



**GREEN CAR INSTITUTE**

*A Non-Profit Corporation*

**Study of  
NEV User Behavior  
in California**

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## Table of Contents

<b>Background .....</b>	<b>3</b>
<b>Summary of Purpose and Methodologies .....</b>	<b>4</b>
<b>Significant Statistical Findings .....</b>	<b>5</b>
<b>NEV Use Statistical Analysis .....</b>	<b>9</b>
Where NEVs are Used .....	10
Why Some Communities are Safe for NEVs .....	11
NEV Trip Types .....	13
NEV Occupancy Rates .....	14
NEV Trip Rates .....	15
NEV Cold Starts .....	16
NEV VMT .....	17
Additional Analysis on VMT, Daily Trips .....	19
Modes Replaced .....	19
Why NEVs are Acquired .....	20
<b>Survey Instrument .....</b>	<b>24</b>
<b>Contributors .....</b>	<b>29</b>

## **Background**

Green Car Institute is a non-profit 501(c)(3) corporation dedicated to research and educational projects in the automotive environmental field. Its mission is to foster greater public understanding of the relationship between low emission/clean fuel vehicles and the environment, along with related automotive areas such as energy efficiency, recycling, and environmentally conscious manufacturing processes. The Institute's projects focus on partnering auto industry and utility/energy company clean fuel technology and research opportunities with public education programs.

The Institute's published studies include market research and analysis of industry trends and products. "The Current and Future Market for Electric Vehicles" and "Future EV Pricing" were both published in September 2000 and became a key part of the testimony for the California Air Resources Board's decision at the time on the Zero Emission Vehicle (ZEV) mandate.

Proprietary research includes a comprehensive survey of "smart growth" communities in the fair-weather regions of the United States (Southeast, Deep South, Southwest, and West Coast), with the aim of measuring land use patterns and transportation infrastructure compatibility with new mobility tools such as neighborhood electric vehicles (NEVs). Similar research includes a published study of travel behavior of 28 families living in the smart growth community of Otay Ranch in Chula Vista, Calif., who were equipped with NEVs for 60 days. Focus group research found that NEVs replaced internal combustion engine vehicle trips 90 percent of the time during the two-month period.

Green Car Institute's expertise is drawn from its members' considerable experience in fields directly related to this study, publicly available industry data, primary and secondary independent research sources, and direct interviews with industry personnel. Funding for research comes from industry grants and private donations.

Green Car Institute partnered with Kenneth Kurani, Ph.D. and Tom Turrentine, Ph.D., of the Access Research Group, who advised questionnaire and sampling design, and conducted statistical analysis. In addition to being the principals of the Access Research Group, they are staff researchers at the Institute of Transportation Studies at University of California, Davis. Research conducted through the ITS-Davis and with affiliated academic departments is considered among the highest quality and most focused on important emerging issues in the field of transportation. Through their affiliation with ITS-Davis, they have conducted market research on electric vehicles and neighborhood electric vehicles for over twelve years.

## Summary of Purpose and Methodologies

This survey was conducted to develop a statistical portrait of the travel behavior and mobility preferences of neighborhood electric vehicle (NEV) owners in California. Based on publicly available industry information, it is estimated that there are approximately 15,000 or more NEVs in service in California as of July 2003. These include GEM vehicles placed into service by Global Electric Motorcars, LLC (a DaimlerChrysler Company), TH!NK Neighbors from Ford Motor Company, plus a variety of smaller-volume products from manufacturers such as Dynasty Motors, Club Car, Pathway, Lido, Taylor Dunn, E-Z-GO, Electric Ox, Gorilla and others.

This volume of NEVs represents the largest single geographic concentration of electric vehicles anywhere in the world. As such, Green Car Institute's aim with this study was to determine why NEV owners acquired a NEV, how they use a NEV in their daily routines, and how this travel behavior fits into the larger context of California emissions, traffic congestion, land use patterns and other factors that make up the mobility matrix of some 35 million residents of the most populous state in America.

We interviewed 260 NEV owners/users by phone for approximately 10-15 minutes each. The names of the respondents were randomly selected from a database of nearly 10,000 GEM vehicles in service in California. Data were collected over two one-week periods (M-F, July 14-18 and M-F, July 21-25, 2003) from 9 a.m. to 5 p.m. PST.

The database was provided by Global Electric Motorcars, which also contributed funding to Green Car Institute. This database was chosen as the control test universe for four key reasons:

- It was available.
- It was the largest single verifiable source of NEV users in California.
- Its data were sorted in ways that made the database relatively simple to use as a test bed – sorted by zip code, city/town, date of purchase, etc.
- No other similarly sized database of California NEV users exists.

Of the 260 people interviewed, 162 were "household" users (retail customers, individual owners), and 98 were "small fleet" operators (business or institutional customers). The sample size of 260 provides a statistically accurate representation of the overall NEV travel behavior of the users of the conservatively estimated 15,000 NEVs in service in California today. This sample size provides a margin of error of 6-8 percent.

In order to provide unassailable data, all statistical extrapolations used in the narrative of this study are based on the assumption of a total population of 10,000 NEVs. The remaining 5,000 NEVs estimated to be in service in California are not counted in this study nor represented by statistical extrapolation.

## Significant Statistical Findings

While an almost unlimited number of statistical findings can be drawn from this survey by cross tabulating results from one data point with another, some findings stand out due to their ramifications at the commercial and regulatory levels. These statistics are particularly important in challenging several **stereotypes** some key opinion leaders and policy makers may hold of the NEV, to wit:

- It's not a real car.
- It's not really an electric car.
- It's a glorified golf cart.
- No one really uses them.
- It's a toy, not a mobility tool.
- It's more fun than functional.
- They're good for gated communities and golf courses, but not for where real people live.

To the contrary, this study found the NEV is used as a daily replacement for an internal combustion engine vehicle more than two-thirds of the time. It is used for far more purposes than anyone might have imagined, usually in trips characterized as "trips of necessity." The functionality of the NEV is underscored by users' reports of the high incidence of employing their NEV to carry goods or do errands. The NEV is viewed by its owners as a viable tool in the toolbox of transportation options available to them. Most NEV users own more than two internal combustion engine vehicles, but the NEV still replaces two-thirds of daily short-distance trips formerly taken with either of those vehicles. While one of five NEV trips may be on the golf course, even there the NEV is often a replacement for a gasoline-powered cart.

Moreover, NEVs are in use in a wide variety of land use settings. It isn't possible to characterize a single "typical" setting. The survey showed that NEVs are in use in relatively equal numbers in small, medium, and large urban centers, in suburbs, master-planned communities, rural areas, gated golf communities, mobile home parks, apartment complexes and numerous other surroundings. This finding graphically demonstrates the fallacy of the stereotype that NEVs are limited in their utility to gated communities and golf courses.

As may be obvious from the high usage rates, NEVs do not appear to be encountering significant obstacles to their use in many, varied communities. One surprising finding of the study is that NEVs are much more likely than a typical car to be carrying more than one person. While standard vehicles in California typically carry a single driver with no passengers more than 70% of the time, NEV users have a completely opposite occupancy rate: 75.4% of all NEV trips carry more than one person. Thus, NEVs are having an impact on congestion and carry an even greater positive environmental benefit than might be

measured by simply counting vehicle cold-starts eliminated, trips taken and vehicle miles traveled (VMT).

Significantly, NEVs are eliminating cold-start emissions and having a measurable impact on the environment in California. This study found the “mean” (or average) number of eliminated cold starts to be 2.28 per day per NEV. (The definition of “cold start” used for this study: a vehicle started after sitting for at least one hour. This is the conventional definition followed by the California Air Resources Board, except in emissions test procedures where a longer “cold soak” is used.)

Using the 10,000 NEV user base assumptions, this means NEVs eliminate 22,800 cold starts per day in California, 159,600 per week, and 7.98 million per year (based on a 50-week use cycle, which allows for vacations of maintenance down time). Those cold-start eliminations come in a disproportionate number from individual NEV owners because small NEV fleet users tend to use their vehicles more frequently during the day, park in shorter durations, and thus create fewer starts that would be considered “cold” in an internal combustion engine vehicle.

The statistically typical NEV user in California takes 7.56 “mean” trips per day. The average number of NEV trips per day for households is 3.32; the average number of NEV trips per day for small fleets is 14.56 (this is a fleet estimate rather than an individual vehicle estimate). Using the 10,000 NEV user base assumptions, it is reasonable to report that NEV users in California take 75,600 one-way trips per day. Using the same formula as above, this equals 529,200 NEV trips a week and 26.46 million one-way NEV trips taken per year in California.

Though NEVs are, by definition, limited-use vehicles, they do rack up an impressive number of vehicle miles traveled (VMT) each year that otherwise would be taken, more often than not, in an internal combustion engine vehicle. In fact, NEV users replaced trips taken in their personal or company-provided internal combustion engine vehicles with NEVs for 64.7% of their trips.

Users were asked to estimate either miles per week or miles per year that their NEV was used. The “mean” of the reported data is 1,258 miles per year per NEV. With a population of 10,000 NEVs, that means NEVs are being driven 12.58 million zero-emission miles per year in California. The statistical NEV user profile includes the following numbers:

Averaging use habits of all NEV users in California:

- 2.28 cold starts are estimated to be eliminated each day by one NEV.
- 798 cold starts are eliminated/year per NEV.
- 7.98 million cold starts are eliminated in California per year in NEVs.

Averaging use habits of all NEV users in California:

- 7.56 trips per day are taken in a NEV.
- 75,600 trips per day are taken in the NEV fleet.
- 529,000 trips per week are taken NEVs.
- 26.46 million trips per year are taken in NEVs.

Averaging the user habits of all NEV users in California:

- 1,258 miles is the average annual NEV mileage.
- 12.58 million miles are driven annually by the entire NEV fleet.

**In summary, California NEV users account for:**

- **7.98 million cold starts eliminated per year.**
- **26.46 million one-way zero-emission trips taken per year.**
- **12.58 million zero-emission miles traveled per year.**
- **64.7% replacement of personal or company-provided internal combustion engine vehicle trips with NEV trips.**

(EDITORIAL NOTE: As detailed in the Survey Results section of this report, there are several statistical qualifiers to the above data.)

Other interesting findings include the following:

Among all NEV users in California:

- 39.2% usually travel less than 1 mile for a one-way trip.
- 35.7% travel 1-3 miles.
- 18.2% travel 3-5 miles.
- 03.1% travel 5-7 miles.
- 03.9% travel 7 or more miles.

Of all NEV users:

- 24.6% usually drive alone.
- 50.8% usually have one passenger.
- 8.8% usually have two passengers.
- 15.8% usually have three passengers.
- 65.3% usually transport cargo in their NEVs.

Of all NEV trips taken in California:

- 64.7% replaced personal or company-provided internal combustion engine vehicles.
- 20.1% replaced electric or gasoline powered golf carts. (In other words, one in five NEV trips is for golfing.)
- 5.0% of NEV trips were “new” or “additional” trips not replacing any other mode of travel.
- 10.1% replaced modes such as walking, biking, public transportation and other.

Of all household NEV users:

- 48.1% own three or more personal internal combustion engine vehicles.
- 28.1% own two.
- 22.5% own one.
- 01.3% own no other vehicle in addition to their NEV.

Of the household users:

- 60.0 % are older than 55 years.
- 22.8 % are 46 to 55.
- 11.1 % are 36 to 45.
- 04.9 % are 26 to 35.
- 01.2 % are under 25.

The most common reasons given for why NEV users perceive their communities to be suitable for NEV travel were:

1. Short distances between destinations.
2. The presence of 35 mph or less streets in their communities.
3. The weather is fair most of the time.

The most common types of trips taken in NEVs in California were:

1. To run local errands,
2. For personal recreation,
3. To visit friends and family, and, interestingly,
4. To deliver or transport goods for businesses or personal reasons.

Households and small fleets are more likely than not to use their NEVs to transport cargo:

- 65.3% of respondents use their NEVs to transport something other than people.

The most common reasons why households acquired a NEV were:

1. The NEV fit their lifestyle.
2. They wanted to “have fun” getting around their communities.
3. They thought the NEV was “cool.”
4. They wanted to “save on gasoline” or provide cheap transportation.
5. They wanted “a more environmentally friendly mode of travel” or wanted a car that fit their travel patterns.

The most common reasons why businesses acquired a NEV were:

1. They wanted a car that fit their company’s travel needs.
2. They wanted “a more environmentally friendly mode of travel.”
3. They wanted to “save on gasoline.”
4. They wanted an affordable fleet vehicle.
5. They wanted an air quality regulatory compliance tool.



## NEV Use Statistical Analysis

Included in this section are the results of the survey along with interpretation of the data collected. The numerical listing of data points generally corresponds with the sequencing of questions on the survey instrument.

**1. Test Sample** – The test sample consists of 162 households and 98 small fleets, for a total of 260 records and representing a universe of 316 NEVs. Not all data points were filled out on every question due to respondents not answering or data input error. Thus, percentages of totals were calculated based on the actual number of responses collected for each question.

While the individual and fleet use of NEVs is different, the cumulative impact of overall NEV usage within both categories is significant and underscores the import role the NEV plays in California's mobility mix. For clarification purposes, the following table provides further detail of NEV fleet sizes and household NEV ownership. In the sample, households represented 62.3 percent of the responses, yet they represent 54 percent of the vehicle universe. Conversely, the small fleets/business users represent 37.7 percent of the respondents but 45.6 percent of the vehicle universe.

<b>Business Fleets</b>	
Average fleet size (144 NEVs/98 businesses)	1.47
Businesses owning 1 NEV	65
Businesses owning 2 NEVs	23
Businesses owning 3 NEVs	7
Businesses owning 4 NEVs	3

<b>Personal Households</b>	
Average number of NEVs owned (172 NEVs/162 households)	1.06
Households owning 1 NEV	154
Households owning 2 NEVs	7
Households owning 4 NEVs	1

**2. Gender distribution of respondents** – The gender distribution is 162 men (60% of the total response pool of 258), and 96 women (40%); data were missing for 2 respondents.

**3. Age distribution of household respondents** – The household sample is strongly skewed toward older persons: some 60 percent of respondents are over the age of 55 years.

<b>Age Category</b>	<b>Number of Household Respondents</b>	<b>Percent of 162 Total</b>
Under 25	2	1.23 %
26 to 35	8	4.94 %
36 to 45	18	11.11 %
46 to 55	37	22.84 %
older than 55	97	59.88 %

#### **4. Where NEVs are used**

Neighborhood electric vehicles are in use in a wide variety of land use settings. It isn't possible to characterize a single "typical" setting. This statistic graphically demonstrates the fallacy of the stereotype that NEVs are limited in their utility to gated communities and golf courses. Data are available from 259 of the 260 respondents.

<b>Community and Operating Environment</b>	<b>Households</b>	<b>Small Fleets</b>	<b>Total</b>	<b>Percent of 259 Total</b>
A small town (less than 10,000 persons)	14	7	21	8.11 %
A medium town (10-50,000 persons)	14	10	24	9.27 %
A larger town (50,000-100,000 persons)	7	6	13	5.02 %
Downtown, central district of a big city (more than 100,000 persons)	4	5	9	3.47 %
Other neighborhoods of a city (more than 100,000 persons)	6	0	6	2.32 %
A suburban community (extension of a city area)	16	2	18	6.95 %
Master-planned community (large development with destinations such as schools, shopping, employment areas)	13	2	15	5.79 %
A gated golf community	43	1	44	16.99 %
A rural, or isolated area	20	8	28	10.81 %
Airport	0	2	2	0.77 %
Industrial park	0	11	11	4.25 %
Military base	1	1	2	0.77 %
School campus	1	7	8	3.09 %
Office complex	0	2	2	0.77 %
Other (Retirement communities, mobile home parks, apartment complexes, etc.)	23	33	56	21.62 %

## 5. Why communities are perceived safe for NEVs

The most common answer across both households and small fleets is the claim that there are short distances between destinations within the use environment of their NEVs. Households are nearly as likely to claim either the presence of 35 mph streets or short distances between destinations as the reason that NEV travel is safe in their community.

Households are also more likely than expected to offer an “other” response. The “other” responses cover a wide variety of reasons, only a few of which appear as if they could be re-categorized into the provided responses. Multiple responses were allowed for this question.

Reason	Households	Small Fleets	Total	Percent of 260 Total
35 mph or less streets	131	51	182	70.00 %
Short distances between destinations	128	71	199	76.54 %
Fair weather	117	40	157	60.38 %
Dedicated roads for low speed vehicles	49	30	79	30.38 %
Parking privileges for electric vehicles and NEVs	49	14	63	24.23 %
Other	23	25	48	18.46 %

Other responses to why the community or use environment is safe for NEVs.

Other reasons	Number
All streets	1
All streets slow	1
Apartment complex	2
Bicycle community	1
Flat town	1
Gated community	1
Golf course	1
Mall property	1
Master-planned community	1
Never on the road	1
No public roads	1
None	12

Not conducive	1
On storage property	1
On-campus access roads	1
Parking lot	1
Patrolled by security	1
People are aware	1
Private property	8
Private ranch	1
Private roads	1
Progressive community	1
Quiet community	1
Rural	1
School campus ease of use	1
Small area	1
Tolerant	1
Used strictly on complex grounds	1
Used with senior park	1
Total	48

## 6. Types of trips for which a NEV is used

Households and small fleets appear to use their NEVs for a wide variety of trips. The households, as would be expected from mostly older people, are not as likely to be commuting to work or chauffeuring children. They are more likely to be running local errands, visiting family and friends, and traveling to personal recreation. Small fleets are most likely to be using their NEVs to deliver goods for their business, provide personal mobility at work, and transport business clients and associates. Multiple responses were allowed for this question.

<b>Trip Type</b>	<b>Households</b>	<b>Small Fleets</b>	<b>Total</b>	<b>Percent of 260 Total</b>
Commute to work/school	21	5	26	10.00 %
Transport children to school	15	0	15	5.77 %
Transport children to recreation/sports/leisure activities	26	0	26	10.00 %
Transport business clients and associates	9	56	65	25.00 %
Run local errands	138	38	176	67.69 %
Personal mobility while at work	23	60	83	31.92 %
Visit friends/family	116	7	123	47.31 %
Personal recreation	122	6	128	49.23 %
Deliver or transport goods for business	115	69	84	32.31 %
Business services (such as a maintenance vehicle)	3	51	54	20.77 %
Other:	17	14	31	11.92 %

Other responses to trip types.

<b>Other Trip Type</b>	<b>Count</b>
Athletic & maintenance	1
Cancer volunteer visits	1
Catering	1
Delivers goods for personal reasons	1
Drive to church	2
Errands on property	1
Garbage to street	1
Gardening	1
Gated community	1
Get around large acreage	1

Horse hay delivery	1
Housekeeping & maintenance	1
Inside park	1
Maintenance	1
Making rounds & event set up	1
Medical assistance	1
Onsite plant mobility	1
Parking enforcement	3
Personal mobility	1
Private property transportation	1
Security	4
Special events	1
Special events & trade shows	1
Uses it to get to bus stop	1
Walk dog	1
Total	31

### 7. NEV occupancy rates

Perhaps surprising since vehicle occupancy of conventional vehicles is so close to one, i.e., driver only, NEV drivers are more likely to carry passengers than not. This is true for both the households and small fleets in the sample.

Number Passengers	Households	Small Fleets	Total	Percent of 260 Total
None	32	32	64	24.62 %
One	96	36	132	50.77 %
Two	11	12	23	8.84 %
Three	23	18	41	15.77 %

### 8. Transport cargo

Households and small fleets are more likely than not to use their NEVs to transport cargo. Data is available from 259 of the 260 respondents.

	Households	Small Fleets	Total	Percent of 259 Total
Yes	106	63	169	65.25 %
No	55	35	90	34.75 %

### 9a. Trips per day

One-hundred and fifty six (156) total respondents reported trips per day. Of these, 74 are households, and 82 are small fleets. The average number of trips per day for these households is 3.89; the average number of trips per day for small fleets is 17.12. Fleet operators were asked to estimate total trips for all vehicles if they were used for the same purpose. If the vehicles were used for different purposes, surveys were completed separately.

	<b>Total Sample</b>	<b>Household</b>	<b>Small Fleets</b>
Mean trips per day	11.66	3.89	17.12
Median trips per day	6.00	4.00	12.00

### 9b. Trips per week

Eighty-nine (89) respondents reported trips per week; 76 households and 13 small fleets. The average number of trips per week for these households is 6.78. The average number of trips per week for these small fleets is 11.46.

	<b>Total Sample</b>	<b>Household</b>	<b>Small Fleets</b>
Mean trips per week	9.18	6.78	11.46
Median trips per week	6.00	6.00	10.00

### 9c. Trips per month

A total of 12 households and small fleets reported trips per month; 9 households and 3 fleets. These are small numbers from which to estimate averages. The average number of trips per month for these households is 12.56. The average number of trips per month for these fleets is 20.00. (The danger of interpreting this mean is highlighted by the fact that the three actual values are 4, 4, and 52.)

	<b>Total Sample</b>	<b>Household</b>	<b>Small Fleets</b>
Mean trips per month	14.42	3.89	17.12
Median trips per month	11.00	12.00	4.00

## 10. Parking duration

Small fleets are less likely than households to leave their NEVs parked for more than an hour between trips. Data is available from 259 of the 260 respondents.

Duration	Households	Small Fleets	Total	Percent of 259 Total
My NEV never sits for more than an hour between trips, except for the last trip of the day.	33	27	60	23.16 %
Maybe one out of four trips	32	28	60	23.16 %
About half my NEV trips	38	17	55	21.24 %
Maybe three out of four trips	10	19	19	7.34 %
Almost all my trips	49	16	65	25.10 %

## 11. Estimated number of eliminated cold starts per day

Cold starts are estimated using the data for estimated trips per day and parking duration, as well as data for the travel mode the NEV is most likely to replace. First, no credit is given for a cold start unless the replaced mode is a personal car, company car, or gasoline golf cart. Next, the responses to question 12 regarding the duration the vehicle is parked between trips are used to assign a probability that a NEV (that replaces a personal car, company car, or gasoline golf cart) makes additional cold starts during the day. The formula is as follows:

$$\left. \begin{array}{l}
 \text{Match 12. Park Duration:} \\
 +(\text{Est Daily Trips } 1) \cdot 0.25, \\
 +(\text{Est Daily Trips } 1) \cdot 0.5, \\
 +(\text{Est Daily Trips } 1) \cdot 0.75, \\
 +(\text{Est Daily Trips } 1) \cdot 1, \\
 ,
 \end{array} \right\} \begin{array}{l}
 \text{when 1} \\
 \text{when 2} \\
 \text{when 3} \\
 \text{when 4} \\
 \text{when 5} \\
 \text{otherwise}
 \end{array}$$

If *12. Park Duration* is equal to 1, the person has indicated their NEV never sits for longer than an hour, except after the last trip of the day. This means the vehicle is in more or less constant use, and once it is warmed up, no further cold starts are eliminated. Still, any vehicle matching this description makes at least one trip per day that eliminates a cold start—the first trip each day.

If *12. Park Duration* is equal to 2, the person has indicated that for about one out of four trips, their NEV sits for more than an hour—such that after that hour, the next trip would eliminate a cold start. So, a probability of eliminating a cold start = 0.25 is assigned to all trips by that NEV. One is added to this estimate, since the first trip of the day is assumed to have a probability of 1.0 of replacing a cold start.



The remainder of the estimates follows this thinking. Note that for fleets the variable *Est Daily Trips* is already an estimate of the total NEV trips per day by all NEVs in each fleet. Therefore, the formula already accounts for multiple vehicles. The results are summarized in the following table.

	<b>Total Sample</b>	<b>Household</b>	<b>Small Fleets</b>
Estimated mean cold starts eliminated per day	2.28	1.92	2.88
Estimated median cold starts eliminated per day	1.18	1.29	1.00
Estimated total number of eliminated cold starts per day by the sample	591	311	280

According to this analysis, the NEVs in the households in this sample are eliminating an average of 1.92 cold starts per day. The NEVs in these small fleets are eliminating an average of 2.88 cold starts per day. NEVs in fleets are less likely than NEVs in households to sit for long periods of time between trips. Some 56.7 percent of small fleets report their NEVs are never (27.8 percent) parked for more than an hour between trips, or are parked over an hour only 25 percent of the time (28.9 percent). In contrast, only 40 percent of households report that their NEVs are typically never parked for an hour between trips (20.3 percent) or are parked over an our about one-fourth the time (19.7 percent).

So, while on average, the small fleets use their NEVs for many more trips per day (14.56 trips per day compared to 3.32 trips per day for households), the difference in eliminated cold starts is much closer.

## 12. Distance of “most” NEV trips

Households are much less likely than fleets to make short trips of less than one mile in their NEVs. This is true in both an absolute and relative sense. Data are available from 258 of 260 respondents.

<b>Distance</b>	<b>Household</b>	<b>Small Fleet</b>	<b>Total</b>	<b>Percent of 258 Total</b>
Less than 1 mile	36	65	101	39.15 %
1-3 miles	72	20	92	35.66 %
3-5 miles	40	7	47	18.22 %
5-7 miles	7	1	8	3.10 %
7 or more miles	7	3	10	3.87 %

### 13a. Miles per year the NEV is driven; or miles per week

Far more respondents (226 respondents) offered an estimate of the number of miles per week they drove their NEV(s), than miles per year (28 respondents). Data were not reported for five respondents.

Of those who did report miles per year, 23 were households and five were small fleets. The average number of NEV miles per year for these households is 463.57. The average number of NEV miles for these fleets is 291. As the sample for fleets is so small, the mean is a poor description of any single fleet. The range of values offered by these fleets varies from 30 miles to 1,120 miles per year. Both of these estimates are skewed upwards by a few very large distances. This is evidenced by the fact the median distances are much lower than the mean distances. The median distance per year for these households is only 350 miles per year; the median for these small fleets is only 200 miles per year. In fact, removing the single longest distance household per year reduces the mean estimate from 463.57 miles to 393.73 miles, and reduces the standard error of the mean from 94.98 miles to 67.37 miles.

Especially as the sample size is small, any calculation of total NEV miles that relies on estimates from the sample of respondents who offered “miles per year” answers should be made with caution.

	<b>Total Sample</b>	<b>Household</b>	<b>Small Fleets</b>
Mean miles per year	432.75	463.57	291.00
Median miles per year	325.00	350.00	200.00

### 13b. Miles per week

Of the 226 respondents who offered an estimate of miles per week, 136 were households and 90 were small fleets. On average, these households reported driving their NEVs 22.91 miles per week. The small fleets drove an average of 32.03 miles per week.

Both of these estimates are skewed upwards by a few very large distances. This is evidenced by the fact the median distances are much lower than the mean distances. The median distance per week for these households is only 15 miles per week; the median for these small fleets is only 20 miles per week.

	<b>Total Sample</b>	<b>Household</b>	<b>Small Fleets</b>
Mean miles per week	27.20	22.91	32.03
Median miles per week	16.00	15.00	20.00

### Additional Analysis on Estimates of Miles per Year

Using the data for miles per year and miles per week, an estimate of the total miles per year can be made. "Mile per week" data is multiplied by 50 to provide an estimate of miles per year. 50 is chosen to reflect at least some likelihood that households will go on vacation, and that a NEV in a household or fleet might be out of service for maintenance or repair sometime during the year.

With this assumption, the following results are obtained:

	<b>Total sample</b>	<b>Household</b>	<b>Small Fleets</b>
Estimated mean miles per year	1,258	1,095	1,533
Estimated median miles per year	750	750	1000
Estimated total NEV miles of travel per year by the sample	320,817	175,212	145,605

### Additional Analysis on Estimated Daily Trips

Daily trips are estimated from the data for questions 11a, b, and c. If trips are reported per week, then the answer is divided by 7 to estimate trips per day. If trips are reported per month, the reported value is divided by 30.

	<b>Total sample</b>	<b>Household</b>	<b>Small Fleets</b>
Estimated mean trips per day	7.56	3.32	14.56
Estimated median trips per day	2.00	1.43	10.00
Estimated total number of trips per day by the sample	1,966	538	1,427

Note that the estimate for small fleets is not per vehicle but for the whole fleet.

## 14. Replaced Modes

What travel mode is replaced by the NEV? Households are most likely to use a NEV rather than a personal car; small fleets are most likely to use a NEV rather than a company car. There is much less likelihood that any other mode is replaced. However, an electric golf cart is mentioned by both households and small fleet operators. Data are available from 258 of 260 respondents.

<b>Mode</b>	<b>Households</b>	<b>Small Fleets</b>	<b>Total</b>	<b>Percent of 258 Total</b>
Personal car	112	14	126	48.84 %
Company car	1	40	41	15.89 %
Golf cart-electric	23	17	40	15.50 %
Golf cart-gasoline	10	2	12	4.65 %
Walking	7	11	18	6.98 %
Bike	1	1	2	0.78 %

Public transport	1	0	1	0.39 %
Additional/new uses	-	-	13	5.04 %
Other	-	-	5	1.93 %

Other responses to the question of replaced mode.

Other Response	Count
4-pass GEM	1
Disabled scooter	1
Forklift	2
Total	4

### 15. Number of personal vehicles (for households only).

Households with NEVs are significantly more likely to own three or more vehicles in addition to their NEV. For those that responded with zero, the NEV is the only vehicle they own. Data is available from 160 of the 162 household respondents.

Number of Personal Vehicles	Number of Households	Percent of 160 Total
Zero	2	1.25 %
One	36	22.50 %
Two	45	28.12 %
Three or more	77	48.13 %

### 16. Why a NEV was acquired (households)

It is nearly impossible to conclude that there is any single reason households acquire NEVs. While “the NEV fits my lifestyle” is the most frequent response, many other responses are nearly as popular. Multiple responses were allowed.

Reason for Acquiring a NEV	Number	Percent of 162 Total
Wanted a more environmentally friendly mode of travel	91	56.17 %
Wanted a car that fit my travel patterns	91	56.17 %
Wanted to have fun getting around community	113	69.75 %
Wanted to save on gasoline	101	62.35 %
Thought the NEV was cool	109	67.28 %
The NEV fit my lifestyle	116	71.60 %
It seemed like the cheapest way to get around my community	101	62.35 %
Other	57	35.19 %

<b>Other Reasons</b>	<b>Number</b>
Accessory options	1
Best deal for money	1
Bragging rights	1
Cheaper than RAV4 or EV1	1
Comfortable & easy to get in for disability	1
Convenience getting in and out	1
Convenient & inexpensive	1
Curiosity & convenient	1
Dependability & power up hills	1
Drag race	1
Economical	1
Economy of it	1
Elderly assistance	1
Engineering design	1
Faster than golf cart	1
For golf course	1
Gift	2
Good sale	1
Great price	1
Handicap accessibility	1
Handicap assistance with walking	1
Handicap assistance	2
Haul trash	1
Inexpensive golf cart	1
Inexpensive	2
Insurance cheaper	2
Investment	1
Medical assistance	1
Needed golf cart & price was right	1
New golf cart	1
Price was right	3
Quality & looks good	1
Replaced old golf cart	5
Replaced second car	1
Replaced tractor	1
Save insurance	1
Safety	1
Safety, bad eyes & needed slower speed	1
Speed	2
Support electric technology	1
Tax credit	1

To be different	1
Walking assistance due to hill	1
Wanted 4-pass cart	1
Wanted new golf cart	1
Weekend use	1
Total	57

### 17. Why a NEV was acquired (businesses)

Similarly, for the small fleets, it is difficult to say there is any outstanding reason these fleets acquired NEVs. “Wanted a car that fits my company’s travel needs” was the single most frequent response; “wanted a more environmentally friendly travel mode” was a close second. Multiple responses were allowed.

Reason	Number	Percent of 98 Total
Wanted a more environmentally friendly mode of travel	53	54.08 %
Wanted a car that fit my company’s travel needs	59	60.20 %
Wanted to save on gasoline	42	42.86 %
Helped meet air quality mandates	33	33.67 %
It was an affordable fleet vehicle	34	34.69 %
Replaced older fleet vehicle	30	30.61 %
Other	40	40.82 %

Other reasons for businesses to acquire NEVs.

Other Reason	Number
Advertising / Promotions	1
Convenience	6
Convenience & used for leasing tours	1
Customer work mobility	1
Donated	3
Efficient, affordable & quiet	1
Efficient & small size	1
First aid transport	1
For fun	1
Gimmick	1
Grants given	1
Grant donation	1
Great payload	1
Interesting	1
Inexpensive	3
Likes the looks	1

Looks futuristic	1
Lower maintenance cost	1
Morale builder at work	1
More spacious than regular golf cart	1
Needed smaller truck-like vehicle	1
Nicer and more convenient than golf cart	1
Price was right & convenient	1
Quiet	1
Replaced big truck & convenience	1
Required for green community in Ladera Ranch	1
State of the art for upscale storage facility	1
Support EV technology	1
Speed	1
Wanted something different for new facility	1
Total	39

## Survey Instrument

Following is the narrative surveyors used to illicit responses from NEV owners.

### Intro

Hello, I'm calling on behalf of Green Car Institute, a non-profit research firm conducting a study of how people use their neighborhood electric vehicles, or NEVs. Results of this study will be released in about a month and presented to the California Air Resources Board. The survey contains 16 short questions that will take approximately 9 minutes to complete. Do you have a few minutes?

If yes, continue to #1A.

If no, go to #1B

### 1A. "Do you still own a neighborhood electric vehicle or vehicles?"

- a. If yes, continue to #2.
- b. If no, thank them for their time and go to the next person.

### 1B. "Before I hang up: Do you still own a neighborhood electric vehicle or vehicles?" (yes / no)

- a. If yes, "Is there a better time we can call back and talk to one of the primary drivers of the NEV?" (record time, thank them and go one to next person) Better time \_\_\_\_\_
- b. If no, thank them for their time and go to the next person.

### 2. Are you the primary driver or share equally in the driving of the NEV(s)? (This should eliminate under 16, non-drivers and other minimal NEV users)

- a. If yes, continue to #3
- b. If no, ask "can we speak to the primary driver of the NEV?"
  1. If yes, wait for primary driver, and then reintroduce the study and go to #3.
  2. If no, "is there a time we can call back and speak to the primary driver?" (take down time, thank them and say goodbye) \_\_\_\_\_

### 3. Is your NEV(s) registered to a private household or business?

- a. Private household
- b. Business



## Demographic Questions

**4. Male or female?** (Voice recognition answer)

- a. M                      b. F

*Please choose the selection that best applies:*

**5. If private household ONLY, ask: What is your age?**

- a. under 25      b. 26-35      c. 36-45      d. 46-55      e. over 56

**6. If private household, ask: What type of community do you live in?**

*If business, ask what type of environment do your NEVs operate in?*

- a) A small town (less than 10,000 persons)
- b) A medium town (10-50,000 persons)
- c) A larger town (50,000-100,000 persons)
- d) Downtown, central district of a big city (more than 100,000 persons)
- e) Other neighborhoods of a city (more than 100,000 persons)
- f) A suburban community (extension of a city area)
- g) Master-planned community (large development with destinations such as schools, shopping, employment areas)
- h) A gated golf community
- i) A rural, or isolated area
- j) Airport
- k) Industrial park
- l) Military base
- m) School campus
- n) Office complex
- o) Other

**7. In which of the following ways does your community lend itself to safe NEV travel? (MULTIPLE ANSWERS ALLOWED)**

- a. 35 mph streets
- b. short distances between destinations
- c. Fair weather
- d. Dedicated roads for low speed vehicles
- e. Parking privileges for electric vehicles and NEVs
- f. Other: \_\_\_\_\_

## Vehicle Use Questions

### 8. For what types of trips do you use your NEV(s)?

(MULTIPLE ANSWERS ALLOWED)

- a. Commute to work/school
- b. Transport children to school
- c. Transport children to recreation/sports/leisure activities
- d. Transport business clients and associates
- e. Run local errands
- f. Personal mobility while at work
- g. Visit friends/family
- h. Personal recreation
- i. Deliver or transport goods for business
- j. Business services (such as a maintenance vehicle)
- k. Other: \_\_\_\_\_

### 9. How many passengers do you typically carry in your NEV(s)?

- a. None
- b. One passengers
- c. Two passengers
- d. Three passengers

### 10. Do you typically transport cargo of any kind in your NEV?

- a. Yes
- b. No

### 11. How many trips do you take in your NEV each day? Or, if you don't use the NEV each day, how many trips per week? Or, if not every week, how many trips per month?

"A trip is each time you go to a destination, park and get out of your vehicle. For example, if you leave home, go to the video store, park and drop off a video, next you drive the NEV to the grocery store, park and buy milk, and then drive home – that is 3 trips." (REVIEWER NOTE: This method of measuring trips is critical for counting cold starts.)

- a. Number of trips you take per day \_\_\_\_\_
- b. Or tell me the number of trips you take per week \_\_\_\_\_
- c. Or tell me the number of trips you take per month \_\_\_\_\_

### 12. Remember that a "trip is every time you get in your NEV, drive it somewhere, and park it. Of all your NEV trips, how often do you leave it parked for more than one hour before your next trip? (Circle one only.)

- a. My NEV never sits for more than an hour between trips, except for the last trip of the day.
- b. Maybe one out of four trips
- c. About half my NEV trips
- d. Maybe three out of four trips
- e. Almost all my trips

**13. How long are most of these NEV trips, including trips other drivers make?**

- a. Less than 1 mile
- b. 1-3 miles
- c. 3-5 miles
- d. 5-7 miles
- e. 7 or more miles

**14. How many miles do you drive your NEV per year? Or, if you don't know per year, per week?**

- a. Miles per year? \_\_\_\_\_
- b. Or miles per week? \_\_\_\_\_

**15. When you drive your NEV, what travel mode are you replacing?**

- a. Personal car
- b. Company car
- c. Golf cart-electric
- d. Golf cart-gasoline
- e. Walking
- f. Bike
- g. Public transportation
- h. Taxi
- i. Other: \_\_\_\_\_

**16. If private household (ONLY), ask: Excluding your NEV, how many personal vehicles does your household own?**

- a. 1
- b. 2
- c. 3 or more

**17. If private household (ONLY), ask: Why did you acquire a NEV?** (Choose as many as apply)

- a. Wanted a more environmentally friendly mode of travel
- b. Wanted a car that fit my travel patterns
- c. Wanted to have fun getting around in my community
- d. Wanted to save on gasoline
- e. Thought the NEV was cool
- f. The NEV fit my lifestyle
- g. It seemed like the cheapest way to get around my community
- h. Other : \_\_\_\_\_

**18. If business (ONLY), ask: Why did you acquire a NEV?** (Choose as many as apply)

- i. Wanted a more environmentally friendly mode of travel
- j. Wanted a car that fit my company's travel needs
- k. Wanted to save on gasoline
- l. Helped meet air quality mandates
- m. It was an affordable fleet vehicle
- n. Replaced older fleet vehicle
- o. Other: \_\_\_\_\_

### **Conclusion**

Do you have a brief comment you'd like to share with us about the use of your GEM? **(If yes, take some notes, and we may include it in the overall report.)**

Well, that concludes our survey. Thank you for your time. Have a nice day.