Analysis of LPG as an alternative fuel in the modern vehicle

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Aim of the Project

The Aim of this investigation is to conduct studied around the use of LPG throughout Ireland and its use in the modern vehicle industry and how it has changed over the past few years.

Background

Liquid petroleum gas or LPG is a fuel with similar properties to petrol. LPG is a mixture made of mainly propane and butane gases that is pressurized and in liquid form. LPG is a bi-product of petrol in which it is made. LPG can be used as an automotive fuel in vehicles and is widely used throughout the world, LPG as an automotive fuel is the third highest used fuel in the world behind petrol and diesel.
This project looks into how LPG can be used as a fuel in the modern vehicle and the affects it will have cost wise and on the carbon emissions.

Objectives

The objectives of this project were to:

- Carrying out a thorough literature review on the topic of how automobiles are fuelled and the ways in which it has changed over the years.
- Conduct surveys and interviews with industry professionals and LPG users.
- Compare running costs of a conventional internal combustion engine running on a variety of fuels and LPG.
- Do a cost analysis of converting an internal combustion engine to run on LPG and analysing the environmental and sustainability impacts of large-scale LPG conversion
- Research the availability of LPG fuel in Ireland and the regulations surrounding the commercial sale of LPG.

Comparison Study

A comparison study was completed on 2 similar cars one petrol car and a second LPG car. The two cars were studied for over 8 fills of petrol and LPG looking at price of fuel, cost to fill each tank, kilometers driven per fill and the emissions of each car were tested and compared.
The 2 cars being studied are shown below:

The comparison study are shown below:

Petrol

	C1	C2
	price	kilometres
1	90.01	623.7
2	100.17	645.5
3	90.07	642.9
4	97.85	639.9
5	95.00	648.5
6	87.00	624.5
7	88.65	608.8
8	86.00	648.5
9		

LPG

	C1	C2
	Price	Kilometres
1	49.15	526.6
2	52.34	531.2
3	50.90	539.5
4	53.69	543.2
5	51.66	545.7
6	49.75	536.2
7	52.51	521.7
8	50.11	534.8

The results show that the LPG car is cheaper to run compared to petrol this is mainly due to LPG having a lower price per litre compared to petrol as LPG has price of 1.06 euro a litre compared to petrol of 1.75.
The kilometre range of the LPG car is lower than that of the petrol car for LPG to be used a second fuel tank has to be installed for the LPG, this LPG although the same size litre tank as the original petrol tank of 60litres can only be filled to 80% of it capacity as a safety feature to allow the gas to expand when heated. The LPG tank used in the LPG car is shown below where it is installed in the spare wheel well in the boot of the car.

The results of the emissions test completed on both cars showed the LPG car to have lower emissions than the petrol car. This was expected from what was learned through the completion of the literature review which stated that LPG has a 20% lower emissions than petrol.

Petrol Emissions:

Test values:			
Emissions			
	Oil temp	76	°C
Idle RPM	CO	0.00	%Vol.
	HC	11	ppm
	RPM	750	rpm
	CO	0.07	%Vol
Raise idle	HC	23	ppm
	Lambda	1.009	
	RPM	2850	rpm

LPG car emissions:

Test values:			
Emissions			
	Oil temp	59	°C
Idle RPM	CO	0.00	%Vol.
	HC	4	ppm
	RPM	650	rpm
	CO	0.03	%Vol
Raise idle	HC	15	ppm
	Lambda	0.993	
	RPM	2740	rpm

Surveys and Interviews

Surveys and interviews were completed to further understand the area of how LPG can be used as an automotive fuel in Ireland. A general survey and a survey targeted towards LPG car users were completed, the aim of the general survey was see if many people had heard of LPG as an automotive fuel and to see if they would consider converting to LPG. Were as the LPG survey was more to understand the negatives associated with LPG vehicles and to see what their owners thought of them over petrol and diesel vehicles.

Interviews were done with an LPG car conversion center, Flogas one of the main suppliers of LPG in Ireland and with a local oil company that does not sell LPG. Questions were asked around the average cost to convert a car to LPG and to further understand how an LPG car operates and the function of each part.

Questions asked around Flogas and the local oil company were to see around the process of delivering LPG, the market for it and would their be enough LPG to cover Ireland if large scale conversion was to take place, the interview with the local oil company asked questions as to why they do not deliver LPG and if they had ever considered selling it in the past or future.

Conclusion

On completion of this project it was shown that LPG can be used as a cheaper alternative fuel to petrol and diesel with lower carbon emissions. It was understood that the average cost to convert a car was between 1000-1500 euro. Although LPG is a cheaper and cleaner fuel than petrol and diesel, if there was to be a large scale LPG conversion in Ireland it would reduce the total emissions by 20% but it would fail to meet the Paris agreement target of having a 30% reduction in emissions from the 2005 value LPG would only decrease the number by 11% this would not be enough to meet the agreement, But a step in the right direction would be taken with further work being done. This is why I believe that LPG is a good alternative fuel but not in the long and with the lack of LPG refueling stations in Ireland it is best suited that Ireland focuses on the push for electric vehicles.

References

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