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U.S. Department of Energy FreedomCAR & Vehicle Technologies Program

Advanced Vehicle Testing Activity

NYPA/TH!NK Clean Commute Program Report – Inception through May 2004

Technical Report

Don Karner
James Francfort
Randall Solomon

November 2004

Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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ABSTRACT

The Clean Commute Program uses TH!NK *city* electric vehicles from Ford Motor Company's electric vehicle group, TH!NK Mobility, to demonstrate the feasibility of using electric vehicles for transportation in urban applications. Suburban New York City railroad commuters use the TH!NK *city* vehicles to commute from their private residences to train stations, where they catch commuter trains into New York City. Electric vehicle charging infrastructure for the TH!NK *city* vehicles is located at the commuters' private residences and at seven train stations. Ford leased 97 TH!NK *city* electric vehicles to commuters from Westchester, Putnam, Rockland, Queens, Nassau, and Suffolk counties for $199 per month per vehicle. The first Clean Commute Program vehicle deliveries occurred in late 2001, with data collection beginning in February 2002. At the end of May 2004, 24 of the lessees had returned their vehicles to Ford and no longer participate in the Clean Commute Program. Reasons given for returning the vehicles include relocation out of the program area, change in employment status, change in commuting status, and, in a few cases, dissatisfaction with the vehicle. In addition, 13 vehicles were returned to Ford when their leases expired. In August 2002, Ford announced that it was ceasing production of the TH!NK *city* and would not extend any TH!NK *city* leases. At the end of May 2004, participants in the Clean Commute Program had driven their vehicles over 370,000 miles, avoiding the consumption of over 17,000 gallons of gasoline. The TH!NK *city* vehicles are driven an average of between 180 and 230 miles per month, and over 95% of all trips taken with the TH!NK *city* vehicles replace trips previously taken in gasoline vehicles. This report covers the period from program inception through May 2004.

CONTENTS

1. PROGRAM DESCRIPTION

The Clean Commute Program was launched in October 2001 by the New York Power Authority (NYPA) and Ford Motor Company's electric vehicle group, TH!NK Mobility, in conjunction with the Long Island Power Authority and the Metropolitan Transportation Authority. The program is designed to reduce air pollution and traffic congestion, and to promote national energy independence by using electricity for transportation.

The program goal is to lease 100 emission-free TH!NK *city* electric vehicles to suburban rail commuters for a period of 34 months. Ford successfully leased a total of 97 TH!NK *city* electric vehicles to commuters from Westchester, Putnam, Rockland, Queens, Nassau, and Suffolk counties for $199 per month, per vehicle. The first Clean Commute Program vehicle deliveries occurred in late 2001, with data collection beginning in February 2002. At the end of May 2004, 24 of the lessees had returned their vehicles to Ford and no longer participate in the Clean Commute Program. Reasons given for leaving the program include relocation out of the program area, change in employment status, change in commuting status, and, in a few cases, dissatisfaction with the vehicle. In addition, 13 vehicles were returned to Ford when their leases expired. In August 2002, Ford announced that it was ceasing production of the TH!NK *city* and would not extend any TH!NK *city* leases.

Clean Commute participants use battery chargers at train station parking lots, where their vehicles are charged during the workday. The train stations currently participating in the Clean Commute Program and their vehicle chargers at those stations are shown in Figures 1 - 7.

Figure 1. Brewster North, Putnam County - Ten chargers.

Figure 2. Chappaqua, Westchester County - Twenty chargers.

Figure 3. Hicksville, Nassau County - Sixteen chargers.

Figure 4. Huntington, Suffolk County - Twenty-two chargers.

Figure 5. Little Neck, Queens County - Eight chargers.

Figure 6. North White Plains, Westchester County - Eight chargers.

Figure 7. White Plains, Westchester County - Ten chargers.

The train station at Nanuet, Rockland County, originally participated in the Clean Commute Program, but no commuters used the chargers. Commuters also have charging equipment installed at their homes, which increased the opportunity for vehicle use.

The TH!NK *city* is a two-passenger electric vehicle with a range of about 50 miles and a top speed of 55 miles per hour. Local Ford dealers lease the TH!NK *city* directly to consumers and provide

maintenance service and basic vehicle instruction. The vehicle was manufactured by Ford's TH!NK Nordic subsidiary in Norway.

The New York Power Authority, in partnership with the Metropolitan Transportation Authority, Metro North Railroad, and Long Island Rail Road coordinate activities to ensure sufficient train station parking and charging stations. Additional support and funding are provided by the New York State Energy Research and Development Authority, the Long Island Power Authority, the New York State Department of Transportation, New York City Department of Transportation, and the United States Department of Energy.

The Department of Energy, through its Advanced Vehicle Testing Activity (AVTA) and the AVTA subcontractor Electric Transportation Applications, provides data collection, analysis, and reporting support for the Clean Commute vehicle operations. This is the second report issued analyzing the Clean Commute Program's vehicle operations. The first report covered from program inception through February 28, 2003. This report covers from program inception through May 30, 2004.

2. DATA COLLECTION

2.1 Objective

The data collection objective is to gather data from Clean Commute Program customers and determine the following accomplishments:

- Vehicle utilization
- Reduction of fuel use
- Reduction of emissions
- Customer satisfaction with the vehicles and infrastructure
- Long-term viability of the program.

2.2 Program Participants

The Clean Commute Program has had a total of 97 participants, each of which leased and took delivery of a TH!NK *city* vehicle. Seventy-one of these participants completed an initial survey. As of May 30, 2004, leases expired for 13 of these 71 respondents, and they returned their TH!NK *city* vehicles to Ford. Due to Ford's cancellation of the TH!NK *city* vehicle, no lease extension was offered. Fifty-eight of the 71 respondents remain active in the Clean Commute Program.

2.3 Collection Methodology

Data collection for the Clean Commute Program, primarily by Internet, began in April 2002. Once participants have taken delivery of their TH!NK *city* vehicle, they are sent an e-mail directing them to a Web page where they are to complete an initial survey. Appendix A presents the initial survey. Data from the survey is automatically entered into a Clean Commute participant database. Initial surveys were completed in May 2002. Of the 97 participants that leased a TH!NK *city* vehicle and took delivery of a vehicle, 71 completed the initial survey.

After completing the initial survey, respondents are requested by e-mail to complete a monthly survey detailing their Clean Commute Program experience. Appendix B presents a monthly survey. The data from these monthly surveys are also automatically entered into the Clean Commute participant database. The first monthly surveys were transmitted in June 2002 to collect data for May. Many of the

26 participants who did not complete an initial survey do provide monthly data. These data have been included in the database.

A supplemental survey was sent to participants in July 2003, which collected additional data requested by NYPA for their evaluation of the Clean Commute Program. Appendix C presents the supplemental survey. The survey was sent to 58 participants in the Clean Commute Program. As an incentive to participate, a stipend of $30.00 was offered to each participant who completed the supplemental survey. As of May 30, 2004, 28 participants had completed the supplemental survey.

Clean Commute Program participant demographic data obtained from the initial survey are presented in Section 3.1. Data for initial survey collection efficiency are presented in Section 3.2.

2.4 Analysis Protocols

Data collected and stored in the Clean Commute participant database are analyzed to determine various measures of program performance. These measures are presented in the following sections:

- Section 3.3, Projected Performance Parameters – Projected Vehicle Use
- Section 3.4, Measured Performance Parameters – Actual Vehicle Use
- Section 3.5, Derived Performance Parameters – Petroleum Abatement and Emissions Reductions.

Results of these analyses are reported and monitored regularly and inform program guidance.

3. DATA ANALYSIS

3.1 Participant Demographics

Participant demographics were obtained from the initial survey (Appendix A). Figures 8 through 11 present demographic data for TH!NK *city* lessees completing the initial survey. Figure 8 presents gender data, which were provided by all 71 of the Clean Commute Program respondents. In addition, gender was gleaned from contact with nine other participants, yielding a total of 80 data points for participant gender. Figure 9 presents participant age distribution data, which were provided by 58 of the 71 participants.

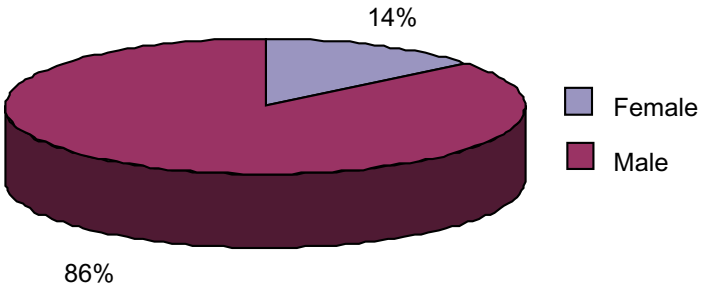


Figure 8. Participant gender.

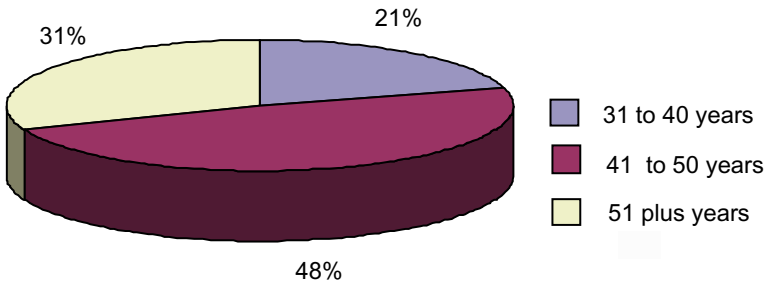


Figure 9. Participant age distribution.

Figure 10 presents participant's annual household income distribution data, which were provided by all 71 of the Clean Commute Program respondents.

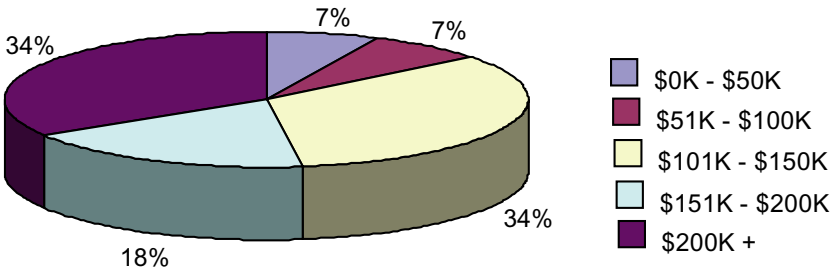


Figure 10. Participant household annual income distribution.

Figure 11 presents data detailing the number of vehicles in participant families other than TH!NK *city*, which were provided by all 71 of the program respondents.

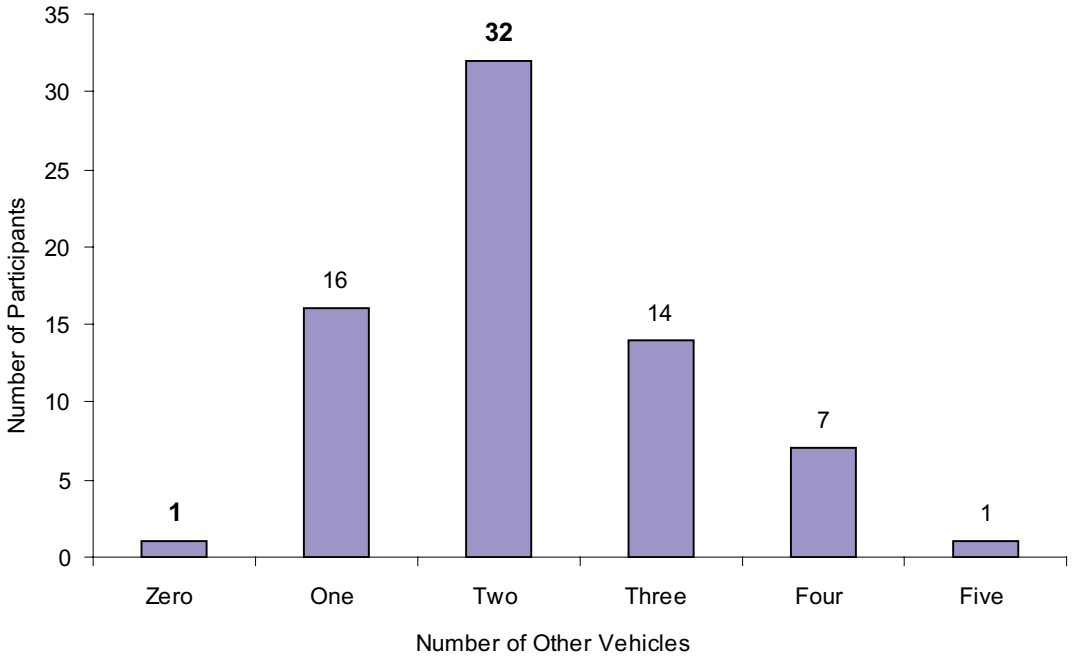


Figure 11. Number of vehicles in participant households other than TH!NK *city*.

3.2 Efficiency of the Data Collection

Ford leased at total of 97 TH!NK *city* electric vehicles to commuters from Westchester, Putnam, Rockland, Queens, Nassau, and Suffolk counties. Of these 97 commuters who leased and took delivery of a TH!NK *city* vehicle, 71 completed the initial survey. Eight returned their vehicles before the initial surveys were completed, and because they submitted only minimal data their responses have been deleted from the database. Sixteen commuters did not complete an initial survey, but they have been submitting ongoing data, which is included in the database. Figure 12 presents the percentage of the 87 Clean Commute Program participants (the 71 initial respondents and the 16 ongoing) completing the initial survey.

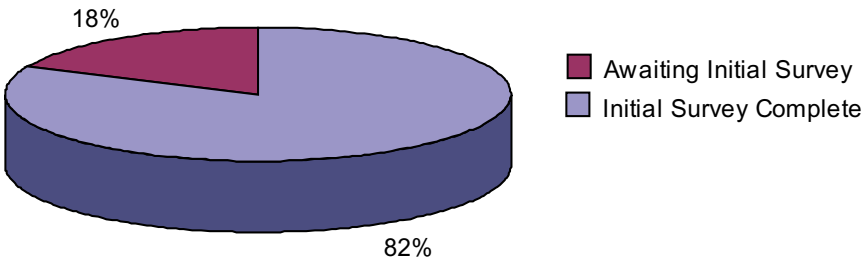


Figure 12. Efficiency of the initial survey data collection.

Supplemental surveys (presented in Appendix D) were transmitted to 58 participants in the Clean Commute Program. To encourage their participation, a stipend of $30.00 was offered to each who would complete the supplemental survey. As of May 30, 2004, 28 participants had completed the supplemental survey. Figure 13 presents the percentage of the 58 participants receiving a supplemental survey who completed the survey. Responses to the Supplemental Survey are presented in Appendix E.

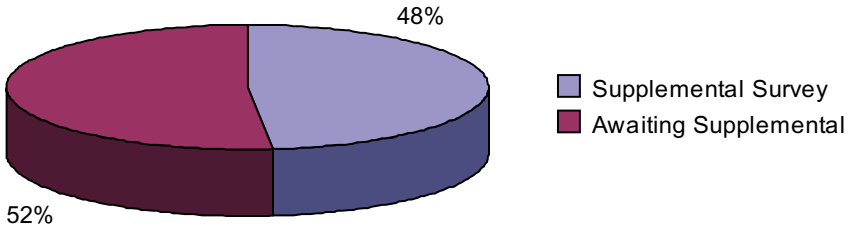


Figure 13. Efficiency of supplemental survey data collection.

3.3 Projected Performance Parameters – Projected Vehicle Use

Based on data from program participants in the initial survey (Appendix A), Figures 14 and 15 present the projected use of TH!NK *city* vehicles. Figure 14 presents the data projecting the type of trips to be taken in their TH!NK *city*, which were provided by 69 of the 71 Clean Commute Program respondents.

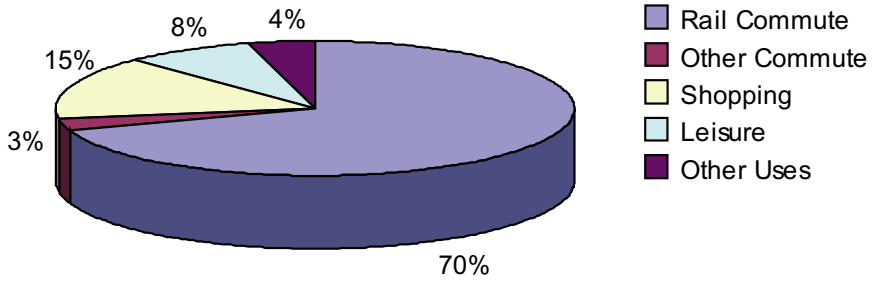


Figure 14. Projected use by trip type.

Figure 15 presents by projected trip type the percentage of TH!NK *city* trips presented in Figure 14 that would otherwise have been taken in a gasoline-fueled vehicle.

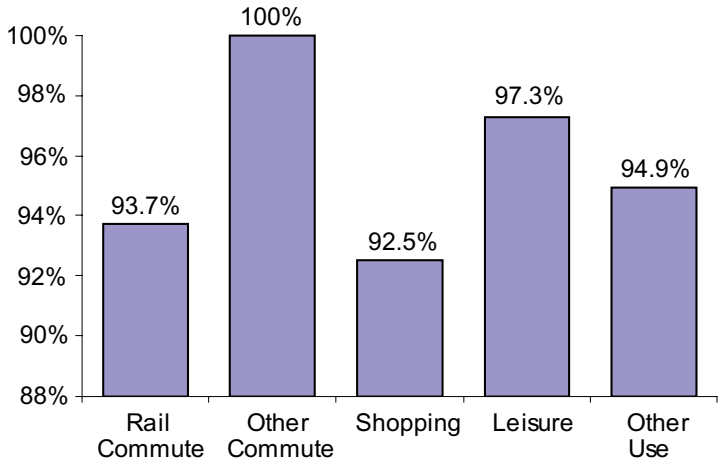


Figure 15. Percentage of projected trips replacing gasoline-fueled vehicle trips.

Figure 16 presents data detailing the prior methods of train station commutes for Clean Commute Program participants, which were provided by all 71 of the Clean Commute Program respondents.

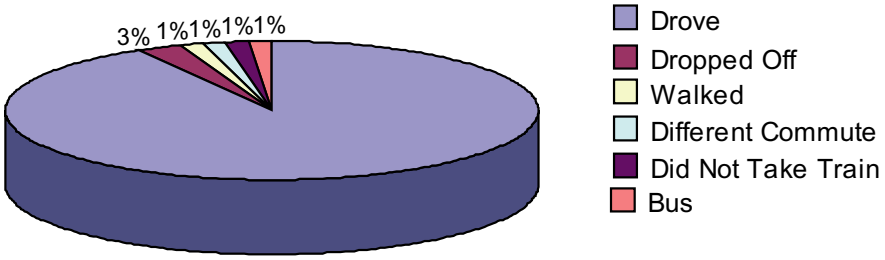


Figure 16. Prior methods of train station commutes.

3.4 Measured Performance Parameters – Actual Vehicle Use

Using data collected from the monthly surveys (Appendix B) and various metrics, Figures 17 through 24 present performance of the TH!NK *city* vehicles. Data were not available from some participants as of May 30, 2004. Therefore, the actual performance parameters may vary slightly from those reported herein. For example, the miles reported to have been driven in the months immediately preceding May 2004 do not fully reflect the actual miles driven, as some participants have not yet reported mileage in these months. This variance will be corrected in the final report, as additional data from the participants will have been collected.

Figure 17 presents total program vehicle usage by month for all respondents in the Clean Commute Program. Data are reported beginning in February 2002, using such manual sources of data as delivery and service records. A significant number of vehicles were added to the program during the months of March and April 2002, resulting in large increases in miles driven in these months. Data for May 2002 and thereafter were collected using the Internet-based monthly survey. Total monthly mileage data for 2004 shows a steady decline. This resulted from two factors: (1) additional participants left the program, either because they no longer needed to commute or their lease expired, and (2) fewer participants reported data. Additional mileage data will be collected as leases expire and vehicles are returned. This will eliminate any mileage reporting deficiencies and increase the total miles driven in 2004.

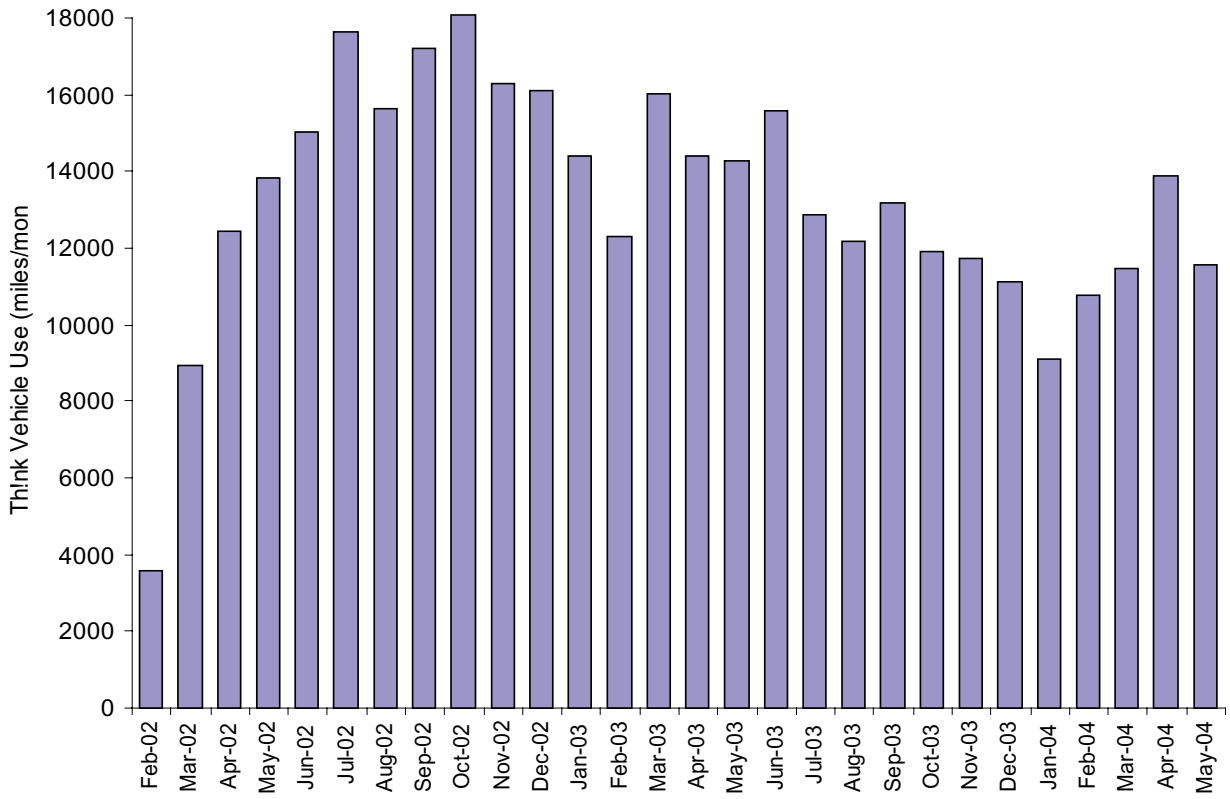


Figure 17. Total program vehicle usage (miles).

Through May 30, 2004, Clean Commute Program respondents reported a total of 371,640 miles of TH!NK *city* operation. Section 3.5 presents the impact on air emissions and fuel utilization of traveling the miles reported using an electric vehicle rather than a gasoline-fueled vehicle.

Charging energy is provided by vehicle chargers located at Clean Commute Program train stations and at program participant's homes. Data for charger power and vehicle efficiency are presented in the U.S. Department of Energy's Summary Data Sheet for Baseline Performance testing conducted on the TH!NK *city,* Appendix E. Table 1 reports the electrical demand for chargers located at train stations for the sampling period May 2002 through February 2003. The TH!NK *city* onboard battery charger demands about 2.5 kW at full power, and the TH!NK *city* operates 2.15 miles for each kWh of AC energy used for battery charging.

Table 1. Charging power peak demands at Clean Commute Program rail stations.

Station	No. of Chargers	2002 (kW)								2003 (kW)	
		May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Brewster N.	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chappaqua	20	19.20	19.20	16.80	15.20	22.40	20.00	22.40	22.40	21.60	20.80
Hicksville	16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Huntington	22	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Little Neck	8	14.80	14.80	14.80	14.80	10.40	10.80	8.40	8.40	9.60	8.00
White Plains	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
North White Plains	8	5.04	2.16	2.16	2.16	4.32	7.02	8.10	9.36	9.36	9.90

N/A = data currently not available.

Each month, program respondents report the occurrence (if any) of the following events.

- Vehicle failed to charge on the home charger
- Vehicle failed to charge at the train station charger
- Vehicle ran out of charge while in operation
- Vehicle broke down on the road
- Vehicle required either preventative or corrective maintenance.

Figures 18 through 22 present the number of each these events occurring during a month, from May 2002 through May 2004. No data were collected for July 2002.

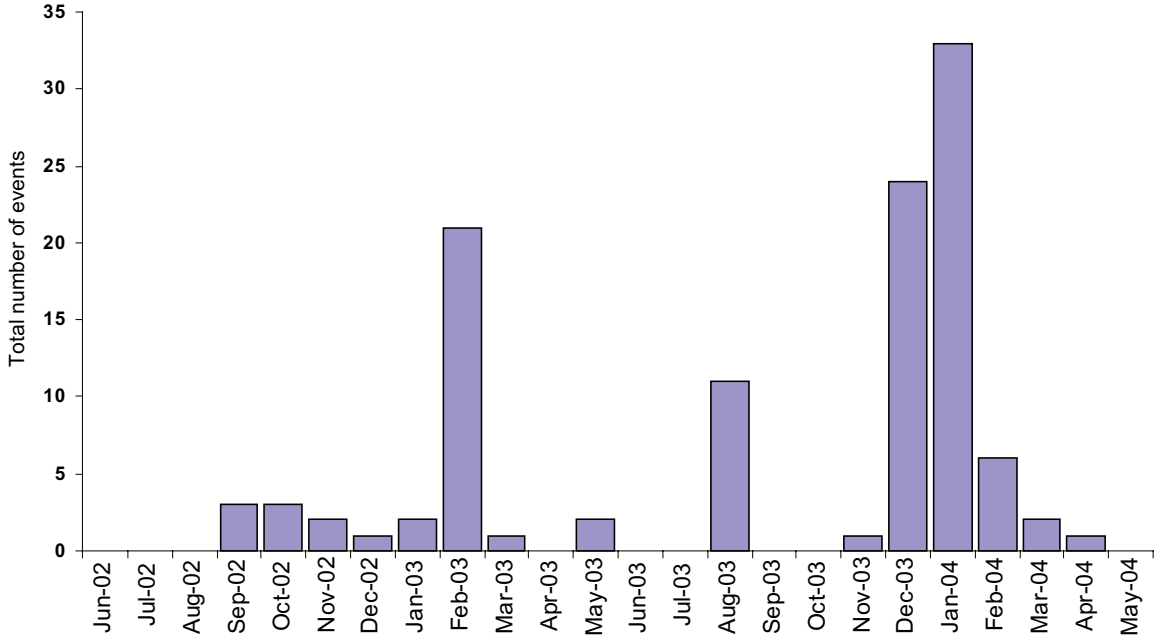


Figure 18. Did not charge, home events, program inception through May 2004.

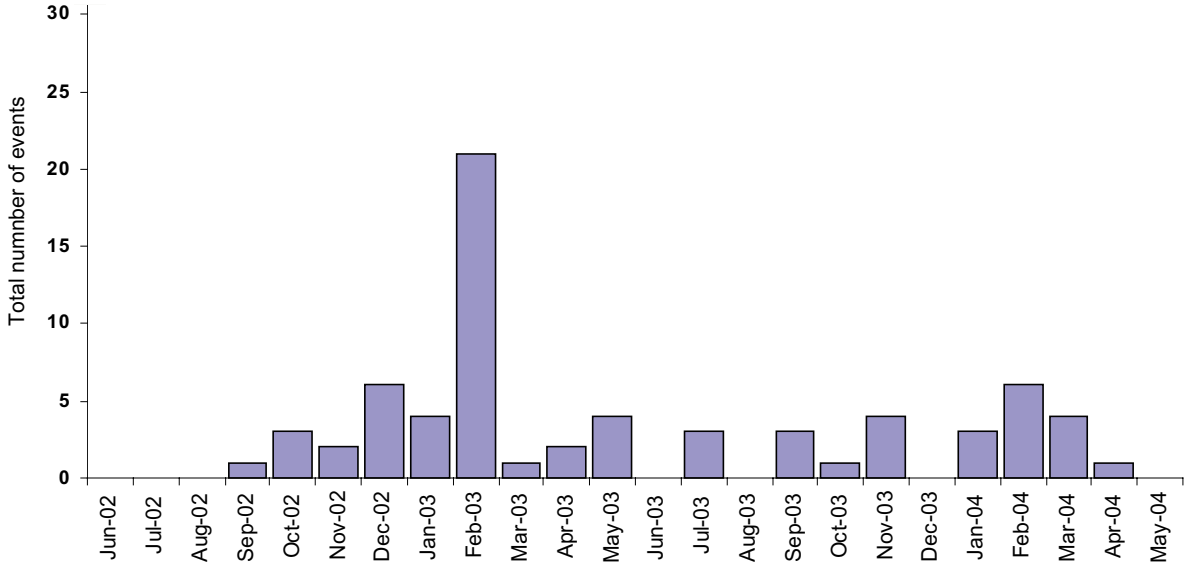


Figure 19. Did not charge, train station events, program inception through May 2004.

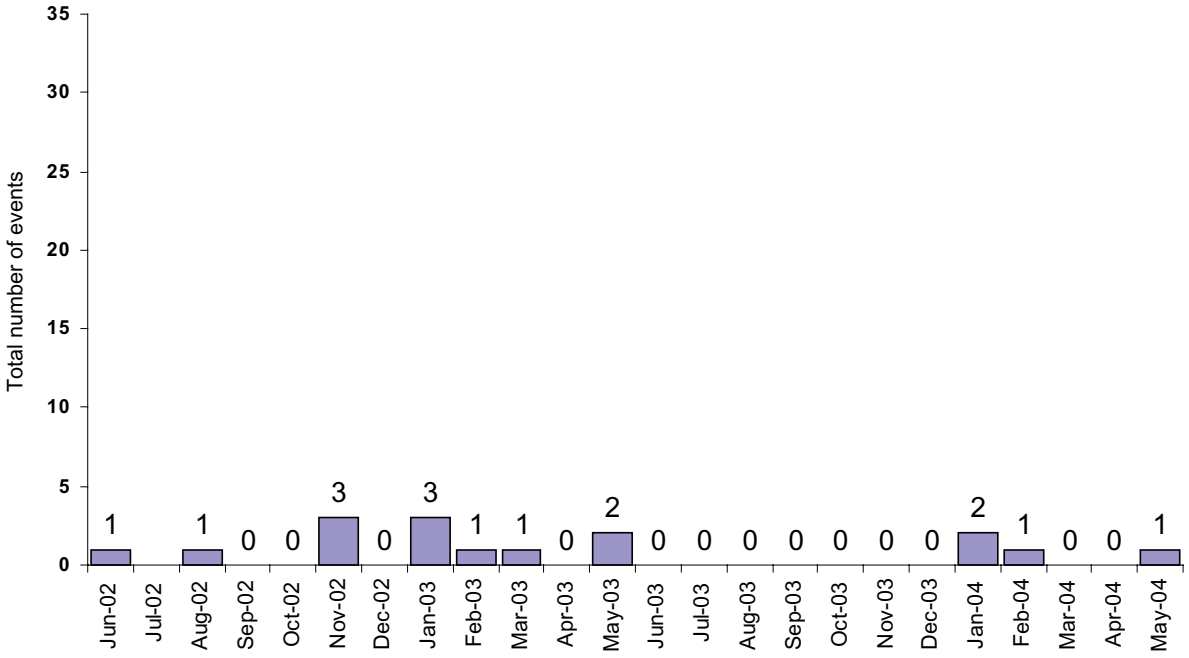


Figure 20. Ran out of charge, program inception through May 2004.

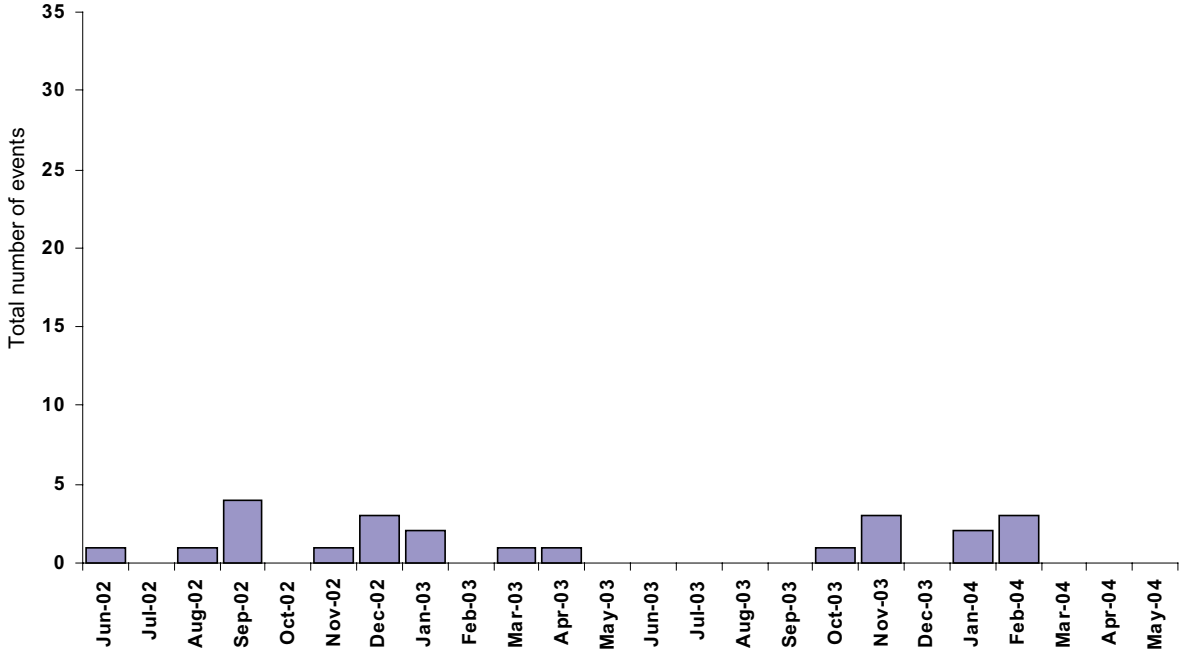


Figure 21. Broke down, program inception through May 2004.

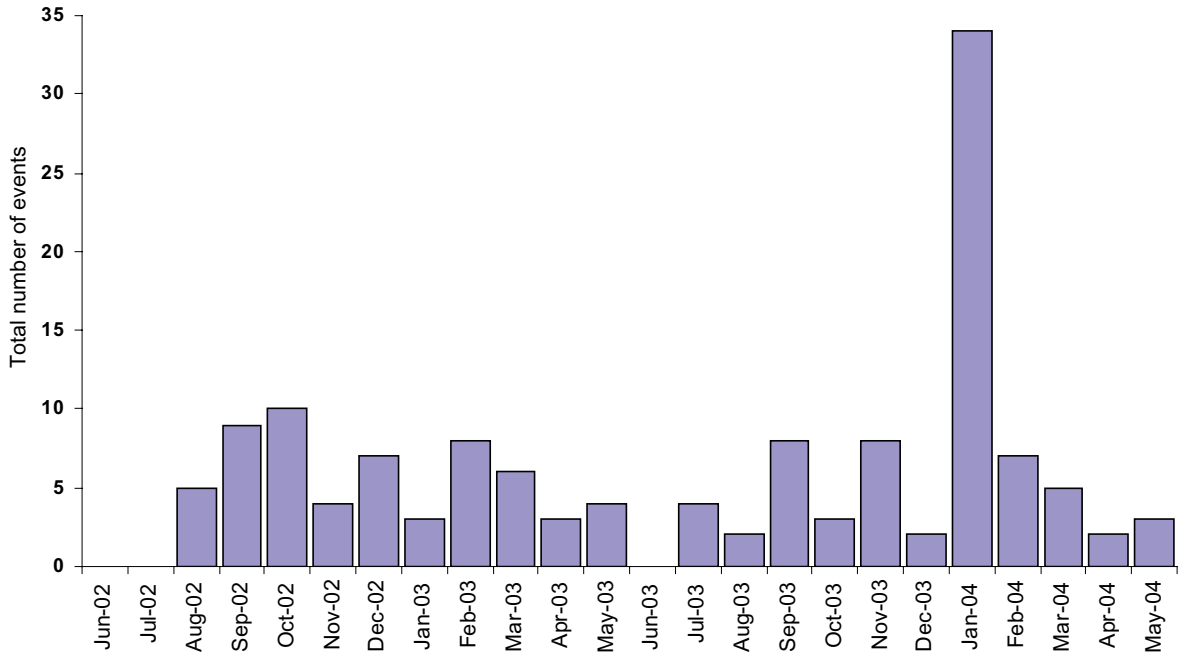


Figure 22. Required maintenance, program inception through May 2004.

Maintenance for the TH!NK *city* vehicles is reported by vehicle system and type of maintenance (scheduled preventative maintenance or maintenance required to correct a specific problem). Figure 23 presents the number of repair events for the electric propulsion system, the charging power system, and all other vehicle systems. The large number of "Other Systems" repairs relates to nonelectric vehicle repairs, such as wiper blade problems. Figure 24 presents the type of maintenance work performed, either repair or scheduled maintenance. Scheduled maintenance is currently required every 3,000 miles for the TH!NK *city*. The primary maintenance activity required is leveling the nickel cadmium traction battery.

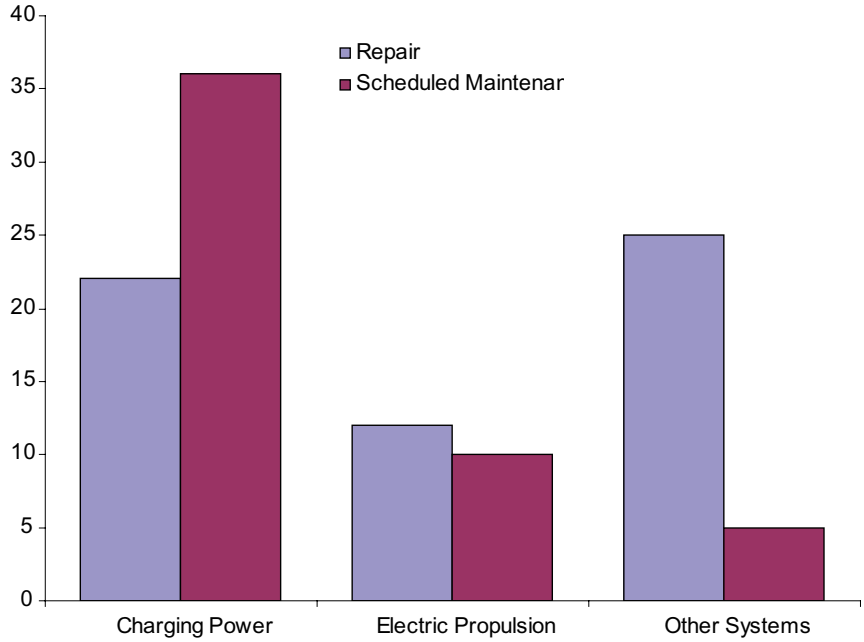


Figure 23. Vehicle maintenance activities by system.

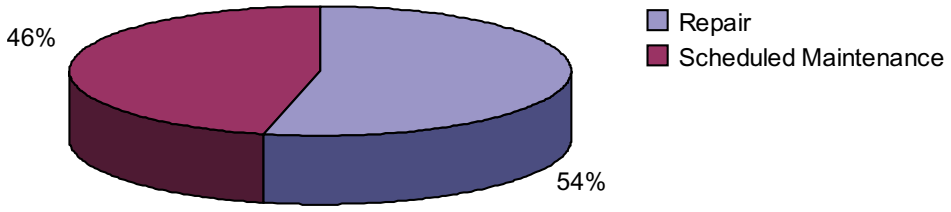


Figure 24. Vehicle maintenance by type.

Participants report their satisfaction with the Clean Commute Program monthly. Figure 25 presents the average participant program satisfaction monthly from program inception through May 2004. Zero represents a respondent who is completely dissatisfied. Ten represents a respondent who is completely satisfied. No data were collected in July 2002.

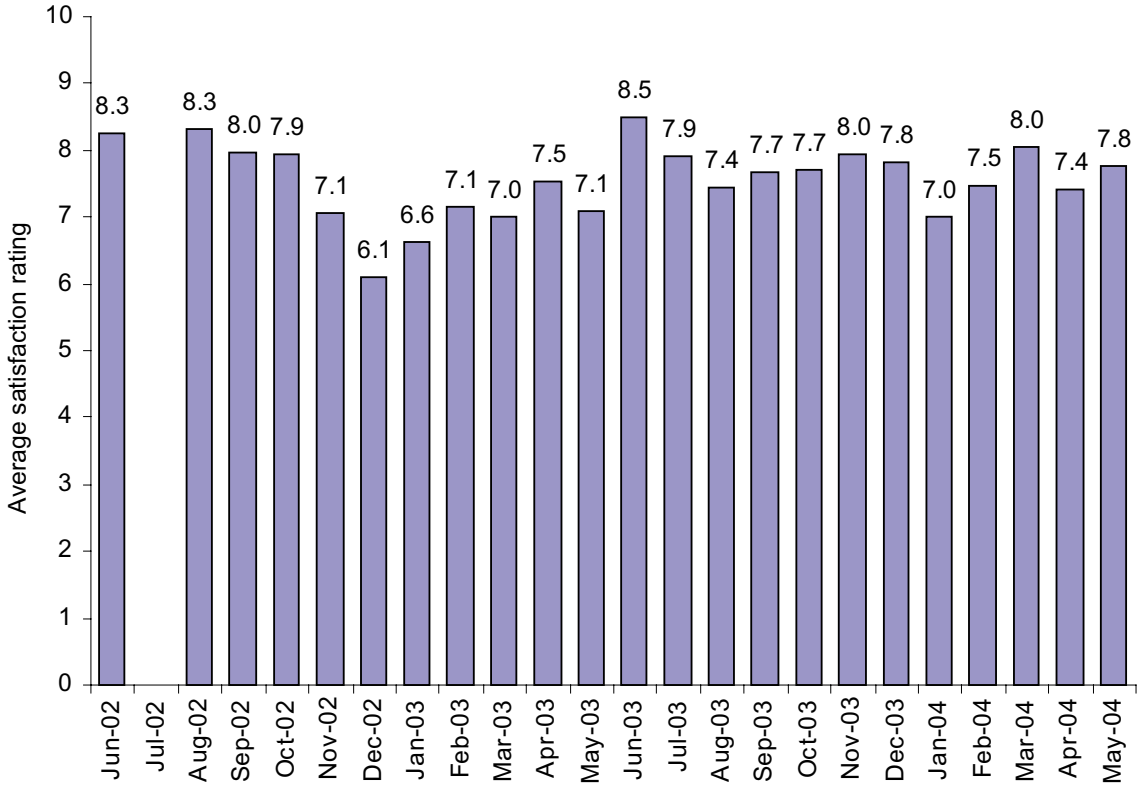


Figure 25. Participant program satisfaction, program inception through February 2003.

Figure 26 presents the distribution of all participant program satisfaction indices, reported from program inception through May 2004, with some participants responding more than once.

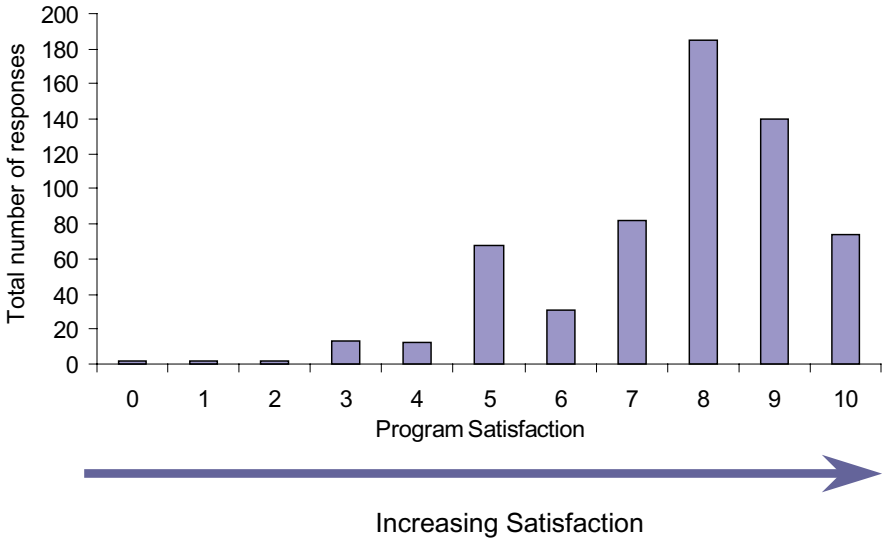
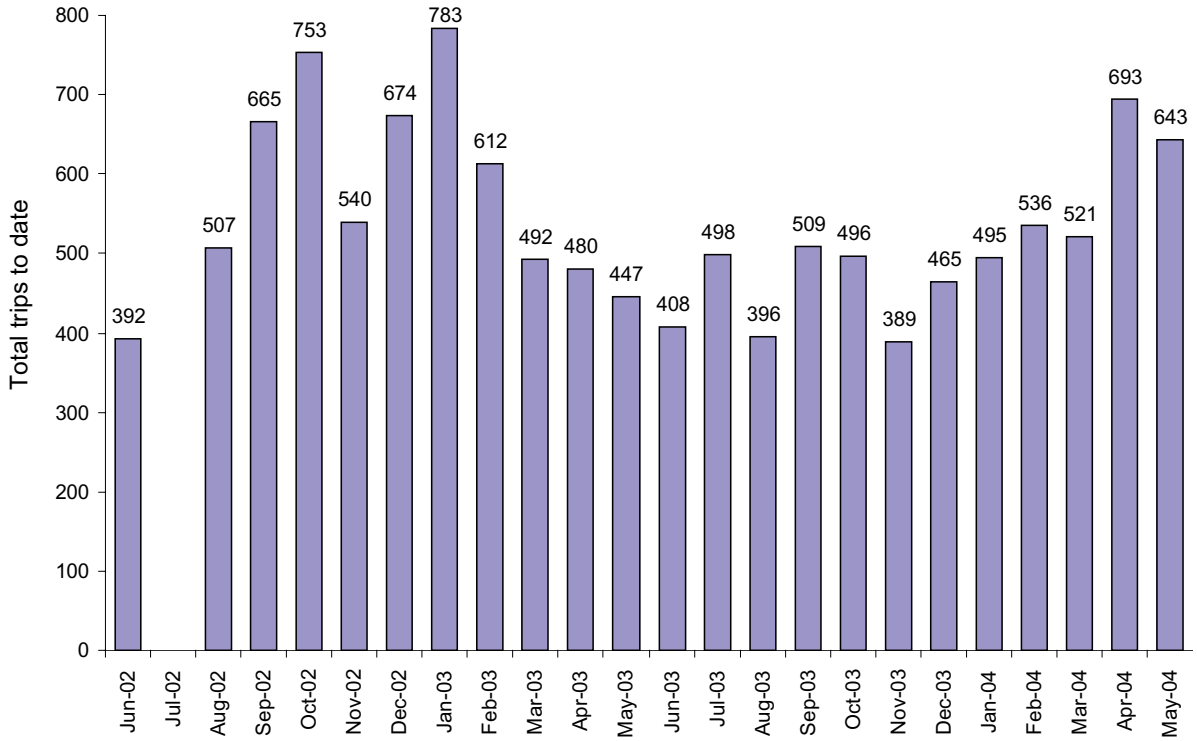


Figure 26. Participant satisfaction distribution, program inception through May 2004.

3.5 Derived Performance Parameters – Petroleum Abatement and Emissions Reductions

Using the data from the monthly survey (Appendix B), environmental benefits from the use of TH!NK *city* vehicles are presented in Figures 27 through 30. Data from some participants were not available as of May 30, 2004. The actual derived performance parameters, therefore, may vary slightly from those reported herein. This difference will resolve in later reports as data from all participants become available. Because formal data collection from the Internet did not begin until May 2002, miles driven, and gasoline and emissions avoided were all extrapolated backward for February, March, and April 2002, based on mileage data collected during May.

As shown in Figure 27, Clean Commute Program participants avoided 12,393 trips that, without the program, would have been driven using an internal combustion engine-powered vehicle. Clean Commute Program participants reported 371,640 miles driven for these 12,393 trips, for an average distance traveled per trip during the reporting period of 30.0 miles. Cold starts and hot soaks produce a significant fraction of the air emissions associated with driving an internal combustion engine-powered vehicle. As shown in Figure 28, Clean Commute Program participants avoided a total of 49,570 cold starts and hot soaks by driving their TH!NK *city* vehicles. Participants also avoided the use of 17,286 gallons of gasoline (Figure 29) by driving their TH!NK *city* vehicles rather than gasoline-fueled vehicles. By avoiding cold starts and hot soaks, and by avoiding the use of gasoline, Clean Commute Program participants reduced emissions of pollutants into the atmosphere, as quantified in Figure 30.



Note: 1. Initial vehicle deliveries occurred in January 2002.
2. Not all current program participants were active in February, March, and April 2002.
3. Participants began returning vehicles as leases began in expire in May 2004.

Figure 27. Estimated avoided gasoline vehicle trips (12,393 trips total).

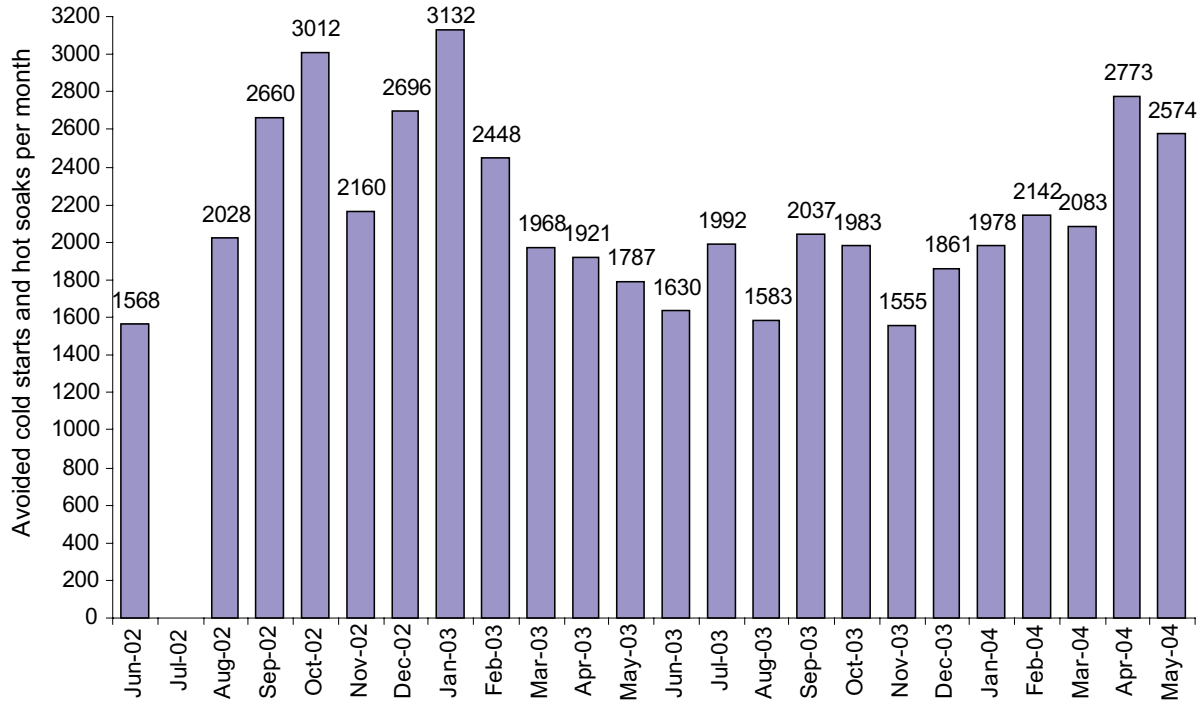


Figure 28. Engine cold starts and hot soaks avoided.

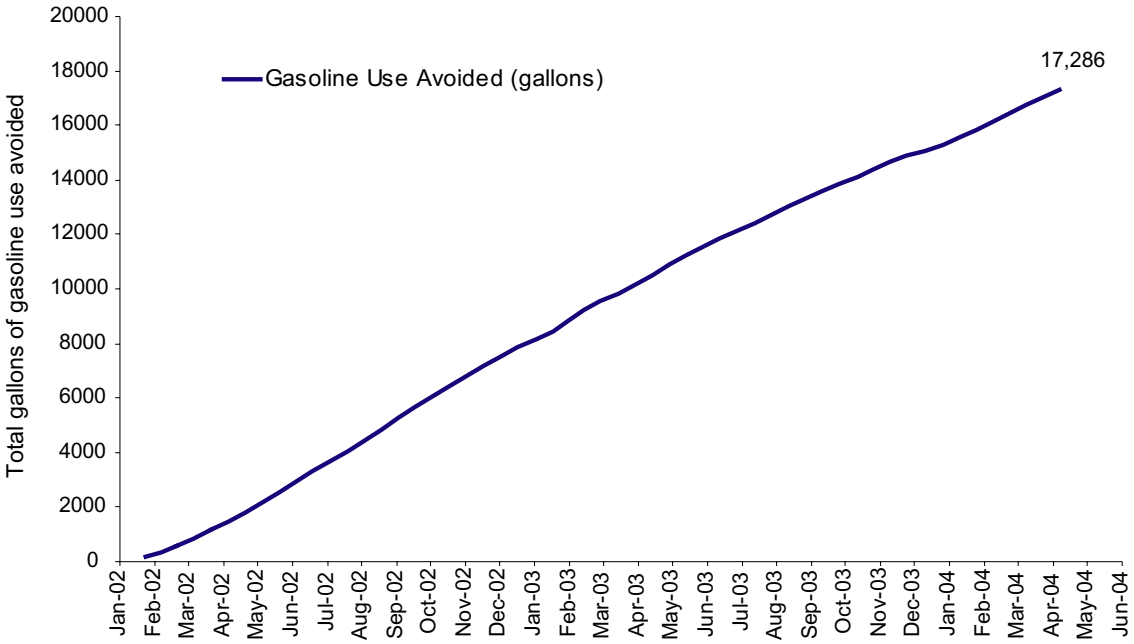


Figure 29. Petroleum use avoided.

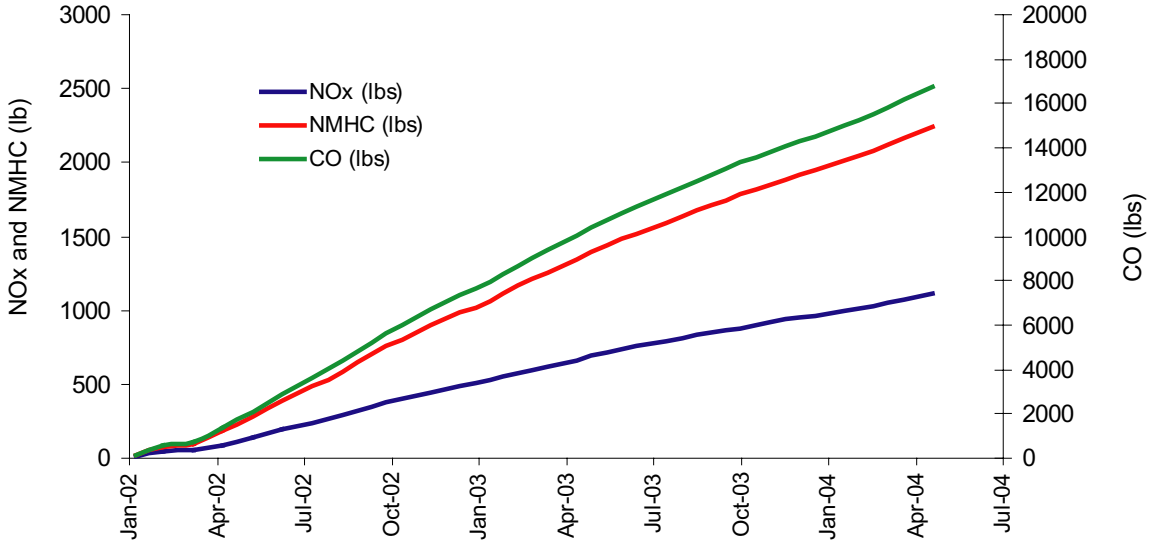


Figure 30. Air emissions avoided.

It is assumed that vehicles replaced by the TH!NK *city* fleet meet average annual emissions and fuel economy factors reported by the USEPA Office of Transportation and Air Quality in their April 2000 Report, EPA420-F-00-013:

- Nitrogen oxides 1.39 grams/mile
- Hydrocarbons 2.80 grams/mile
- Carbon monoxide 20.9 grams/mile
- Gasoline 0.0465gallon/mile (21.5 miles/gallon).

4. CONCLUSIONS

Using the data collected through May 30, 2004, the following conclusions can be reached in regard to the Clean Commute Program:

- Clean Commute Program participants have driven over 370,000 miles since program inception. During this period, they avoided the use of over 17,000 gallons of gasoline and avoided over 12,000 round trips in gasoline-fueled vehicles.
- Clean Commute participants average between 180 and 230 miles/month of vehicle use. Some variation in vehicle use is detectable based on season of the year, with cold months seeing less use than temperate months.
- Data collection efficiency began at 80% (of participants having completed an initial survey). After the announcement by Ford canceling the TH!NK *city* vehicle, data collection efficiency fell to 48% for the supplemental survey issued to participants (even with a $30 stipend offered for completed surveys).
- While the majority of trips using the TH!NK *city* are for rail station commute, one third of the trips have been for other family activities, indicating that the TH!NK *city* can integrate with family transportation.
- Over 90% of rail station commuting before the Clean Commute Program was in gasoline-fueled vehicles, indicating that the Clean Commute Program can have a significant affect on gasoline usage and emissions.
- Over 95% of all trips with the TH!NK *city* replaced trips that would have otherwise been taken in a gasoline-fueled vehicle, indicating that the TH!NK *city* vehicles are replacing gasoline vehicle trips, not just being used for additional trips.
- Participants frequently reported insufficient range for the TH!NK city vehicle to complete all the trips they would like to make using the TH!NK city vehicle. Incidents of charge depletion were, however, low. Together, these data indicate that participants would use the TH!NK city vehicle for more trips if it had additional range, but have adequately adapted to the limited range for the trips which are taken with the TH!NK city vehicle.
- Events for which the vehicle did not charge are dominated by a few participants reporting a high number of events. These appear to have been related to extended charger outages, either at their home or at their train station, rather than to a high number of random charging failure events.
- Failure on the road was frequent (6.2 events/100,000 miles) compared to equivalent internal combustion vehicles. This is also high compared to electric vehicles tested by the AVTA (Toyota's electric RAV4 - 1.5 events/100,000 miles), although participants rated vehicle reliability mostly excellent or high in the supplemental survey.
- Frequency of vehicle repair was high (37 events/100,000 miles) compared to equivalent internal combustion vehicles.
- Vehicle repair time was predominantly ten days to two weeks. In only a few instances was the vehicle repaired in one day.
- Most repair problems appear to be associated with the charging system and may relate to the charge connector.
- Program participant satisfaction is skewed by a few participants frequently reporting that they were completely dissatisfied (zero rating). This significantly reduces the average satisfaction rating. Many participants routinely reported that they are completely satisfied with the Clean Commute Program (ten rating).

Appendix A

NYPA/TH!NK Clean Commute Program – Initial User Survey

Please have the Clean Commuter using your TH!NK *city* answer the following questions.

1. Please describe the primary Clean Commuter using your TH!NK *city*.

   ☐ MALE ☐ FEMALE ☐☐ AGE

2. Please check off your approximate household income. This will help us attract future Clean Commute Program participants.

   ☐ $50,000 and under ☐ $50,001 to $100,000 ☐ $100,001 to $150,000

   ☐ $150,001 to $200,000 ☐ $200,001 and greater

3. What was the odometer reading when you received your TH!NK *city*? _____
   (Please record all digits on the odometer including tenths)

4. On what date did you receive your TH!NK *city*? __month/day/year___

5. How many motor vehicles, other than the TH!NK *city*, are in your household?

   ☐1 ☐2 ☐3 ☐4 ☐5

6. Have you ever leased a car before for use in your household? ☐ YES ☐ NO

7. Please characterize how you will be using the TH!NK *city* and the approximate percentage of trips that will be involved with each type of use. Please provide your best guess. Example – commute 65%, shopping, 25%, and school 10% of the trips. The percentage must total 100%.

Trip Type	Percentage of All Trips	Would These Trips Be Driven in a Gasoline Vehicle If You Did Not Have a Th!nk City?
Rail commute	%	☐ Yes ☐ No
Other commute	%	☐ Yes ☐ No
Shopping	%	☐ Yes ☐ No
Leisure	%	☐ Yes ☐ No
All other uses	%	☐ Yes ☐ No

8. Before leasing the TH!NK *city*, how did you primarily get to the train station?

   ☐ DROVE GASOLINE VEHICLE & PARKED ☐ WALKED ☐ BUS ☐ BICYCLE

   ☐ CARPOOL ☐ DROPPED OFF AT STATION ☐ DID NOT TAKE TRAIN

   ☐ OTHER _____

9. Will your TH!NK *city* be charged in your garage or outside? ☐ GARAGE ☐ OUTSIDE

10. How did you hear about the NYPA/TH!NK Clean Commute Program?

☐ INFORMATION RECEIVED AT MY TRAIN STATION ☐ PRINT MEDIA

☐ ELECTRONIC MEDIA ☐ WORD OF MOUTH ☐ OTHER

_____

11. What were your primary reasons for becoming a Clean Commuter?

☐ CONCERN ABOUT THE ENVIRONMENT ☐ INTERESTED IN THE TECHNOLOGY

☐ GREAT PARKING SPOT ☐ LOWER FUEL COSTS ☐ LOWER VEHICLE COSTS

☐ OTHER _____

12. Please provide any general comments that you have about the TH!NK *city* or the NYPA/TH!NK Clean Commute Program.

Appendix B

NYPA/TH!NK Clean Commute Program
Monthly User Survey

Please have the primary Clean commuter using your TH!NK *city* answer the questions.

1. How many miles are on the TH!NK *city* odometer? _____
   (Please record all digits on the odometer including tenths)
2. On what date did you read the odometer? __month/day/year___
3. What is the reading of the energy meter? _____
   (Please record all digits on the meter)
4. What date did you read the energy meter? __month/day/year___
5. List the number of times, if any, that the following events occurred with the TH!NK *city* this month?

   ☐ Did not have enough range to meet my needs
   ☐ Did not charge at home
   ☐ Did not charge at my rail station
   ☐ Ran out of charge on the road
   ☐ Broke down on the road
   ☐ Required maintenance (see #6)

6. If your TH!NK *city* required maintenance, please provide the following information (example provided):

Maintenance Start Date	Vehicle System Repaired			Maintenance Type		Cost Of Repair ($)	Days Out Of Service For Repair
	Electric Propulsion	Charging Power	Other Systems	Repair Failure	Routine Service		
						$	
/ /						$	
/ /						$	
/ /						$	
/ /						$	
/ /						$	

Electric propulsion system includes the motor, motor controller, battery and onboard battery charger
Charging power system includes off vehicle power control station, charge connector (plug) and charge inlet (receptacle)

7. How many round trips did you drive your TH!NK *city* this month? ☐ ☐
8. How many of these round trips would have been driven in a gasoline-powered car if you did not have your TH!NK *city?* ☐ ☐
9. Compared to last month, are you using your TH!NK *city* for more trips?

   ☐ More trips ☐ Less trips ☐ About the same number of trips

10. If you are using your TH!NK city for more or less trips, please briefly explain why.

_____

_____

_____

_____

11. If more public charging stations could be installed, please identify where you would use them.

☐ Shopping Centers (the mall) ☐ Movie theaters ☐ Sports Events ☐ Cultural Events

☐ Elementary or high schools ☐ Food stores ☐ Large office buildings or complexes

☐ Other _____

12. Please rate your overall satisfaction with the TH!NK *city* and the NYPA/TH!NK Clean Commute Program with 10 being Completely Satisfied and 0 being Completely Dissatisfied

Dissatisfied ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Satisfied

Appendix C

NYPA/TH!NK Clean Commute Program Supplemental Questions

Please respond to each of the following questions. You will not be able to submit this Supplemental Survey unless you have entered a response to each question. A check for $30.00 will be sent within three weeks of you submitting this Supplemental Survey.

1. Do you use your EV as your primary vehicle?

    a. yes
    b. no

2. How many people in your household are licensed drivers?

    a. 1
    b. 2
    c. 3
    d. more than 3

3. How many people in your household drive the TH!NK *city*?

    a. 1
    b. 2
    c. 3
    d. more than 3

4. What portion (in miles) of your average <u>weekly commute</u> is done on:

    a. Streets with speed limits at or below 35 mph _____ miles
    b. City, county and state roads with speed limits 35-55 mph _____ miles
    c. Parkways with speed limits 55-70 mph _____ miles
    If none, enter zero (0).

5. What portion (in miles) of <u>all other trips</u> are done on:

    a. Streets with speed limits at or below 35 mph _____ miles
    b. City, county and state roads with speed limits 35-55 mph _____ miles
    c. Parkways with speed limits 55-70 mph _____ miles
    If none, enter zero (0).

6. Name the top three types of trips you make in the TH!NK City other than when you are driving to and from the train station:

    1. _____
    2. _____
    3. _____

7. What about the "Clean Commute Program" least satisfies you? _____

8. How much would you be willing to pay monthly to lease a similar EV if the Clean Commute Program was not available (includes the loss of preferred parking and free charging)? _____ $/mo

9. What features convinced you to lease the vehicle? (Please check all that apply or enter a feature in "other".)
    a. low cost
    b. simple electric fueling
    c. guaranteed upfront parking
    d. other (please specify) _____

10. If a reserved parking place at the train station was not included as part of the lease, would you still consider leasing an electric vehicle?
    a. yes
    b. no

11. Please list additional locations where you would like to see public charging _____.

12. Would you consider leasing another electric vehicle?
    a. yes
    b. no

13. Would you consider purchasing an electric vehicle?
    a. yes
    b. no

14. If you were to lease another electric vehicle, what length of lease would you prefer?
    a. 2 year
    b. 3 year
    c. 4 year
    d. 5 year

15. Do you prefer driving your EV more or less than a gasoline vehicle?
    a. more
    b. the same
    c. less

16. Of the time you charge your car, what percent is :

    At Home: _____

    At the public charging station: _____

    (Answers must total 100%)

17. How important is the ability to charge your vehicle at home?
    a. extremely important
    b. very important
    c. somewhat important
    d. not important
    e. not important at all

18. List three improvements that could be made to the vehicle to enhance its value to you:
    1. _____
    2. _____
    3. _____

19. Do you feel the vehicle and included services you are currently receiving are:

a. a bargain
b. about right
c. expensive

20. How would you rate the vehicle's reliability?

a. excellent
b. very good
c. good
d. fair
e. poor

21. How would you rate the vehicle's handling & steering?

a. excellent
b. very good
c. good
d. fair
e. poor

22. How would you rate the vehicle's interior noise level?

a. excellent
b. very good
c. good
d. fair
e. poor

23. How would you rate the convenience of charging hardware?

a. excellent
b. very good
c. good
d. fair
e. poor

24. How would you rate the vehicle's air conditioning?

a. excellent
b. very good
c. good
d. fair
e. poor

25. How would you rate the vehicle's heating?

a. excellent
b. very good
c. good
d. fair
e. poor

26. What seating capacity would you prefer in your vehicle?

a. excellent
b. very good
c. good
d. fair
e. poor

27. How would you rate the vehicle's cargo capacity?

a. excellent
b. very good
c. good
d. fair
e. poor

28. How has leasing the TH!NK *city* affected your household's usage of your other vehicles?

a. added the EV vehicle and used another less
b. sold a vehicle and replaced it with the EV
c. avoided the purchase of an additional vehicle

29. For the three cars that you use the most (in addition to your TH!NK City) please list what type of vehicle that you have? (Please check all that apply, or indicate "none" if you have less than three additional cars)

Vehicle 1	Vehicle 2	Vehicle 3
a. luxury	a. luxury	a. luxury
b. minivan	b. minivan	b. minivan
c. fullsize	c. fullsize	c. fullsize
d. sport utility	d. sport utility	d. sport utility
e. midsize	e. midsize	e. midsize
f. performance	f. performance	f. performance
g. pickup	g. pickup	g. pickup
h. compact/subcompact	h. compact/subcompact	h. compact/subcompact
i. full size van	i. full size van	i. full size van
j. none	j. none	j. none

30. How would you characterize the terrain of your typical commute?

a. mostly flat
b. somewhat hilly
c. very hilly

31. How often do you drive with a passenger who is a licensed driver?

a. all of the time
b. most of the time
c. sometimes
d. rarely
e. never

32. How often do you drive with children who use a child safety seat?

a. all of the time
b. most of the time
c. sometimes
d. rarely
e. never

33. Does your employer have an established program that offers incentives for participating in an alternative transportation program?

    a. yes
    b. no

34. If yes to question 33, please list a brief description of incentive:

    _____

    Name of employer (optional):_____

35. Do you primarily work at one work site all day, or do you travel around to different locations?

    a. one site
    b. travel to multiple sites

36. Does your employer have a central motor pool or fleet?

    a. yes
    b. no

37. If yes to question 36, do you have access to these cars?

    a. yes
    b. no

38. If yes to question 36, are any of these cars electric or some other alternative fuel?

    a. yes
    b. no

39. What would it take for this vehicle to become more widely used? (Please check all that apply)

    a. lower cost
    b. more interior space
    c. more driving range – 100 miles
    d. more driving range – 120 miles
    e. more places to charge
    f. other (please specify) _____

40. What suggestions do you have for improvements in the Clean Commute Program?

    _____

    _____

    _____

41. Please provide the name and address of the person you wish to receive the compensation for completing the Clean Commute Monthly Survey for July 2003.

    Name; _____

    Street; _____

    City; _____ State;_____ Zip:_____

Please allow three weeks to receive your check for $30.00.
Thank you for taking the time to provide us with your feedback. It is greatly appreciated.

Appendix D

NYPA Supplemental Survey Responses

Total respondents = 49

1. a-27 b-22
2. a-0 b-34 c-10 d-5
3. a-17 b-22 c-7 d-3
4. average a-34 miles b-20 miles c-3.5 miles
5. average a-23 miles b-11 miles c-3 miles
6. shopping, errands, pickup/drop-off
7. NA
8. average $152.58
9. a-37 b-33 c-32 d-21 (environmental concerns)
10. a-31 b-18
11. shopping malls, schools, municipal parking lots
12. a-48 b-1
13. a-39 b-10
14. a-22 b-25 c-1 d-1
15. a-28 b-13 c-8
16. average a-22.57% b-77.43%
17. a-24 b-10 c-12 d-2 e-1
18. NA
19. a-17 b-29 c-3
20. a-12 b-25 c-6 d-5 e-1
21. a-6 b-21 c-16 d-6 e-0
22. a-2 b-19 c-17 d-7 e-4
23. a-15 b-18 c-13 d-2 e-1
24. a-3 b-10 c-11 d-14 e-11
25. a-4 b-10 c-19 d-10 e-6
26. a-0 b-11 c-9 d-28 e-1
27. a-4 b-9 c-14 d-14 e-8
28. a-25 b-14 c-10
29. vehicle 1: a-9 b-9 c-6 d-14 e-8 f-0 g-0 h-3 i-0 j-0
29. vehicle 2: a-1 b-0 c-4 d-11 e-2 f-4 g-1 h-10 i-0 j-16
29. vehicle 3: a-0 b-2 c-1 d-2 e-2 f-2 g-0 h-3 i-0 j-37
30. a-16 b-24 c-9
31. a-0 b-3 c-27 d-18 e-1
32. a-0 b-1 c-6 d-4 e-38
33. a-0 b-49
34. NA
35. a-47 b-2
36. a-2 b-47
37. a-1 b-1
38. a-0 b-2
39. a-16 b-16 c-21 d-33 e-43 f-NA
40. NA

Appendix E

Th!nk *city* Summary Data Sheet

UEVAMERICA

U.S. DEPARTMENT OF ENERGY
ADVANCED VEHICLE TESTING ACTIVITY

1999 Ford TH!NK City Urban Electric Vehicle

VEHICLE SPECIFICATIONS[1]

VEHICLE FEATURES

Base Vehicle: 1999 Ford TH!NK City
VIN: YYCDA11A0WAAA1018
Seatbelt Positions: Two
Standard Features:

- CARB Certified as a ZEV
- AM/FM CD
- Front Wheel Drive
- Single Speed Transmission
- Front Disc/Rear Drum Brakes
- Regenerative Braking
- Heated Front & Rear Windshields
- Passenger Compartment Pre-heat
- State-Of-Charge Meter
- Back-up Alarm
- Low Rolling Resistance Tires
- Thermoplastic Body Panels
- Daytime Running Lights
- Driver Air Bag
- ABS Plastic Roof

BATTERY

Manufacturer: SAFT
Type: Nickel Cadmium (NiCd)
Number of Modules: 19
Weight of Modules: 12.9 kg
Weight of Pack(s): 245 kg
Pack(s) Location: Under Seats
Nominal Module Voltage: 6 VDC
Nominal System Voltage: 114 VDC
Nominal Capacity (C/3): 100 Ah

WEIGHTS

Design Curb Weight: 2112 lbs
Delivered Curb Weight: 2043 lbs
Distribution F/R: 55/45 %
GVWR: 2563 lbs
GAWR F/R: 1334/1289 lbs
Payload: 451 lbs
Performance Goal: 400 lbs

DIMENSIONS

Wheelbase: 77.8 inches
Track F/R: 54.9/52.5 inches
Length: 117.0 inches
Width: 62.2 inches
Height: 60.8 inches
Ground Clearance: 4.3 inches
Performance Goal: 5.0 inches

CHARGER

Location: On Board
Type: Conductive
Input Voltages: 240 VAC - Single Phase

TIRES

Tire Mfg: Continental
Tire Model: ContEcoContact EP
Tire Size: 155/70/R13
Tire Pressure F/R: 35/35 psi

DRIVE MOTOR

Output: 27 kW
Type: AC Induction

TEST NOTES:

1. This vehicle does not comply with Federal Motor Vehicle Safety Standards applicable on the date of manufacture
2. Based on Drive Cycle Range

This vehicle meets all HEV America Minimum Requirements (except #1) listed on back of this sheet
Values in red indicate the Performance Goal was not met. All Power and Energy Values are DC unless otherwise specified.

PERFORMANCE STATISTICS

Acceleration 0-30 mph

At 100% SOC: 7.8 seconds
At 50% SOC: 8.3 seconds
Performance Goal: 8.5 seconds

Maximum Speed @ 50% SOC

At 1/4 Mile: 49.9 mph
In 1 Mile: 54.6 mph
Performance Goal: 45 mph in one mile

Constant Speed Range @ 35 mph

Range: 65.5 miles
Energy Used: 8.8 kWh
Average Power: 4.6 kW
Efficiency: 134.7 Wh-DC/mile
Specific Energy: 36.0 Wh/kg
Performance Goal: 30 miles

Range at Maximum Speed

Range: 40.5 miles
Energy Used: 8.7 kWh
Average Power: 9.5 kW
Efficiency: 215.2 Wh-DC/mile
Specific Energy: 35.6 Wh/kg

Driving Cycle Range

Range per SAE J1634: 30.2 miles
Energy Used: 7.6 kWh
Average Power: 5.2 kW
Efficiency: 251.2 Wh-DC/mile
Specific Energy: 31.0 Wh/kg
Performance Goal: 30 miles

Braking From 45 mph

Controlled Dry: 110.3 feet
Controlled Wet: 120.8 feet
Panic Wet: 123.7 feet
Course Deviation: 0.0 feet

Handling

Average Time: 60.2 seconds
Average Dodge Neon Time: 54.6 seconds

Gradeability (Calculated)

Maximum Speed @ 3%: 48.7 mph
Maximum Speed @ 6%: 40.3 mph
Maximum Grade: 33.6 %

Charging Efficiency[2]:

Efficiency: 465 Wh-AC/mi
Energy Cost: @ $0.10/kWh: $0.047/mi

Charger

Max Ground Current: <0.01 mA
Max Battery Leakage : <0.01 MIU
Max DC Charge Current: 20.2 A
Max AC Charge Current: 10.9 A
Peak Demand: 2440 W
Time to Recharge: 7.15 hours
Performance Goal: 12 hours