



Examining the demand for hybrid electric and alternatively fuelled vehicles

Dr. Brian Caulfield
Department of Civil, Structural and
Environmental Engineering
Trinity College Dublin



Presentation Overview

- Background
- Goals of the study
- Data collection and methodology
- Results
- Conclusions

The results in this presentation are taken from – *McMahon, B., Caulfield, B., Farrell, S. 2009. Examining the demand for hybrid electric and alternatively fuelled vehicles. Transport Policy (Under review)*



Background (1)

The transport sector consumes the largest amount of energy in Ireland (SEI, 2008)

In the period 2005-2007, transport energy demand grew by 6.3% per annum, whereas demand in other sectors either fell or grew at a rate of less than 1% (SEI, 2008)

With increasing global demand and fluctuating oil prices, Ireland could find itself in a 'liquid fuels' crisis resulting in serious consequences for transportation (Forfas, 2006)



Background (2)

Over the past number of years car manufacturers have introduced a number of alternatively fuelled vehicles

This trend is set to increase with the reduction of VRT rates and the increase in fuel prices

HEVs are seen by many as the optimum short to medium term solution to the problem of providing a more fuel efficient vehicle. (Van Mierlo, 2006, Romm, 2006, Lipman, 2006).

Between July and October 2008, after the change in car taxes, the share of cars sold in VRT bands A, B and C, increased by 84% (SEI, 2008)



Goals of the study

- To gain an understanding of Irish consumer attitudes towards and the potential uptake of hybrid and flexifuel vehicles
- To examine the attributes Irish consumers consider important when buying a vehicle
- Examine and quantify the value that respondents place on fuel costs, VRT and CO2 emissions when purchasing a car



Data collection and methodology (1)

- 500 paper copies of the questionnaire were delivered to customers of a car company throughout Ireland in March 2008
- The recipients of the survey had purchased a new car 6 months prior to receiving the survey
- 168 questionnaires were returned, resulting in a response rate of 34%
- The survey contained a number of stated preference scenarios which asked respondents to choose between three vehicles which differed based upon fuel cost, VRT and emissions



Data collection and methodology (2)

Below is an example of one of the stated preference scenarios presented to respondents in the survey.

	(A) Conventional Vehicles	(B) Hybrid Vehicles	(C) FlexiFuel Vehicles
Fuel Costs	10% less than usual	25% less than usual	20% more than usual
Vehicle Registration Tax	0% Change	50% less than usual	20% less than usual
CO ₂ Emissions	40% less than existing vehicles	30% less than existing vehicles	80% less than existing vehicles
I would choose: (✓ only one)	(A) <input type="checkbox"/>	(B) <input type="checkbox"/>	(C) <input type="checkbox"/>



Results (1) Examining the factors that impact upon individuals car purchasing decisions

Rank	Attributes	Average score
1	Reliability	3.76
2	Safety	3.75
3	Price	3.15
4	Style/Appearance/Image	3.11
5	Size of Car/Internal Space	3.08
6	Fuel consumption	2.81
7	Performance/Power	2.66
8	Brand name	2.48
9	Vehicle registration tax	2.48
10	CO ₂ Emissions	2.44
11	Road tax	2.25
12	Alternative fuel	2.23



Results (2) Examining the impact age and income have on environmental concerns

Cross tabulation between age and fuel cost, VRT and CO₂ emissions

Ages	Fuel Costs	VRT	CO ₂ emissions
17-25	3.33	2.00	1.67
26-35	2.62	2.59	2.05
36-45	2.91	2.46	2.56
46-55	3.03	2.49	2.88
56-65	2.76	2.81	2.53
66+	2.22	1.57	1.75

Cross tabulation between income and fuel cost, VRT and CO₂ emissions

Income	Fuel Costs	VRT	CO ₂ emissions
Less than €19,000	3.00	2.50	3.00
€20,000 - €39,999	3.47	2.71	2.76
€40,000 - €59,999	2.89	2.61	2.28
€60,000 - €79,999	2.75	3.00	2.52
€80,000 - €99,999	2.65	1.69	2.24
€100,000+	2.37	2.16	2.50



Results (3) Opinions on HEVs and AFVs

Opinions of HEVs

	Strongly agree	Agree	Neither	Disagree	Strongly disagree
HEVs are better for the environment than conventional vehicles	34%	45%	16%	3%	2%
HEVs are cheaper to run than conventional vehicles	12%	40%	35%	9%	4%
HEVs will be the car of choice in the next ten years	12%	43%	31%	11%	3%

N = 168

Opinions of AFVs

	Strongly agree	Agree	Neither	Disagree	Strongly disagree
AFVs are better for the environment than conventional vehicles	38%	42%	14%	5%	1%
AFVs are cheaper to run than conventional vehicles	8%	27%	40%	19%	6%
AFVs will be the car of choice in the next ten years	10%	45%	26%	15%	4%

N = 168



Results (4) Willingness to detour to an alternative filling station

Willingness to detour to an alternative fuel filling station

	Would not detour	5 – 10 km	10km +
What is the maximum number of kilometres you would be willing to detour to buy alternative fuels	26%	56%	18%

N = 168



Results (5) Stated preference model results

The utility functions for the three vehicle alternatives are as follows:

$$U_{\text{conventional}} = \alpha_1 (\text{fuel costs}) + \alpha_2 (\text{VRT}) + \alpha_3 (\text{CO}_2 \text{ emissions}) \quad (1)$$

$$U_{\text{HEV}} = \alpha_4 (\text{fuel costs}) + \alpha_5 (\text{VRT}) + \alpha_6 (\text{CO}_2 \text{ emissions}) \quad (2)$$

$$U_{\text{AVF}} = \alpha_4 (\text{fuel costs}) + \alpha_5 (\text{VRT}) + \alpha_6 (\text{CO}_2 \text{ emissions}) \quad (3)$$



Results (6) Stated preference model results

MNL Model results

		Coefficient
Conventional Vehicles	Fuel Costs	-0.034 (-2.1)*
	V.R.T.	-0.035 (-1.7)
	CO ₂ emissions	-0.022 (-3.1)**
HEVs	Fuel Costs	-0.045 (-10.9)**
	V.R.T.	-0.012 (-4.0)**
	CO ₂ emissions	-0.010 (-3.0)**
AFVs	Fuel Costs	-0.023 (-9.7)**
	V.R.T.	-0.012 (-4.1)**
	CO ₂ emissions	-0.016 (-4.8)**
Gender		0.909 (2.6)**
Age		-0.394 (-2.8)*
Education		0.373 (2.5)**
Detour		0.227 (2.5)*
ρ^2 (D)		0.302
χ^2 (c)		0.140
Final Likelihood		-869.94

*Significant at a 95% confidence level

**Significant at a 99% confidence level



Conclusions

The results show that while individuals are concerned with emissions, the main concerns individuals have when purchasing new cars is cost.

Issues such as reliability and safety were found to be the most important considerations when purchasing a new car.

The majority of respondents indicated that they thought HEVs and AFVs were environmentally friendly and would become commonplace in the next 10 years.



Conclusions (2)

A major concern of respondents was the scarcity of outlets selling biofuel.

One respondent wrote *'The relative lack of availability of biofuel has been a factor since I bought the car. Good intentions only go so far if you can't get the fuel'*.

This is the 'chicken and egg' problem, in that people will not buy AFVs until the fuel is widely available.

More research needs to be conducted on the purchasing trends since the July 2008 VRT changes.



Questions?

Contact Details

Dr Brian Caulfield

Department of Civil, Structural and Environmental Engineering

Trinity College Dublin

Email: brian.caulfield@tcd.ie