Consumer Attitudes Towards Alternative Powertrains

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Background

- Research conducted in May and June 2008
- 25 minute internet-based survey
- Over 4000 respondents
- 54% male, 46% female
- 62% college-educated
- Median income of $75k
- Mean age = 43
Consumer interest in hybrid-electric vehicles continues to grow, but many concerns exist among those not considering any alternative powertrain.

### Alternative Powertrain Purchase Consideration

<table>
<thead>
<tr>
<th>Powertrain Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid-Electric (HEV)</td>
<td>62%</td>
</tr>
<tr>
<td>Flexible Fuel (E85) (FFV)</td>
<td>43%</td>
</tr>
<tr>
<td>Clean Diesel (CDV)</td>
<td>16%</td>
</tr>
<tr>
<td>None of these</td>
<td>19%</td>
</tr>
</tbody>
</table>

### Why Are You Not Considering an Alternative Powertrain Vehicle?

1. Expense. 2. Not offered on vehicles I am interested in. 3. New technology, afraid of making a huge investment into something new.”  
   – Subaru Legacy owner

“Cost is exorbitant compared to the number of years I get out of a vehicle. I’ll never make up the difference in cost.”  
   – Jeep Patriot owner

“Have not seen them to be stable in the current market.”  
   – GMC Envoy/Envoy XL owner

“I am not informed on long-term reliability and cost maintenance.”  
   – Toyota Avalon owner

“I do not feel any of them have been perfected to the point they are truly reliable and they seem to be more expensive initially and repair wise.”  
   – Chrysler Sebring Convertible owner

“I don’t believe the vehicle I am considering has this option. I would consider if the option was available.”  
   – Chrysler Town & Country owner

Multiple Mention
While many reasons exist for consumer consideration of hybrid-electric vehicles, consumers more often mention economical motivation, rather than environmental consciousness.

**Why Are You Considering a Hybrid-Electric Vehicle?**

- **Better fuel economy**: 90%
- **Lower fuel costs**: 90%
- **Better for the environment**: 70%
- **Decrease U.S. dependency on foreign oil**: 62%
- **Lower emissions**: 53%
- **Improved carbon footprint**: 39%
- **Tax credit**: 37%
- **Ownership of cutting edge/new technology**: 11%
- **Able to drive in HOV lane**: 8%
- **Social status of being an HEV owner**: 3%
- **Other**: 1%

*Multiple Mention*

Similar to reasons for interest in hybrid-electric vehicles, consumer concerns tend to focus around monetary issues as well. However, the limited amount of models available with this powertrain also contributes to apprehension.

**Single Greatest Concern of a Hybrid-Electric Vehicle**

- Among Hybrid-Electric Considerers -

- Vehicle price: 22%
- Higher maintenance costs: 13%
- Lifespan of battery pack: 11%
- Desired vehicle may not be available as HEV: 11%
- Reliability/dependability of battery pack: 9%
- Unsure about new technologies: 8%
- Lower engine performance/acceleration: 7%
- I do not have any concerns: 5%
- Availability of service stations for repairs: 5%
- Insufficient driving range: 3%
- Technology may be phased out: 3%
- Disposal of battery pack: 2%
- Resale value: 1%
- Other: 1%

Note: Sum may not add up to 100% due to rounding

“Being able to find the vehicle that I want locally (very popular right now...hard to find).” – *Mercury Mariner owner*

“Environmental damage from battery pack both through production and disposal.” – *Chrysler Voyager owner*

“Risks involved with accidents.” – *Ford Explorer Sport owner*
Although basic vehicle owners expect the most fuel economy improvement from a hybrid-electric version of their already fuel-efficient vehicles, sporty vehicle owners are willing to pay nearly $300 more for less of a fuel economy gain. While pickup owners are willing to pay one of the lowest premiums for this technology, they expect nearly twice the fuel economy of a traditional model.

### Fuel Economy Expected – Hybrid-Electric Version of Vehicle Considered

<table>
<thead>
<tr>
<th></th>
<th>Expected Fuel Economy (MPG) of Segment Primarily Considered (Avg)</th>
<th>Additional Fuel Economy Expected (MPG) from a Hybrid-Electric Version of Segment Primarily Considered (Avg)</th>
<th>Additional amount willing to spend for a Hybrid-Electric powertrain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>33.1</td>
<td>20.0</td>
<td>53.1</td>
</tr>
<tr>
<td>Conventional</td>
<td>28.2</td>
<td>17.9</td>
<td>46.1</td>
</tr>
<tr>
<td>Sporty</td>
<td>25.7</td>
<td>18.6</td>
<td>44.3</td>
</tr>
<tr>
<td>STUDY AVERAGE</td>
<td>25.3</td>
<td>17.3</td>
<td>42.6</td>
</tr>
<tr>
<td>CUV</td>
<td>25.4</td>
<td>17.0</td>
<td>42.4</td>
</tr>
<tr>
<td>Utility</td>
<td>22.3</td>
<td>16.6</td>
<td>38.9</td>
</tr>
<tr>
<td>Van</td>
<td>22.9</td>
<td>15.8</td>
<td>38.7</td>
</tr>
<tr>
<td>Pickup</td>
<td>20.1</td>
<td>15.9</td>
<td>36.0</td>
</tr>
</tbody>
</table>

Note: Numbers may not add up to total due to rounding.
Concerns with the price of the vehicle, as well as general lack of knowledge regarding the technology itself are among the most mentioned reasons as to why consumers are not considering a hybrid-electric vehicle. Performance concerns and worries regarding the relative newness of this powertrain also hinder interest.

**Why Are You NOT Considering a Hybrid-Electric Vehicle?**

- Cost premium of HEV: 43%
- I don't know enough about it: 35%
- Desired vehicle not available with Hybrid-Electric powertrain: 30%
- Cost of ownership: 29%
- Concerned about performance: 26%
- Longevity of battery life: 23%
- Unproven technology: 17%
- Never thought about it: 15%
- Not a significant increase in fuel economy: 14%
- Battery makes vehicle unsafe: 3%
- Other: 6%

Multiple Mention:

- None: 19%
- CDV: 16%
- FFV: 43%
- HEV: 62%

Even non-considerers recognize the potential of cost savings in terms of increased fuel economy from a hybrid-electric vehicle, while environmental benefits are once again seen as less important.

**Single Greatest Benefit of a Hybrid-Electric Vehicle**

*Among Hybrid-Electric Non-Considerers*

- Lower fuel costs: 29%
- Better fuel economy: 26%
- Decrease U.S. dependency on foreign oil: 16%
- Better for the environment: 15%
- Lower emissions: 6%
- Tax credit: 4%
- Improved carbon footprint: 2%
- Social status of being an HEV owner: 1%
- Able to drive in HOV lane: * (less than 1%)
- Ownership of cutting edge/new technology: * (less than 1%)
- Other: 2%

*Indicates less than 1%

Note: Sum may not add up to 100% due to rounding

“It is a win-win because it provides a lower yearly fuel cost and it is better for the environment and reduces dependency on foreign oil.” – **Chevrolet Caprice owner**

“Decreased dependency on oil no matter where it comes from.”

“Lower fuel cost and usage, plus environmental and tax benefits.” – **Kia Sorento owner**

“Decreased dependency on oil no matter where it comes from.”

– **Chevrolet Caprice owner**

“It is a win-win because it provides a lower yearly fuel cost and it is better for the environment and reduces dependency on foreign oil.” – **Chrysler PT Cruiser owner**

“Lower fuel cost and usage, plus environmental and tax benefits.”

– **Kia Sorento owner**
Three out of four consumers feel that increased fuel economy warrants consideration of a clean diesel vehicle, while one-half specifically mention lower fuel costs. Traditional benefits of this powertrain regarding performance are among the least mentioned reasons for consideration.

**Why Are You Considering a Clean Diesel Vehicle?**

- Better fuel economy: 76%
- Lower fuel costs: 50%
- Better for the environment: 44%
- Vehicle's range on one tank: 43%
- Decrease U.S. dependency on foreign oil: 35%
- Lower emissions: 35%
- Higher engine power/torque: 32%
- Towing capability: 21%
- Tax credit: 16%
- Social status of being Clean Diesel owner: 3%
- Other: 1%

Multiple Mention: None – 19%  
CDV – 16%  
FFV – 43%  
HEV – 62%  
None – 19%
Unlike hybrid-electric considerers, clean diesel considerers remain wary of the high comparative cost of diesel fuel and where it is available, while less express concern with the actual price of the vehicle.

**Single Greatest Concern of a Clean Diesel Engine**

- Among Clean Diesel Considerers -

- Higher fuel costs: 23%
- Availability of fuel: 18%
- Desired vehicle may not be available with Clean Diesel: 13%
- Vehicle price: 12%
- I do not have any concerns: 9%
- Higher maintenance costs: 7%
- Availability of service stations for repairs: 4%
- Emissions: 4%
- Difficulty starting engine (e.g., in cold weather): 4%
- More frequent maintenance required: 3%
- Lower engine performance/acceleration: 2%
- Other: 1%

“Diesel fuel is selling at a premium to 93 octane gas, about 15-20% higher.” — Mercedes-Benz C-Class owner

“Finding diesel gas stations - getting harder and harder to find.” — Acura MDX owner

“No vehicles available in California.” — Toyota RAV4 owner
As pickup owners have traditionally found the most utility from diesel versions of a vehicle in their segment, these consumers are willing to pay the most for this technology. However, the increase in fuel economy expected is low, compared to other segment owners.

### Fuel Economy Expected – Clean Diesel Version of Vehicle Considered

- **Among Clean Diesel Considerers** -

<table>
<thead>
<tr>
<th>Segment</th>
<th>Expected Fuel Economy (MPG) of Segment Primarily Considered (Avg)</th>
<th>Additional Fuel Economy (MPG) Expected from a Clean Diesel Version of Segment Primarily Considered (Avg)</th>
<th>Additional amount willing to spend for a Clean Diesel powertrain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic*</td>
<td><img src="Expected_Fuel_Economy_Basic.png" alt="Graph" /></td>
<td><img src="Additional_Fuel_Economy_Basic.png" alt="Graph" /></td>
<td><img src="Additional_Cost_Basic.png" alt="Graph" /></td>
</tr>
<tr>
<td>Conventional</td>
<td><img src="Expected_Fuel_Economy_Conventional.png" alt="Graph" /></td>
<td><img src="Additional_Fuel_Economy_Conventional.png" alt="Graph" /></td>
<td><img src="Additional_Cost_Conventional.png" alt="Graph" /></td>
</tr>
<tr>
<td>Sporty*</td>
<td><img src="Expected_Fuel_Economy_Sporty.png" alt="Graph" /></td>
<td><img src="Additional_Fuel_Economy_Sporty.png" alt="Graph" /></td>
<td><img src="Additional_Cost_Sporty.png" alt="Graph" /></td>
</tr>
<tr>
<td>CUV*</td>
<td><img src="Expected_Fuel_Economy_CUV.png" alt="Graph" /></td>
<td><img src="Additional_Fuel_Economy_CUV.png" alt="Graph" /></td>
<td><img src="Additional_Cost_CUV.png" alt="Graph" /></td>
</tr>
<tr>
<td>STUDY AVERAGE</td>
<td><img src="Expected_Fuel_Economy_Study_Average.png" alt="Graph" /></td>
<td><img src="Additional_Fuel_Economy_Study_Average.png" alt="Graph" /></td>
<td><img src="Additional_Cost_Study_Average.png" alt="Graph" /></td>
</tr>
<tr>
<td>Utility*</td>
<td><img src="Expected_Fuel_Economy_Utility.png" alt="Graph" /></td>
<td><img src="Additional_Fuel_Economy_Utility.png" alt="Graph" /></td>
<td><img src="Additional_Cost_Utility.png" alt="Graph" /></td>
</tr>
<tr>
<td>Van*</td>
<td><img src="Expected_Fuel_Economy_Van.png" alt="Graph" /></td>
<td><img src="Additional_Fuel_Economy_Van.png" alt="Graph" /></td>
<td><img src="Additional_Cost_Van.png" alt="Graph" /></td>
</tr>
<tr>
<td>Pickup</td>
<td><img src="Expected_Fuel_Economy_Pickup.png" alt="Graph" /></td>
<td><img src="Additional_Fuel_Economy_Pickup.png" alt="Graph" /></td>
<td><img src="Additional_Cost_Pickup.png" alt="Graph" /></td>
</tr>
</tbody>
</table>

* Caution: Small sample size

Note: Numbers may not add up to total due to rounding

As with clean diesel considerer concerns, higher fuel costs is the greatest contributor to lack of consideration for this powertrain, followed closely by lack of knowledge and lack of thought.

**Why Are You NOT Considering a Clean Diesel Vehicle?**

- Higher fuel costs: 45%
- I don't know enough about it: 43%
- Never thought about it: 29%
- Concerned about fuel availability: 20%
- Cost premium of Clean Diesel: 18%
- Desired vehicle not available with Clean Diesel engine: 13%
- Concerned about emissions: 11%
- Cost of ownership: 11%
- Concerned about noise: 10%
- Not a significant increase in fuel economy: 9%
- Concerned about performance: 6%
- Other: 3%

Multiple Mention:

- None: 19%
- CDV: 16%
- FFV: 43%
- HEV: 62%

Almost one-fourth of consumers not considering a clean diesel vehicle still feel that the greatest benefit of this powertrain is better fuel economy, while more than one out of ten indicate better for the environment.

**Single Greatest Benefit of a Clean Diesel Engine**

- Among Clean Diesel Non-Considerers -

- Better fuel economy: 24%
- Better for the environment: 13%
- Lower fuel costs: 11%
- Decrease U.S. dependency on foreign oil: 10%
- Higher engine power/torque: 10%
- Vehicle’s range on one tank: 9%
- Lower emissions: 6%
- Tax credit: 4%
- Towing capability: 4%
- Social status of being Clean Diesel owner: * (less than 1%)
- Other: 7%

*Indicates less than 1%*

Note: Sum may not add up to 100% due to rounding

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“Diesel engines last longer and have fewer moving parts.” — *Mercedes-Benz C-Class owner*

“Improvements over the traditional diesel.” — *Chrysler Town & Country owner*

“Low cost of ownership, especially maintenance.” — *Ford Freestyle owner*
After a brief description of the technology, approximately one-half of consumers would be interested in purchasing a plug-in hybrid-electric vehicle (PHEV), if it became available. More males and younger consumers exhibit interest in this emerging powertrain technology than do their respective counterparts.

**Initial Interest in Purchasing Plug-In Hybrid-Electric Vehicle**
Highlighting a potential issue regarding education on PHEVs and the capability which early versions have achieved, PHEV initial considerers on average expect vehicles’ utilizing this technology to run 78 miles in all-electric mode. Consumers expect this to be possible with an average plug-in charge time of 5.8 hours.

### All-Electric Mileage Range Expected – *Plug-In Hybrid-Electric Version of Vehicle Considered*

- **Among Plug-In Hybrid-Electric Initial Considerers** -

<table>
<thead>
<tr>
<th>Type</th>
<th>Mileage Range Expected</th>
<th>Hours for Full Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>80.7</td>
<td>5.7</td>
</tr>
<tr>
<td>STUDY AVERAGE</td>
<td>78.0</td>
<td>5.8</td>
</tr>
<tr>
<td>Pickup</td>
<td>77.0</td>
<td>5.8</td>
</tr>
<tr>
<td>Utility</td>
<td>76.9</td>
<td>6.5</td>
</tr>
<tr>
<td>CUV</td>
<td>75.6</td>
<td>6.0</td>
</tr>
<tr>
<td>Sporty*</td>
<td>73.8</td>
<td>5.8</td>
</tr>
<tr>
<td>Basic</td>
<td>72.1</td>
<td>5.5</td>
</tr>
<tr>
<td>Van*</td>
<td>69.8</td>
<td>5.4</td>
</tr>
</tbody>
</table>

*Caution: Small sample size*
Similar to standard hybrid-electric vehicles, consumers find the greatest benefits of PHEVs to be lower fuel costs and better fuel economy, followed closely by environmental concerns.

**Greatest Benefits of a Plug-In Hybrid-Electric Vehicle**
*Among Plug-In Hybrid-Electric Initial Considerers*

- **Lower fuel costs**: 60%
- **Better fuel economy**: 53%
- **Decrease U.S. dependency on foreign oil**: 49%
- **Better for the environment**: 46%
- **Lower emissions**: 29%
- **Convenience of charging at home**: 22%
- **Tax credit**: 15%
- **Quieter vehicle**: 10%
- **Able to drive in HOV lane**: 1%
- **Ownership of cutting edge/new technology**: 1%
- **Social status of being a PHEV owner**: *
- **Other**: *

*Multiple Mention*
*Indicates less than 1%*

“Better performance vehicle, high speed with high torque.” – **Jeep Grand Cherokee owner**

“More than three answers to above, decrease U.S. dependency on ALL oil, better for the environment, quieter, lower fuel cost, lower emission and better economy.”
– **Pontiac Grand Prix owner**

“Please develop this technology quickly - I will buy a Chevy Volt or another PHEV when it’s available!!!”
– **Saturn L-Series owner**
Consumers considering a PHEV find the greatest concern with the driving range of the vehicle, followed very closely by the price of the vehicle. Also unique to this powertrain, three out of ten consumers express concern with the availability of plug-in sites, which once again suggest a necessity for consumer education.

### Greatest Concerns of a Plug-In Hybrid-Electric Vehicle

- **Among Plug-In Hybrid-Electric Initial Considerers**

<table>
<thead>
<tr>
<th>Concern</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient driving range</td>
<td>42%</td>
</tr>
<tr>
<td>Vehicle price</td>
<td>41%</td>
</tr>
<tr>
<td>Lifespan of battery pack</td>
<td>34%</td>
</tr>
<tr>
<td>Availability of plug-in sites</td>
<td>30%</td>
</tr>
<tr>
<td>Higher maintenance costs</td>
<td>25%</td>
</tr>
<tr>
<td>Reliability/dependability of battery pack</td>
<td>24%</td>
</tr>
<tr>
<td>Price of electricity</td>
<td>21%</td>
</tr>
<tr>
<td>Availability of service stations for repairs</td>
<td>17%</td>
</tr>
<tr>
<td>Lower engine performance/acceleration</td>
<td>15%</td>
</tr>
<tr>
<td>Desired vehicle may not be available as PHEV</td>
<td>11%</td>
</tr>
<tr>
<td>Disposal of battery pack</td>
<td>9%</td>
</tr>
<tr>
<td>Unsure about new technologies</td>
<td>9%</td>
</tr>
<tr>
<td>Technology may be phased out</td>
<td>7%</td>
</tr>
<tr>
<td>Resale value</td>
<td>3%</td>
</tr>
<tr>
<td>I do not have any concerns</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
</tr>
</tbody>
</table>

**Multiple Mention**

- “A large percentage of my driving is extended highway trips, (i.e., several hundred miles in a day).” – **Volkswagen Golf owner**
- “Emissions generated by burning coal... which is where most of our electricity comes from around here. It's a trade-off.” – **Honda Civic owner**
- “That a large pickup would be so heavy that performance and range would be significantly reduced.” – **Dodge Ram Pickup HD owner**
The most agreed upon opinion among alternative powertrain considerers is that the U.S. should decrease its dependence on foreign oil. Fewer clean diesel considerers agree that I prefer technologies that are proven, while hybrid-electric considerers are the least likely to agree that the auto emissions issues have been greatly exaggerated.

### Consumer Opinions

- **Among Alternative Powertrain Considerers**

- The U.S. should decrease its dependence on foreign oil: 93%
- Vehicle stability and security are important to me: 91%
- I'm willing to pay a bit more for a vehicle up-front if operating costs are lower: 85%
- Acceleration and good handling are important to me: 78%
- I prefer technologies that are proven (i.e., tried and tested): 77%
- Prefer systems which proactively keep me safe in cornering situations: 75%
- To me, fuel economy is more important than a powerful engine: 71%
- Traction in icy conditions is important to me: 70%
- I'll pay a bit extra for “green” or environmentally friendly products: 64%
- The price is the most important factor when I'm considering a new vehicle: 61%
- I am an avid recycler: 59%
- Federal and state governments should subsidize the purchase of alternative power vehicles: 59%
- Willing to sacrifice fuel economy for increased handling and stability: 34%
- The auto emissions issues have been greatly exaggerated: 20%

% “Strongly”/“Somewhat” Agree
Alternative powertrain non-considerers find the most agreement with *vehicle stability and security are important to me*. As perceptions certainly differ between considerers and non-considerers, the most differentiation is seen considering agreement with *I’ll pay a bit extra for “green” or environmentally friendly products* (28 percentage points), *I’m willing to pay a bit more for a vehicle up-front if operating costs are lower* (18 percentage points), *federal and state governments should subsidize the purchase of alternative power vehicles* (15 percentage points) and *to me, fuel economy is more important than a powerful engine* (13 percentage points).

### Consumer Opinions

- **Among Alternative Powertrain Non-Considerers**

<table>
<thead>
<tr>
<th>Issue</th>
<th>% “Strongly”/“Somewhat” Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle stability and security are important to me</td>
<td>91%</td>
</tr>
<tr>
<td>The U.S. should decrease its dependence on foreign oil</td>
<td>90%</td>
</tr>
<tr>
<td>I prefer technologies that are proven (i.e., tried and tested)</td>
<td>83%</td>
</tr>
<tr>
<td>Acceleration and good handling are important to me</td>
<td>80%</td>
</tr>
<tr>
<td>Traction in icy conditions is important to me</td>
<td>72%</td>
</tr>
<tr>
<td>Prefer systems which proactively keep me safe in cornering situations</td>
<td>71%</td>
</tr>
<tr>
<td>I’m willing to pay a bit more for a vehicle up-front if operating costs are lower</td>
<td>67%</td>
</tr>
<tr>
<td>The price is the most important factor when I’m considering a new vehicle</td>
<td>64%</td>
</tr>
<tr>
<td>To me, fuel economy is more important than a powerful engine</td>
<td>58%</td>
</tr>
<tr>
<td>I am an avid recycler</td>
<td>49%</td>
</tr>
<tr>
<td>Willing to sacrifice fuel economy for increased handling and stability</td>
<td>45%</td>
</tr>
<tr>
<td>Federal and state governments should subsidize the purchase of alternative power vehicles</td>
<td>44%</td>
</tr>
<tr>
<td>I’ll pay a bit extra for “green” or environmentally friendly products</td>
<td>36%</td>
</tr>
<tr>
<td>The auto emissions issues have been greatly exaggerated</td>
<td>25%</td>
</tr>
</tbody>
</table>
Conclusions

• Consumers consider fuel economy to be very important
• Consumers need to be more educated about alt powertrain technology
• The car-buying public has unrealistic expectations about the cost and benefits of alt powertrain
• Potential car buyers are slightly more realistic about diesel than they are about hybrids and plug-ins