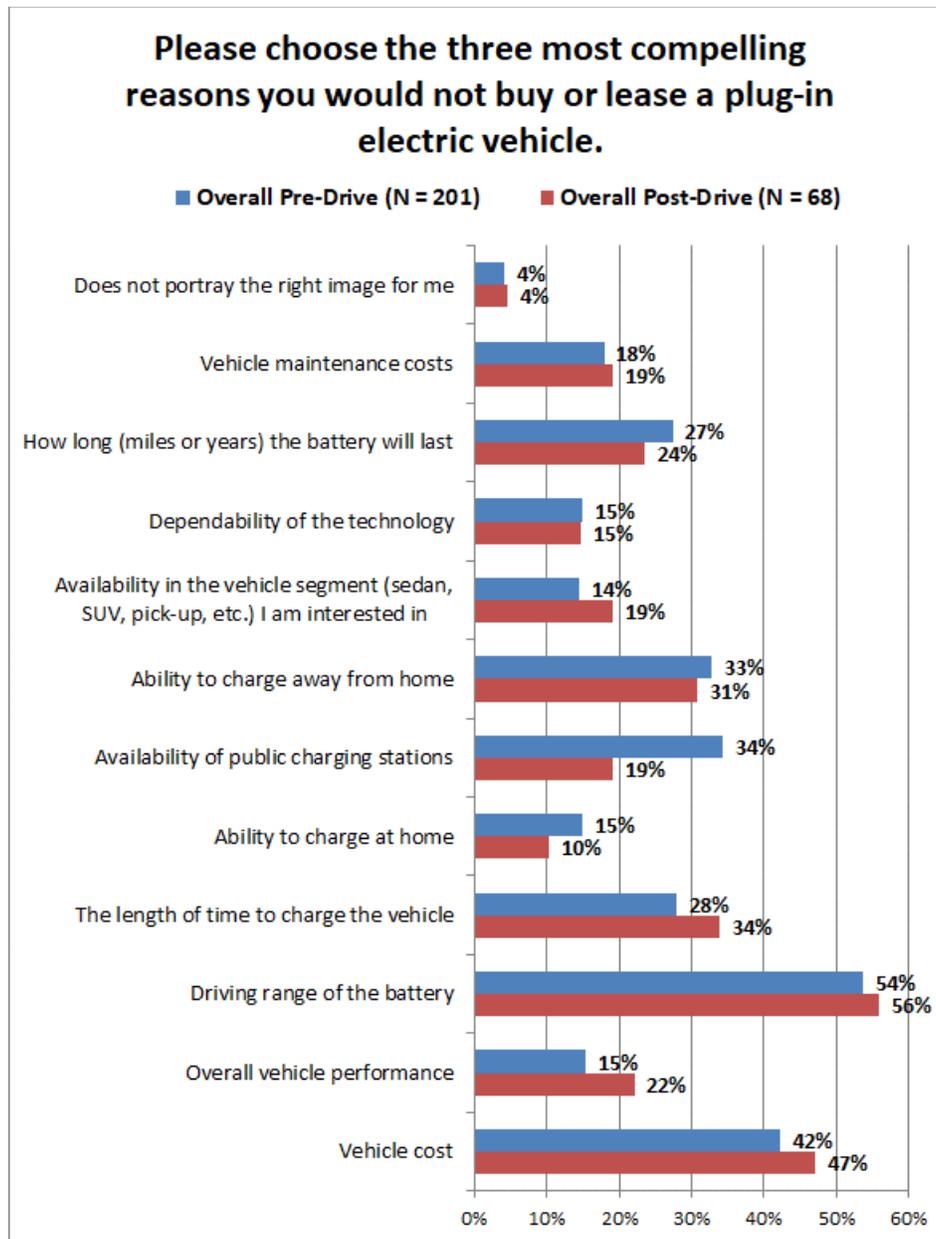


Figure 24: Reasons to not consider a PEV

4.6 Post-Drive Required Battery Range

Respondents did not report a large shift in their required AEV battery range for them to consider purchasing or leasing one (Figure 25). There was a small shift in the percentage of respondents that would be comfortable with a lower AEV range. As an example, before the event 33% would

have been satisfied with an AEV with a 100-mile range or less. After the event that percentage shrank to 29%. Respondent median required AEV battery range remained 200 miles.

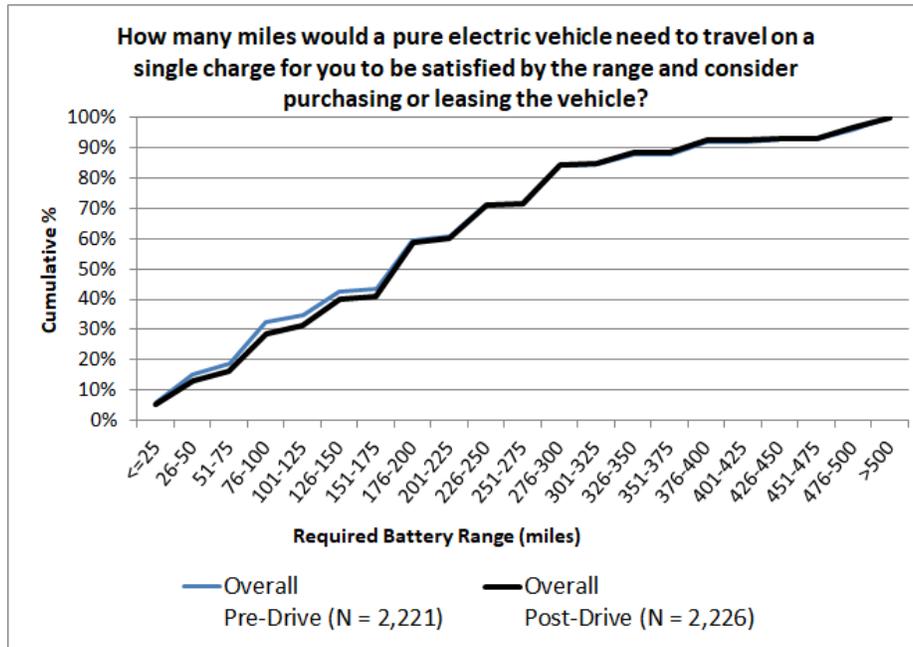


Figure 25: Post-drive required battery range

5 Potential Influences on Expectation to Consider

This section details a series of investigations completed to determine if existing participant attributes aligned with whether a participant expected to at least consider purchasing or leasing a PEV, or whether the PEV exposure at the events affected them differently. These comparisons were completed based on the set of respondents whose responses to the pre- and post-drive questionnaires could be linked based on their provided email addresses, consistent with Section 4 results. Every comparison analyzed showed an increase in the percentage of respondents expecting to consider PHEVs or AEVs.

5.1 Previous PEV Exposure and Expectation to Consider Acquiring

Respondents with the lowest prior PEV exposure reported the greatest increase in their expectation that they would consider purchasing a PEV. Additionally, respondents with increased levels of prior PEV exposure were more likely to expect to consider purchasing a PEV (Figure 26). Respondents provided their prior exposure to PEVs in the pre-drive survey, as detailed in Section 3.5. Respondents were grouped as “firsthand” if they previously owned, sat in, or drove a PEV. Of the remaining respondents, those that had a neighbor with a PEV were grouped as “neighbor.” Next, the remaining respondents were grouped as “parking lot” if they had previously seen PEVs in parking lots. Finally, all the remaining respondents were grouped as “none” if they had only seen PEVs in advertisements, seen PEVs in social media, heard of PEV tax incentives, or not been exposed to PEVs at all.

“Firsthand” respondents reported the highest percentage expecting to consider a PEV in the pre-drive results. “Neighbor” respondents were the next most likely to expect to consider, followed by “parking lot,” and finally “none.” This trend held for PHEVs as well as AEVs. “None” respondents reported 49% expected to consider a PHEV while 70% of “firsthand” respondents expected the same. After the events, respondents across the groups reported similar percentages expecting to consider a PHEV. A majority of “none” respondents (71%) expected to consider purchasing a PHEV, and 74% of “firsthand” respondents expected the same. Similar trends were reported regarding AEVs, where in the pre-drive survey 44% of “none” respondents expected to consider an AEV, while 72% of “firsthand” respondents expected to consider an AEV. In the post-drive survey, 63% of “none” respondents expected to consider an AEV, while 79% of “firsthand” respondents expected the same. The percentages expecting to consider a PHEV were relatively even in the post-drive respondent groups, while the percentages expecting to consider an AEV continued to increase from lower to higher levels of prior exposure. These results may indicate that respondents require more exposure to AEVs than PHEVs in order to increase their acceptance of the technology. In both cases it appears that increased exposure impacted respondents’ willingness to consider PEVs.

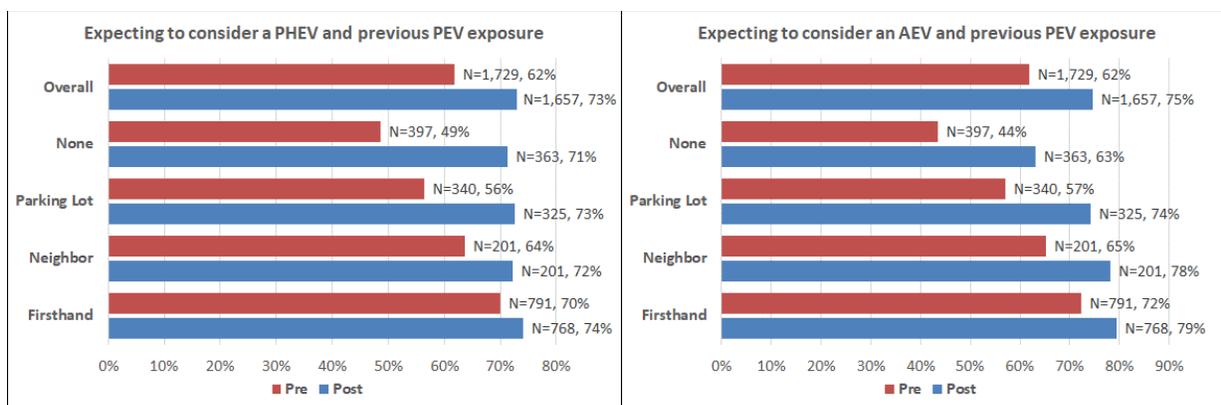


Figure 26: Considering a PEV and PEV exposure

5.2 Charging Station Awareness and Expectation to Consider Acquiring

Respondents with the lowest awareness of charging stations reported the greatest increase in their expectation that they would consider purchasing a PEV. Additionally, respondents with a higher awareness of PEV charging stations were more likely to expect to consider acquiring a PEV (Figure 27). Respondents were grouped into categories based on their awareness of PEV charging stations as reported in the pre-drive survey and detailed in Section 3.5. Any respondents aware of charging stations at their place of work were classified as “work.” Of the remaining respondents, those that were aware of charging stations at stores and places they visit were classified as “stores.” Any remaining respondents that passed charging stations regularly while driving were classified as “pass.” Respondents that did not report awareness of any of these types of charging station awareness were classified as “none.”

Respondents not aware of PEV charging stations were least likely to expect to consider a PHEV or an AEV. However, these same respondents reported the greatest increase (19%) in their expectation to consider a PEV between the pre- and post-drive surveys. “Work” respondents were most likely to expect to consider a PHEV or AEV (70% and 72%, respectively) in the pre-drive surveys. “Pass” respondents were more likely to expect to consider a PHEV or an AEV than “store” respondents. “Pass” respondents were most likely (82%) to expect to consider purchasing an AEV in the post-drive surveys. The percentage expecting to consider a PHEV was relatively consistent across the groups in the post-drive survey. The groups aware of charging stations were more likely to expect to consider an AEV than those that were not aware of charging stations in the post-drive survey. This could point to respondents wanting to have charging options for an AEV, while that desire might be less important for a PHEV.

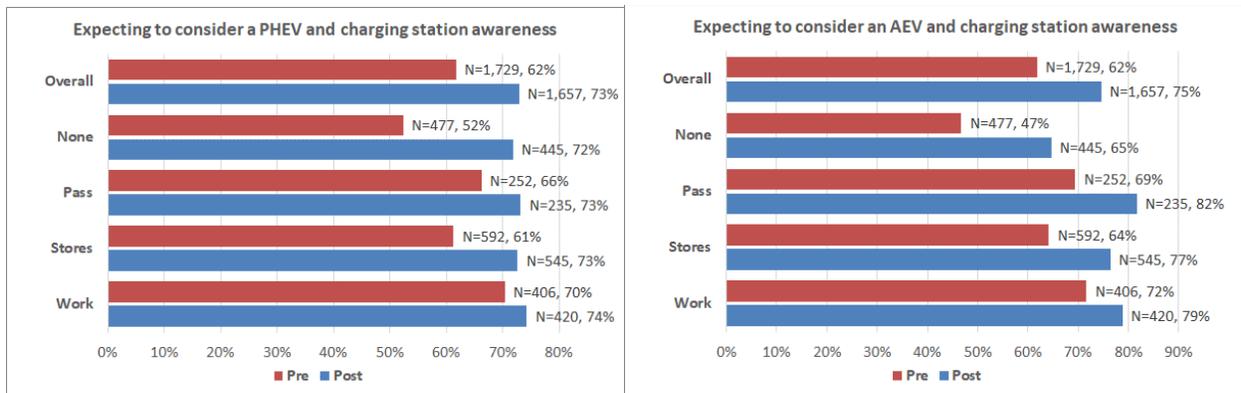


Figure 27: Considering a PEV and charging station awareness

5.3 Ability to Charge at Home and Expectation to Consider Acquiring

Respondents unsure if they were able to charge at home reported the greatest increase in their expectation that they would consider purchasing a PEV. Additionally, respondents able to park a vehicle near an existing outlet at home were more likely to expect to consider a PHEV or an AEV (Figure 28). Respondents reported their ability to park their vehicles near an existing outlet in the pre-drive survey, as detailed in Section 3.5. The percentage of respondents able to park near an existing outlet that expect to consider a PEV increased in the post-drive survey to 76% for PHEVs and 79% for AEVs. Respondents that did not know if they could park near an existing outlet reported the greatest increase in the percentage expecting to consider a PEV from the pre- to post-drive surveys. The percentage expecting to consider PHEVs increased by 17% (rounding) and the percentage expecting to consider AEVs increased by 18%. While not having the ability to charge a vehicle at home did not appear to stop respondents from considering a PEV, the ability to charge at home did appear to significantly impact respondents' willingness to consider a PEV.

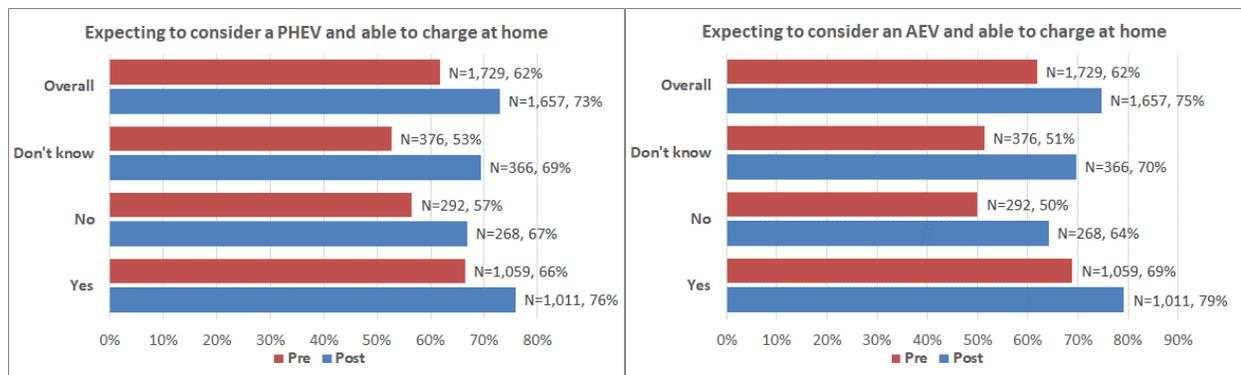


Figure 28: Considering a PEV and ability to charge at home

5.4 Technology Tested and Expectation to Consider Acquiring

Respondents who tested a single technology (PHEV or AEV) were more likely to expect to consider that technology after the event than the other PEV technology (Figure 29). Respondents reported the technology type they tested in the post-drive survey, as detailed in Section 4.1. Respondents reported similar likelihoods to expect to consider a PHEV before either testing only

a PHEV or an AEV (62% before a PHEV test and 61% before an AEV test). However, after the test, the likelihood that a respondent would expect to consider a PHEV rose to 79% for those that tested a PHEV and to only 67% for those testing an AEV. Before the events, the likelihood that a respondent would expect to consider an AEV was higher for those who tested an AEV (72%) than those who tested a PHEV (49%). After the events, the likelihood that a respondent would expect to consider an AEV rose to 87% for those having tested an AEV, and to only 59% for those having tested a PHEV. The expectation to consider a PHEV rose the most (a 17% increase) for those that tested only a PHEV, while the expectation to consider an AEV rose the most (15%) for those that tested only an AEV or both technologies. These results seem to show that while the events affect respondents' views of PEVs overall, the experience more strongly affects the respondents' views of the specific technology tested. Coupled with the results showing prior PEV exposure aligning with increased willingness to consider PEVs, these results seem to show that direct exposure to a technology increases willingness to consider the specific technology.

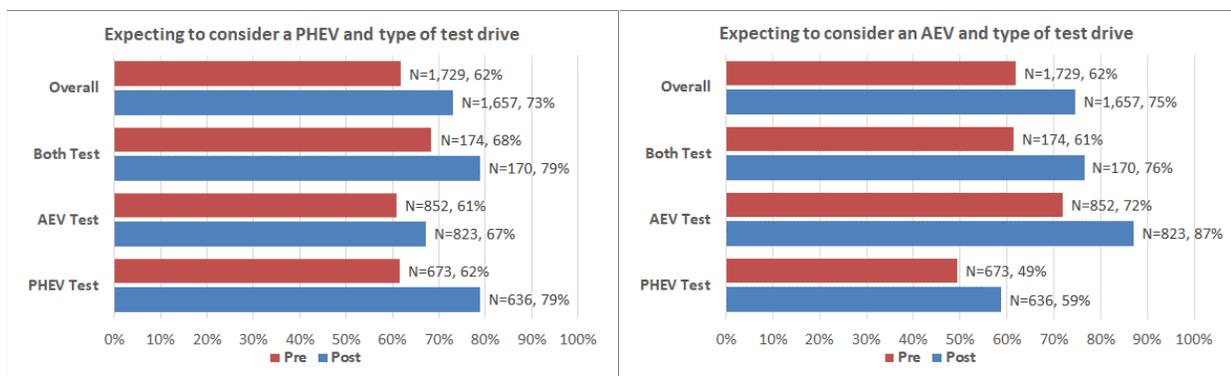


Figure 29: Considering a PEV and technology tested

5.5 Purchase Preference and Expectation to Consider Acquiring

Respondents did not show large differences in the percentage that expected to consider purchasing a PEV based on their acquisition preferences for buying or leasing a new or used vehicle (Figure 30), as reported in the pre-drive questionnaire and detailed in Section 3.2. Respondents were able to select multiple acquisition options. Pre-drive respondents reporting they were considering leasing a new vehicle were least likely to consider acquiring a PHEV (60%). Those considering buying a used vehicle were slightly more likely to consider a PHEV (62%), and those considering buying a new vehicle were most likely to consider a PHEV (65%). This trend of increasing interest in PHEVs from new vehicle leasers, to used vehicle buyers, to new vehicle buyers also appeared in the post-drive results (69%, 74%, and 75%, respectively). AEV interest was more mixed by acquisition preference. Those considering leasing a new vehicle were most likely to consider an AEV in the pre-drive survey (69%) and in the post-drive survey (78%). The same percentage in the post-drive survey (78%) of those considering buying a used vehicle expect to consider an AEV. New vehicle buyers expect to consider an AEV at a similar but smaller percentage (75%). These results show little influence of acquisition preference and interest in considering a PEV.

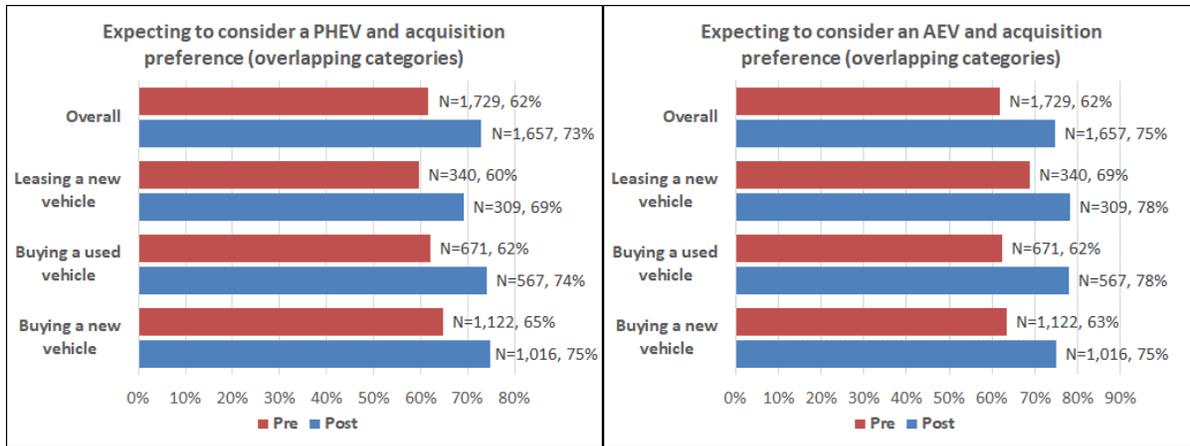


Figure 30: Considering a PEV and acquisition preference

5.6 Vehicle Ownership and Expectation to Consider Acquiring

Respondent current vehicle ownership did not appear to greatly affect interest in PEVs (Figure 31). Respondents reported the number of vehicles owned by their household in the pre-drive survey, as detailed in Section 3.3. Current household vehicle ownership did not consistently align with respondents' expectations to consider PEVs. Respondents with three or more household vehicles were somewhat less likely to consider PHEVs or AEVs than households with one or two vehicles. However, among households with vehicles, respondents with three or more household vehicles reported the highest increase in likelihood to consider PHEVs (14%) and AEVs (13%) from the pre- to the post-drive surveys. The relatively small sample of respondents without any household vehicles reported the lowest percentage (52%) expecting to consider AEVs in the pre-drive survey but reported the highest percentage (82%) expecting to consider AEVs in the post-drive survey.

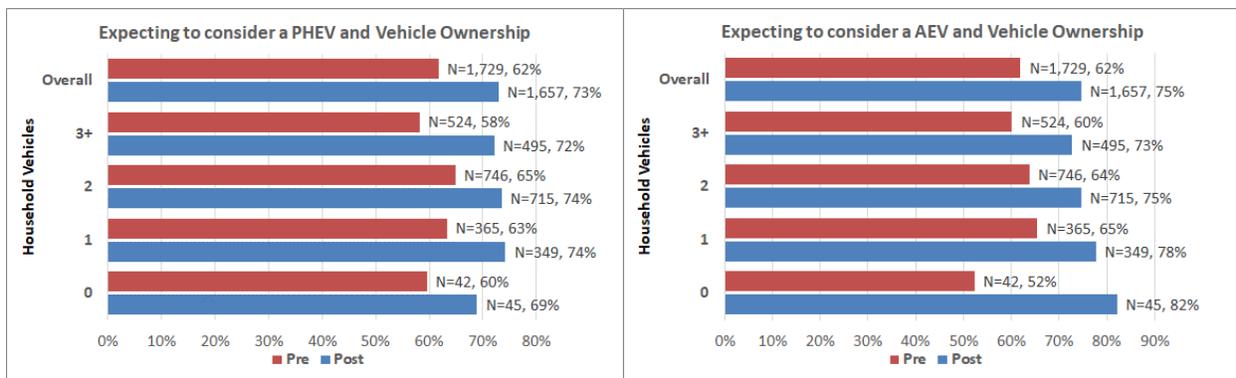


Figure 31: Considering a PEV and number of household vehicles

6 Follow-Up Views

Respondents were provided a questionnaire by email several months after their PEV experience based on the address they provided in the pre- and post-drive surveys. The timing of these questionnaires varied depending on event coordinators' efforts, and response rates were much lower than the other questionnaires. Follow-up respondents were asked about their perceptions of PEVs as well as what actions they may have taken following the events. Those respondents that purchased a PEV were asked about their PEV habits. The complete follow-up data sample is used in this section because limiting responses to just those responses that could be linked to the other two questionnaires resulted in very small sample sizes.

6.1 Follow-Up PEV Acceptance

Follow-up respondents showed higher acceptance of PHEVs than AEVs based on the percentage of respondents believing PHEVs are as good or better than traditional gasoline vehicles (88%) compared to the percentage (72%) saying the same about AEVs (Figure 32). Comparing these results to the pre- and post-drive results in Section 4 shows that respondents increased acceptance of PHEVs from 73% in the pre-drive to 86% in the post-drive and to 88% in the follow-up. AEV acceptance was more mixed, as it rose from 61% in the pre-drive to 77% in the post-drive and fell to 72% in the follow-up. The comparison to the pre- and post-drive results provides context, but the much smaller sample size in the follow-up response group limits conclusions for the broader group of participants.

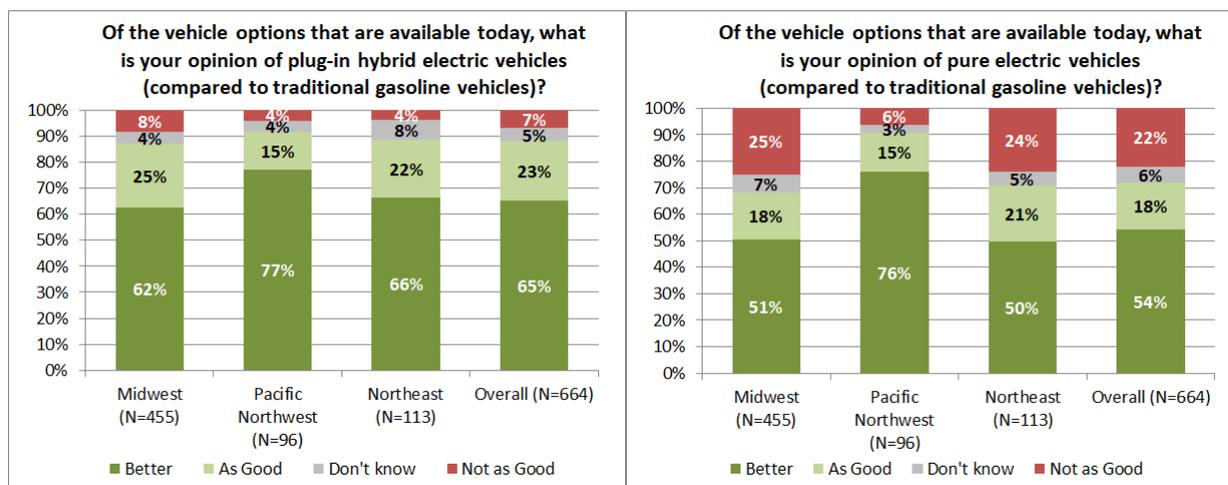


Figure 32: Follow-up PEV acceptance

6.2 Follow-Up Engagement

A majority (67%) of follow-up respondents reported taking further actions to research PEVs (Figure 33). The most common action (54%) was researching PEVs online. The next most common action (26%) was speaking with a salesperson. Pacific Northwest respondents reported the highest number taking further action (81%), including the highest number having been to a PEV dealer (42%) and having spoken to a salesperson (44%).

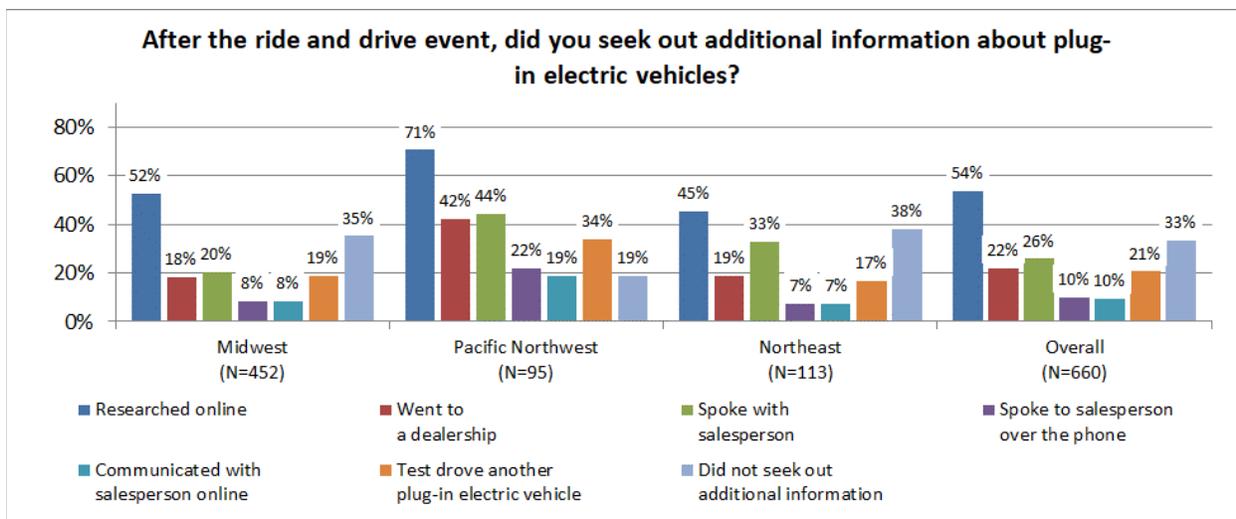


Figure 33: Follow-up PEV actions taken

6.3 Follow-Up Plans to Purchase

Follow-up respondents reported their expectations for purchasing a PEV (Figure 34). Overall, 25% of respondents reported having purchased a PEV. A large majority (73%) at least expected to eventually purchase a PEV. This range aligns with the percentages that expected to consider purchasing a PHEV or AEV (73% and 75%, respectively) in the post-drive results in Section 4. However, the smaller follow-up sample sizes do not make this a direct comparison. Pacific Northwest respondents were the most likely to have purchased a PEV (45%).

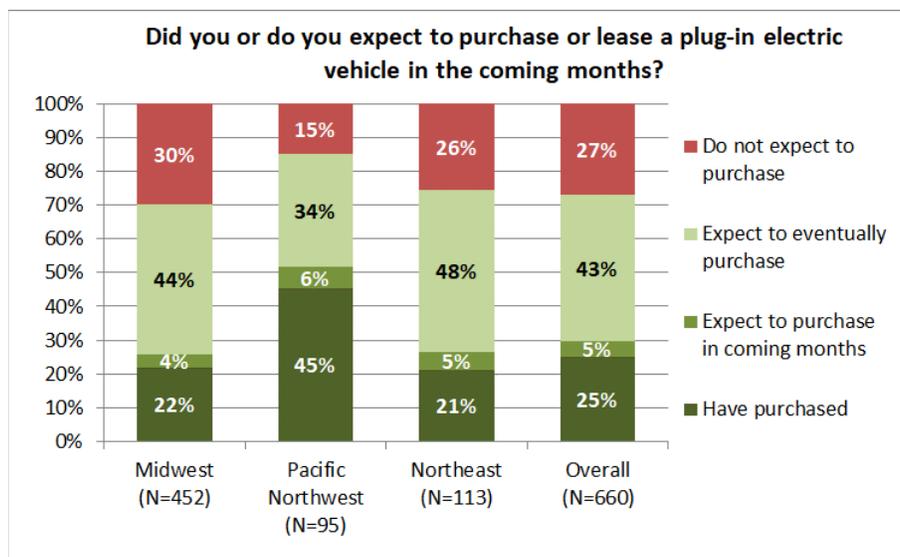


Figure 34: Follow-up plans to acquire a PEV

Follow-up respondents that expected to at least eventually purchase a PEV (Figure 35) reported a higher interest in acquiring an AEV (54%) compared to a PHEV (33%). Post-drive respondents, as noted in Section 4, were more likely to say they expected to purchase an AEV (34%) than a PHEV (26%). Pacific Northwest reported the highest interest in AEVs (73%).

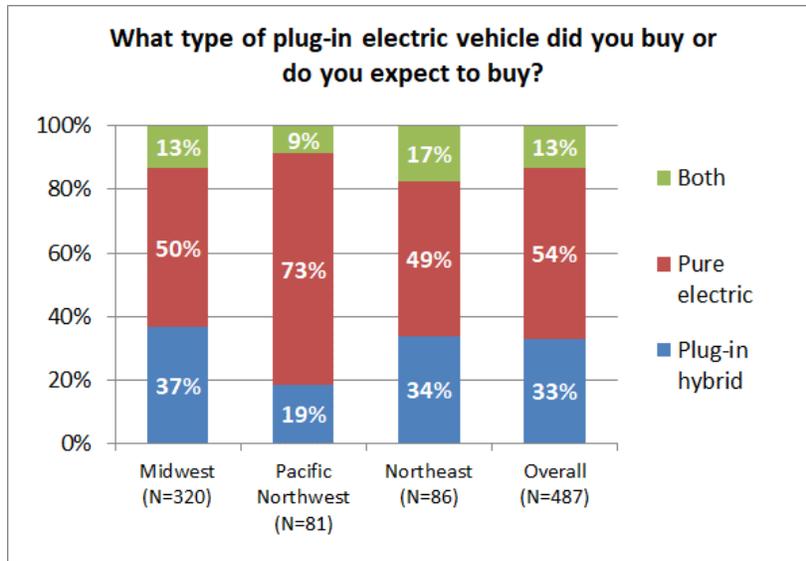


Figure 35: Follow-up type of PEV acquired

6.4 Follow-Up Reasons for Considering

Follow-up respondents reported similar reasons for considering PEVs as found in the pre- and post-drive surveys (Figure 36). The most often noted reason was environmental impact, which was noted by 62% of respondents (compared to the 54% and 49% of pre- and post-drive respondents noted in Section 4). Fuel costs were the second most mentioned reason at 50%. Pacific Northwest respondents were most likely (78%) to say environmental impact was a top reason to consider a PEV. Pacific Northwest respondents were more likely to think charging at home is important (35%), while Northeast respondents were less likely to think the same (13%) compared to follow-up respondents overall (24%).

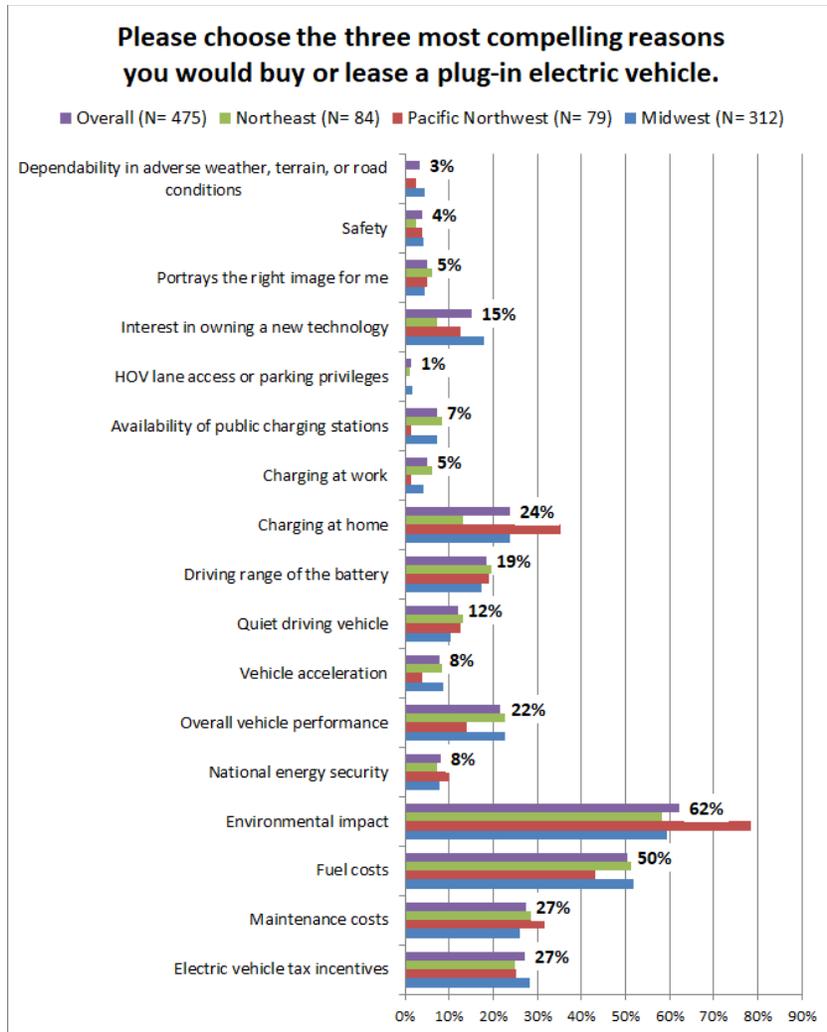


Figure 36: Follow-up reasons to consider a PEV

6.5 Follow-Up Reasons for Not Considering

Follow-up respondents' reasons for not considering PEVs aligned with pre- and post-drive respondents (Figure 37). The driving range of the battery was the most noted concern (56%). Vehicle cost was the second most noted concern (46%). Ability to charge away from home (38%), availability of public charging stations (37%), and length of time to charge (37%) were the next group of concerns.

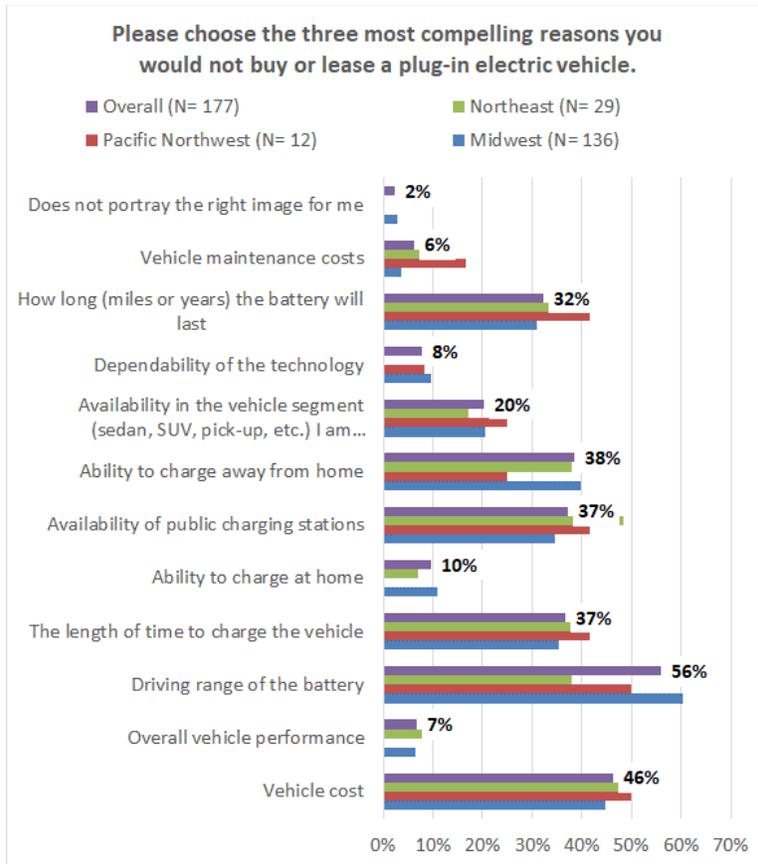


Figure 37: Follow-up reasons to not consider a PEV

6.6 Owner Sentiments

Follow-up respondents who had purchased or leased a PEV were asked about their sentiments towards the vehicles. Nearly all respondents (98%) stated they would recommend a PEV to others (Figure 38). A large majority (73%) stated they will definitely purchase or lease another PEV, and 99% stated they will likely purchase or lease another PEV (Figure 39).

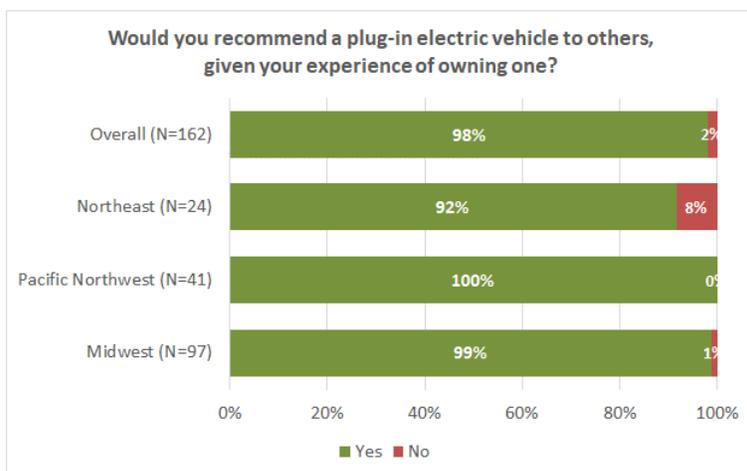


Figure 38: Willing to recommend a PEV

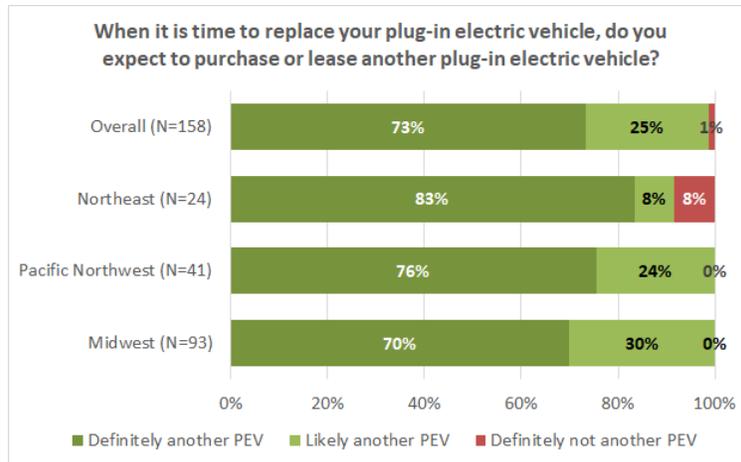


Figure 39: Expectation to purchase a PEV again

6.7 Plug-In Electric Vehicle Owner Behaviors

The majority (88%) of overall follow-up respondents who purchased or leased a PEV replaced another vehicle with the PEV in their household (Figure 40). Northeast respondents were most likely (21%) to have purchased or leased a PEV as an additional vehicle in their household.

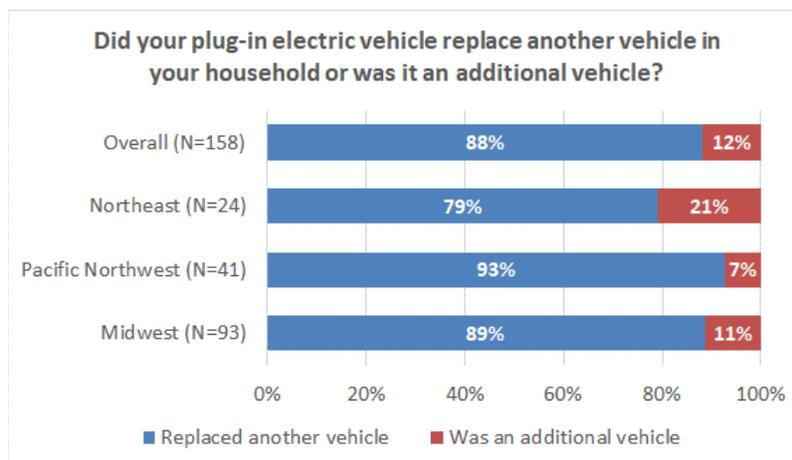


Figure 40: Replace or add

The largest percentage of PEV owners overall (51%) stated they use their PEV for long-distance trips (Figure 41). A smaller percentage (46%) stated they use another household vehicle for long-distance travel. Northeast PEV owners were more likely (63%) to use another household vehicle for long-distance trips. Much smaller percentages reported using other vehicles such as a rental car, public transportation, or the vehicle of a family or friend.

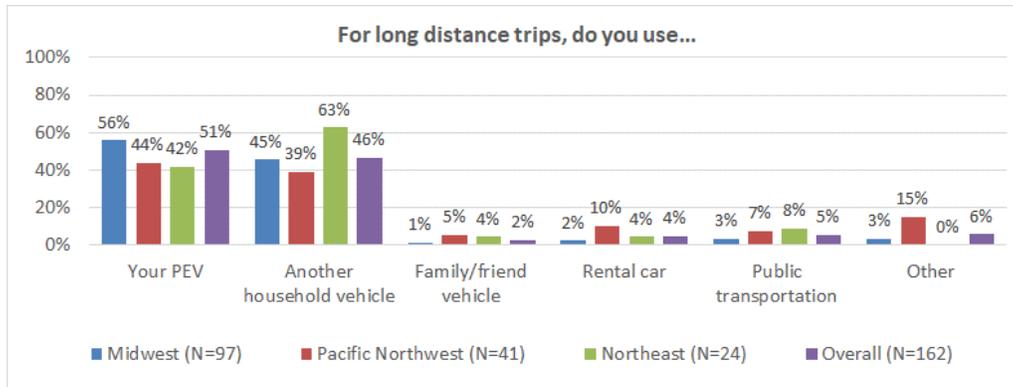


Figure 41: Long-distance trip vehicle use

PEV owners were asked about their charging behavior (Figure 42). Overall, a large majority charge at home regularly or all the time (93% combined). This points to the possibility that the ability to charge at home likely impacted the purchase decision, as a much lower 58% of pre-drive respondents could park near an existing outlet at home. Overall, 39% of respondents reported they had charged at work at least rarely. Northeast respondents were more likely to have charged at work at 57%. A smaller percentage overall (10%) reported charging at work all the time. A large majority of respondents (85%) reported charging at public stations at least rarely. However, most respondents (66%) reported charging at a public station only rarely. Northeast respondents reported the highest likelihood of charging publicly regularly or all the time (38% combined when rounded).

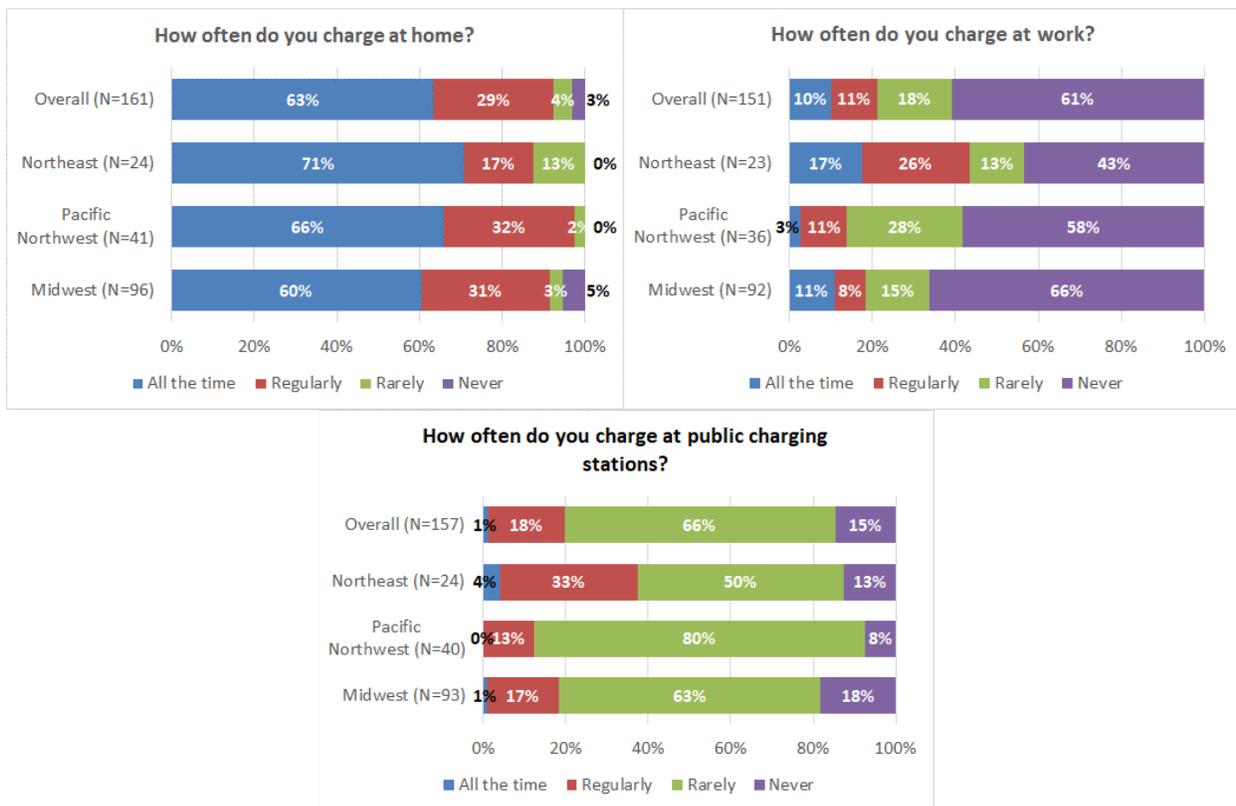


Figure 42: Location of PEV charging habits

A minority (29%) of PEV owners stated the driving range of their vehicles completely meets their needs (Figure 43). A majority overall (52%) stated they rarely needed to adjust their driving plans to charge their PEV. Smaller percentages stated they often need to adjust driving plans (11%) or that the driving range is not sufficient for their needs (9%).

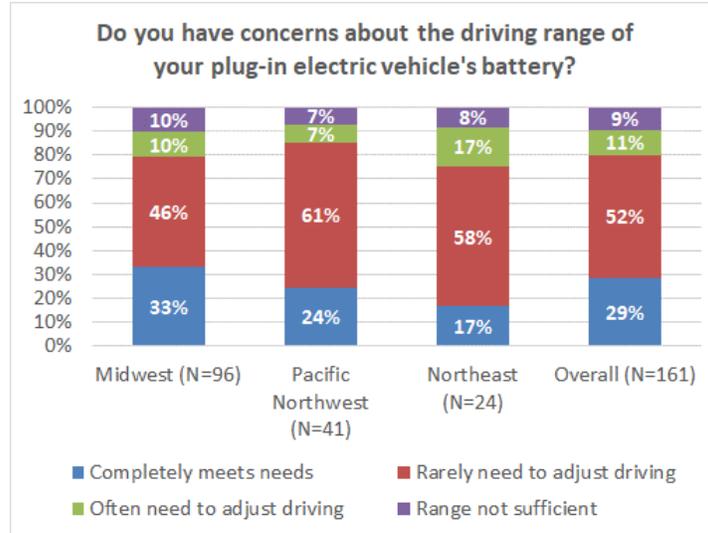


Figure 43: Battery range concerns

6.8 Follow-Up Required Battery Range

Follow-up respondents provided different battery range requirements depending on whether they were considering (or had acquired) a PEV or if they did not expect to acquire a PEV (Figure 44). Those respondents that expected to acquire a PEV, or had already done so, had a median required AEV battery range of 200 miles—the same median required range by pre- and post-drive respondents overall. However, those that do not expect to consider a PEV had a higher median required range of 300 miles. This likely indicates battery range is an important barrier for these respondents.

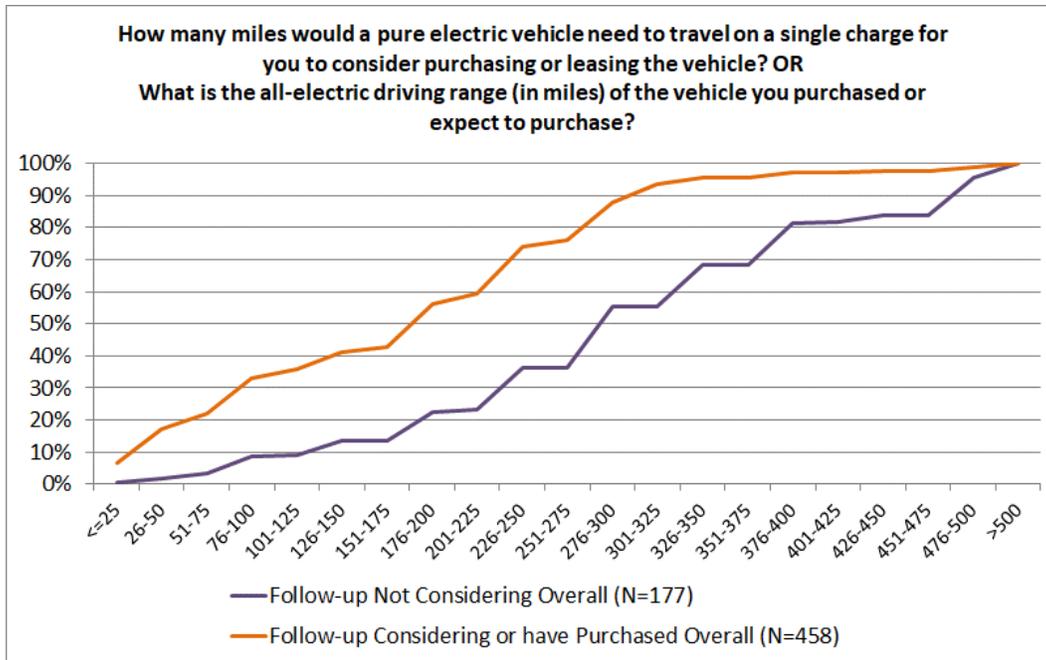


Figure 44: Follow-up required battery range

7 Conclusion

The PEV showcase projects conducted over 9,000 surveys in three distinct regions (Pacific Northwest, Midwest, and Northeast) over three years from 2017 to 2019. Surveys primarily captured respondents' levels of interest in PEVs and what might impact that interest.

The results of the surveys showed increased exposure to, and awareness of, PEVs and PEV charging stations aligns with increased acceptance of PEVs and expectations to consider purchasing PEVs. Those respondents with higher levels of prior exposure to PEVs came to the events more likely to consider PEVs to be as good or better than traditional gasoline vehicles. These higher prior PEV exposure respondents were also more likely to expect to consider purchasing a PEV as their next vehicle. Similarly, those respondents who were aware of public PEV charging stations were more likely to view PEVs positively and expect to consider purchasing one.

A comparison of survey results from before and after the events showed respondents were more likely to consider purchasing PEVs after the event experience than before. This relationship held across a range of analyzed respondent segments. Those respondents with the lowest levels of prior PEV exposure and prior PEV charging station awareness showed the greatest increase in expectation to consider purchasing a PEV. These consistent survey results show the events likely increased participants' willingness to purchase PEVs.

While respondents showed increased acceptance of PEVs after the events, the top reasons to not consider a PEV did not change significantly. Respondent top concerns with PEVs after the events continued to be the vehicle driving range of the battery and the cost of PEVs.

Respondent views of PEVs varied by region. Pacific Northwest respondents reported the highest levels of exposure to PEVs and PEV acceptance prior to the events, while Midwest respondents reported the lowest pre-event PEV exposure and acceptance levels. Compared to Midwest respondents, Northeast respondents reported similar but generally higher levels of PEV exposure and acceptance prior to events.

The survey data captured from these events allow for an increased understanding of how consumer acceptance of PEV technologies is impacted. Analysis of these metrics show increased exposure is aligned with increased acceptance of PEV technologies.

References

Forth. “Go Forth.” Accessed December 23, 2019. <https://forthmobility.org/>.

Midwest EVOLVE. “Midwest (EVOLVE) Electric Vehicle Opportunities: Learning, eVents, Experience project.” Accessed December 23, 2019. <https://www.midwestevolve.org/>.

Plug In America. “Plug In America – Electric Vehicle Advocacy and Education.” Accessed December 23, 2019. <https://pluginamerica.org/>.

Singer, Mark. 2017. *The Barriers to Acceptance of Plug-in Electric Vehicles: 2017 Update*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5400-70371. Accessed October 3, 2019. <https://www.nrel.gov/docs/fy18osti/70371.pdf>.

U.S. Census Bureau. 2017. “Household Size by Vehicles Available.” 2010–2014 American Community Survey 5-Year Estimates. Accessed August 30, 2017. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_14_5YR_B08201&prodType=table.

Clean Cities. “Clean Cities Coalition Network.” U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Vehicle Technologies Office. Accessed December 23, 2019. <https://cleancities.energy.gov/>.

Appendix A. Pre-Drive Survey

I. Welcome

Thank you for participating in our survey!

Before you take part in the plug-in electric vehicle event, we would like to ask you about your views of plug-in electric vehicles.

Your feedback can help with future efforts and is extremely valuable.

Public reporting burden for this collection of information is estimated to average 10 minutes per response (30 minutes total), including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-23, Paperwork Reduction Project (1910-5171), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (1910-5171), Washington, DC 20503.

OMB Control #: 1910-5171 Exp Date: 1/31/2020

II. Email address and event

*1. Which event are you participating in?

- Employer Hosted (the event is held at your place of work)
- Public (the event is NOT held at your place of work and is open to the public)
- Physical Showcase (the event is held at a retail outlet)
- Fleet Event (the event is for fleet vehicle purchases)
- Other (please specify)

*2. Please provide your email address:

(Your email address will be used to link your responses before and after the event. It will not be shared, disclosed, or sold to third parties.)

*3. Which are you considering for your next vehicle?

(Please select all that apply)

- Buying a new vehicle
- Leasing a new vehicle
- Buying a used vehicle
- Leasing a used vehicle
- Not expecting to buy or lease a vehicle

III. Perception of plug-in electric vehicles

Informational Note: Plug-in electric vehicles can be charged by being plugged into a household type outlet or specially designed charging equipment. These can be defined as **plug-in hybrid** or **pure** electric vehicles. Hybrids that cannot be plugged in are not included in this definition.

A **plug-in hybrid** electric vehicle can be powered by either the battery or the gasoline engine. A **pure** electric vehicle is powered only by the battery.

*4. Of the vehicle options that are available today, what is your opinion of **plug-in hybrid** electric vehicles? (These are vehicles that can be plugged in, but also have a gasoline-powered engine to extend their range.)

- Better than traditional gasoline vehicles
- Just as good as traditional gasoline vehicles
- Not as good as traditional gasoline vehicles
- Don't know

*5. Do you expect to consider a **plug-in hybrid** electric vehicle for your next vehicle purchase or lease? (These are vehicles that can be plugged in, but also have a gasoline-powered engine to extend their range.)

- Will definitely not purchase or lease
- Plan to not consider
- Do not expect to consider
- Don't know
- Expect to consider
- Expect to purchase or lease
- Will definitely purchase or lease

*6. Of the vehicle options that are available today, what is your opinion of **pure** electric vehicles? (These are vehicles that are powered only by their batteries and do not have gasoline engines.)

- Better than traditional gasoline vehicles
- Just as good as traditional gasoline vehicles
- Not as good as traditional gasoline vehicles
- Don't know

*7. Do you expect to consider a **pure** electric vehicle for your next vehicle purchase or lease? (These are vehicles that are powered only by their batteries and do not have gasoline engines)

- Will definitely not purchase or lease
- Plan to not consider
- Do not expect to consider
- Don't know
- Expect to consider
- Expect to purchase or lease
- Will definitely purchase or lease

IV. Plug-in electric vehicle exposure

*8. How have you encountered plug-in electric vehicles (either pure electric or plug-in hybrid)? Please select all that apply.

- Own or lease a plug-in electric vehicle
- Sat in a plug-in electric vehicle
- Driven a plug-in electric vehicle
- Neighbor or acquaintance with plug-in electric vehicle
- Seen plug-in electric vehicles in parking lots or on the road
- Seen plug-in electric vehicles in ads
- Seen plug-in electric vehicles in social media
- Heard of plug-in electric vehicle tax incentives
- Never exposed to plug-in electric vehicles
- Other (please specify):

*9. Are you aware of electric vehicle charging stations along the routes you drive and the places you visit in a typical day? (Please select all that apply.)

- Pass charging stations regularly while driving
- At your place of work
- At the stores and places you visit
- Not aware of any

*10. Could you park a vehicle near an existing electrical outlet to be plugged in most days at or near your home?

- Yes
- No
- Don't know

*11. How many miles would a **pure** electric vehicle need to travel on a single charge for you to be satisfied by the range and consider purchasing or leasing the vehicle? (This vehicle is powered only by its battery and does not have a gasoline engine.)

Miles:

V. Reasons for plug-in electric vehicle interest

*12. Please choose the **three** most compelling reasons you would buy or lease a plug-in electric vehicle. (Please select only three issues.)

- Electric vehicle tax incentives
- Maintenance costs
- Fuel costs
- Environmental impact
- National energy security
- Overall vehicle performance
- Vehicle acceleration
- Quiet driving vehicle
- Driving range of the battery
- Charging at home
- Charging at work

- Availability of public charging stations
- HOV lane access or parking privileges
- Interest in owning a new technology
- Portrays the right image for me
- Safety
- Dependability in adverse weather, terrain, or road conditions

13. Were there any other primary reasons you are considering buying or leasing a plug-in electric vehicle?

VI. Reasons for not considering a plug-in electric vehicle

*14. Please choose the **three** most compelling reasons you would **not** buy or lease a plug-in electric vehicle. (Please select only three issues.)

- Vehicle cost
- Overall vehicle performance
- Driving range of the battery
- The length of time to charge the vehicle
- Ability to charge at home
- Availability of public charging stations
- Ability to charge away from home
- Availability in the vehicle segment (sedan, SUV, pick-up, etc.) I am interested in
- Dependability of the technology
- How long (miles or years) the battery will last
- Vehicle maintenance costs
- Does not portray the right image for me

15. Were there any other primary reasons you decided not to consider buying or leasing a plug-in electric vehicle?

VII. Household vehicle usage

16. How many vehicles does your household own or lease?

Vehicles:

17. How many miles do you drive one-way in a typical daily commute?

Miles:

18. How many miles do you travel in a typical year in the vehicle you drive most often?

Miles:

19. Do you ever use the vehicle you drive most often for towing?

- Yes
- No

VIII. Survey complete

Thank you for taking the pre-drive questionnaire!

Appendix B. Post-Drive Survey

I. Welcome

Thank you for participating in our survey!

Now that you have taken part in the plug-in electric vehicle event, we would like to ask you about your views of plug-in electric vehicles.

Your feedback can help with future efforts and is extremely valuable.

Public reporting burden for this collection of information is estimated to average 10 minutes per response (30 minutes total), including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-23, Paperwork Reduction Project (1910-5171), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (1910-5171), Washington, DC 20503.

OMB Control #: 1910-5171 Exp Date: 1/31/2020

II. Email address and vehicle type

*1. Please provide your email address:

(Your email address will be used to link your responses before and after the event. It will not be shared, disclosed, or sold to third parties.)

2. Which event did you participate in?

- Employer Hosted (the event was held at your place of work)
- Public (the event was NOT held at your place of work and was open to the public)
- Physical Showcase (the event was held at a retail outlet)
- Fleet Event (the event was for fleet vehicle purchases)
- Other (please specify)

*3. What type of vehicle did you drive or ride in?

- Plug-in hybrid electric vehicle
- Pure electric vehicle
- Both
- Neither

*4. Are you expecting to buy or lease a vehicle in the future?

- Yes
- No

III. Perception of plug-in electric vehicles

Informational Note: Plug-in electric vehicles can be charged by being plugged into a household type outlet or specially designed charging equipment. These can be defined as **plug-in hybrid** or **pure** electric vehicles. Hybrids that cannot be plugged in are not included in this definition.

A **plug-in hybrid** electric vehicle can be powered by either the battery or the gasoline engine. A **pure** electric vehicle is powered only by the battery.

*5. Of the vehicle options that are available today, what is your opinion of **plug-in hybrid** electric vehicles? (These are vehicles that can be plugged in, but also have a gasoline-powered engine to extend their range.)

- Better than traditional gasoline vehicles
- Just as good as traditional gasoline vehicles
- Not as good as traditional gasoline vehicles
- Don't know

*6. Do you expect to consider a **plug-in hybrid** electric vehicle for your next vehicle purchase or lease? (These are vehicles that can be plugged in, but also have a gasoline-powered engine to extend their range.)

- Will definitely not purchase or lease
- Plan to not consider
- Do not expect to consider
- Don't know
- Expect to consider
- Expect to purchase or lease
- Will definitely purchase or lease

*7. Of the vehicle options that are available today, what is your opinion of **pure** electric vehicles? (These are vehicles that are powered only by their batteries and do not have gasoline engines.)

- Better than traditional gasoline vehicles
- Just as good as traditional gasoline vehicles
- Not as good as traditional gasoline vehicles
- Don't know

*8. Do you expect to consider a **pure** electric vehicle for your next vehicle purchase or lease? (These are vehicles that are powered only by their batteries and do not have gasoline engines.)

- Will definitely not purchase or lease
- Plan to not consider
- Do not expect to consider
- Don't know
- Expect to consider
- Expect to purchase or lease
- Will definitely purchase or lease

IV. Plug-in electric vehicle range

*9. How many miles would a **pure** electric vehicle need to travel on a single charge for you to be satisfied by the range and consider purchasing or leasing the vehicle? (This vehicle is powered only by its battery and does not have a gasoline engine.)

Miles:

V. Reasons for plug-in electric vehicle interest

*10. Please choose the **three** most compelling reasons you would buy or lease a plug-in electric vehicle. (Please choose only three issues.)

- Electric vehicle tax incentives
- Maintenance costs
- Fuel costs
- Environmental impact
- National energy security

- Overall vehicle performance
- Vehicle acceleration
- Quiet driving vehicle
- Driving range of the battery
- Charging at home
- Charging at work
- Availability of public charging stations
- HOV lane access or parking privileges
- Interest in owning a new technology
- Portrays the right image for me
- Safety
- Dependability in adverse weather, terrain, or road conditions

11. Were there any other primary reasons you are considering buying or leasing a plug-in electric vehicle?

VI. Reasons for not considering a plug-in electric vehicle

*12. Please choose the **three** most compelling reasons you would **not** buy or lease a plug-in electric vehicle. (Please select only three issues.)

- Vehicle cost
- Overall vehicle performance
- Driving range of the battery
- The length of time to charge the vehicle
- Ability to charge at home
- Availability of public charging stations
- Ability to charge away from home
- Availability in the vehicle segment (sedan, SUV, pick-up, etc.) I am interested in
- Dependability of the technology
- How long (miles or years) the battery will last
- Vehicle maintenance costs
- Does not portray the right image for me

13. Were there any other primary reasons you decided not to consider buying or leasing a plug-in electric vehicle?

VII. Survey complete

Thank you for taking the post-drive questionnaire!

Appendix C. Follow-Up Survey

I. Welcome

Thank you for participating in our survey!

Several months have passed since you took part in the plug-in electric vehicle showcase event. We would like to ask you some questions about how you currently view plug-in electric vehicles.

Your feedback can help with future efforts and is extremely valuable.

Public reporting burden for this collection of information is estimated to average 10 minutes per response (30 minutes total), including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-23, Paperwork Reduction Project (1910-5171), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (1910-5171), Washington, DC 20503.

OMB Control #: 1910-5171 Exp Date: 1/31/2020

II. Email address

*1. Please provide your email address:

(Email addresses are used to link surveys taken before and after the event.)

2. Which event did you participate in?

- Employer Hosted (the event was held at your place of work)
- Public (the event was NOT held at your place of work and was open to the public)
- Physical Showcase (the event was held at a retail outlet)
- Fleet Event (the event was for fleet vehicle purchases)
- Other (please specify)

III. Perception of plug-in electric vehicles

Informational Note: Plug-in electric vehicles can be charged by being plugged into a household type outlet or specially designed charging equipment. These can be defined as **plug-in hybrid** or **pure** electric vehicles. Hybrids that cannot be plugged in are not included in this definition.

A **plug-in hybrid** electric vehicle can be powered by either the battery or the gasoline engine. A **pure** electric vehicle is powered only by the battery.

*3. Of the vehicle options that are available today, what is your opinion of **plug-in hybrid** electric vehicles? (These are vehicles that can be plugged in, but also have a gasoline-powered engine to extend their range.)

- Better than traditional gasoline vehicles
- Just as good as traditional gasoline vehicles
- Not as good as traditional gasoline vehicles
- Don't know

*4. Of the vehicle options that are available today, what is your opinion of **pure** electric vehicles? (These vehicles are powered only by their batteries and do not have gasoline engines.)

- Better than traditional gasoline vehicles
- Just as good as traditional gasoline vehicles
- Not as good as traditional gasoline vehicles
- Don't know

IV. Follow-up actions

*5. After the ride and drive event, did you seek out additional information about plug-in electric vehicles? (Please select all that apply.)

- Researched plug-in electric vehicle models online
- Went to a plug-in electric vehicle dealership
- Spoke with a plug-in electric vehicle salesperson or representative
- Communicated with a plug-in electric vehicle salesperson or representative over the phone
- Communicated with a plug-in electric vehicle salesperson or representative online
- Test drove another plug-in electric vehicle
- Did not seek out additional information

*6. Did you or do you expect to purchase or lease a plug-in electric vehicle in the coming months?

- Have purchased or leased a plug-in electric vehicle
- Expect to purchase or lease a plug-in electric vehicle in the coming months
- Expect to eventually purchase or lease a plug-in electric vehicle
- Have not and do not expect to purchase or lease a plug-in electric vehicle

V. Type of plug-in electric vehicle purchased

*7. What type of plug-in electric vehicle did you buy or do you expect to buy?

- Plug-in hybrid electric vehicle
- Pure electric vehicle
- Both

8. What is the all-electric driving range (in miles) of the vehicle you purchased or expect to purchase?

Miles:

VI. Reasons for plug-in electric vehicle interest

*9. Please choose the **three** most compelling reasons you would buy or lease a plug-in electric vehicle. (Please select only three issues.)

- Electric vehicle tax incentives
- Maintenance costs
- Fuel costs
- Environmental impact
- National energy security
- Overall vehicle performance
- Vehicle acceleration
- Quiet driving vehicle
- Driving range of the battery
- Charging at home

- Charging at work
- Availability of public charging stations
- HOV lane access or parking privileges
- Interest in owning a new technology
- Portrays the right image for me
- Safety
- Dependability in adverse weather, terrain, or road conditions

10. Were there any other primary reasons you considered buying or leasing a plug-in electric vehicle?

VII. Sentiments about owned vehicle

*11. Would you recommend a plug-in electric vehicle to others, given your experience of owning one?

- Yes
- No

*12. When it is time to replace your plug-in electric vehicle, do you expect to purchase or lease another plug-in electric vehicle?

- Will definitely replace with another plug-in electric vehicle
- Will likely replace with another plug-in electric vehicle
- Will probably not replace with another plug-in electric vehicle
- Will definitely not replace with another plug-in electric vehicle

*13. Did your plug-in electric vehicle replace another vehicle in your household or was it an additional vehicle?

- Replaced another vehicle
- Was an additional vehicle

*14. For long-distance trips, do you use...

- Your plug-in electric vehicle
- Another of your household vehicles
- A family or friend's vehicle
- A rental car
- Public transportation
- Other (please specify):

VIII. Charging preferences and range concerns

*15. Please indicate where and how frequently you charge your vehicle.

	Never	Rarely	Regularly	All the time
At home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At public charging stations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*16. Do you have concerns about the driving range of your plug-in electric vehicle's battery?

- The all-electric driving range completely meets your needs
- Rarely need to adjust your driving plans to charge your car
- Often need to adjust your driving plans to charge your car
- The all-electric driving range is not sufficient for your needs

IX. Reasons for not considering a plug-in electric vehicle

*17. How many miles would a pure electric vehicle need to travel on a single charge for you to be satisfied by the range and consider purchasing or leasing the vehicle? (This is a vehicle that is powered only by its battery and does not have a gasoline engine.)

Miles:

*18. Please choose the **three** most compelling reasons you would **not** buy or lease a plug-in electric vehicle. (Please select only three issues.)

- Vehicle cost
- Overall vehicle performance
- Driving range of the battery
- The length of time to charge the vehicle
- Ability to charge at home
- Availability of public charging stations
- Ability to charge away from home
- Availability in the vehicle segment (sedan, SUV, pick-up, etc.) I am interested in
- Dependability of the technology
- How long (miles or years) the battery will last
- Vehicle maintenance costs
- Does not portray the right image for me

19. Were there any other primary reasons in your decision not to buy or lease a plug-in electric vehicle?

X. Survey complete

Thank you for taking the follow-up questionnaire!