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The U.S. Transportation Sector in the Year 2030: Results of a Two-Part Delphi Survey

September 2011

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The US Transportation Sector in the Year 2030: Results of a Two-Part Delphi Survey

Energy Systems Division

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The US Transportation Sector in the Year 2030: Results of a Two-Part Delphi Survey

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EXECUTIVE SUMMARY

A two-part Delphi Survey was given to transportation experts attending the *Asilomar Conference on Transportation and Energy* in August, 2011. The survey asked respondents about trends in the US transportation sector in 2030. Topics included: alternative vehicles, high speed rail construction, rail freight transportation, average vehicle miles traveled, truck versus passenger car shares, vehicle fuel economy, and biofuels in different modes.

The survey consisted of two rounds -- both asked the same set of seven questions[1]. In the first round, respondents were given a short introductory paragraph about the topic and asked to use their own judgment in their responses. In the second round, the respondents were asked the same questions, but were also given results from the first round as guidance. The survey was sponsored by Argonne National Lab (ANL), the National Renewable Energy Lab (NREL), and implemented by University of California at Davis, Institute of Transportation Studies. The survey was part of the larger Transportation Energy Futures (TEF) project run by the Department of Energy, Office of Energy Efficiency and Renewable Energy.

Of the 206 invitation letters sent, 94 answered all questions in the first round (105 answered at least one question), and 23 of those answered all questions in the second round. 10 of the 23 second round responses were at a discussion section at Asilomar, while the remaining were online. Means and standard deviations of responses from Round One and Two are given in Table 1 below. One main purpose of Delphi surveys is to reduce the variance in opinions through successive rounds of questioning. As shown in Table 1, the standard deviations of 25 of the 30 individual sub-questions decreased between Round One and Round Two, but the decrease was slight in most cases.

[1] After some respondents were confused about the exact definition of fuel economy used in Question 6 (fuel economy standards), we changed the question in Round Two to ask about truck and passenger car "EPA sales-weighted (unadjusted) highway/city fuel economy" rather than just "fuel economy."

Table 1: Summary Table for Round One and Two

		Round One				Round Two			
		Responses	Surveyed	Mean	Std. Dev.	Responses	Surveyed	Mean	Std. Dev.
1a.	**Estimate share of new vehicle sales in 2030 in the US for the following for $4/gallon gas in $2011 (%)**								
	Natural Gas	105	206	2.2	2.8	23	105	2.6	3.6
	Fuel Cell	105	206	2.6	3.1	23	105	1.7	1.6
	Battery Electric	105	206	4.6	3.9	23	105	3.2	2.8
	Plug-in Hybrid Electric	105	206	8.4	6.3	23	105	7.6	6.1
	Flex Fuel Vehicle	105	206	15.7	10.3	23	105	11.1	7.4
	Hybrid	105	206	16.2	8.7	23	105	18.4	9.2
1b.	**Estimate share of new vehicle sales in 2030 in the US for the following for $8/gallon gas in $2011 (%)**								
	Natural Gas	105	206	4.4	5.1	23	105	4.5	5.4
	Fuel Cell	105	206	3.7	4.1	23	105	2.7	2.4
	Battery Electric	105	206	8.6	6.7	23	105	6.6	4.3
	Plug-in Hybrid Electric	105	206	14.0	8.4	23	105	14.0	8.6
	Flex Fuel Vehicle	105	206	16.6	11.2	23	105	15.6	9.5
	Hybrid	105	206	20.6	9.5	23	105	24.3	6.5
2a.	**Estimate share of trips between 100-600 by high-speed rail in 2030 for $4/gallon gas $2011 (%)**	99	206	3.9	3.7	23	105	2.5	3.1
2b.	**Estimate share of trips between 100-600 by high-speed rail in 2030 for $8/gallon gas $2011 (%)**	99	206	7.8	6.6	23	105	4.4	5.4
3a.	**Of commodities that could be feasibly shipped by truck or rail (commodities other than coal, non-metallic minerals, metallic ores), what fraction (in ton-miles) will be shipped by rail (versus truck) in 2030 for $4/gallon gasoline $2011 (%)**	99	206	11.5	2.8	23	105	10.1	1.9
3b.	**Of commodities that could be feasibly shipped by truck or rail (commodities other than coal, non-metallic minerals, metallic ores), what fraction (in ton-miles) will be shipped by rail (versus truck) in 2030 for $8/gallon gasoline $2011 (%)**	99	206	15.6	4.2	23	105	14.5	4.1

		Round One				Round Two			
		Responses	Surveyed	Mean	Std. Dev.	Responses	Surveyed	Mean	Std. Dev.
4a.	**Estimate vehicle-miles traveled per capita in 2030 for $4/gallon gasoline $2011 (miles)**	96	206	10,195	1,918	23	105	10,315	1215
4b.	**Estimate vehicle-miles traveled per capita in 2030 for $8/gallon gasoline $2011 (miles)**	96	206	8,582	2,098	23	105	8,682	1,394
5a.	**Estimate the market share of light-duty trucks in 2030 for $4/gallon gasoline $2011 (%)**	96	206	38.3	8.3	23	105	39.1	9.3
5b.	**Estimate the market share of light-duty trucks in 2030 for $8/gallon gasoline $2011 (%)**	96	206	27.6	8.9	23	105	31.0	8.9
6a.	**Estimate the EPA sales-weighted (unadjusted) city/highway fuel economy for the following (MPG):**								
	Passenger cars	95	206	57	7.5	22	105	54.5	7.2
	Light trucks	95	206	44.4	8.5	22	105	42.5	5.5
7a.	**How much energy (in %) for the following modes will come from biofuels in 2030 for $4/gallon gasoline $2011 (%)**								
	Rail	94	206	5.8	7.1	23	105	5.8	4.3
	Ship	94	206	6.7	8.8	23	105	6.3	6.1
	Air	94	206	8.9	10.6	23	105	6.5	4.6
	Heavy Trucks	94	206	10.4	9.0	23	105	9.9	6.2
	Light Duty Vehicles	94	206	14.5	9.3	23	105	11.4	6.0
7b.	**How much energy (in %) for the following modes will come from biofuels in 2030 for $8/gallon gasoline $2011 (%)**								
	Rail	94	206	9.3	9.7	23	105	8.8	8.1
	Ship	94	206	9.8	11.2	23	105	8.4	7.8
	Air	94	206	13.4	12.6	23	105	11.4	8.2
	Heavy Trucks	94	206	17.1	11.1	23	105	14.2	9.3
	Light Duty Vehicles	94	206	20.5	11.2	23	105	16.6	9.7

Below are key findings from this study:

Question 1 – Share of alternative fuel vehicles

- General pessimism about natural gas and fuel cell vehicles even when gasoline is $8/gallon. Under both the $4 and $8 per gallon scenarios, fuel cells remain virtually non-existent vehicle option. Many respondents discussed the high cost of new infrastructure as the primary barrier.
- Hybrid vehicles expected to have 18-24% sales share by the year 2030 (using Round Two results). This far exceeds the EIA projection of 5% hybrid vehicle penetration in 2030. One respondent boldly stated that hybrids would capture 60-70% of the vehicle market in 2030.
- Battery electric vehicles are the most sensitive to oil prices – the expected share nearly doubles with a doubling of oil price.
- Among all powertrains, respondents expressed the greatest uncertainty about flex-fuel vehicles.

Question 2 – HSR penetration

- Respondents extremely pessimistic about the future of High Speed Rail. Most see little build-out by 2030 (and beyond).
- Round two responses were even more pessimistic about HSR than Round One.

Question 3 – Freight-rail penetration

- Respondents saw freight-rail as constrained by new rail infrastructure which they saw as growing very slowly over time.
- Some respondents commented that the increased fuel economy of trucks would make them look more attractive and dampen potential share increases by rail.

Question 4 – VMT per capita

- At $4/gallon, VMT per capita is expected to stay at today's level
- Based on Round Two responses, the expected VMT demand price elasticity is -0.38 (assuming constant income).
- High degree of uncertainty even in Round Two on the future VMT

Question 5 - Share of trucks among new LDVs

- Nearly all respondents thought truck share would decrease, but the percentage of decrease was highly uncertain. This was the only question in which the variance of the responses increased or stayed the same from Round One to Round Two.
- Many respondents thought the new truck fuel economy standards would make trucks more attractive.

Question 6 – Fuel Economy Standards

- Given the new fuel economy and emission standards announced by EPA/NHTSA, few respondents thought the average passenger car and truck fuel economy standard would stray far from the line.

- Some respondents commented that the new standards will likely be re-negotiated downwards in coming years.

Question 7 – Biofuels among transportation modes

- <10% of energy for shipping, air, and rail expected to come from biofuels in 2030 even at $8/gallon gasoline
- Light-duty vehicles expected to have between 11-17% energy from biofuels in 2030.
- Many respondents highly dislike biofuels as an alternative moving forward.

1. Introduction

Understanding the future of the US transportation sector will assist the energy and environmental communities in their long-range planning and policymaking. One way to make predictions about the future is to solicit opinions from the experts of a community. This Delphi survey serves this purpose. Here we present results of the survey administered in August and September of 2011 to attendees of the *Asilomar Conference on Transportation and Energy.* This group is comprised of transportation experts in academia, government, and industry.

1.1 Background on TEF

This survey is part of a larger study called the Transportation Energy Futures (TEF) study, an initiative sponsored by the US Department of Energy and implemented by the National Renewable Energy Laboratory and Argonne National Laboratory. The TEF is investigating specific issues regarding future energy use and greenhouse gas (GHG) emissions in the US Transportation Sector. Four areas being explored under the TEF study are: 1. Light-duty vehicles, 2. Non-light-duty vehicles (Medium- and Heavy-duty vehicles and non-highway modes), 3. Fuels, and 4. Transportation Demand.

1.2 Methodology of Survey

We conducted a two-part Delphi Study on major transportation trends in the US in the year 2030. The respondent pool came from attendees of the *2011 Asilomar Conference on Transportation and Energy.* The year 2030 was chosen because it represents a reasonable planning horizon for most transportation stakeholders (one exception is the railroad infrastructure, which likely has a longer planning horizon).

Round One was conducted entirely online. Individuals who had RSVP'ed "yes" to the Asilomar Conference were emailed the invitation letter on July 27, 2011 (Appendix D). They were given two weeks to complete the survey. One week before the deadline, a reminder email was sent to those who had not responded. Round Two was conducted in

two venues – 11 Round One respondents participated in a roundtable discussion at the Asilomar Conference. Because the time and location of the discussion was not widely publicized, we decided to hold an additional online survey one week after the conference. The invitation letter to the online Round Two was emailed on Sept. 6, 2011. Both rounds of the survey were anonymous, although respondents had the option of providing contact information. The online survey was administered using the application *LimeSurvey* (LimeSurvey, 2011), an application commonly used for academic online surveys.

2. Question Results

This section provides details for each individual question. In addition to giving the question background, we provide the results of Round One and Two and a summary of the comments for the question.

Question 1: Alternative fuels Penetration in 2030

Question 1a: *Estimate share of new vehicle sales in 2030 in the US for the following for $4/gallon gas ($2011): natural gas, fuel cell, battery electric, plug-in hybrid electric, flex fuel vehicle, hybrid.*

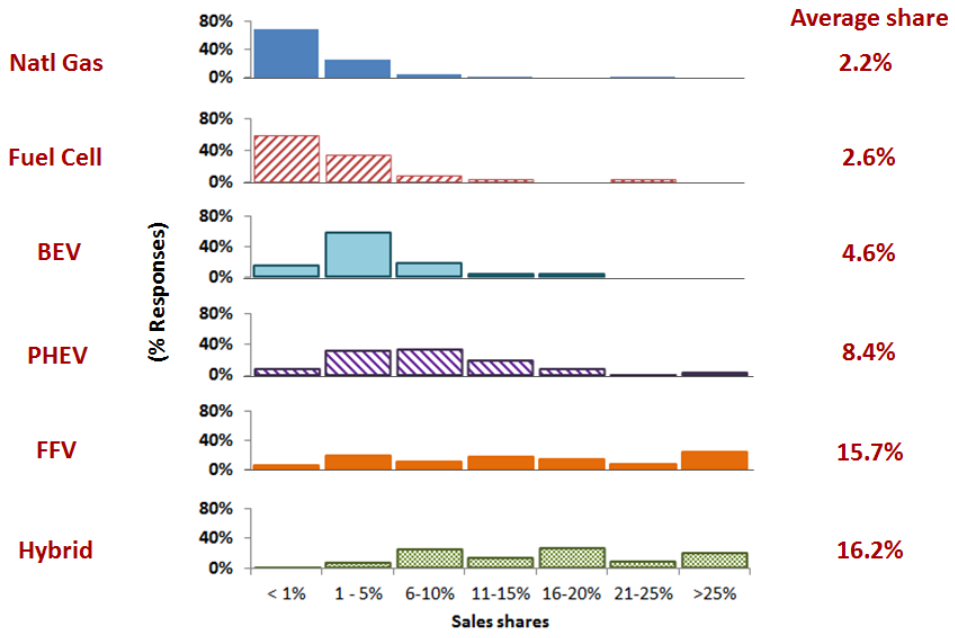

Figure 1. Round One responses to question 1a (n=105)

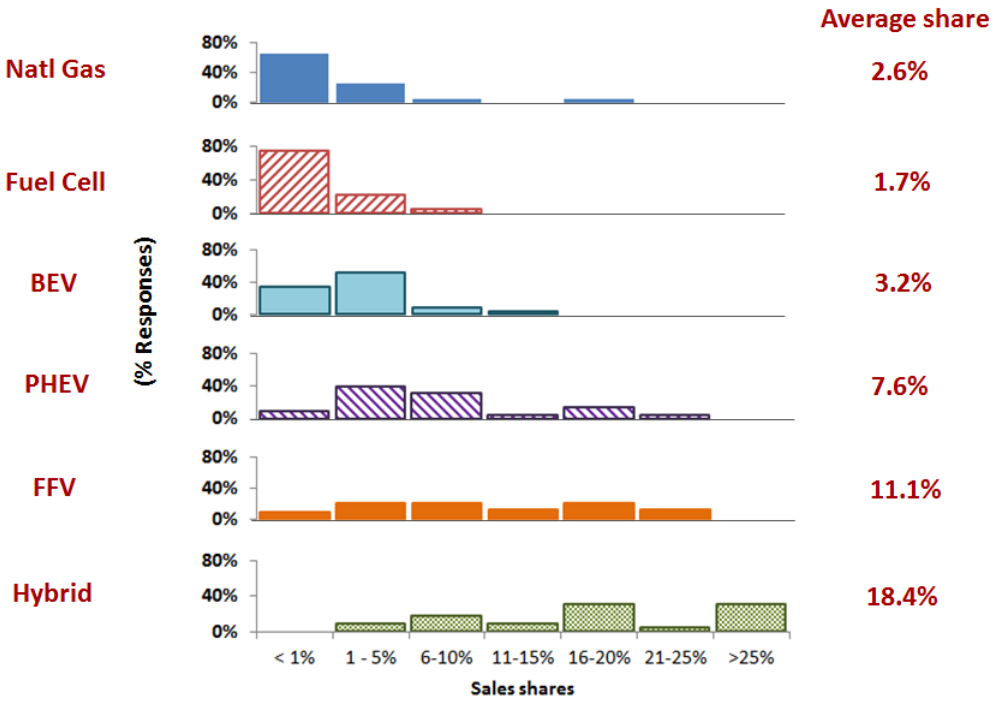

Figure 2. Round Two responses to question 1a (n=23)

Question 1b: *Estimate share of new vehicle sales in 2030 in the US for the following for $8/gallon gas ($2011): natural gas, fuel cell, battery electric, plug-in hybrid electric, flex fuel vehicle, hybrid.*

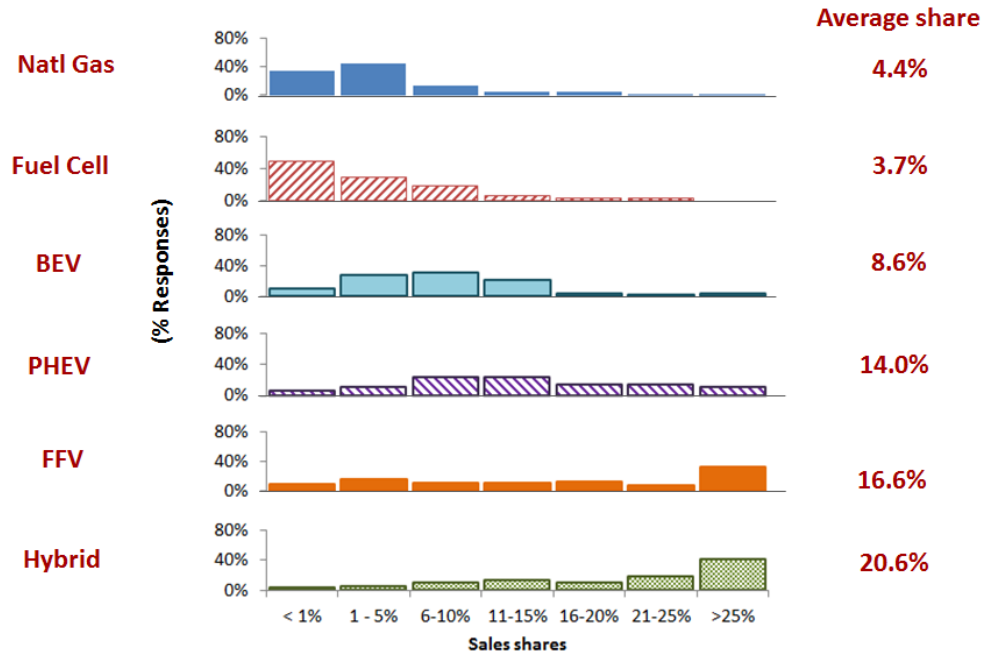

Figure 3. Round One responses to question 1b (n=105)

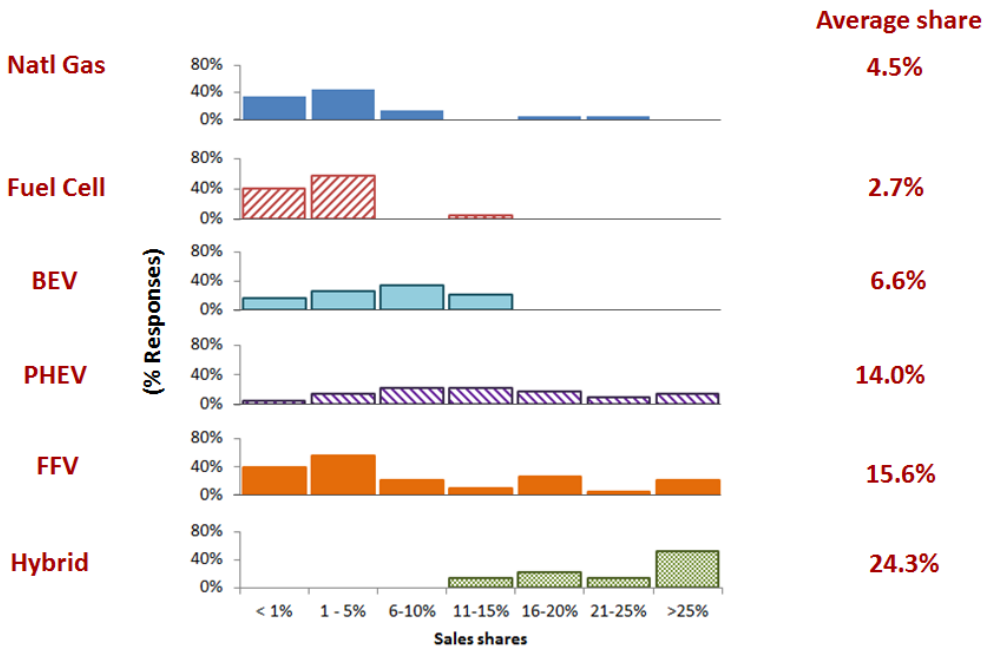

Figure 4. Round Two responses to question 1b (n=23)

Summary of Comments: 47 respondents commented on question 1a or 1b. Some respondents thought that $4/gallon gasoline would do little to convince consumers to purchase alternative fuel vehicles. Many thought that hybrid vehicles would dominate other alternative fuel powertrains due to lower incremental costs. Several respondents mentioned the importance of federal policy for cheap gas prices. One respondent thought that hybrid electric vehicles will capture 60-70% of the LDV market if the federal government continues increasing fuel economy standards.

For $8/gallon gasoline, respondents were more optimistic about all powertrains. One respondent thought that a doubling of fuel prices would roughly double the sales share of alternative fuel vehicles. Another respondent thought that other alternative fuels would become competitive well before $8 and therefore gasoline would never actually reach $8. Another respondent commented that at $8/gallon gasoline, a single powertrain was more likely to dominate LDV sales. Lastly, one respondent questioned the omission of diesel vehicles, stating they would likely be a large part of the LDV fleet in the future.

Question 2: Share of Medium Distance Trips by HSR

Question 2a/2b: *Estimate share of trips between 100-600 by high-speed rail in 2030 for $4/gallon and $8/gallon gas in $2011 (%)*

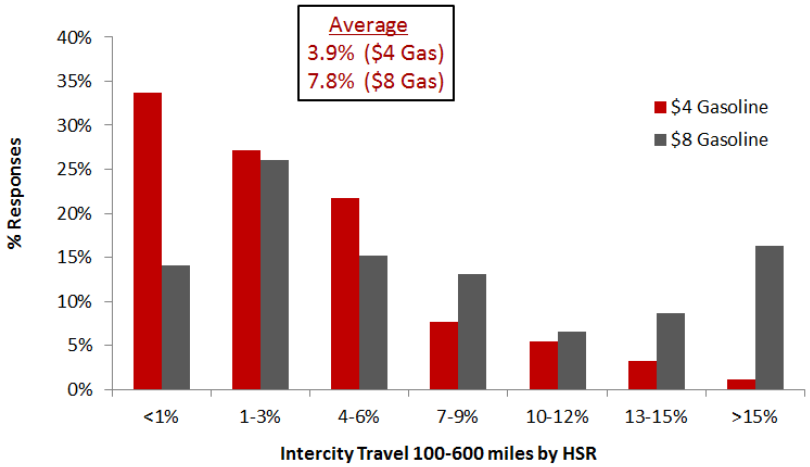

Figure 5 Round One responses to question 2a/2b (n=99)

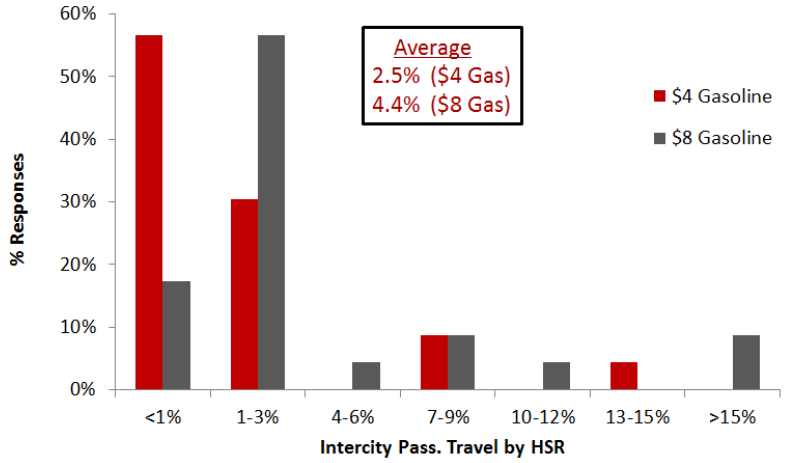

Figure 6 Round Two responses to question 2a/2b (n=23)

Summary of Comments: Most respondents expect HSR penetration to be very limited with small demonstration projects in the Northeast US and in California by 2030. Some respondents thought HSR construction would be stymied in legal battles and NIMBY concerns all the way to 2030 with no construction occurring. Some thought the Obama Administration was far too optimistic about HSR construction. Users are expected to only be high income individuals.

Question 3: Freight Rail

Question 3a/3b: *Of commodities that could be feasibly shipped by truck or rail (commodities other than coal, non-metallic minerals, metallic ores), what fraction (in ton-miles) will be shipped by rail (versus truck) in 2030 for $4/gallon and $8/gallon gasoline in $2011 (%)*

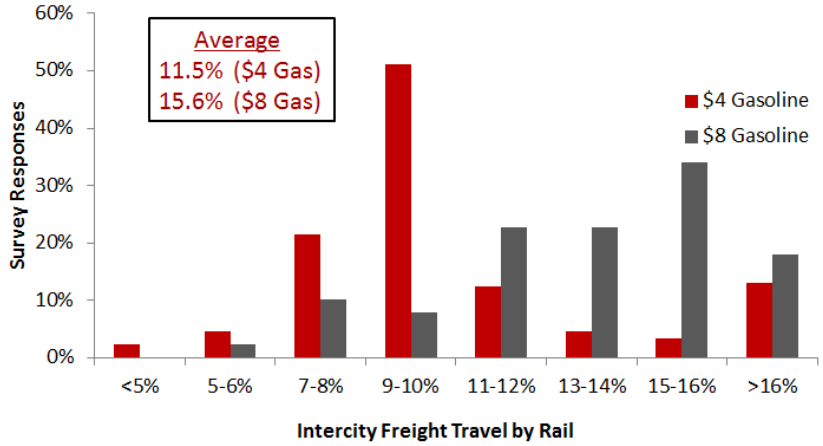

Table 2.7 Round One responses to question 3a/3b (n=99)

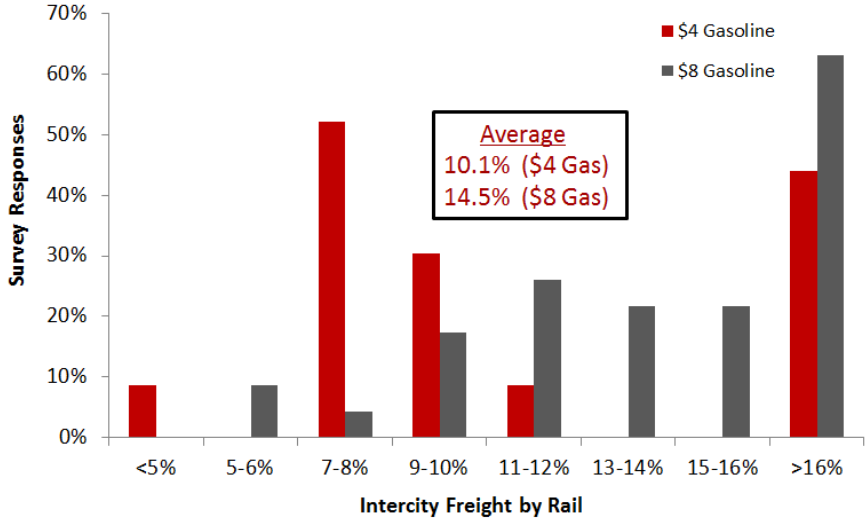

Figure 8 Round Two responses to question 3a/3b (n=23)

Summary of Comments: Most respondents expected rail freight to be infrastructure constrained in the coming decades (as it is today). Without a large-scale rail construction project today, most respondents expect the rail share to stay close to today's value. One commented that rail makes more sense the higher the gasoline price.

Question 4: VMT per Capita

Question 4a/4b: *Estimate vehicle-miles traveled per capita in 2030 for $4/gallon and $8/gallon gasoline in $2011 (miles)*

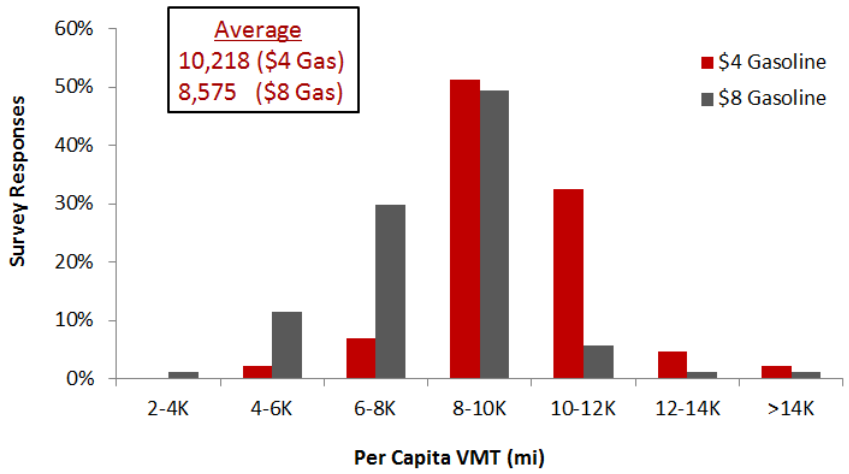

Figure 9 Round One responses to question 4a/4b (n=96)

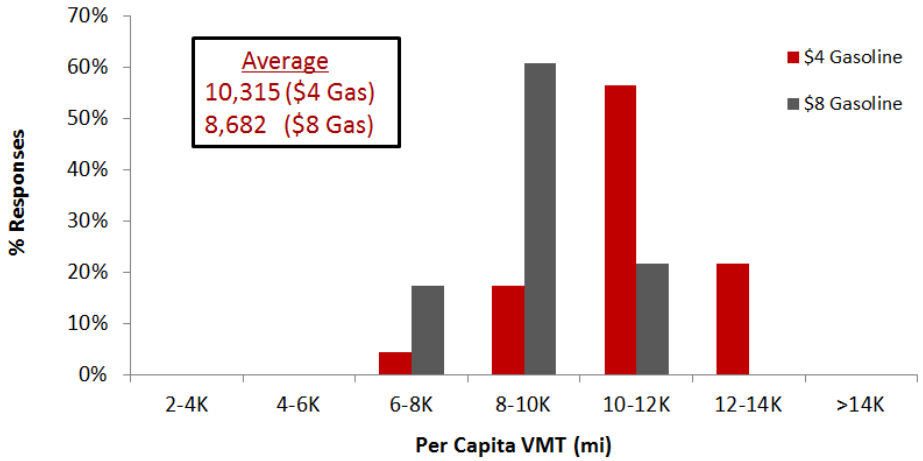

Figure 10 Round Two responses to question 4a/4b (n=23)

Summary of Comments: Most respondents expect VMT per capita to be leveling off or declining from now until 2030. Respondents said future VMT will depend on: efficiency of vehicles, demographic changes (e.g. aging population), congestion cost, parking cost, transportation funding, land-use decisions, and home-based work decisions. Some thought the effect of $8/gallon gas would be large, while others commented the effect would be small.

Question 5: Cars vs. Trucks

Question 5a/5b: *Estimate the market share of light-duty trucks in 2030 for $4/gallon and $8/gallon gasoline in $2011 (%)*

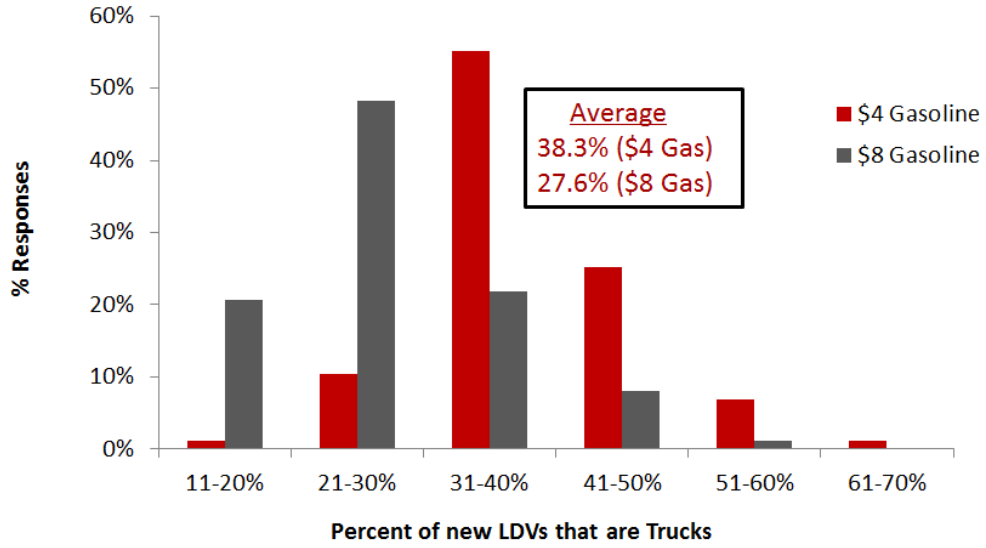

Figure 11 Round One responses to question 5a/5b (n=96)

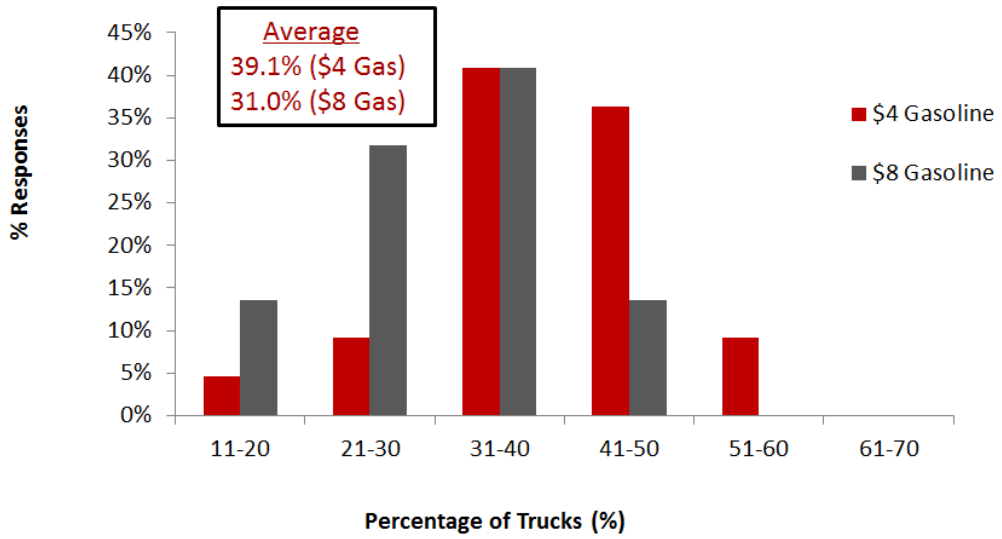

Figure 12 Round Two responses to question 5a/5b (n=23)

Summary of Comments: This question elicited a range of answers, highlighting the uncertainty in the trend. Some thought the truck share would decrease substantially in the future (particularly at $8/gallon) because of reduced discretionary household funds and changing trends. Others, thought the truck share would stay the same or decrease slightly because of vehicle efficiency gains, hybridization of trucks, and the utility trucks provide

(such as the ability to move large objects). Lastly, some thought this share would be determined mostly by regulatory policy than by fuel price.

Question 6: Fuel Economy Standards

Question 6: *Estimate the EPA sales-weighted (unadjusted) city/highway fuel economy for passenger cars and light trucks*

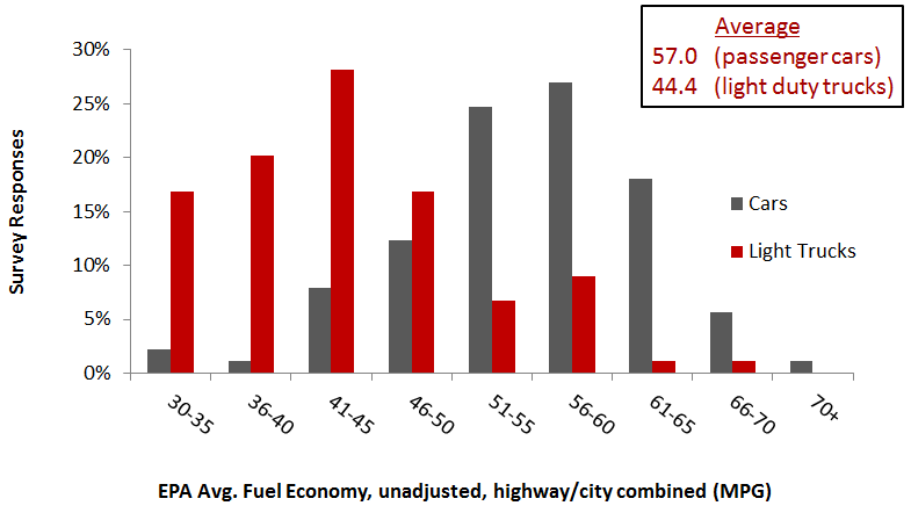

Figure 13 Round One responses to question 6 (n=95)

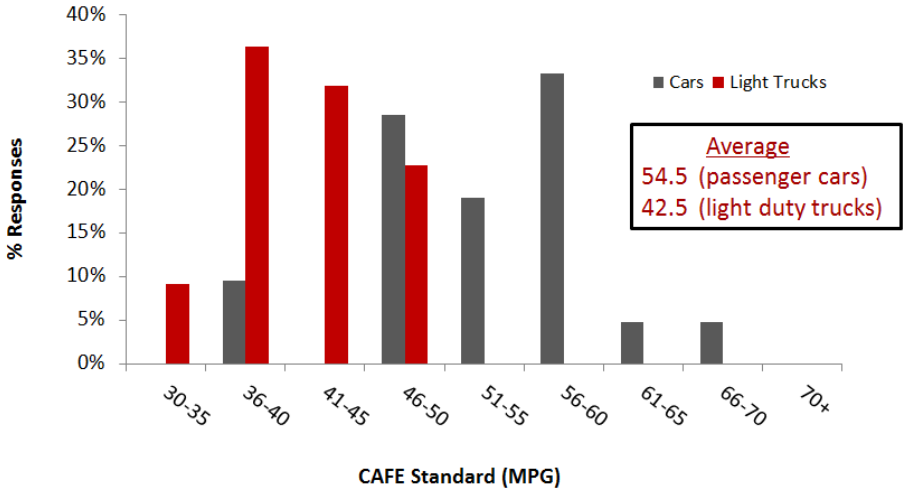

Figure 14 Round Two responses to question 6 (n=22)

Summary of Comments: Many first round comments asked for clarification on what fuel economy we wanted (EPA or on-road). Some respondents said there was a clear link

between the on-road fuel economy and the future penetration rates of alternative fuel vehicles.

Question 7: Biofuels in Transportation

Question 7a: *How much energy (in %) for the following modes will come from biofuels in 2030 for $4/gallon gasoline in $2011 (%): rail, ship, air, heavy truck, light duty vehicle.*

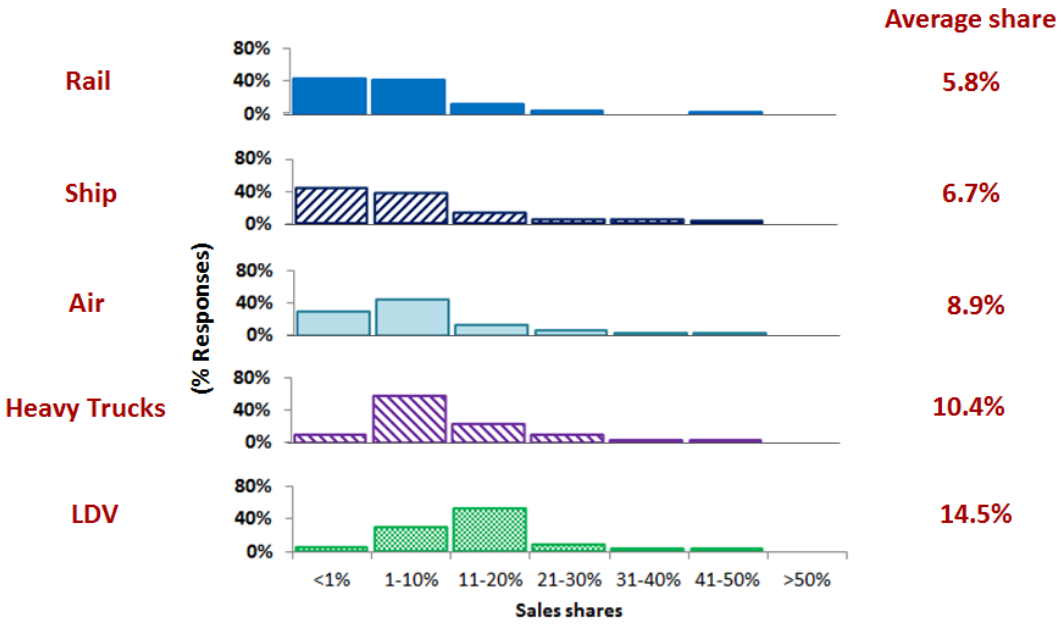

Figure 15 Round One responses to question 7a (n=94)

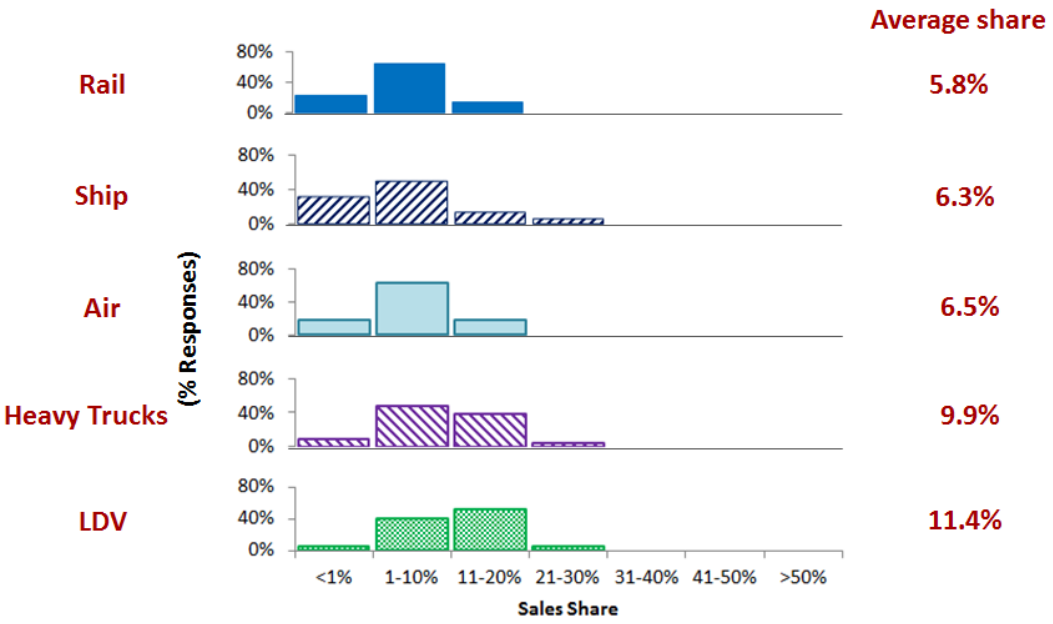

Figure 16 Round Two responses to question 7a (n=23)

Question 7b: *How much energy (in %) for the following modes will come from biofuels in 2030 for $8/gallon gasoline in $2011 (%): rail, ship, air, heavy truck, light duty vehicle.*

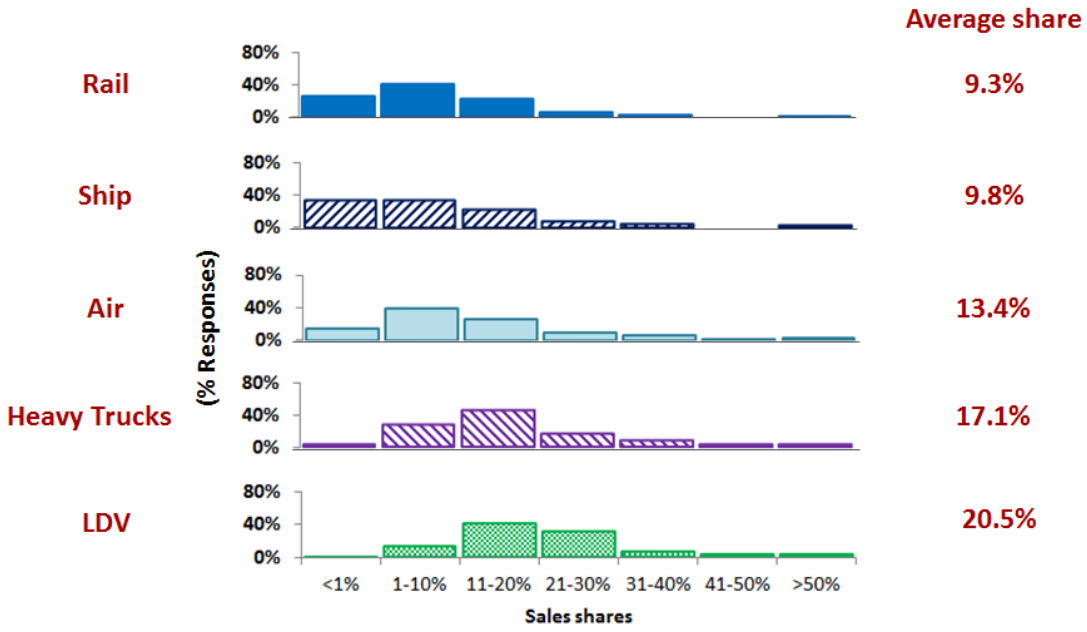

Figure 17 Round One responses to question 7b (n=94)

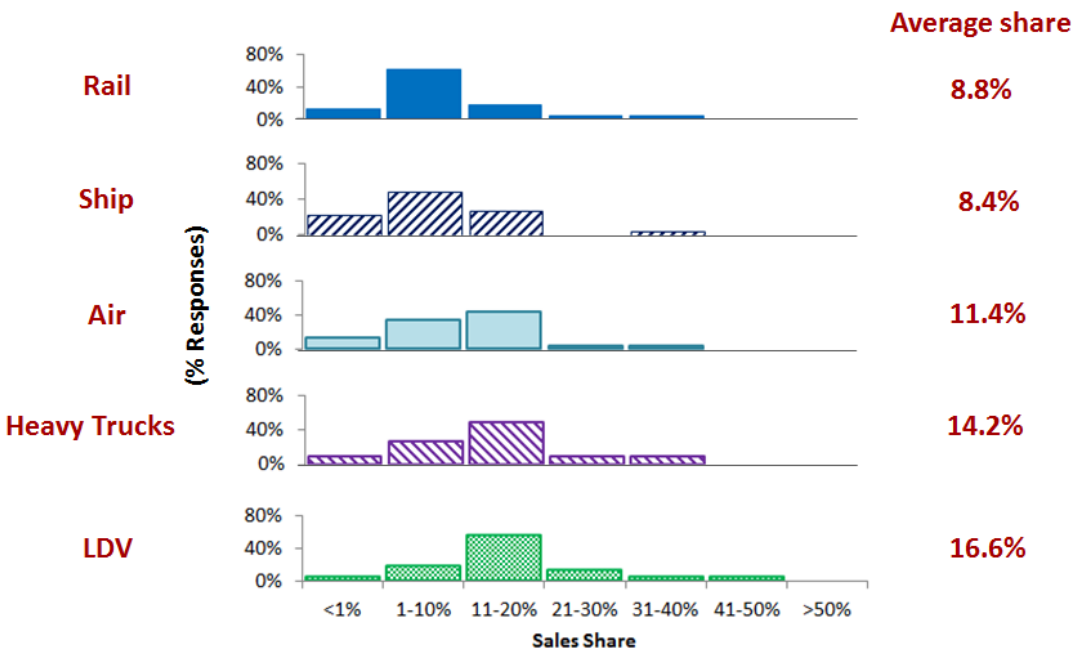

Figure 18 Round Two responses to question 7b (n=23)

Summary of Comments: Responses to question 7a/7b varied widely. Many respondents thought biofuels would be used in small amounts in each of the vehicle types, but there was little agreement (especially in Round One) about the level of the penetration. Some of the uncertainty stems from the slow progress of advanced biofuels. Many respondents discredited biofuels as a poor alternative fuel moving forward.

3. Conclusion

This survey demonstrates that considerable variation exists among expert opinion about the future transportation system in the US. Topics for which the greatest amount of consensus exists are those dealing with railway: the high-speed passenger rail and freight rail. Respondents overwhelmingly thought that the rail infrastructure of 2030 would look very much like it does today. Others topics tended to have much greater variation in responses such as the future penetration of alternative vehicles in the US market. Also, respondents appeared to struggle predicting the share of light trucks in the LDV fleet (question 5) and the percentage of biofuels in different modes in 2030 (question 7). Most respondents thought that a higher fuel price ($8.00/gal vs. $4.00/gal) would lead to somewhat more efficient vehicles, more efficient travel modes, or to somewhat greater use of alternative fuels, but few respondents predicted large responses to fuel prices. One objective of this survey was to see whether the distribution of responses would narrow after participants reviewed the responses from Round One. For most (25 of 30) of the sub-questions the variance in the responses was slightly lower. The questions posed in this survey cut across complex issues and future trends in transportation are subject to many uncertain factors.

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APPENDIX A: Round One Responses

Question 1a – Alt. Fuel Vehicles ($4/gallon)

NG	BEV	PHEV	Hybrid	FFV	H2	Question 1a comments
< 1%	< 1%	< 1%	< 1%	< 1%	< 1%	think number of flexfuel vehicles does not correlate with altlfuels use, ethanol use much lower than flexfuel capacity suggests
< 1%	< 1%	< 1%	< 1%	< 1%	< 1%	
< 1%	< 1%	< 1%	>25%	< 1%	< 1%	At $4 gas, BEVs will be niche vehicles and PHEVs will have a hard time getting to mass adoption. Most OEM long range plans already include some degree of hybridization across their offerings, even if its just stop-start (mild hybrid) technology. I can't speak to FFVs.
< 1%	< 1%	< 1%	>25%	< 1%	< 1%	
< 1%	< 1%	< 1%	>25%	< 1%	< 1%	
< 1%	< 1%	< 1%	>25%	< 1%	< 1%	
< 1%	< 1%	< 1%	>25%	>25%	< 1%	
< 1%	< 1%	>25%	>25%	>25%	< 1%	
< 1%	< 1%	>25%	>25%	>25%	< 1%	Hybrid electric vehicles will become more prevelant in model lines and the younget generations will be more inclined to purchase them for reasons of: environmental/climate change, economics, and familiarity of the technology.
< 1%	< 1%	>25%	>25%	>25%	< 1%	Biofuel production needs to be addressed especially if the bio-waste-fuel production demo plants under development in the central CA valley go main stream by 2012/2013.
< 1%	< 1%	1 - 5%	>25%	>25%	< 1%	
< 1%	< 1%	1 - 5%	>25%	>25%	< 1%	
< 1%	< 1%	1 - 5%	>25%	>25%	< 1%	
< 1%	< 1%	1 - 5%	>25%	>25%	< 1%	Forthcoming CAFE and GHG standards will have an impact on the market penetrations of these technologies.
< 1%	< 1%	1 - 5%	>25%	>25%	< 1%	I assume near zero cost for flex fuel. Hybrid and plug-in hybrid costs should reduce over time. No real driver for increased fuel effiency in this scenario.
< 1%	1 - 5%	1 - 5%	>25%	>25%	< 1%	Where are diesels ? Assume Flexfuel.

< 1%	1 - 5%	1 - 5%	>25%	>25%	< 1%	Hybrid electric vehicles can make economic sense for a significant percentage of consumers, even assuming a continued increase in the efficiency of conventional vehicles. The incremental cost of plug-in hybrids however, is not generally justifiable ves hybrids, so they will remain a niche vehicle. Without a significant breakthrough in battery technology, electric vehicles will only appeal to the few who can affort to pay a significant amount to make a statement. Similarly, the cost of high pressure gas storage limits the economic viability of NGVs. FCVs face cost hurdles in both gas storage and the cost of the FC.
< 1%	1 - 5%	1 - 5%	>25%	>25%	< 1%	
< 1%	1 - 5%	1 - 5%	>25%	>25%	< 1%	I am not particularly knowledgeable about this issue, so these are my best estimates based on the information you have made available.
< 1%	1 - 5%	1 - 5%	>25%	>25%	< 1%	Advanced technologies...can not compete with $4.00 gas without g0vernment subsidy.
< 1%	1 - 5%	1 - 5%	1 - 5%	>25%	< 1%	
< 1%	1 - 5%	1 - 5%	1 - 5%	>25%	< 1%	
< 1%	1 - 5%	1 - 5%	1 - 5%	>25%	< 1%	
< 1%	1 - 5%	1 - 5%	1 - 5%	>25%	< 1%	
< 1%	1 - 5%	1 - 5%	1 - 5%	>25%	< 1%	
< 1%	1 - 5%	1 - 5%	1 - 5%	>25%	< 1%	
< 1%	1 - 5%	1 - 5%	1 - 5%	>25%	< 1%	
< 1%	1 - 5%	1 - 5%	11 - 15%	>25%	< 1%	BEV's contingent on continued cost reduction in batteries. FCV's contingent on hydrogen infrastructure availability. FFV' contigent on E85 availability and/or policy incentives.
< 1%	1 - 5%	1 - 5%	11 - 15%	>25%	< 1%	price of gas is too low. many vehicles will be conventional gasoline vehicles at this fuel price.
< 1%	1 - 5%	1 - 5%	11 - 15%	>25%	< 1%	Assuming EVs will remain limited in their range, unless dramatic battery breakthrough occurs. Assuming automakers make "flex fuel" vehicles that nominally allow for use of various ethanol blends, but that consumers will mostly still fill them up with just gasoline.
< 1%	1 - 5%	1 - 5%	11 - 15%	>25%	< 1%	Relatively cheap gas will discourage the adoption of more expensive BEVs and PHEVs. NG and H2 will also be hard to sell at that gas price.
< 1%	1 - 5%	1 - 5%	11 - 15%	>25%	< 1%	
< 1%	1 - 5%	1 - 5%	11 - 15%	1 - 5%	< 1%	I doubt the H2 infrastructure will get built. The advantages of PHEVs, using the (mostly) existing infrastructure, and relying on a familiar energy commodity--from a system we need to clean up anyway-- will make H2 moot.
< 1%	1 - 5%	1 - 5%	11 - 15%	1 - 5%	< 1%	
< 1%	1 - 5%	1 - 5%	11 - 15%	1 - 5%	< 1%	
< 1%	1 - 5%	1 - 5%	11 - 15%	1 - 5%	< 1%	Cost of hybrids should drop; advances in conventional and hybrid drivetrains should make them tough competitors to altfuel vehicles
< 1%	1 - 5%	1 - 5%	11 - 15%	1 - 5%	< 1%	

< 1%	1 - 5%	1 - 5%	11 - 15%	1 - 5%	< 1%	
< 1%	1 - 5%	1 - 5%	11 - 15%	1 - 5%	< 1%	The cost and inconvenience of natural gas, BEV, fuel cell vehicles and PHEVs will discourage sales. Consumers will be challenged given perpetual slow economic growth and high tax burdens. FFV legislative support expires in MY 2019 and consumers do not like E85.
< 1%	1 - 5%	1 - 5%	11 - 15%	1 - 5%	< 1%	plug hybrid will displace hybrid, ethanol will be less important after subsidies disappear.
< 1%	1 - 5%	1 - 5%	11 - 15%	1 - 5%	< 1%	
< 1%	1 - 5%	1 - 5%	16 - 20%	1 - 5%	< 1%	
< 1%	1 - 5%	1 - 5%	16 - 20%	1 - 5%	< 1%	
< 1%	1 - 5%	11 - 15%	16 - 20%	1 - 5%	< 1%	There will be some ZEVs (battery and FCV), but more FCVs because of battery cost and range issues. HEVs will and FFVs will capture a major shares of the market. NGVs will not become prevalent because of envronmental aspects of NG
< 1%	1 - 5%	11 - 15%	16 - 20%	1 - 5%	< 1%	
< 1%	1 - 5%	11 - 15%	16 - 20%	1 - 5%	< 1%	
< 1%	1 - 5%	11 - 15%	16 - 20%	1 - 5%	< 1%	
< 1%	1 - 5%	11 - 15%	16 - 20%	1 - 5%	< 1%	
< 1%	1 - 5%	11 - 15%	16 - 20%	1 - 5%	< 1%	I would say that battery and hydrogen electric vehicles are in the long term strategic plan of every major automaker. Natural gas will be used to make electricity and hydrogen in 2030, but NG combustion engines won't be embraced by light duty vehicle consumers.
< 1%	1 - 5%	11 - 15%	16 - 20%	1 - 5%	< 1%	Do you mean the price is $4 per gallon over the entire period? Or only in the final year? It makes a difference. At this price level, demand for more fuel efficient vehicles will be higher than the current EIA scenario. Extrapolating current technologies and policies (dropping support for ethanol, diffusion of renewables) favors grid-based vehicles.
< 1%	1 - 5%	11 - 15%	16 - 20%	1 - 5%	< 1%	With gas prices at only $4 it is unlikely any alt fuel vehicles will have significant penetration.
< 1%	1 - 5%	11 - 15%	16 - 20%	1 - 5%	< 1%	If gasoline prices remain flat in real dollars for the next 20 years, there is little to no incentive for consumer to use an alternative fuel. I expect OEMs to continue to expand the production of ethanol FFVs because of the minor incremental cost (~$100 per vehicle) to manufacture. I also expect virtually all cars to be mild hybrids (start-stop) so that fuel consumption at idle is eliminated, again because of the low production costs. PHEVs will attract a small share of consumers with technology (PHEV-10 or PHEV-20) because the payback will be there for some drivers.
< 1%	1 - 5%	11 - 15%	16 - 20%	11 - 15%	< 1%	
< 1%	1 - 5%	11 - 15%	16 - 20%	11 - 15%	< 1%	Current pricing of $4 per gallon provides little incentive, but Federal Mandates will drive a portion of these technologies alone.

< 1%	1 - 5%	11 - 15%	16 - 20%	11 - 15%	< 1%	You won't see much change at current fuel costs ($4/gallon)
< 1%	1 - 5%	11 - 15%	16 - 20%	11 - 15%	< 1%	If fuel cells can overcome infrastructure dilemma, they will do better.
< 1%	1 - 5%	11 - 15%	16 - 20%	11 - 15%	< 1%	
< 1%	1 - 5%	11 - 15%	16 - 20%	11 - 15%	< 1%	
< 1%	1 - 5%	11 - 15%	16 - 20%	11 - 15%	< 1%	More about technical development (or supply side) challenges than demand challenges - FCVs' need for H2 infrastructure will not be easily overcome - in the (sort of) BAU case, the US Govt's irrational avoidance of E80 and flex-fuel vehicles will be preserved
< 1%	1 - 5%	11 - 15%	16 - 20%	11 - 15%	< 1%	
< 1%	1 - 5%	11 - 15%	16 - 20%	11 - 15%	< 1%	
< 1%	1 - 5%	11 - 15%	16 - 20%	11 - 15%	1 - 5%	
< 1%	1 - 5%	16 - 20%	16 - 20%	11 - 15%	1 - 5%	Low carbon electricity and low carbon hydrogen will not yet be cost-competitive in 2030. Carbon sequestration deployment will be very limited.
< 1%	1 - 5%	16 - 20%	16 - 20%	11 - 15%	1 - 5%	
< 1%	1 - 5%	16 - 20%	16 - 20%	11 - 15%	1 - 5%	Most cost effective CAFE will continue to be FFV (if credit still in place), followed by HEV. BEV constrained by range and cost. NGV and FCV constrained by infrastructure and potentially costs.
< 1%	1 - 5%	16 - 20%	16 - 20%	11 - 15%	1 - 5%	Flex fuel vehicles are an illusory solution - as long as consumers have access to conventional gasoline containing whatever minimum percentage ETOH is "mandated" under RFSII, they will use conventional gasoline -- i.e., they won't use E85.
< 1%	1 - 5%	16 - 20%	16 - 20%	11 - 15%	1 - 5%	
< 1%	1 - 5%	16 - 20%	16 - 20%	11 - 15%	1 - 5%	
< 1%	1 - 5%	16 - 20%	21 - 25%	11 - 15%	1 - 5%	
< 1%	1 - 5%	16 - 20%	21 - 25%	11 - 15%	1 - 5%	next generation of consumers values environment, and will select hybrids and/ or electric vehicles
< 1%	1 - 5%	21 - 25%	21 - 25%	16 - 20%	1 - 5%	Home refueling is appealing. Price of alternative technologies will drop as prudcutions volumes increase.
< 1%	1 - 5%	6 - 10%	21 - 25%	16 - 20%	1 - 5%	Without a price signal, alternatives to gasoline such as hydrogen will be unattractive. Unless there is another price or regulatory signal. Plug in Hybrids fill the same niche as H2. Electricity will be attractive because of low cost of operation. Renewable resources wind resources will possibly create a low cost energy source at night for EVs.
1 - 5%	1 - 5%	6 - 10%	21 - 25%	16 - 20%	1 - 5%	In 2030, I expect battery cost of a 125mile BEV to be reduced such that the price will be comparable to a gasoline vehicle. I expect the BEV will offer sufficient consumer usability above and beyond the gasoline vehicle to be attractive at a similar price. Flex fuel vehicles should be separated from vehicles consuming flex fuel. It is possible that all "conventional vehicles" would be "flex fuel vehicles," however, the amount of E85 fuel they consume could be nil. So the question is ambiguous.

1 - 5%	1 - 5%	6 - 10%	21 - 25%	16 - 20%	1 - 5%	
1 - 5%	1 - 5%	6 - 10%	21 - 25%	16 - 20%	1 - 5%	
1 - 5%	1 - 5%	6 - 10%	21 - 25%	16 - 20%	1 - 5%	CAFE credits are the only thing keeping FFVs alive, PHEVs will never become price competitive, new CO2 standards will drive increase in HEV production, FCV is the "holy grail" and will gain considerable ground accordingly.
1 - 5%	1 - 5%	6 - 10%	21 - 25%	16 - 20%	1 - 5%	
1 - 5%	11 - 15%	6 - 10%	6 - 10%	16 - 20%	1 - 5%	Both graphs (EIA and Bandivadekar) include "TDI diesel" (as if that is the sum total of diesel technology), yet your question does not provide a place for this powertrain option in your answer matrix. Given this fact, any result you get from this survey question will be contaminated with this bias. Why did you do this? Now it feels like every question that follows No. 1 in this survey could be slanted for some unknown agenda. You lost me at Q1.
1 - 5%	11 - 15%	6 - 10%	6 - 10%	16 - 20%	1 - 5%	
1 - 5%	11 - 15%	6 - 10%	6 - 10%	16 - 20%	1 - 5%	
1 - 5%	11 - 15%	6 - 10%	6 - 10%	16 - 20%	1 - 5%	New CAFE and GHG standards announced, this may impact.
1 - 5%	16 - 20%	6 - 10%	6 - 10%	16 - 20%	1 - 5%	
1 - 5%	16 - 20%	6 - 10%	6 - 10%	16 - 20%	1 - 5%	
1 - 5%	16 - 20%	6 - 10%	6 - 10%	16 - 20%	1 - 5%	
1 - 5%	16 - 20%	6 - 10%	6 - 10%	16 - 20%	1 - 5%	
1 - 5%	6 - 10%	6 - 10%	6 - 10%	21 - 25%	1 - 5%	
1 - 5%	6 - 10%	6 - 10%	6 - 10%	21 - 25%	1 - 5%	
1 - 5%	6 - 10%	6 - 10%	6 - 10%	21 - 25%	1 - 5%	We better hope we don't have $4 gasoline in 2030.
1 - 5%	6 - 10%	6 - 10%	6 - 10%	21 - 25%	1 - 5%	
1 - 5%	6 - 10%	6 - 10%	6 - 10%	21 - 25%	1 - 5%	
1 - 5%	6 - 10%	6 - 10%	6 - 10%	21 - 25%	1 - 5%	As long as CAFE standards continue to be incremented at a reasonable rate, hybrid electric vehicles will capture 50-75% of the market in 2030. Other advanced technology vehicles will not be cost effective compared to conventional hybrids.
1 - 5%	6 - 10%	6 - 10%	6 - 10%	21 - 25%	1 - 5%	
1 - 5%	6 - 10%	6 - 10%	6 - 10%	21 - 25%	1 - 5%	
1 - 5%	6 - 10%	6 - 10%	6 - 10%	21 - 25%	1 - 5%	
1 - 5%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	1 - 5%	
1 - 5%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	11 - 15%	
1 - 5%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	11 - 15%	HEVs and diesels probably will be necessary to meet raised CAFE standards. Flex fuel sales depend on continued favorable CAFE treatment. FF doesn't cost much additional, real question is how much E85 will they use, which also depends on continued subsidies.
1 - 5%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	21 - 25%	
11 - 15%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	CA ZEV Regulation, and the 10 states that adopt CA's policy, will have an effect on the plug-in and fuel cell EVs sold, in addition to market factors such as fuel prices and vehicle attributes.
21 - 25%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	

6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	Markedly increasing the share of 100% battery electric will depend primarily on battery technology advances, which I think will occur. Most other solutions are interim.
6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	I think it's likely that hybrid electric vehicle rates will continue at an increasing rate, slightly faster than linear growth, up to 10% of the vehicle share. Plug-in hybrids will provide extended electric range for high-end users, but will remain a small market share due to high battery costs. Flex fuel vehicle share will decrease over time to a small share (<5%) as "drop-in" fuel production rises. "Drop-in" fuels can be used in conventional vehicles. Fuel cell vehicles and 100% electric vehicles will represent tiny shares due to ongoing technical challenges and costs associated with battery and fuel cell production, cost and performance. Natural gas vehicle share has declined over time and few manufacturers are producing natural gas vehicles. The share of natural gas vehicles in 2030 will be similar to today.
6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	I believe that flex fuels will be less competitive than drop in fuels. 100% battery electronic vehicles will still not be price competitive in this scenario. The demand for both hybrids will go up and technology advances and cost decrease.
6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	
6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	6 - 10%	

Question 1b – Alt. Fueled Vehicles ($8/gallon)

NG	BEV	PHEV	Hybrid	FFV	H2	Question 1b Comments
>25%	>25%	>25%	>25%	>25%	11-15%	
11-15%	>25%	>25%	>25%	>25%	11-15%	
11-15%	>25%	>25%	>25%	>25%	11-15%	At $8, PHEVs become a compelling option for mass market consumers. However, it will take time before PHEVs can scale to reach a broad mass market given the constraints of current and projected battery technology. Remember, HEVs a decade since introduction represent a mere 2.5% of U.S. vehicles sold. BEVs and natural gas become a viable niche market with room to grow.
11-15%	11-15%	>25%	>25%	>25%	11-15%	
11-15%	11-15%	>25%	>25%	>25%	11-15%	
1-5%	11-15%	>25%	>25%	>25%	1-5%	
1-5%	11-15%	>25%	>25%	>25%	1-5%	
1-5%	11-15%	>25%	>25%	>25%	1-5%	
1-5%	11-15%	>25%	>25%	>25%	1-5%	At 8$ per gallon, people will be doing anything they can to get away from a gas-powered car.

1-5%	11-15%	>25%	>25%	>25%	1-5%	Biofuel production needs to be addressed especially if the bio-waste-fuel production demo plants under development in the central CA valley go main stream by 2012/2013. And, the need to convert building AC equipment from Electric based to natural gas/absorption based, thus freeing up electric grid to do smart charging of electric and plug in hybrid vehicles.
1-5%	11-15%	>25%	>25%	>25%	1-5%	Don't really think cost will drive the technology choice, but rather size of the vehicle choice. The new technologies will always have a premium and if gas is at $8/gal there will be a rise in all energy costs as well.
1-5%	11-15%	11-15%	>25%	>25%	1-5%	
1-5%	11-15%	11-15%	>25%	>25%	1-5%	
1-5%	11-15%	11-15%	>25%	>25%	1-5%	
1-5%	11-15%	11-15%	>25%	>25%	1-5%	Fuel price will increase movement toward alternatives. Still no H2 infrastructure.
1-5%	11-15%	11-15%	>25%	>25%	1-5%	Where are diesels ? Assume Flexfuel.
1-5%	11-15%	11-15%	>25%	>25%	1-5%	Somewhat dependent upon how quickly gasoline reaches $8/gallon - one step in 2012 or gradually? Answers above assume a linear increase. A near-term stp increase would increasingly favor natural gas. Note that Europe has had $8/gallon gasoline for years.
1-5%	11-15%	11-15%	>25%	>25%	1-5%	
1-5%	11-15%	11-15%	>25%	>25%	1-5%	
1-5%	11-15%	11-15%	>25%	>25%	1-5%	Vehicles become more cost competative. Battery electric still stymied...but see plug in hybrid gaining acceptance. CNG still not attractive for passsenger car use.
1-5%	11-15%	11-15%	>25%	>25%	1-5%	
1-5%	11-15%	11-15%	>25%	>25%	1-5%	
1-5%	11-15%	11-15%	>25%	>25%	1-5%	
1-5%	11-15%	11-15%	>25%	>25%	1-5%	
1-5%	11-15%	11-15%	>25%	>25%	1-5%	By 2030 Fuel Economy will double - if the economy grows, then affluence will continue to grow. This means that $8/gallon gasoline will feel like less than $4/gallon today.
1-5%	1-5%	11-15%	>25%	>25%	1-5%	
1-5%	1-5%	11-15%	>25%	>25%	1-5%	With a doubling of gas prices, I would expect roughly a doubling of alternative vehicles sales.
1-5%	1-5%	11-15%	>25%	>25%	1-5%	
1-5%	1-5%	11-15%	>25%	>25%	1-5%	

1-5%	1-5%	11-15%	>25%	>25%	1-5%	
1-5%	1-5%	11-15%	>25%	>25%	1-5%	At double the price you need double the MPG to maintain the lifestyle enabled by your VMT. A PHEV10 should get ~75m mpge, but with consumers in a pessimistic outlook about future price increases they will be interested in better if they can afford it. HEVs will be very common. Hydrogen will be crippled by its infrastructure problem.
1-5%	1-5%	11-15%	>25%	>25%	1-5%	
1-5%	1-5%	11-15%	>25%	>25%	1-5%	At $8/gal, we could get a lot of demand for HEVs. They're already familiar and have momentum. I could see more natural gas, but with it's price linked to that of petroleum, it might not be as favorable.
1-5%	1-5%	11-15%	>25%	>25%	1-5%	
1-5%	1-5%	11-15%	>25%	11-15%	16-20%	
1-5%	1-5%	1-5%	>25%	11-15%	21-25%	FCVs will only make large inroads into the fleet if the government provides very large levels of support....sort of contradicted by initial assumptions
1-5%	1-5%	1-5%	>25%	11-15%	6-10%	
1-5%	1-5%	1-5%	>25%	11-15%	6-10%	
1-5%	1-5%	1-5%	>25%	11-15%	6-10%	People will simply drive less or purchase efficient petrol engines rather than F150s and Escalades.
1-5%	1-5%	1-5%	>25%	11-15%	6-10%	plug hybrid technology is the logical choice for consumers who cannot give up the private car
1-5%	1-5%	1-5%	>25%	11-15%	6-10%	
1-5%	1-5%	1-5%	>25%	11-15%	6-10%	
1-5%	1-5%	1-5%	11-15%	11-15%	6-10%	
1-5%	1-5%	1-5%	11-15%	11-15%	6-10%	compeitors to gasoline will do better than before.
1-5%	1-5%	1-5%	11-15%	11-15%	6-10%	
1-5%	1-5%	1-5%	11-15%	1-5%	6-10%	
1-5%	1-5%	16-20%	11-15%	1-5%	6-10%	
1-5%	1-5%	16-20%	11-15%	1-5%	6-10%	
1-5%	1-5%	16-20%	11-15%	1-5%	6-10%	High gasoline prices will push consumers to drive less. New car buyers will consider electric options, including hydrogen which will have well developed fueling infrastructure.
1-5%	1-5%	16-20%	11-15%	1-5%	6-10%	
1-5%	1-5%	16-20%	11-15%	1-5%	6-10%	
1-5%	1-5%	16-20%	11-15%	1-5%	6-10%	With gasoline prices doubling and the performance of advanced vehicle technologies improving while their costs decline, the market share for alternative fueled vehicles is brighter. However, pure battery electrics face stiff competition with HEVs and PHEVs which provide almost all the advantages of BEVs at a lower cost. Hence, BEV market share remains low. The lack of a hydrogen infrastructure inhibits fuel cell vehicle sales. FFVs grow at a faster rate. NGVs benefit from very low NG prices (due to shale gas which finally solves it environmental problems) and the introduction of ERNGVs (extended range natural

						gas vehicles) which, like EREVs, have a small alternative on-board power source that keeps the incremental costs low. The future is a mix of vehicle technologies.
16-20%	1-5%	16-20%	11-15%	1-5%	6-10%	
16-20%	1-5%	16-20%	11-15%	1-5%	6-10%	Use will be limited by transportation needs of multi-use vehicles (such as trucks, tow vehicles, family vehicle, etc.)
16-20%	1-5%	16-20%	11-15%	1-5%	< 1%	One alternative fuel vehicle will likely predominate. My guess is hybrid electric.
16-20%	16-20%	16-20%	11-15%	1-5%	< 1%	
21-25%	16-20%	16-20%	1-5%	1-5%	< 1%	
6-10%	16-20%	16-20%	1-5%	1-5%	< 1%	
6-10%	16-20%	16-20%	1-5%	1-5%	< 1%	Other than FCVs (still challenged by infrastructure needs), everything is pushed "a little bit more" - with key exception of the obviously do-able E80 and flex-fuel vehicles that Govts' can attain (low hanging fruit) relatively easily
6-10%	21-25%	16-20%	1-5%	1-5%	< 1%	
6-10%	21-25%	16-20%	1-5%	1-5%	< 1%	
6-10%	21-25%	21-25%	16-20%	1-5%	< 1%	
6-10%	21-25%	21-25%	16-20%	16-20%	< 1%	Biofuels made from cellulosic and waste feedstock will increase, but will not yet be widely used in 2030 because of cheaper sugarcane-based biofuels.
6-10%	6-10%	21-25%	16-20%	16-20%	< 1%	
6-10%	6-10%	21-25%	16-20%	16-20%	< 1%	NGV capture higher % due to life cycle cost savings @$8/gal as do PHEVs. HEV and FFV still cheapest but meeting high CAFE Std. BEV % increases due to hi fuel costs and FCV lag due to lack of broad based intrastructure
6-10%	6-10%	21-25%	16-20%	16-20%	< 1%	See above comment - the above assumes gasoline price increases linearly - if price increases are front loaded, move everything up one level except battery electric.
6-10%	6-10%	21-25%	16-20%	16-20%	< 1%	
6-10%	6-10%	21-25%	16-20%	16-20%	< 1%	
6-10%	6-10%	21-25%	16-20%	16-20%	< 1%	
6-10%	6-10%	21-25%	16-20%	16-20%	< 1%	once there is no $ penalty for alternate fuels, the market will increase
<1%	6-10%	21-25%	16-20%	16-20%	< 1%	With the possible exception of more dramatic shifts in the weather the price of petroleum will be the biggest driver for change. At this price or higher I think virtually every light duty vehicle will be hybridized and or Flex Fuel.
<1%	6-10%	21-25%	21-25%	16-20%	< 1%	
<1%	6-10%	21-25%	21-25%	16-20%	< 1%	$8 gasoline will drive attention to further reduce petroleum use, but not significantly. $8 is still too low, and conventional vehicle fuel economy will be high enough that even $8/gallon is not a serious pinch for the consumer.
<1%	6-10%	21-25%	21-25%	16-20%	< 1%	
<1%	6-10%	21-25%	21-25%	16-20%	< 1%	
<1%	6-10%	6-10%	21-25%	21-25%	< 1%	

<1%	6-10%	6-10%	21-25%	21-25%	< 1%	
<1%	6-10%	6-10%	21-25%	21-25%	< 1%	Sorry. Contaminated premise: You left out diesel again. I assume you know gasoline in some European countries cost this now, and that more than 50% of light-duty vehicles sold there now are diesel because of fuel prices. I cannot take this survey seriously.
<1%	6-10%	6-10%	21-25%	21-25%	< 1%	
<1%	6-10%	6-10%	21-25%	21-25%	< 1%	
<1%	6-10%	6-10%	21-25%	21-25%	< 1%	
<1%	6-10%	6-10%	21-25%	21-25%	< 1%	
<1%	6-10%	6-10%	21-25%	21-25%	< 1%	
<1%	6-10%	6-10%	21-25%	6-10%	< 1%	
<1%	6-10%	6-10%	21-25%	6-10%	< 1%	
<1%	6-10%	6-10%	21-25%	6-10%	< 1%	
<1%	6-10%	6-10%	21-25%	6-10%	< 1%	
<1%	6-10%	6-10%	21-25%	6-10%	< 1%	
<1%	6-10%	6-10%	21-25%	6-10%	< 1%	
<1%	6-10%	6-10%	6-10%	6-10%	< 1%	$8/gallon average gasoline will not happen, expect perhaps for a brief price spike. There is so much that is profitable at $8/gallon that supply will rapidly expand to meet demand (which will be falling). These questions are meaningless.
<1%	6-10%	6-10%	6-10%	6-10%	< 1%	
<1%	6-10%	6-10%	6-10%	6-10%	< 1%	
<1%	6-10%	6-10%	6-10%	6-10%	< 1%	
<1%	6-10%	6-10%	6-10%	6-10%	< 1%	
<1%	< 1%	6-10%	6-10%	< 1%	< 1%	
<1%	< 1%	6-10%	6-10%	< 1%	< 1%	BEVs at low end of range for both 1a and 1b. HFCVs a wild card, could be higher if high gas prices seen as permanent and govt policy adequately supported.
<1%	< 1%	6-10%	6-10%	< 1%	< 1%	
<1%	< 1%	6-10%	6-10%	< 1%	< 1%	
<1%	< 1%	< 1%	6-10%	< 1%	< 1%	
<1%	< 1%	< 1%	6-10%	< 1%	< 1%	
<1%	< 1%	< 1%	< 1%	< 1%	< 1%	This scenario shows the same trends as the $4 scenario, but the alternative fuel shares become more pronounced, due to the high gasoline cost. Both hybrids and plug-in hybrids will be popular in this scenario, with hybrids comprising 11-15% of LDVs and plug-in hybrids comprising 6-10% of LDVS. The plug-in hybrid vehicle share will always be lower than the hybrid share due to the higher up-front vehicle price. Natural gas vehicles are more prevalent (1-5%) as U.S. natural gas production expands and the natural gas is much cheaper than petroleum fuels. Flex fuel vehicles, battery electric vehicles and fuel cell vehicles will represent a small fraction in this scenario, similar the $4/gallon gasoline scenario or a slightly higher share.

<1%	< 1%	< 1%	< 1%	< 1%	< 1%	I think the cost of battery operated vehicles will become more competitive as gas prices increase.
<1%	< 1%	< 1%	< 1%	< 1%	< 1%	
<1%	< 1%	< 1%	< 1%	< 1%	< 1%	

Question 2a/2b – Highspeed Rail

$4/gallon	$8/gallon	Question 2a/b Comments
<1%	1-3%	Do not believe cost/performance data for highspeed rail is reliable enough to stimulate necessary investments.
<1%	<1%	I am skeptical (to say the least) that our country will have the financial resources or political will to build out HSR infrastructure.
1-3%	>15%	At $4 gas, the cost of driving and flying remains virtually unchanged from today. Therefore, HSR may make some dent in air travel (since I would expect HSR to be comparable in price to air travel but with some added advantages). I would also expect HSR to replace a small fraction of car trips, but this would likely be limited to a narrow segment of high income households. At $8 gas, the cost equation becomes highly favorable to HSR against both air and road travel.
10-12%	>15%	
13-15%	>15%	Aside from shifts in economics and mode, a shift in consciousness in the coming generations will be ushered in by realization of the impacts of dwindling supplies of fossil fuels and the environmental impacts of their extraction and combustion
4-6%	7-9%	
1-3%	1-3%	very little will be built by 2030
<1%	<1%	The only corridors where HSR makes sense in terms of potential patronage and cost are the Northeast Corridor and California. Even there, costs of capital and operations would be exorbitant and the NIMBY issues will be huge obstacles -- and the U.S. national political process will result in absurd decisions and misteps (as in the California HSR comedy that is now playing out). LaHood and his team are delusional when it comes to HSR.
1-3%	4-6%	Depends on how quickly high speed rail infrastructure is created.
4-6%	4-6%	There is a missing element to the discussion. How many people are traveling together? For one person quality public rail transit can be cost effective given quality of access to transportation options at either end of the travel. However, if 2 or more are traveling together, forget air and rail options, they cost more those traveling than the personal car.
	1-3%	Again this is not a question of gasoline price but rather the extensive capital investment that is unlikely to be sustainable.
10-12%	>15%	
	1-3%	
<1%	1-3%	From a cost/benefit standpoint I think the significant upfront infrastructure investment and local transporation issues are challenging hurdles.
<1%	1-3%	Most personal trips require use of a car at destination. Few can afford cost of rail plus car rental. Most business trips already go by air or rail. Large increase in high-speed rail facility seems unlikely.
13-15%	>15%	

1-3%	1-3%	Traffic patterns only really support an east coast corridor, with potentially a LA-SD addition.
4-6%	7-9%	
1-3%	1-3%	Very hard to answer since I can't tell what percentage of national travel occurs on the corridors where high speed rail is planned. I think high-speed rail is very likely on the east coast and could replace a percentage of that travel, but very unlikely elsewhere in the US by 2025.
4-6%	>15%	during previous spikes in fuel cost rail travel climbed dramatically. Supply is constrained. I don't see usage growing and rails being built until fuel prices are clearing and premanantly climbing
4-6%	7-9%	
4-6%	13-15%	
4-6%	13-15%	
1-3%	4-6%	
<1%	<1%	
<1%	<1%	
4-6%	10-12%	
1-3%	4-6%	Presumes the system is built which may be difficult in current econ/political environment.
10-12%	>15%	
<1%	1-3%	This remains highly controversial for the areas through which the rail must travel, and the huge infrastructure costs involved are too big to assume that we will have substantial deployment by 2030. We need a success story here, which could take a decade or more to achieve, before other areas are willing to make the investment. That means a huge time lag between success story(s) and subsequent implementation in other regions.
4-6%	>15%	At $4/gal. high speed rail will be moderately popular, taking over much of the short hop air traffic in the corridors, given a good transit system at the destinations. At $8/gal. it will be extremely popular, again given cost and time efficient transit at the destination.
4-6%	7-9%	
4-6%	10-12%	
<1%	1-3%	
4-6%	10-12%	
<1%	1-3%	HSR systems are too expensive, especially given likely continued national budget problems...I don't expect these systems to be built
4-6%	7-9%	
4-6%	4-6%	
<1%	<1%	Inter city high speed rail is extremely expensive and would require massive infrastructure costs at the expense of rail freight. Americans are not stupid.
<1%	4-6%	if the $8 gasoline was $2/gal or more tax that went to HSR
1-3%	7-9%	
1-3%	4-6%	
7-9%	13-15%	
7-9%	13-15%	
4-6%	>15%	I believe that gas prices will figure heavily into whether or not people decide to take the high speed rail. At $8/gallon, I think people will be more eager to take the train.
4-6%	7-9%	
7-9%	>15%	
1-3%	7-9%	
7-9%	10-12%	I don't have a good sense of this, but I'd imagine that people would be

		motivated to displace some air travel with high speed rail travel.
<1%	<1%	
1-3%	4-6%	System is still likely to be limited by 2030 and it will be hard to compete with air as costs rise, though it's advantage vs car gets better.
	1-3%	HSR, as much as I like it (having taken it in Europe, Japan, Korea, and China) has passed the US by. Not only can we not agree on the technology, but the lawyers will ensure that HSR is not built in anyone's back yard.
1-3%	4-6%	
4-6%	10-12%	
1-3%	7-9%	I'm hopeful we'll have a good US "demo" project in a major corridor by 2030 that can capture a significant number of trips, particularly at $8/gallon gas.
>15%	>15%	
1-3%	1-3%	Republican intransigence about any infrastructure investment will continue for a decade and will delay construction of useful amounts of HSR beyond 2030
<1%	<1%	
<1%	1-3%	Investment in infrastructure is still the main barrier -- Based on UK parallels, the "threshold" rail to air mileage is about 400miles, whci most (?) US long trips would exceed
1-3%	4-6%	
<1%	<1%	
<1%	<1%	
1-3%	4-6%	
7-9%	13-15%	
<1%	1-3%	Assumes that car and air costs scale with price of gasoline
1-3%	1-3%	One needs to consider tolls - on a trip from DC to NYC, road tolls are more than gasoline.
<1%	1-3%	
1-3%	7-9%	
<1%	1-3%	The U.S. will not be in a position to afford major investments in new infrastructure systems for the foreseeable future.
10-12%	13-15%	
4-6%	7-9%	my numbers are low because I am concerned by the lack of investment dollars and political will to develop high speed rail.
4-6%	13-15%	I assume that jet fuel will also increase in price, so the price of air travel will rise making rail more economical.
<1%	<1%	Despite Obama's goal, high speed rail will not be in enough markets and available to enough people to affect a reasonably large percentage of 100-600mile VMT.
1-3%	1-3%	
<1%	<1%	
<1%	<1%	
<1%	<1%	
7-9%	13-15%	
10-12%	>15%	
13-15%	>15%	
1-3%	10-12%	
1-3%	4-6%	Obama is overly optimistic with respect to the anticipated access to HSR by 2030. With the current poliltical funding climate, the environmental regulations and the time for contstruction, very few high speed rail lines will be operational by 2030. That being said, those that are operational are likely

		to have fairly high ridership IF they are priced right and provide access to major population centers with good transit
4-6%	>15%	
<1%	4-6%	
1-3%	1-3%	
1-3%	7-9%	
1-3%	1-3%	
<1%	1-3%	Too expensive. Anti-tax R's will never allow it to be funded.
1-3%	4-6%	
7-9%	>15%	
<1%	1-3%	
<1%	1-3%	
4-6%	7-9%	
<1%	1-3%	
<1%	<1%	
<1%	<1%	
<1%	1-3%	
<1%	<1%	
<1%	1-3%	Largely depends on build out of HSR infrastructure and service availability. Long lead times required (10yrs+) to build an HSR regional network.
1-3%	4-6%	
1-3%	4-6%	Our society is becoming more mobile, as are jobs, with Skype, laptops, etc. Fixed rail of any type goes in the opposite direction. High-speed rail will disappoint in cost, performance and speed.
7-9%	10-12%	I think 100 - 600 mile trips will continue to be dominated by air travel through 2030 for both petroleum price scenarios, due to the high cost rail of infrastructure, the larger network of U.S. airports compared to rail and likely improvements in airplane amenities and speed over time as the era of high efficiency comfort jets takes off (such as Boeing 787). The high petroleum fuel case may result in slightly greater development in high speed rail by 2030, but the effect is likely to be small because infrastructure development requires a long investment cycle and is not very vulnerable to fluctuating petroleum markets. Furthermore, many trains currently use diesel fuel (rather than electricity) and operational costs for these trains are as sensitive to petroleum prices as passenger jet fuel costs are.
4-6%	10-12%	I don't believe the investment for high-speed rail is on track to have greater influence on the way people travel. I do think that economic incentive and the rail in CA will make a significant difference on commuter flights. There is little incentive for high-speed rail for many drivers if gas prices stagnate.
1-3%	4-6%	
10-12%	>15%	

Question 3a/3b – Rail freight

$4/gallon	$8/gallon	1a comments
11-12%	15-16%	Govt subsidies for removing rail infrastructure chokepoints unlikely because freight rail industry will not cooperate re improved passenger rail
9-10%	>16%	The factors favoring truck transport (flexibility, just-in-time, etc.) will be hard to overcome at moderate gas prices. At high prices, I think rail will become increasingly important.
11-12%	>16%	
15-16%	>16%	
>16%	>16%	As IT and other advances in logistics (including understanding and forecasting of consumer demand across regions) make shipment of non-perishables easier to plan in advance, energy and infrastructure costs will make up a larger and larger fraction of shipping and rail will become more and more competitive versus trucks.
9-10%	11-12%	
11-12%	11-12%	rail freight is virtually at capacity and nothing is said about plans for building more capacity
9-10%	9-10%	Consumers and producers will continue to demand timely reliable deliveries, which obviate against significant increases in mode share for rail. Increased cost of fuel, Even at $8/gallon, will be offset by (a) more fuel efficient HDVs and (b) greater ease/speed of truck travel on highways as passenger VMT will be diminished somewhat by $8/gallon fuel.
11-12%	13-14%	Freight rails lines are near capacity and there are not many plans to expand capacity - they compete with passenger rail. One aspect might be to include waterway shipments - which I expect to increase with gasoline prices going to 8$/gal
9-10%	11-12%	Assuming that for the most part Rail infrastructure does not increase in size. And "smart communities" or AB-32 like laws are implemented, in 2030, traditional trucks would move goods from a rail or port hub to a community hub where the commodities are then transferred to smaller "Clean" delivery trucks. SO, total truck miles go up and rail use remains about constant to population growth. Cost of fuel for trucks and rail are relative to each other, unless rail or trucks find a lower cost alternative fuel stock (Domestic centric could change the mix depending on which one it favors.)
9-10%	9-10%	Shouldn't this be based in diesel price?
11-12%	15-16%	
11-12%	15-16%	
11-12%	>16%	
13-14%	15-16%	Even at $4/gallon there is pressure to reduce fuel cost. However, there is limited ability to move goods by rail due to infrastructure, distances, and trip times.
13-14%	>16%	
7-8%	9-10%	The difference in shipping energy costis small relative to the time value of of the worth of the cargo. And there is significant potential for increasing MPG efficiency for HD trucks.
15-16%	>16%	
11-12%	13-14%	Rail might make more sense as the price of gas goes up. But, the cost of the goods shipped may simple increase instead.
11-12%	15-16%	It is my understanding that rail too has only limited infrastructure and without a national committment to freight rail expansion movements are limited.
11-12%	15-16%	
11-12%	>16%	
11-12%	>16%	
11-12%	15-16%	
>16%	9-10%	

11-12%	15-16%	
9-10%	13-14%	
9-10%	15-16%	I don't know anything about this.
11-12%	13-14%	I'm assuming that gasoline prices are a surrogate for changes in all fuel prices, including diesel.
11-12%	>16%	$4/gal. means no real change. $8/gal. will influence decisions towards efficiency.
11-12%	15-16%	
11-12%	>16%	
9-10%	13-14%	
11-12%	15-16%	
9-10%	13-14%	at $4 gas0line, and with improved truck efficiency, no reason to think rail will surge. At $8 gasoline, rail share will increase, but not dramatically
11-12%	13-14%	
13-14%	13-14%	
11-12%	13-14%	Rail construction and removal of bottlenecks are extremely difficult projects hindered by the federal and state governments and unions. Not much progress to be made here.
11-12%	>16%	at $8 trucking would see a big shake out
11-12%	>16%	
7-8%	9-10%	WE can not build rail infrastructure fast enough, or afford it, to meet the growing rail needs without any mode shift.
5-6%	7-8%	
11-12%	13-14%	
9-10%	15-16%	
7-8%	15-16%	Increased truck fuel economy due to engine and aerodynamic improvements will make trucking more competitive at similar fuel prices. However, trucking costs are more sensitive to fuel price so with sustained fuel price increases there could be a large change in mode split.
13-14%	>16%	
11-12%	15-16%	
9-10%	11-12%	
9-10%	9-10%	
11-12%	15-16%	Rail's modal share of TMT for commodities that can be shipped by either rail or truck has been relatively constant at 10-12% for the past 15 years. With fuel prices flat, I expect it to continue at the same level. If fuel prices double, then rail's share could inch up, but the economics of just-in-time delivery will limit rail's growth.
11-12%	13-14%	
11-12%	13-14%	Infrastructure does not exist for US transport for goods to many additional locations. Progress will also be made in efficiency of Truck transport as well.
13-14%	15-16%	Gas at $8/gallon might shift more demand for passenger rail (making freight rail less efficient). However, it seems like the railroads have better capacity to enhance rail lines and still provide cheaper rates than the equivalent trucking costs at $8/gal.
13-14%	>16%	
13-14%	15-16%	I assume $8 gasoline reflects increase in all fossil fuel prices, or at least includes diesel
9-10%	>16%	
11-12%	13-14%	Infrastructure is still the main barrier and, in this timeframe, cannot see how the Govt budget accommodates the relatively high expense of material expansion - my small growth rate is based on better optimisation of the current capacity
5-6%	7-8%	
11-12%	11-12%	
11-12%	11-12%	Policy is needed to move more shipments to rail mode.
11-12%	15-16%	
9-10%	13-14%	Delivery logistics out weigh increased fuel costs--still favoring trucking

11-12%	13-14%	This Q is difficult to understand - if 2007 rail levels = 10.7%, why does this show the 4 levels lower than 11-12%?
11-12%	13-14%	
11-12%	>16%	
15-16%	>16%	
11-12%	>16%	
>16%	>16%	Road congestion will lead to greater rail use.
11-12%	>16%	
11-12%	13-14%	The price of gasoline has nothing to do with shipping - this question should be looking at the price of diesel. We see fuel economy of trucks increasing, and shippers getting smarter about how trucks are used. As the fuel economy of trucks improves, and human behavior being what it is, people will continue to value speed and convenience over money. It would take a much higher price than $8/gallon to meaningfully change our goods transportation behavior and infrastrucutre.
7-8%	9-10%	
9-10%	9-10%	
13-14%	9-10%	
9-10%	>16%	
11-12%	>16%	
13-14%	>16%	
13-14%	>16%	
11-12%	13-14%	In addition to the change in fuel cost, a major investment would need to be made in rail in order for it to take on a higher share of commodity shipments, which is possible, but not likely in the next 20 years.
13-14%	>16%	
11-12%	>16%	
15-16%	>16%	
11-12%	15-16%	
11-12%	13-14%	
9-10%	>16%	I have no idea.
9-10%	11-12%	
9-10%	>16%	
11-12%	13-14%	It will be extremely difficult for rail to significantly expand its freight share. Existing rail systems are near capacity and it is extremely expensive to build new rail lines. Further, rail will never be competitive for shorter hauls, regardless of fuel price.
11-12%	15-16%	
9-10%	15-16%	
9-10%	11-12%	
11-12%	11-12%	
11-12%	13-14%	
9-10%	15-16%	
11-12%	13-14%	
5-6%	7-8%	
9-10%	9-10%	Don't see any reason for a mjor change. Societal changes will require more flexibility, not less. If gas goes up, so does rail cost.
13-14%	15-16%	Assuming $4.00 per gallon gasoline, I expect the rail share for commodity transport will be slightly higher than it is today (approximately 13-14%) due increased rail infrastructure and capacity in 2030 and increased road traffic. I expect the percentage to be higher (15-16%) under the $8 per gallon scenario because rail uses less diesel energy per ton-mi compared to truck transport.
15-16%	>16%	I sincerely hope that by 2030, the trucking industry will no longer operate on the backs of he workers, who misclassified as independent contractors, subsidizing the goods movement that

		should be paid by the corporations that are importing and moving goods in America. I predict a change in transport methods based on labor and air quality standards, and an increased reliance on rail as the price of diesel mirrors gasoline in this scenario.
>16%	>16%	

Question 4a/4b - VMT per capita

$4/gallon	$8/gallon	Question 4a/4b comments
9000	7000	discretionary vehicle use likely to decline under any fuel-cost scenario
12000	9000	Due to demand inelasticity, I would estimate not a significant impact to passenger VMT at doubled gas prices.
11500	7500	I would expect to see far greater consolidation of trips and adoption of car pooling or public transit at prices north of $8.
12000	10000	
6500	5500	Rising energy costs and numbers of people, together with less threatening trends (shifts in values and lifestyles) will cause these lines to peak and decline - hopefully by 2030.
15000	13000	
10000	9500	if vehicles are more efficient, then there will be little change at $8/gal
9800	9600	There is ample evidence that VMT growth rates/capita are levelling off due to structural/demographic changes (aging population, saturation of women's entry into workforce, slower growing economy than in past) and I believe this will continue, such that VMT/capita will flatline before 2030 under assumption of $4/gallon gas. $8/gallon gas will not have a significant dampening effect due to (a) higher CAFE standards producing more fuel efficient vehicles that offset higher fuel prices; and (b) the continuing extraordinary mobility advantages of personal auto travel.
10500	9500	At 8$/gal, people will increase use of alt fueled vehicles- however, the vast majority will simply drive less.
11000	9000	Mass trans options vs personal vehicles needs to look at the ease of travel options at either end of the "getting from A to B" process. Security, travel costs by air, size of group traveling and reason for travel need to be considered. Do wages or cost of living ratios change. Some travel is needed for work and day to day living, everything else is optional, so people choose optional travel based upon needs and desires of the family group. Might look at trends for core travel and optional travel to help do forecasts.
12000	10000	
8500	6500	
1000	7000	
10500	8500	
12000	10000	I expect this is leveling off. Fuel cost will have an impact but somewhat mitigated by improved mpg.
9000	7500	
9800	8500	Average personal vehicle efficiency will likely increase 50% between now and 2030, offsetting half of a fuel cost increase.
13000	10000	
10500	10000	Other factors, such as the economy, my have a greater impact on VMT than the price of gas.
9200	8000	with 8 dollar gas, leisure travel will be curtailed a bit. Efficiency will take place reducing VMT.
9000	8500	
8000	5500	

10000	8000	
10000	9000	
12000	10000	Congestion and cost of parking are two big factors in VMT that are omitted from your list of VMT factors.
10000	7500	
10000	8000	Heavily dependant on other policy factors including transportation funding, land-use decisions, and encouragement or discouragement of infill.
10000	5000	
11000	8200	
9000	5000	
15000	10000	
9000	8000	
12000	10000	
12000	10500	average vehicle efficiency will be much higher in 2030, offsetting some effects of $8 gasoline
8500	7500	Virtual office
8000	7000	
10000	9000	People will drive less to make their F150 trucks last longer given the plan to outlaw large vehicles.
9500	8000	there are a lot of wasted miles right now that would disappear even without land use changes. Hybrid vehicles will keep the VMT/cap from going too low.
12000	9000	
10500	10000	
12766	6766	
10000	8500	
10000	9000	At $8/gallon, people will start cutting out non-essential trips.
8000	6000	Local land use policies including vertical growth and increased commuter bus and rail lines will steal some VMT back from autos in the $4 case. In the $8 case, additional economic pressure will push people to live closer to high-density urban cores that discourage daily driving.
10000	7500	
9500	8000	
10000	9000	I think that people are moving towards urban environments and working closer to home. As gas prices increase, more workers will telecommute and vacation closer to home.
10000	7500	Only higher fuel prices will reduce VMT other than a recession (as happened in 2008).
10000	9700	Time budget is also a factor in VMT. There is only so much time in a person's day. Expect that 10,000 miles per capita is approaching saturation. If fuel prices double, then people will cut back.
10000	9700	
11500	11000	Gas price will not substantially affect this; demographics will.As Americans age, many will drive reduced miles.
10000	9000	VMT will not decrease as dramatically as some might expect at $8/gallon, particularly with CAFE standards now scheduled to increase to over 50 mpg.
10000	6000	
12000	10000	
11000	9000	
6000	5000	Some reduction expected, but not material - fundamental belief in a low price elasticty of demand - although it seems a HUGE rise for US motorists to $8/gallon, gasoline prices would still be below an EU norm; would need to rise much higher to have a significant impact
9000	7000	

9500	9200	
10000	9500	
7000	5000	
12500	10000	higher fuel price reduces VMT but advanced technology and higher fuel economy increases VMT
12000	11000	
10000	8000	
11900	10500	
11000	10000	With a congested system and a leveling of income per capita, VMT trends will be less than historical growth.
10000	9000	
9000	6000	I think road congestion and better development (and redevelopment) patterns will lead to a reduction in VMT
10000	9000	
9500	9000	The rate of car ownership may level off, in which case VMT/capita could also level off. This could be unrelated to fuel price, and be more of a function of urbanization and an aging population. People are going to go where they want to go, and the price of fuel only changes some travel decision at the margin.
10000	10000	
11000	10000	
9000	8000	
10000	20000	
8000	7000	
6000	4000	
12500	8000	
9000	7000	there is already a trend for people to move closer to work. Previous increases in VMT per capita had a lot to do with the increased speeds and efficiency in vehicles. As investment in transportation infrastructure stagnates, congestion will increase, which offsets the speed and time to travel certain distances. Price of gasoline is certainly a factor, but so is travel time. I think we have close to maxed out distance to work and it will begin to decline.
10000	7000	
10000	9000	
12000	10000	
10000	7500	
12000	12000	
12000	6000	
12000	10000	
10000	8000	
11000	10000	VMT is limited primarily by congestion and the value of a person's time. $4/gal will not affect future rises in VMT/capita and $8/gal will have only a moderate impact.
12000	9000	
12000	10000	
10000	9000	
11000	9500	
12000	11000	
10000	8000	
8000	6000	Laptops, Skype etc. will decrease the need for travel, but if gas stays at $4 after 20 years of

		inflation, more driving is encouraged.
11000	8000	For $4 per gallon gasoline, I expect the VMT to be modestly higher for 2030 than 2008, assuming that the upwards trend in VMT shown will continue to rise over time and plateau at some natural threshold around 11,000 – 12,000 VMT per capita. The threshold represents the average upper limit, beyond which the average utility derived from each additional VMT diminishes quickly. For the $8/gallon scenario I predict transport demand will decrease to approximately 8,000 VMT per capita.
10000	6000	Employment rate, economic growth, transportation prices beyond gasoline prices, demographics, land use, and individual preferences, and war are highly speculative.
10000	9000	

Question 5a/5b – Truck sales share

$4/gallon	$8/gallon	Question 5a/5b comments
31-40%	11-20%	Likely changes in US population demographics (decline in families with high incomes and two or more children), congestion/costs discourage investment in higher-cost vehicles
31-40%	11-20%	
31-40%	21-30%	I wouldn't expect much to change at $4 gas. In fact, since it looks like the Obama Administration is going to allow light trucks to meet less stringent fuel economy targets than cars, I can easily see automakers deliberately pushing truck sales to meet the targets. At $8, I don't think we'd see a large difference since LDV fuel economy will be substantially higher than today, effectively offsetting much of the increase in the cost of driving.
31-40%	11-20%	
21-30%	11-20%	
31-40%	21-30%	
21-30%	11-20%	
31-40%	21-30%	
31-40%	21-30%	$8 gas will trump "fashion" desire for large SUVs
41-50%	41-50%	Per the previous question comments. I think the use of trucks fall into use and needs of the family, not counting trucks that are business related, trucks allow for "Stuff" to be hauled around. As long as people gain more "stuff" and they travel with that "Stuff", then the truck/van transport option will hold its own no matter the costs of fuel. At the same time, the commute option where mass transportation options are minimal, will see an increase in small commute vehicles. Cost Effect Plug in hybrid trucks will sell well for the "Stuff" haulers, and those businesses that do a lot of local driving.
51-60%	41-50%	
21-30%	11-20%	
41-50%	21-30%	
31-40%	21-30%	
31-40%	21-30%	
41-50%	31-40%	
31-40%	21-30%	In the long run, more dependent upon regulatory treatment, which is what drove the large past increase, than fuel price. People will buy vehicles that meet their nees/wants.
31-40%	21-30%	
41-50%	31-40%	
31-40%	21-30%	The market will not be sustainable at 36% with higher fuel prices. There will always be a light truck market though.
31-40%	21-30%	

31-40%	11-20%	
31-40%	21-30%	
31-40%	31-40%	
51-60%	31-40%	
21-30%	11-20%	
31-40%	21-30%	Light trucks are expected to get substantially more efficient along with cars. Even at $8/gallon the cost of fuel as proportion of income in 2030 is likely to be modest for most middle/high income.
31-40%	21-30%	
41-50%	21-30%	automakers will continue to make more fuel efficient light duty trucks, helping to close the gap between car and light truck sales
31-40%	11-20%	The genuine market for light trucks is probably about 10-20% of the market. I would expect it to return under $8 gas scenario as people who don't need them, but like them, give them up for more efficient vehicles.
31-40%	11-20%	
41-50%	31-40%	
61-70%	41-50%	
41-50%	31-40%	part of EIA estimated drop may be because of EPA definitional changes in what constitutes a light truck. with unchanged definitions, I don't expect share to drop much with $4 gasoline, especially because car-based SUVs are getting quite efficient
41-50%	31-40%	Definition of light truck not clear, evolving New GHG standards favor trucks
31-40%	31-40%	
31-40%	21-30%	Hybrid technology (although actually not used for most miles driven) will enable the sale of large vehicles.
31-40%	21-30%	they will be hybrid, smaller, lightweight vehicles that look like trucks and still get worse mileage than cars
21-30%	11-20%	
31-40%	31-40%	Smaller ranges might make this question more interesting. Vehicle definitions are also changing, crossovers and small SUVs (alternative fuel powered) may become very common.
41-50%	11-20%	
31-40%	21-30%	
31-40%	21-30%	
31-40%	21-30%	Disparate vehicle regulations will encourage automakers to build car styles that provide most of the functionality of today's light trucks.
21-30%	11-20%	
31-40%	21-30%	
31-40%	21-30%	
41-50%	31-40%	Many light-truck configurations have become very functional, useful vehicles, which is why they are so popular.
51-60%	31-40%	With low fuel prices and higher CAFE standards, I expect people will resume their love affair with SUVs.
41-50%	21-30%	
41-50%	31-40%	Needs (cargo, work, towing, recreation, utility) will continue and these vehicles will also get more fuel efficient.
31-40%	21-30%	At $8/gallon, only those that truly need the size of a light duty truck/SUV will bother to pay the full cost of purchasing and operating such a vehicle. Plus, I think as the income gap widens, economy in vehicle purchases will increase.
21-30%	11-20%	
21-30%	21-30%	these vehicles are impractical for most people; fashion will change
31-40%	11-20%	

21-30%	11-20%	
31-40%	21-30%	
31-40%	21-30%	
31-40%	31-40%	
31-40%	21-30%	
31-40%	21-30%	LDT still required for commercial uses; improved fuel economy assumed for LDT so $8/gal not as big of impact
41-50%	31-40%	There's an increasing blur between light trucks & cars in the middle of the market - i.e., hard to classify. Only big trucks & small cars easy to identify. Ranges are not precise enough. Expect $4 LTV share to be 41-45 & $8 share to be 36-40%.
41-50%	31-40%	
41-50%	21-30%	
31-40%	21-30%	
31-40%	21-30%	
31-40%	21-30%	
31-40%	21-30%	
41-50%	41-50%	People will still demand utility and convenience. $8/gallon is not high enough to drive people away from trucks, considering the increasing fuel economy.
51-60%	41-50%	
41-50%	41-50%	
31-40%	21-30%	
41-50%	21-30%	
31-40%	31-40%	
11-20%	11-20%	
41-50%	21-30%	
31-40%	21-30%	
31-40%	21-30%	
41-50%	31-40%	
31-40%	31-40%	
31-40%	11-20%	
31-40%	31-40%	
41-50%	21-30%	New CAFE and GHG stds have loopholes that will push more models into LDT category
51-60%	41-50%	
31-40%	21-30%	
51-60%	51-60%	Vehicle size is driven primarily by per capita disposable income. The drop in vehicle size in 2008-9 was driven far more by the recession than by high fuel prices. As the economy recovers, customers will go back to demanding more utility, luxury, and features. Further, the CAFE and CO2 standards provide large incentives to reclassify cars as light trucks. Finally, efficiency improvements coming to all vehicles will make owning larger vehicles and light trucks far more practical, as mid-size SUVs will get 35 mpg, if not more.
41-50%	21-30%	
21-30%	11-20%	
31-40%	21-30%	
41-50%	31-40%	
21-30%	11-20%	
31-40%	21-30%	New federal CAFE and fleet CO2 agreement will have a large effect on this trend.
41-50%	31-40%	
31-40%	21-30%	I expect the share of trucks to be similar (31-40%) to the EIA projection for 2030 under the

		$4/gallon gasoline scenario. If gasoline is $8/gallon, I think the truck share will be slightly lower than in the $4/gallon case (26-34%).
41-50%	31-40%	
31-40%	31-40%	

Question 6a/6b - Fuel economy standards

Passenger Cars	Light-Duty Trucks	Question 6 comments
45	40	Do not believe passenger fleet mix will support average based on dominance of most-efficient smallest vehicles, difference between capability & reality will increase with congestion reducing real results
45	30	
56.5	40.6	Assuming $4 (2011$) gas, automakers will meet CAFE, presuming the law holds for the full period. I've assumed automakers will win a reduced increase of 3.5% annually for light trucks and will further win an overturning of the proposed 5% annual improvement in the latter years of the 2016-2025 CAFE regime. My estimates also assume gas prices remain at $4. I actually believe they will be far north of this and therefore all LDVs may greatly exceed CAFE targets.
65	45	
69	60	International standards drive car makers in a 'race to the top' and a shift in peoples' values and understanding of the impacts of driving.
54.2	42	
55	30	this is highly uncertain and depends on domestic politics
60	55	
60	58	Industry tends to outsript CAFE for ability to produce efficient cars.
65	55	Trucks are always going to be heavier than cars, especially the smaller cars. It is a "moving a mass" law of physics that gets in the way here. Start and stop actions of a truck will always use more energy than a smaller lighter car.
60	60	
50	40	
65	50	
60	45	
50	40	
52	42	
55	40	EPA-rated MPG, not on-road. An increase of 1.5-2% per year should be achievable with no change in weight/size/performance. A larger increase can be achieved by encouraging downsizing.
55	40	
56	56	
52	45	
54.5	41.5	
57	48	
52	44	
55	45	
60	40	
70	45	Assuming roughly 70 mpg for passenger cars and 45 mpg for light trucks, 80% sales for passenger cars and 20% sales for light trucks, average fuel economy will be roughly 65%.
65	50	Numbers are EPA test (not real-world) which will be much lower.

54.5	54.5	
65	45	
62	62	
65	40	
50	45	
56.2	56.2	
65	45	these are EPA values, not onroad...as are your figures. I'm not sure the 54 mpg standard will be met for 2025, but even if it is, credits will lower the ACTUAL fuel economy. My numbers are "actual" though EPA
62	42	
50	40	
54	40	
45	35	
55	35	
55	48	
60	45	
62	40	
64	42	
70	45	
54.5	45.5	
55	35	
56	43	I've assumed that the percentage difference in fuel economy between passenger car and light-duty trucks remains the same in 2030 when compared with current values.
42	30	There are technical limits to technology advances as well as cost concerns that will limit advances.
60	50	The price of a barrel of oil will be a major driver. We'll see if peak oil has an effect by 2030.
60	50	
42.5	30.5	
55	30	
56	56	This is dependent on the penetration of ZEVs or near ZEVs.
40	30	
50	38	
55	45	Reflecting Obama's recent "ponderings" on where CAFE standards ought to be heading
80	70	
45	35	
55	40	Although PHEVs and BEVs will increase market shares and FCEVs will start penetrating the market, costs will not allow a more massive deployment of all of these.
60	60	
56.2	40	large size P/U trucks will not be required to meet the high CAFE std
65	45	
60	42	Standards through 2025 (approximately) have now been negotiated and announced.
60	45	
65	50	
35	30	
50	40	
60	48	
65	50	This question should define the test mode - cafe is city/hwy unadjusted combined 55%/45%, with no air conditioning, etc. I think these targets are not so strenuous for the automakers to reach.
60	50	

66	44	
45	38	
65.5	50.5	This question premise needs to be amended to show that the new fuel economy standards are not just negotiated but agreed to by EPA/NHTSA, CARB and OEMs.
50	35	
60	35	
55	42	tested MPG, on-road will be different (lower)
55	30	
50	40	
65	50	
58	40	
60	60	
55	50	
54.5	54.5	Don't expect the 2025 standard to increase -- and could be weakened in mid-term review.
60	45	
65	55	
50	50	The figures show combined mpg, so that is what I put, above. Note that the 54.5 mpg number touted for 2025 is a fiction. After a wide assortment of credits are accounted for, the real CAFE number will be less than 45 mpg for 2025.
50	35	
60	35	
60	45	
55	45	Proposed CAFE std very optimistic and probably will be rolled back or stretched out.
56	46	
60	40	Make sure to clarify which number you are citing, and also ensure survey respondands cite comparable numbers. I am using "EPA certification test" numbers used in averaging the CAFE fleet. But "window sticker" numbers are lower, and "real world" numbers are even lower.
55	50	Goals have been achieved in the past and will be in the future.
50	40	
60	45.5	
62	50	

Question 7a – Biofuels in different modes ($4/gallon)

Air	Rail	Ship	LDV	Heavy Truck	Question 7a comments
<1%	<1%	<1%	1-10%	1-10%	Environmental costs, low energy density, high production costs mean an economy that can't afford high subsidies for biofuels won't have many biofuels
<1%	<1%	<1%	11-20%	1-10%	
1-10%	<1%	<1%	1-10%	1-10%	
1-10%	<1%	<1%	21-30%	11-20%	
11-20%	1-10%	31-40%	<1%	1-10%	Other resource constraints (land, water) restrict the potential for biofuels.
11-20%	21-30%	11-20%	41-50%	31-40%	
11-20%	<1%	11-20%	11-20%	11-20%	

41-50%	11-20%	21-30%	21-30%	21-30%	I think this is much harder to predict than the preceding questions. There is so much uncertainty about potential breakthroughs in the economics of biofuel production. Fuel cost and economics will drive the percentages.
1-10%	1-10%	1-10%	11-20%	21-30%	Biofuels will work best as an alt fuel for heavy trucks, ship, rail and air. Lit-duty vehicles will go electric. Ship engines and rail engines have a long life span, so they will "trun over" slowly. Air still needs to find a dense enough biofuel.
41-50%	41-50%	41-50%	41-50%	41-50%	By 2030 the alternative fuel technologies that focus on waste conversion vs diverting food to fuel will have made the transition to full industrial production levels. Domestic supplies not tied to external fuel prices will drive the costs down to a level that a profit can still be made with reduced international costs to do business. New planes, ships, train and trucks are now in use that only use bio fuels or natural gas related fuel stocks.
1-10%	1-10%	1-10%	31-40%	11-20%	
41-50%	1-10%	<1%	11-20%	1-10%	
1-10%	<1%	<1%	11-20%	<1%	
1-10%	1-10%	1-10%	11-20%	1-10%	
<1%	<1%	<1%	11-20%	1-10%	Biofuels are not competitive at $4/gallon.
11-20%	21-30%	1-10%	11-20%	21-30%	
<1%	<1%	<1%	11-20%	1-10%	LDVs - current limit of corn ethanol, combined with declining total LD fuel demand. Second-gen fuesl are far from "near-viability". HD - mandated biodiesel Air/rail/ship - not economically viable in spite of publicity statements.
1-10%	1-10%	1-10%	21-30%	1-10%	
1-10%	<1%	1-10%	1-10%	1-10%	
<1%	<1%	<1%	11-20%	<1%	
<1%	1-10%	1-10%	11-20%	11-20%	
1-10%	1-10%	<1%	<1%	<1%	
1-10%	1-10%	1-10%	21-30%	11-20%	
1-10%	1-10%	<1%	11-20%	1-10%	
<1%	<1%	<1%	11-20%	<1%	
1-10%	1-10%	1-10%	1-10%	1-10%	
11-20%	1-10%	1-10%	11-20%	11-20%	
<1%	<1%	1-10%	1-10%	1-10%	
<1%	1-10%	1-10%	1-10%	1-10%	
<1%	1-10%	1-10%	1-10%	1-10%	I am doubtful about the potential of biofuels at $4/gal gas.
11-20%	11-20%	11-20%	11-20%	11-20%	
31-40%	<1%	<1%	1-10%	11-20%	
<1%	1-10%	1-10%	11-20%	11-20%	
1-10%	<1%	<1%	1-10%	1-10%	this is anybody's guess.....depends on success of cellulosic ethanol projects
11-20%	1-10%	1-10%	1-10%	1-10%	
<1%	1-10%	<1%	11-20%	1-10%	
<1%	<1%	<1%	11-20%	1-10%	
<1%	<1%	<1%	1-10%	1-10%	
11-20%	1-10%	1-10%	11-20%	1-10%	

<1%	<1%	<1%	1-10%	1-10%	
31-40%	<1%	31-40%	11-20%	1-10%	
<1%	<1%	<1%	1-10%	1-10%	
1-10%	1-10%	1-10%	1-10%	1-10%	
21-30%	11-20%	11-20%	31-40%	21-30%	
1-10%	1-10%	1-10%	11-20%	1-10%	
21-30%	21-30%	21-30%	21-30%	21-30%	
<1%	1-10%	1-10%	11-20%	1-10%	Expect ship and rail to be closer to 1-2%, while trucks are close to 8-10%. LDVs may be about 15%.
<1%	<1%	<1%	1-10%	1-10%	
1-10%	11-20%	11-20%	11-20%	11-20%	
1-10%	1-10%	1-10%	11-20%	11-20%	
21-30%	1-10%	1-10%	1-10%	1-10%	
1-10%	<1%	<1%	11-20%	1-10%	biofuels will get more expensive and shrink to a niche (octane correction for LDV) under political pressure from food/feed/fiber and environmental concerns
1-10%	1-10%	1-10%	11-20%	1-10%	
<1%	<1%	<1%	11-20%	1-10%	There are technical barriers to material uses of biofuels in air - The needed cost incentive to persuade suppliers to divert from (lucrative) road transport to other uses would prohibit their use - marine needs to move away from very dirty bunker fuels to "clean hydrocarbons" before it is ready for biofuels - my opinion is that we need MORE in road transport, without its use being diverted to other transport applications, where simply efficiency is a more attractive abatement option
1-10%	<1%	<1%	41-50%	21-30%	
<1%	1-10%	<1%	1-10%	1-10%	
1-10%	<1%	<1%	1-10%	<1%	Airline industry will have to comply with international carbon emission rules
21-30%	1-10%	31-40%	21-30%	21-30%	
<1%	<1%	<1%	11-20%	1-10%	biodiesel only without substantial development of diesel fuels from bio sources. Ethanol continues to be mandated at 15% or more in gasoline.
1-10%	11-20%	11-20%	11-20%	21-30%	
1-10%	1-10%	1-10%	11-20%	1-10%	
1-10%	1-10%	1-10%	11-20%	1-10%	
11-20%	11-20%	11-20%	11-20%	11-20%	
1-10%	<1%	1-10%	11-20%	1-10%	
1-10%	11-20%	1-10%	11-20%	11-20%	
1-10%	1-10%	<1%	11-20%	11-20%	
11-20%	11-20%	11-20%	11-20%	11-20%	I think the amount of biofuel in the blend has nothing to do with the price of gasoline. It is political, not economic argument for biofuel in the blend.
1-10%	11-20%	11-20%	11-20%	11-20%	
<1%	<1%	<1%	11-20%	1-10%	
1-10%	1-10%	1-10%		1-10%	
					Disagree with the premise on the use of bio-based diesel.
1-10%	<1%	<1%	21-30%	1-10%	
21-30%	<1%	21-30%	1-10%	21-30%	
<1%	<1%	<1%	11-20%	1-10%	

1-10%	<1%	<1%	11-20%	1-10%	
1-10%	1-10%	1-10%	1-10%	1-10%	
<1%	<1%	<1%	1-10%	1-10%	
1-10%	1-10%	1-10%	21-30%	11-20%	
1-10%	<1%	1-10%	11-20%	11-20%	
<1%	<1%	<1%	1-10%	<1%	
<1%	<1%	<1%	1-10%	1-10%	
1-10%	1-10%	<1%	11-20%	11-20%	
1-10%	1-10%	1-10%	11-20%	1-10%	
11-20%	11-20%	11-20%	11-20%	11-20%	There has been little or no progress on genuine low carbon fuels, such as cellulose or algae, for the last decade and they are still many years away. Also, hopefully environmentalists and others will wake up and realize that food-based biofuels do not reduce carbon emissions, due to indirect land use impacts, and increase starvation worldwide by reducing the amount of food produced and raising food prices. There might be some future for genuine low carbon fuels post 2030.
<1%	<1%	<1%	11-20%	<1%	
1-10%	1-10%	1-10%	1-10%	1-10%	
1-10%	<1%	<1%	1-10%	1-10%	
1-10%	<1%	<1%	1-10%	1-10%	
1-10%	1-10%	1-10%	11-20%	1-10%	
21-30%	<1%	1-10%	31-40%	41-50%	I assume "$8/gallon" means oil prices are rising generally, which affects jet and diesel fuel (fuels much more prevalent in aviation and HDVs).
31-40%	1-10%	1-10%	1-10%	1-10%	Biofuels are a bad idea for a variety of reasons and will be discredited. Algae might be the exception but hasn't been developed. Air travel is the probably exception.
1-10%	1-10%	<1%	11-20%	1-10%	For $4/gallon gasoline, the air and rail biofuel shares will be relatively low, because biofuels that meet ASTM standards for jet fuel are difficult to produce and because rail uses diesel fuel and fewer options exist for diesel engines than gasoline engines. Ships will use an insignificant quantity of biofuel because ships use bunker fuel, the cheapest and nastiest fuel available, and regulations requiring ships to use biofuel are nonexistent today and unlikely in the future. Approximately 11-20% of fuel used in the light duty vehicles will be biofuel, primarily due to the RFS2 and the CA LCFS (to a lesser extent). Approximately 10% of fuel used in trucks will be biofuel, a significant volume, but less than the share of fuel in light duty vehicles.
1-10%	1-10%	<1%	11-20%	1-10%	I think bio-fuels will get slightly cheaper and burn cleaner therefore be easier to get through environmental permitting.
11-20%	11-20%	11-20%	11-20%	11-20%	

Question 7b – Biofuels in different modes ($8/gallon)

Air	Rail	Ship	LDV	Heavy Truck	Question 7b comments
1-10%	<1%	<1%	11-20%	11-20%	Same as previous, any increase driven by politically motivated subsidies, not by ability of biofuels to compete in market even at higher gasoline costs
1-10%	1-10%	1-10%	21-30%	11-20%	
11-20%	1-10%	1-10%	11-20%	11-20%	

1-10%	<1%	<1%	21-30%	21-30%	
21-30%	1-10%	>50%	1-10%	11-20%	
11-20%	21-30%	11-20%	>50%	41-50%	
21-30%	<1%	21-30%	11-20%	11-20%	
>50%	21-30%	21-30%	31-40%	31-40%	
1-10%	11-20%	11-20%	21-30%	31-40%	Same as above - just pushed further out.
>50%	>50%	>50%	>50%	>50%	See above comments for $4/gallon, and when the biofuel/natural gas based products production levels become common from domestic sources, the $8/gallon normalized costs may not ever become a reality. Example, Natural Gas costs are not tied to the international market prices.
1-10%	1-10%	1-10%	41-50%	11-20%	
>50%	1-10%	<1%	21-30%	1-10%	
21-30%	1-10%	1-10%	21-30%	1-10%	heavy-duty vehicles will convert to natural gas which will remain cheap relative to diesel.
11-20%	11-20%	11-20%	11-20%	11-20%	
1-10%	1-10%	<1%	21-30%	11-20%	
21-30%	31-40%	11-20%	21-30%	31-40%	
<1%	<1%	<1%	21-30%	11-20%	Some cellulosic ethanol and soy biodiesel becomes economic at higher fuel prices,but soy volume limited as crop demand increases.
1-10%	1-10%	1-10%	21-30%	1-10%	
1-10%	1-10%	1-10%	1-10%	1-10%	
1-10%	1-10%	1-10%	11-20%	1-10%	alternative are affordable at 8.00 price Supply constraints
1-10%	11-20%	11-20%	11-20%	11-20%	
21-30%	<1%	<1%	11-20%	41-50%	
11-20%	11-20%	11-20%	21-30%	11-20%	
1-10%	1-10%	<1%	11-20%	1-10%	
1-10%	<1%	<1%	11-20%	1-10%	
11-20%	11-20%	11-20%	1-10%	11-20%	
21-30%	1-10%	11-20%	11-20%	21-30%	Assumes high-potential for 'drop-in' fuels
1-10%	<1%	1-10%	11-20%	1-10%	
<1%	1-10%	1-10%	11-20%	11-20%	
<1%	1-10%	1-10%	11-20%	1-10%	
31-40%	31-40%	31-40%	31-40%	31-40%	
31-40%	1-10%	1-10%	21-30%	21-30%	
1-10%	11-20%	11-20%	21-30%	21-30%	
11-20%	<1%	<1%	11-20%	1-10%	
11-20%	1-10%	1-10%	11-20%	11-20%	
1-10%	1-10%	1-10%	1-10%	1-10%	
1-10%	1-10%	1-10%	21-30%	1-10%	Infrastructure costs and barriers, low energy content, performance issues and feedstock constraints will cap the biofuels market unless miracles happen.
<1%	<1%	<1%	11-20%	1-10%	
<1%	<1%	<1%	11-20%	11-20%	
11-20%	1-10%	1-10%	21-30%	11-20%	
1-10%	1-10%	1-10%	11-20%	11-20%	
41-50%	<1%	31-40%	1-10%	1-10%	
1-10%	1-10%	<1%	11-20%	21-30%	
1-10%	1-10%	1-10%	1-10%	1-10%	I'm guessing that the industry will move towards electrification rather than biofuels as a carbon mitigation strategy.
31-40%	21-30%	21-30%	41-50%	31-40%	

1-10%	1-10%	1-10%	11-20%	1-10%	
21-30%	21-30%	21-30%	21-30%	21-30%	
<1%	1-10%	1-10%	21-30%	11-20%	Rail and ship may move up to about 5%; HDV to about 15% and LDVs to 25%
1-10%	1-10%	<1%	11-20%	11-20%	
11-20%	31-40%	31-40%	21-30%	31-40%	I believe there is more likely a chance for commercial fuels to take this course.
11-20%	11-20%	11-20%	21-30%	21-30%	
31-40%	11-20%	11-20%	11-20%	11-20%	
1-10%	<1%	<1%	11-20%	1-10%	same arguments apply
11-20%	11-20%	11-20%	11-20%	11-20%	
<1%	<1%	<1%	21-30%	11-20%	See logic above as to why will not be more biofuels in non-road transport uses, regardless of prices - in fact, higher gasoline prices will RAISE the value of biofuels in road transport further, thus stopping substitute uses - It is still a HUGE issue to address the "blend wall" issue in LDVs and HDVs before trying to substitute biofuels' use elsewhere
11-20%	<1%	<1%	>50%	21-30%	
<1%	1-10%	<1%	1-10%	1-10%	
1-10%	1-10%	<1%	1-10%	1-10%	
21-30%	11-20%	31-40%	31-40%	31-40%	
<1%	<1%	<1%	11-20%	1-10%	same as above no break through technologies for diesel fuels. Penetration is mandated based not price based.
11-20%	11-20%	11-20%	11-20%	21-30%	Ought to keep the terminology the same.
11-20%	11-20%	11-20%	21-30%	11-20%	
11-20%	11-20%	1-10%	21-30%	11-20%	
11-20%	11-20%	11-20%	11-20%	11-20%	
1-10%	<1%	1-10%	11-20%	11-20%	
1-10%	21-30%	1-10%	11-20%	21-30%	
11-20%	11-20%	<1%	21-30%	11-20%	
11-20%	11-20%	11-20%	11-20%	11-20%	I think the amount of biofuel in the blend has nothing to do with the price of gasoline. It is political, not economic argument for biofuel in the blend.
1-10%	21-30%	21-30%	11-20%	21-30%	
<1%	<1%	<1%	11-20%	1-10%	
11-20%	1-10%	1-10%	1-10%	11-20%	
<1%	<1%	<1%	<1%	<1%	Same as above.
11-20%	1-10%	<1%	41-50%	11-20%	
21-30%	<1%	21-30%	<1%	11-20%	
<1%	<1%	<1%	21-30%	11-20%	
1-10%	<1%	<1%	21-30%	11-20%	
1-10%	11-20%	11-20%	11-20%	11-20%	
1-10%	1-10%	1-10%	11-20%	11-20%	
1-10%	1-10%	1-10%	31-40%	11-20%	
1-10%	<1%	1-10%	21-30%	21-30%	
<1%	<1%	<1%	1-10%	<1%	
<1%	<1%	<1%	1-10%	1-10%	
1-10%	11-20%	<1%	21-30%	21-30%	
11-20%	11-20%	11-20%	21-30%	11-20%	

11-20%	11-20%	11-20%	11-20%	11-20%	Nonsense question. Large quantities of biofuels will drive down the price of gasoline.
1-10%	1-10%	1-10%	21-30%	1-10%	High oil prices probably mean high commodity prices and high biofuel prices. This will limit the increase in biofuel use that might have otherwise occured.
1-10%	1-10%	1-10%	11-20%	11-20%	
11-20%	<1%	<1%	1-10%	11-20%	
11-20%	1-10%	<1%	11-20%	1-10%	
1-10%	1-10%	1-10%	11-20%	11-20%	
31-40%	<1%	1-10%	31-40%	>50%	
31-40%	1-10%	1-10%	1-10%	1-10%	Don't think gas price is a significant factor here.
1-10%	1-10%	<1%	21-30%	11-20%	Similar to previous scenario, but with higher shares for LDVs and HDVs.
1-10%	1-10%	<1%	31-40%	21-30%	
11-20%	11-20%	11-20%	11-20%	11-20%	

APPENDIX B: Round Two Responses

Question 1a – Alt. fuel vehicles ($4/gallon)

Survey	NG	BEV	PHEV	Hybrid	FFV	H2	1a comments
online	16 - 20%	6 - 10%	< 1%	< 1%	< 1%	6 - 10%	
online	>25%	1 - 5%	< 1%	1 - 5%	< 1%	1 - 5%	inability to subsidize will turn mandates towards most cost-effective technologies
online	1 - 5%	< 1%	< 1%	< 1%	< 1%	< 1%	
online	16 - 20%	6 - 10%	1 - 5%	< 1%	< 1%	16 - 20%	
online	>25%	< 1%	< 1%	< 1%	< 1%	6 - 10%	Hybrids will capture 60-75% of the market by 2030.
online	6 - 10%	1 - 5%	< 1%	< 1%	< 1%	1 - 5%	
online	>25%	1 - 5%	1 - 5%	< 1%	< 1%	1 - 5%	$4 gasoline means that no alternative technology/fuel makes economic sense. The only reason any of these are above 1% is because of CAFE, and HEVs are the most economical way to meet higher standards.
online	>25%	1 - 5%	1 - 5%	< 1%	< 1%	>25%	Hybrid vehicles provide the only clear value proposition here.....natural gas and fuel cell vehicles require too much infrastructure to succeed at $4 gasoline.
online	16 - 20%	16 - 20%	11 - 15%	6 - 10%	1 - 5%	6 - 10%	
online	6 - 10%	6 - 10%	1 - 5%	< 1%	1 - 5%	11 - 15%	
online	16 - 20%	1 - 5%	< 1%	< 1%	< 1%	16 - 20%	
online	16 - 20%	6 - 10%	1 - 5%	1 - 5%	1 - 5%	16 - 20%	I suppose I will side with the experts and authorities, despite the risks in doing so.
online	>25%	21 - 25%	1 - 5%	< 1%	16 - 20%	< 1%	
Asilomar	10	5	3	1	1	3	
Asilomar	15	10	5	2	2	15	
Asilomar	25	5	5	1	1	20	
Asilomar	40	20	10	0	0.5	40	
Asilomar	6	4	2	2	1	10	
Asilomar	30	10	5	<1%	<1%	50	
Asilomar	20	25	10	2	5	20	
Asilomar	5	2	1	0	2	8	
Asilomar	20	20	1	<1%	10	3	
Asilomar	15	10	5	0	0	15	

Question 1b – Alt. fuel vehicles ($8/gallon)

Survey	NG	BEV	PHEV	Hybrid	FFV	H2	Question 1b comments
online	>25%	11-15%	<1%	<1%	<1%	16-20%	
online	>25%	1-5%	<1%	1-5%	<1%	1-5%	
online	11-15%	1-5%	1-5%	1-5%	1-5%	1-5%	
online	21-25%	6-10%	1-5%	<1%	1-5%	16-20%	
online	>25%	<1%	<1%	<1%	<1%	6-10%	Fuel prices will not be consistently at $8 per gallon. That's at least $250 per barrel. Far too many fuels are profitable at far less than $250 per barrel.
online	16-20%	1-5%	<1%	<1%	<1%	1-5%	
online	>25%	6-10%	11-15%	1-5%	1-5%	>25%	HFCVs are the most promising option for deep reductions in oil use and CO2 emissions, but they will only penetrate the market if projected improvements in technology/costs take place and the government maintains considerable support to get them thru the valley of death. Not at all certain that these will happen. Other options also depend on assumptions, but not to the same degree.
online	>25%	11-15%	1-5%	1-5%	<1%	>25%	
online	21-25%	21-25%	11-15%	11-15%	6-10%	11-15%	
online	11-15%	11-15%	1-5%	<1%	6-10%	16-20%	
online	21-25%	6-10%	1-5%	<1%	<1%	>25%	
online	16-20%	11-15%	6-10%	1-5%	1-5%	16-20%	
online	>25%	>25%	6-10%	<1%	21-25%	6-10%	
Asilomar	30	20	6	2	3	5	
Asilomar	20	15	10	4	4	20	
Asilomar	30	10	10	2	5	30	
Asilomar	50	25	12	0	0.5	50	
Asilomar	16	10	6	5	3	10	
Asilomar	45	20	10	2	2	20	
Asilomar	15	40	15	4	10	25	
Asilomar	35	20	15	1	2	8	
Asilomar	40	40	2	1	20	6	
Asilomar	20	20	10	0	0	15	

Question 2a/2b – Highspeed rail

Survey	$4/gallon	$8/gallon	Question 2a/b Comments
online	<1%	1-3%	
online	1-3%	1-3%	highspeed rail prohibitively costly in most US regions
online	<1%	1-3%	
online	<1%	1-3%	

online	<1%	<1%	Investment is just too high.
online	<1%	<1%	High speed passenger rail is a waste of money.
online	<1%	1-3%	
online	<1%	1-3%	trips primarily in the northeast corridor...but price and availability continues to be a hangup
online	7-9%	10-12%	
online	<1%	1-3%	The issue is not demand, but supply. NIMBY will rule.
online	<1%	1-3%	
online	13-15%	>15%	On this, however, I have a stronger opinion considering the rapidly declining affordability (as well as shift in social consciousness) of plane travel (and subsequent mode shift to high-speed rail). But this is a hopeful prediction.
online	1-3%	7-9%	
Asilomar	<1%	<1%	
Asilomar	1	3	
Asilomar	1	2	
Asilomar	<1%	<1%	
Asilomar	3	6	
Asilomar	<10%	<10%	requires long range planning - price of gas will not impact HSR
Asilomar	2	3	
Asilomar	2	25	
Asilomar	<1%	1	in some location it will work but to make it work needs access supersized parking facilities and/or supporting land use policies and local transit system that collect and feed into the HSR system that support system is not being….
Asilomar	<1%	1	

Question 3a/3b – Rail freight

Survey	$4/gallon	$8/gallon	Question 3a/3b comments
online	11-12%	15-16%	
online	11-12%	7-8%	diminished coal profits will force rails to price-compete
online	11-12%	13-14%	
online	9-10%	13-14%	
online	9-10%	11-12%	
online	9-10%	11-12%	
online	9-10%	13-14%	
online	9-10%	11-12%	rail is too slow, and freight trucks will get much more efficient, so fuel costs won't be prohibitive
online	9-10%	>16%	
online	9-10%	11-12%	
online	9-10%	13-14%	
online	15-16%	>16%	Better logistics, information technology
online	5-6%	>16%	
Asilomar	10	15	
Asilomar	12	15	
Asilomar	15	20	
Asilomar	10	10	
Asilomar	10	15	
Asilomar	5	8	

Asilomar	11	13	
Asilomar	11	20	
Asilomar	11	13	
Asilomar	10	15	

Question 4a/4b – VMT per capita

Survey	$4/gallon	$8/gallon	Question 4a/4b comments
online	10000	9000	
online	10000	8000	
online	10000	8700	
online	9500	8000	
online	12000	11000	No reason for the annual increase in per capita VMT to decline significantly.
online	10000	9000	
online	10000	8000	Significant potential for VMT reduction but depends on the state of the economy and federal/state/local policy. Also, autonomous vehicles could actually increase VMT if people are willing to commute longer distances.
online	10500	9000	
online	10000	7500	
online	10000	9000	
online	9750	8500	
online	9000	7000	
online	12000	11000	
Asilomar	10000	9000	
Asilomar	10000	8000	
Asilomar	9000	8000	
Asilomar	10000	8500	
Asilomar	12000	11000	
Asilomar	7000	6000	
Asilomar	12000	11000	
Asilomar	11500	6500	to maintain fuel budge, MPG must double in new vehicle. This assumes constant vehicle price, but alt. vehicle will cost more so improvement must be greater than 2x in this scenario.
Asilomar	11000	8000	
Asilomar	12000	10000	

Question 5a/5b – Truck sales share

Survey	$4/gallon	$8/gallon	Question 5a/5b comments
online	41-50%	31-40%	
online	31-40%	21-30%	
online	31-40%	21-30%	
online	41-50%	31-40%	
online	51-60%	41-50%	Drop in light truck market share was caused as much by the recession as by rising fuel prices. The light truck market will recover and continue to grow as vehicles, overall, become more efficient (the cost of driving a mile with $8 per

			gallon and a fleet average of 70 mpg is less than $3 per gallon and a fleet average of 25).
online	31-40%	41-50%	
online	41-50%	31-40%	
online	31-40%	21-30%	
online			
online	41-50%	31-40%	
online	31-40%	21-30%	
online	31-40%	21-30%	I'm no expert!
online	41-50%	31-40%	
Asilomar	30	35	
Asilomar	40	25	
Asilomar	60	50	
Asilomar	30	20	
Asilomar	40	35	
Asilomar	20	15	
Asilomar	50	40	
Asilomar	35	20	
Asilomar	50	40	
Asilomar	50	25	

Question 6a/6b – Fuel economy standards

Survey	Passenger Cars	Light-Duty Trucks	Question 6 comments
online			
online	50	40	
online	53	36	
online	55	45	
online	70	50	
online	50	40	
online	50	45	CAFE standards likely to be modified to meet reality if $4 gasoline holds. For $8, some of the non-oil options will look reasonable. However, also have to consider that oil prices will respond to demand; if US and other countries greatly reduce demand, price will stay low.
online	65	48	current 2025 standards provide some loopholes, so 50+ mpg average may not be quite that much....but I expect attainment and continued improvement, with lots of hybrids in the fleet
online		45	
online	50	42	
online	55	40	
online	56	45	
online	55	40	
Asilomar	60	40	
Asilomar	59	38	
Asilomar	40	30	
Asilomar	60	45	

Asilomar	40	35	
Asilomar	60	50	
Asilomar	56	45	
Asilomar	50	36	
Asilomar	50	50	
Asilomar	60	50	

Question 7a – Biofuels in different modes ($4/gallon)

Survey	Air	Rail	Ship	LDV	Heavy Truck	Question 7a comments
online	<1%	<1%	<1%	<1%	<1%	
online	<1%	<1%	<1%	11-20%	1-10%	
online	1-10%	<1%	<1%	1-10%	<1%	
online	<1%	1-10%	1-10%	11-20%	11-20%	
online	1-10%	1-10%	1-10%	1-10%	1-10%	
online	<1%	<1%	<1%	11-20%	1-10%	
online				1-10%	1-10%	
online	1-10%	1-10%	1-10%	11-20%	1-10%	real possibility that cellulosic will not become competitive at $4 gasoline
online	1-10%	11-20%	11-20%	11-20%	11-20%	
online	1-10%	1-10%	1-10%	11-20%	11-20%	
online	1-10%	<1%	<1%	1-10%	1-10%	
online	1-10%	1-10%	1-10%	11-20%	11-20%	I'll side with the experts again, and with a somewhat more optimistic view toward biofuels.
online	11-20%	1-10%	<1%	21-30%	11-20%	
Asilomar	5	5	4	8	5	
Asilomar	10	10	10	15	15	
Asilomar	1	1	0	10	2	
Asilomar	20	10	20	20	20	
Asilomar	8	10	5	10	10	
Asilomar	20	20	25	15	25	
Asilomar	5	4	13	17	20	
Asilomar	1	5	5	5	5	
Asilomar	10	10	10	10	10	
Asilomar	20	20	5	20	20	

Question 7b – Biofuels in different modes ($8/gallon)

Survey	Air	Rail	Ship	LDV	Heavy Truck	Question 7b comments
online	<1%	<1%	<1%	<1%	<1%	
online	<1%	<1%	<1%	11-20%	1-10%	
online	1-10%	<1%	<1%	1-10%	<1%	
online	1-10%	1-10%	1-10%	11-20%	11-20%	

online	11-20%	1-10%	1-10%	1-10%	1-10%	
online	<1%	1-10%	1-10%	11-20%	1-10%	
online	1-10%	1-10%	1-10%	11-20%	11-20%	
online	11-20%	1-10%	1-10%	21-30%	11-20%	
online	11-20%	11-20%	11-20%	11-20%	11-20%	
online	11-20%	1-10%	1-10%	21-30%	21-30%	
online	11-20%	1-10%	<1%	11-20%	11-20%	
online	1-10%	1-10%	11-20%	11-20%	21-30%	In fact, this follow-up survey is more interesting from the point of view of being able to see the distribution of experts' previous responses. I don't have any great confidence in my own former stances, but it is enlightening to compare them with the revealed opinions of others.
online	11-20%	1-10%	1-10%	41-50%	11-20%	
Asilomar	10	10	5	15	10	
Asilomar	15	15	15	20	20	
Asilomar	1	1	0	10	2	
Asilomar	20	10	20	20	20	
Asilomar	12	15	7	15	15	
Asilomar	30	30	40	25	40	
Asilomar	6	6	15	20	20	
Asilomar	2	10	10	10	10	
Asilomar	15	15	15	15	15	
Asilomar	40	40	5	40	40	

APPENDIX C: Questionnaire

Instructions

In the following pages you will be asked seven questions about US transportation in the year 2030. You will be provided with brief background information before each question and asked to make predictions assuming the price of gasoline is $4/gallon and $8/gallon (in $2011). Use the other assumptions provided below.

Assumptions

- Gas prices follow similar patterns of spikes and stasis to those in 2000-2010
- No domestic or international carbon policy such as cap and trade is in place by 2030
- Clean energy subsidies and federal energy mandates terminate in their final year without renewal unless otherwise specified. This includes the RFS II, ethanol blender's credits, and ethanol import tariff.
- Federal agencies like the EPA, DOE, NSF are funded at historical levels.
- The US economy continues to grow at a slow but steady rate (assume 2-3% GDP growth per year).
- Natural gas, ethanol, hydrogen, and electricity costs increase at historical growth rates.

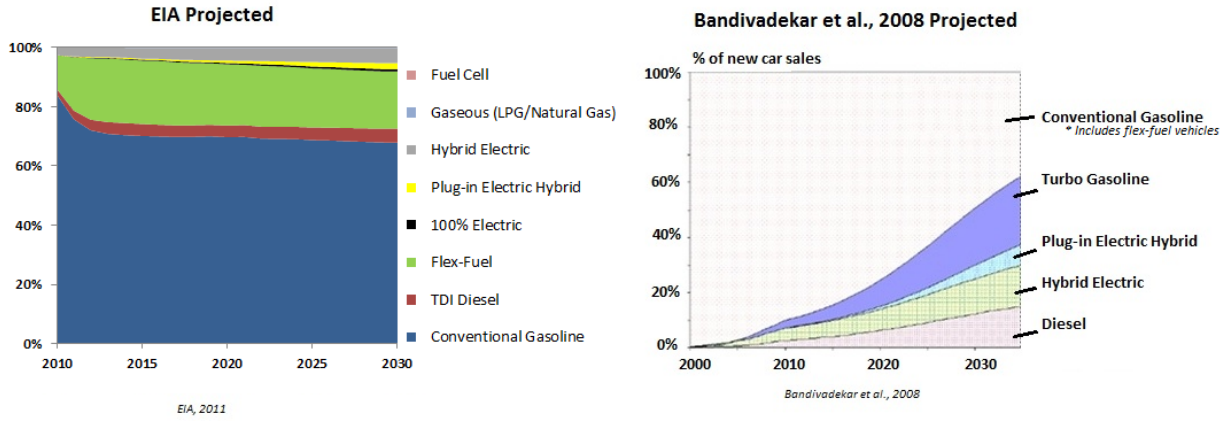
This questionnaire was used in both rounds of the Delphi survey. In the Round Two, the respondent was also given the results from the first round. For each question, we attempted to provide a small amount of information about what others had forecasted for the year 2030. Question 6 (fuel economy standards) has potentially biased responses because after the survey invitation was emailed, the Obama Administration announced new fuel economy and emission standards out to 2025. Thus, some respondents likely new about the new standards and other did not.

Question 1: Alternative fuels Penetration in 2030

Background provided to respondent:

The rate at which alternative fuel vehicles will penetrate the US light-duty vehicle fleet in coming years is an open question. The EIA's Annual Energy Outlook (AEO) Reference Scenario (EIA, 2011) predicts that alternative fuel vehicles (mostly hybrid electric and plug-in hybrid electric) will account for 7% of new light-duty vehicles

sales by 2030, or 27% when including flex-fuel vehicles. However, Bandivadekar et al. (2008) note that the EIA's penetration rates of alternative fuels are typically conservative. In their study On the Road in 2035, the authors contend that hybrid electric and plug-in hybrid electric vehicles alone will account for 20% of new light-duty vehicle sales in 2030. Both forecasts predict that natural gas, 100% electric, and fuel cell vehicles will each account for <1% of new light-duty vehicles in 2030.



Question 1a: Estimate share of new vehicle sales in 2030 in the US for the following for $4/gallon gas ($2011): natural gas, fuel cell, battery electric, plug-in hybrid electric, flex fuel vehicle, hybrid.

Question 1b: Estimate share of new vehicle sales in 2030 in the US for the following for $8/gallon gas ($2011): natural gas, fuel cell, battery electric, plug-in hybrid electric, flex fuel vehicle, hybrid.

Question 2: Share of Medium Distance Trips by HSR

Background provided to respondent: In the US, trips of 100 – 600 mi are taken mostly by car or air, with 92% passenger-mi traveled by car and 8% by air in 2008 (Kosinski et al., 2011). High-speed rail could be competitive with air for intercity trips of these distances in the future if costs and door-to-door travel times are comparable. High speed rail has been proposed in the US starting with major travel corridors (shown below). By 2025, the Obama Administration wants 80% of Americans to have access to high speed rail (access is defined as living within 30 miles of a high speed rail connection point).

Question 2a: Estimate share of trips between 100-600 by high-speed rail in 2030 for $4/gallon gas in $2011 (%)

Question 2b: Estimate share of trips between 100-600 by high-speed rail in 2030 for $8/gallon gas in $2011 (%)

Question 3: Freight Rail

Background provided to respondent: In the US most interstate freight is moved by truck and rail. While rail does not provide the same point-to-point access that trucks provide, many commodities are shipped increasingly by a combination of truck and rail. This has been due in part to the increasing use of shipping containers as well as due to removing infrastructure and logistical barriers to transferring containers between rail and trucks (and ships).

Most commodities can be moved using less energy by rail or a combination of rail and truck than by truck alone. Indeed, coal, non-metallic minerals, and metallic ores are not economical to move by truck. Of commodities excluding coal, minerals, and ore, amounts shipped in ton-miles by truck and by rail in recent years are listed below.

Commodities shipped (10^9 ton-mi) by mode (excluding coal, non-metallic minerals, metallic ores)

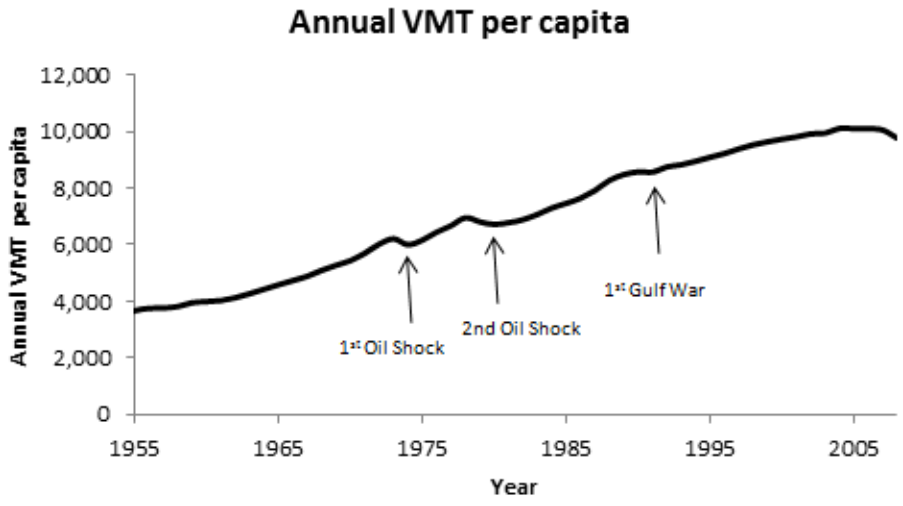
	1993	%	1997	%	2001	%	2007	%
Truck	4,732,000	84.8%	7,302,000	89.7%	7,545,000	88.3%	8,353,000	89.5%
Rail	848,000	15.2%	839,000	10.3%	1,001,000	11.7%	978,000	10.5%

Question 3a: Of commodities that could be feasibly shipped by truck or rail (commodities other than coal, non-metallic minerals, metallic ores), what fraction (in ton-miles) will be shipped by rail (versus truck) in 2030 for $4/gallon gasoline in $2011 (%)

Question 3b: Of commodities that could be feasibly shipped by truck or rail (commodities other than coal, non-metallic minerals, metallic ores), what fraction (in ton-miles) will be shipped by rail (versus truck) in 2030 for $8/gallon gasoline in $2011 (%)

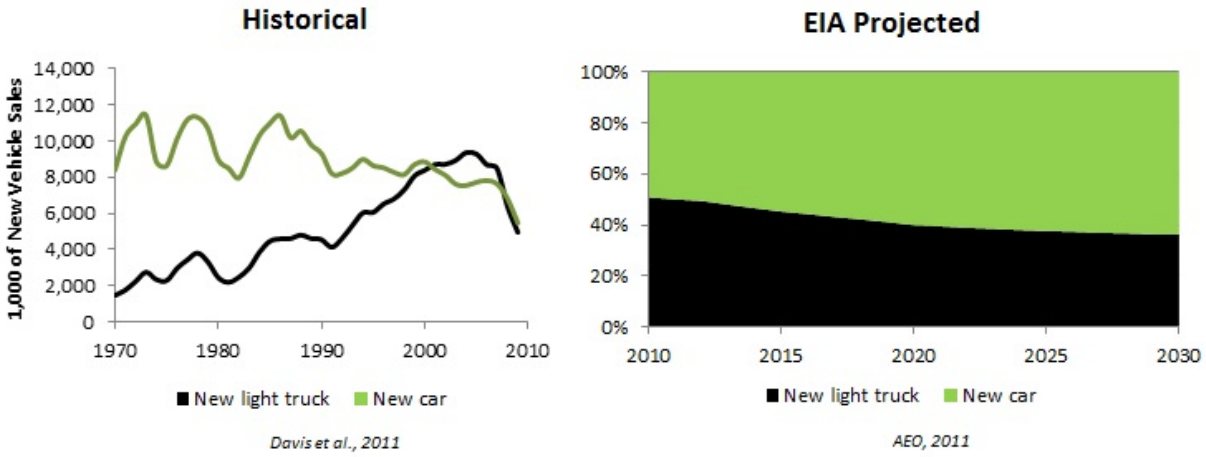
Question 4: VMT per Capita

Background provided to respondent: In 2008, annual vehicle miles traveled (VMT) per capita decreased from the previous year for the first time since 1990-1991 (see graph). Other travel demand indicators also fell in 2008 including the average annual VMT for work trips and the total number of trips per household (Davis et al., 2011). VMT is affected by population size, employment rate, economic growth, transportation prices, demographics, land use, and individual preferences. In 2008, the annual VMT per capita was 9,766 miles.



Question 5: Cars vs. Trucks

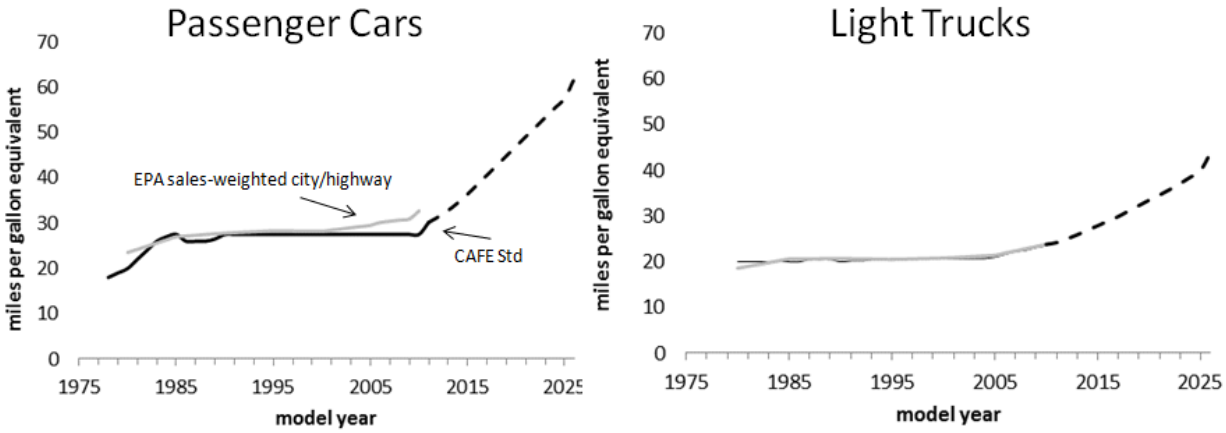
Background provided to respondent: Light-duty trucks (including pickups, vans, and sports-utilities) became enormously popular in the 1990s but experienced a two-year decline in sales in 2008-2009. Most people believe the decline was tied to rising fuel prices in the US. The EIA's AEO Reference Scenario predicts that 36% of new vehicles in 2030 will be light trucks.



Question 6: Fuel Economy Standards

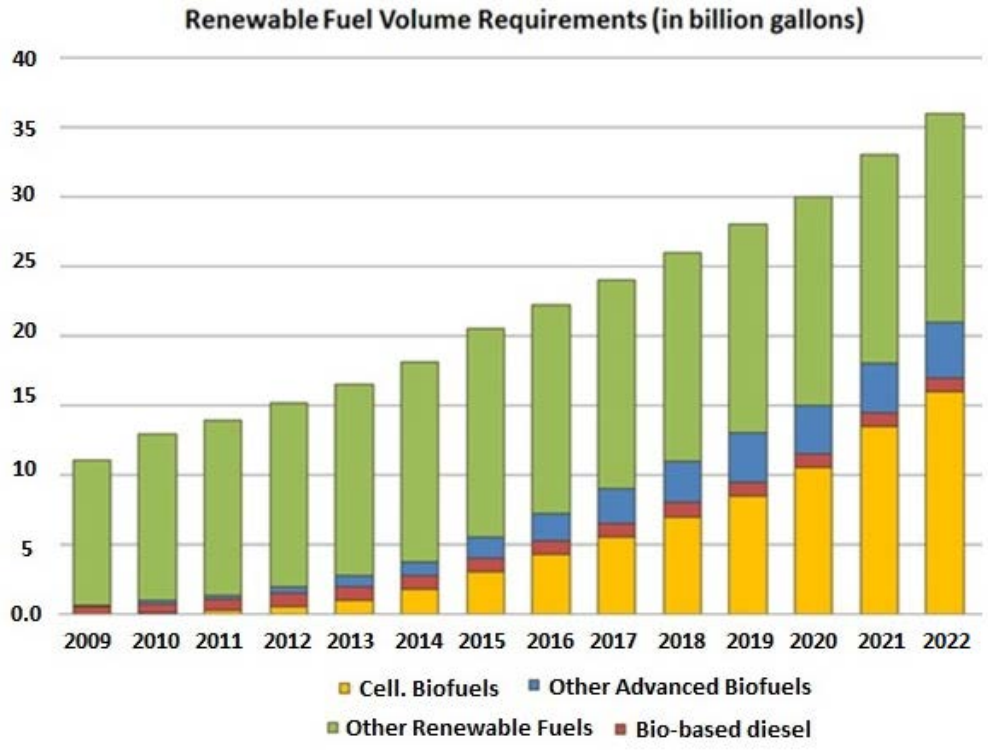
Background provided to respondent: In June 2011, the Obama Administration announced new fuel economy and GHG standards for passenger cars and light trucks out to the year 2025. The graphs below show the MPG targets.

Note: The announcement about new standards to 2025 was made a few days after posting this question in the first online survey. Thus, some respondents were aware of the announcement and others were not. We have also changed the verbiage in the question from "estimate the average fuel economy...." to "estimate the EPA sales-weight (unadjusted) city/highway fuel economy..." because respondents were confused if we meant real-world fuel economy or EPA fuel economy.



Question 7: Biofuels in Transportation

Background provided to respondent: Biofuels offer an alternative to petroleum-based fuels, but they face cost, quality, and supply challenges. Whether the US will reach the mandated 36 billion gallons of biofuel by 2022 as required by the Energy and Independence and Security Act of 2007 is an open question. Certainly, advanced biofuels like lignocellulosic ethanol have failed to meet production goals in each year of the mandate. Furthermore, the US Congress is considering reducing or eliminating the long-established ethanol blender's credit and import tariff, which will likely increase costs to blenders.



APPENDIX D: Invitation Letter for Round One

Dear Mr. Colleague:

Argonne National Laboratory (ANL) is interested in your expert opinion on the future of the U.S. transportation system. We request your participation in a Delphi survey we are conducting with attendees of the Asilomar Conference on Transportation and Energy. Participants of the Delphi survey will include experts in industry, academia, and the research community.

The Delphi survey is part of a larger study called the Transportation Energy Futures (TEF) study run by ANL and the National Renewable Energy Laboratory (NREL) which hopes to better understand the uncertainties and barriers faced in the U.S. transportation sector in the next 20 years. Results from the TEF study will inform DOE decision makers about programs and policies that could result in large reductions of petroleum use and GHG emissions.

This Delphi study consists of two parts: the first is an on-line survey which will ask your opinion on important trends in transportation. This part will take 10-25 minutes to complete, depending on how much elaboration you are willing to make. The second part will consist of a short (~1 hr.) group meeting at the Asilomar Conference in August, 2011 where you and other survey respondents will discuss results from the Part One survey. We hope this discussion will lead to consensus on the trends or will highlight uncertainties in the trends. Finally, the survey and discussion results will be used in the TEF study. All responses are completely anonymous.

Below is a link to the Part One online survey. We ask that you complete this survey by August 12. Thank you in advance for your participation in this important study.

http://survey.its.ucdavis.edu/limesurvey_1_90/index.php?sid=45779&newtest=Y&lang=en

If you have questions, feel free to contact Geoff Morrison at the Institute of Transportation Studies at (XXX)-XXX-XXXX or gmorrison@ucdavis.edu.

Sincerely,
Dr. Larry Johnson

APPENDIX E: Invitation Letter for Round Two

Dear Colleague:

In July, you submitted a response to our online Delphi survey on the future of the U.S. transportation system. The high response rate (100 respondents) and comments from attendees at the Asilomar conference indicated a strong interest in the survey. We held a second round of the survey at the Asilomar conference, but unfortunately, many attendees did not hear about the location and time of the meeting and were unable to attend. We would like to extend the opportunity to participate in the second round to you and to share with you the results of the first round.

If you were unable to attend the side-meeting to participate in the second round at Asilomar, please click on the link below to the survey which will allow you to review the Round 1 results, and then answer the online survey once more. The questions are the same, but we are interested to see how the distributions of answers change after respondents review the results of the first round. The following link will take you to the on-line survey:

http://survey.its.ucdavis.edu/limesurvey_1_90/index.php?sid=45779&newtest=Y&lang=en

We would like your Round 2 survey completed by Sept. 14th. If you have questions, please contact Geoff Morrison at the Institute of Transportation Studies at (XXX-XXX-XXXX) or gmorrison@ucdavis.edu. Thank you for your help with this important survey. Final results will be documented and made available online at the Institute of Transportation Studies website:

http://pubs.its.ucdavis.edu/

Sincerely,
Dr. Larry Johnson

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