Future Consumers Weigh in on Hybrid Vehicles: A Look at College Students' Opinions and Knowledge

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Introduction

In this modern day and age, it’s hard to imagine anything threatening our way of life. However, with a current world population just over 6.5 billion and a finite carrying capacity, we are living in a world where resources are depleting at a fast rate. The depletion of oil is one of the biggest concerns facing the world right now. Developed countries, like the United States and England, need oil in higher quantities than ever before. There is also the added strain that countries like China and India, who are growing at a rampant pace, are placing on the oil supply. Alternative energy resources, while available, are not in widespread use. But why not? Solar-power, hydro-power, and hybrid vehicles and just some of the many suggestions for reducing our dependency on oil. Hybrid vehicles use less oil, pollute less and, in short, would help combat our oil problem.

Literature Review

“The rapid development of the automotive industry, unlike that of any other industry, has prompted the progress of human society from a primitive one to a highly developed industrial society.”¹

Hybrid means that propulsion energy comes from two or more energy sources.² An electric hybrid relies on a battery and fuel to supply energy for propulsion.³ The diagram drawn on the next page (Figure 1) illustrates how the two energy sources work together.
The fuel is converted into energy which propels the wheels into motion. That motion in turn propels the passengers and chassis along. Conversely, the electric (battery) motor acts the same way. However, rather than needing refueling, the battery is recharged through regenerative breaking and power from the fuel source.

Regenerative breaking is the storing of energy into the battery cells from the inertia that is created with every touch of the breaks, explained to me by Dr. Stuart Birnbaum, Professor of Geology at UTSA, who has owned a hybrid vehicle for three years.

Alternative energies and hybrid cars appear to be the best option we have to ensure the quality of living we currently sustain, but there are many drawbacks.

Through the research I have completed and articles I have read, I have learned a lot about hybrid cars and the positives/negatives of them. To begin to understand hybrids, it is appropriate to consider how hybrids started and why they received little attention for over half a century.

"Electric vehicles were in widespread use in urban areas during the years 1890-1916". GMC had one of the first ever battery/fuel powered trucks using a lead-acid battery. At that time, vehicle technology was very new and both gasoline powered vehicles and hybrid vehicles
were vying for the edge. Eventually gasoline powered vehicles won out. “The demise of the electric vehicles was due to the development of an electrical device [ironic as it may seem], the starter motor.”

The 1960s were a time of radical changes and interest in hybrid vehicles was renewed. However, technology to make such vehicles economical has been slow coming. The 1990s technology of hybrid vehicles was comparable to that of the early 1900s, with some obvious advances.

Today we have hybrid vehicles that are capable of improving fuel efficiency and also produce lower emissions than conventional vehicles. An electric vehicle, which eliminates the need for fuel and relies solely on a battery, is what I envision hybrids becoming as technology improves. Electric hybrids convert extra energy into electricity and use it to help power the electric motor.

Current electric vehicles are still too limited in range before the batteries need recharging. Once the batteries are in need of recharging it is difficult to do so because there are limited locations available and recharging is a time consuming process.

As great as the potential is for hybrids, there are several drawbacks because technology has not advanced as fast as we need it to. Even though the battery recharges itself while the vehicle is running on fuel, the overall lifespan of the battery is significantly shorter than in a non-hybrid car and cannot be replaced as easily in the home.

On top of the issues mentioned above, the cost of hybrids is still very high due to the new technology that is being used in them. High costs discourage people from buying hybrids, thus keeping the costs high. With such a high cost, the technology will improve very slowly.
Some suggestions to improve attitudes towards hybrids include the implementation by the federal government of "tax credits and other incentives to encourage rapid production and consumer purchase ..." With a lower cost, the technology could flourish and improve to where electric hybrids would become economical. Realistically, a drive range of 80 km would satisfy more than 80% of car use. "Educating society [is] necessary to appreciate the value of environmental protections."

Methodology

Based on this knowledge, I formulated my thesis to discover what college-aged students know and believe about hybrid vehicles. I chose college students, 18 to 25 years old, because they are the emerging consumers and the fate of our planet is in their hands.

I hypothesized that the general population would not have much knowledge about hybrid vehicles. Males would claim to possess more knowledge than females would claim. Finally, I hypothesized that the older the respondent is, the more knowledgeable they would be, and I thought that the younger respondents would have the least knowledge when comparing age.

To test my hypotheses, over a four week period I handed out 160 surveys to four classes: an Honors Course, an upper level Geography course and two core classes that students take to satisfy UNT’s general education requirement. Each survey contained 20 questions, asking students to rate their answers as “Strongly Agree,” “Agree,” “Neither,” “Disagree,” and “Strongly Disagree” (see Appendix A).

Results

First, I looked at the data as a whole: what did all 160 students think/know? About 65% said they did not know anything about the mechanics of hybrid vehicles. This lead me to
conclude that while almost all, roughly 92%, believe hybrids are good for the environment, they
don't know why nor exactly what they are capable of.

Among the perceived disadvantages of hybrid vehicles, the greatest number of
respondents said that their dream car did not come in a hybrid option. The majority of
respondents stated they had no opinion on the length of the total life of the battery or how long a
battery takes to charge, 71% and 79% respectively, which I infer as they “do not know.” This
proves that education and information about hybrids is not freely accessible to the average
person. As a whole, the greatest surprise was that 61% said that they would buy a hybrid and
enjoy driving one; this surprised me, considering that most know little to nothing about hybrid
technology.

Figure 2. Percentage of response to Question 20.

![Pie Chart](image1.png)

While 63% of respondents believe that hybrid vehicle technology is always improving,
48% did not know if the technology is more advanced than our current form of vehicle
technology. Even though hybrids have existed since the early 1900s, 53% were under the
impression that hybrid technology is a relatively recent innovation. Despite this, 77% are under the correct assumption that hybrids get better gas mileage than single-engine cars.

While 77% of those surveyed believe there is a real need for hybrid technology and that it would be useful for city or business fleet vehicle use, 58% did not know if hybrids produce enough horsepower. In recognizing that it would be a useful fleet vehicle, 68% said that hybrids would be a good investment for a company. Opinions split almost down the middle about whether or not hybrid vehicles cost too much, with 51% believing that hybrid vehicles were too expensive. Keeping that in mind, a majority, roughly 59%, believe that owning a hybrid will save money in the long run.

In comparison of male and female responses based strictly on knowledge, 85% of females admitted that they did not know about the mechanics of hybrids; by comparison, 71% of men admit they didn’t know how hybrids worked. Though they didn’t know much about hybrid technology, more men than women expressed that they understood the technology and capabilities of hybrids. With the exception being the history of hybrid technology, both men and women were equally mistaken in assuming hybrid technology was a recent development. Another item that both men and women knew nothing about (with 16% of men knowing slightly more) was the length of life of a hybrid battery. Overall, a higher percentage of men claimed to know slightly more in most of the categories than the female respondents.
When comparing data based on age, again strictly based on knowledge, I found that 23 to 25 year olds were too small of a sample size because they only made up 7.5% of the data collected. According to the age comparisons, the younger the respondent, the more likely they were to think that hybrids can travel great distances without refueling and that the technology is constantly improving. Conversely, the older the respondent, the more likely they were to know the history of hybrid technology. The other two questions that dealt strictly with knowledge of
hybrids did not exhibit any significant trends. An interesting outlier I observed was that responses from 21 year olds were vastly lower than the other large sample populations.

The fact of the matter is, we can push education, but only the interested will listen. Better marketing tactics need to be used to encourage the use of hybrids so that the technology can make an impact.

As stated before, the 18-25 year old college population will be the same group who will begin buying cars in the near future. One hindrance to hybrid vehicles at this time is their aesthetic appeal. Most are not attracted to the body design nor the variety of models currently available (see Figure 5).

Figure 5.

While it is an almost even split between those who believe that the body design is appealing, it is slightly skewed in favor of the negative. Another issue college age students have with hybrids is that they believe that they do not produce enough horsepower (see graph on next page). If we are ever to get hybrids in common use, these two areas of perception need to be improved upon.
Problems

While conducting the survey, a few problems became apparent. Most problematic to my research was that the questions on the survey were worded in either a negative way or in an opinionated way. For example, Question 19 says “The recharge time of hybrid batteries is too long.” By saying “too long,” the question is implying a negative reaction. If the question had been worded, “The recharge time of hybrid batteries is short” a different reaction may have been recorded. Questions like eight and 12, for example, state “Hybrid vehicles cost too much” and “Hybrids have enough horsepower” respectively. These can be difficult to answer because cost and horsepower have different meanings to different people. To a student who works full-time to pay all his or her bills, a $10,000 car might be expensive, but to a student who has plenty of financial support, a $50,000 car is a bit expensive. Moreover, having “enough” horsepower usually depends on how you drive.
Another apparent problem was that the surveys were tricky to read since the columns were only labeled at the top. Towards the bottom of the page it could be difficult to differentiate between “agree” and “neither” at a quick glance (see Appendix A).

When discussing the results, my mentor brought up an interesting point: males tend to claim that they know more than they really do, especially when it comes to vehicles. Perhaps a better way of gathering data would be to administer a knowledge test that had right and wrong answer choices before administering the opinion survey I created. Then, by comparing the scores of the knowledge test to their opinion survey, I would get a better idea of how the results may be biased.

Human error played a role in the recording of the answers. The fact that the columns were only labeled at the top made the surveys difficult to read, making accuracy a factor while recording the data. The same difficulties with badly marked columns caused mistakes that did not play a huge role in the data collection, but merely slowed the process.

Conclusions

In conclusion, as I had anticipated, men claimed that they knew more about hybrid technology than women claimed to know. I thought that the older the respondent, the more knowledgeable they would be. However, the younger respondents indicated that they knew about as much as older respondents.

There is an overwhelming number of those who say they know nothing about the mechanics of hybrids; this outcome suggests that further education is needed as to how the two energy sources work together to propel the vehicle. Also, education is needed about the history of how and when hybrid vehicles were developed. Perhaps a more educated consumer base will present different attitudes towards hybrid vehicles and other conservation technology. As such,
arming future consumers with plenty of accurate, balanced information should be a major
teaching priority in the near future.

None of this education will do any good, though, unless marketing practices are changed
so that hybrids are more appealing to potential consumers. From my survey alone, I was able to
conclude that hybrid vehicles are not considered trendy by today’s college body. Further
research and surveying will have to be done in order to find what will be marketable to future
consumers.

Current marketing practices are geared toward selling but not understanding hybrid
technology. When trying to gather information about hybrid vehicles, I looked to the current
models available. Nothing on their web pages gave me a greater understanding of hybrids. If I
were an average consumer looking at this page (www.toyota.com/prius/index.html), why would I
buy this car considering I wouldn’t be able to figure out how it works? The most basic level of
knowledge, that hybrids have better fuel economy, seems to be all marketers are considering
when selling these vehicles. This is largely due to the rising gas prices. Perhaps, showing off the
capabilities of a hybrid vehicle in commercials, rather than parading the fuel efficiency, would
amass a larger consumer base.

Both education and marketing need to be geared toward the current college population
because they will become our future consumers. There is not one subgroup within this
population that could be marketed/educated more than the others because the consumer base is
virtually untouched as of now.
End Notes

1. Mehrdad Ehsani, “Hybrid Electric Vehicles,” *Modern Electric, Hybrid Electric. and Fuel Cell Vehicles, 2005.* 118-120.

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Victor Wouk, “The Second Century of Electric and Hybrid Vehicles” *Vehicular Technology Conference, 1984. 34th IEEE 34* (21-23 May 1984): 183-90. IEEE Xplore Database (accessed October 23, 2006).

3. Wouk, “The Second Century,” 183-90.

4. Ehsani, “Hybrid Electric Vehicles,” 118-120.

5. Wouk, “The Second Century,” 183-90.

6. Kaushik Rajashekara, “History of Electric Vehicles in General Motors” *IEEE Transactions on Industry Applications* 30:4 (July/August 1994): 897-904. IEEE Xplore Database (October 23, 2006).

7. Wouk, “The Second Century,” 183-90.

8. Massyoshi Kanai, “Media’s Coverage of the Hybrid Prius in Japan” <http://ist-socrates.berkeley.edu/~es196/projects/2004final/Kanai.pdf> 1-15. (accessed October 23, 2006).

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Rajashekara, “History,” 897-904.

11. Kurani, “Marketability,” 153-8.

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13. Willie D. Jones "Take This Car and PLUG IT" *IEEE Spectrum* (July 2005): 10-3. IEEE Xplore Database (accessed October 23, 2006).

14. Wouk, "The Second Century," 183-90.

15. Kanai, "Media's Coverage," 1-15.
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## Appendix A

### A survey over your knowledge of Gas/Electric Hybrid Vehicles

| Date: |
|-------|

| Sex (Circle One): | M | F |
|-------------------|---|---|

| Age (Circle One): | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|-------------------|----|----|----|----|----|----|----|----|

| Do you drive (Circle One): | Yes | No |
|----------------------------|-----|----|

| Do you own your own car (Circle One): | Yes | No |
|----------------------------------------|-----|----|

| Strongly Agree: | SA |
|-----------------|----|

| Agree:         | A  |
|----------------|----|

| Neither/No Opinion: | N  |
|---------------------|----|

| Disagree:         | D  |
|--------------------|----|

| Strongly Disagree: | SD |
|--------------------|----|

### Questions (Please mark an X in the column of your choice):

| 1. I know a lot about the mechanics of Hybrid vehicles. | SA | A | N | D | SD |
|--------------------------------------------------------|----|---|---|---|----|
| 2. Hybrid vehicles can travel long distances before refueling. |    |   |   |   |    |
3. Hybrid technology is good for the environment.

4. At this time, my dream car comes in a hybrid option.

5. Hybrids would be a profitable investment for a car company.

6. Hybrid vehicle technology is more advanced than those that use a single non-gas fuel source.

7. Hybrid technology is always improving.

8. Hybrid vehicles cost too much.

9. I would enjoy driving a hybrid.

10. Hybrid technology is a recent technology, becoming experimental in the last 30 years.
|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 11. Hybrid vehicles get better gas mileage than gasoline-powered cars. |   |   |   |   |   |
| 12. Hybrids have enough horsepower. |   |   |   |   |   |
| 13. There is a real need for hybrid technology. |-SA |A |N |D SD|
| 14. Hybrids would be a useful fleet vehicle for a city or business. |   |   |   |   |   |
| 15. In the long run, I will save money by buying a hybrid car. |   |   |   |   |   |
| 16. The design body of hybrid vehicles is visually appealing. |   |   |   |   |   |
| 17. I like the variety of hybrid models currently available. |   |   |   |   |   |
|   |   |
|---|---|
| 18. The hybrid battery has a long life. |   |
| 19. The recharge time of hybrid batteries is too long. |   |
| 20. I would buy a hybrid car. |   |