

The Investigation and Adaption of Existing Fossil Fuel Drive Train to An Electric Drive Train

SEMIAR PAPAER

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Abstract General

Investigation into the problems using light goods vehicles and the impact it creates to the environment and using this information to find a better solution. By conducting tests on an established delivery system like Tesco home deliveries where the van rarely travels long distances and always returns to base allowing opportunity for recharge. Using this delivery style combines many different traits of a light goods vehicle like start/stop and motorway miles which is representative of the industry. Once the information has been gathered, a suitable electric drive system can be identified that fits the application of the van. The carbon foot print of the system can be compared and contrasted to see if this is a viable solution for companies.

Abstract Technical

Investigation in of the underlining impact vehicles have the environment, focussing on light goods vehicles. Using the delivery system Tesco uses, due to the nature of the deliveries, combining both start/stop and motorway operations where the pollutants is at its highest, is representative of the industry. Data can then be extrapolated to gain an understanding of loads the van is subjected to gain an insight of a suitable electric system to use which would also dictate the capacity and type of battery. With this data, an estimate of the decrease or increase in carbon footprint can be investigated to gain an understanding of the ethical and economical standpoints surrounding electrifying a vehicle.

Introduction

The electrification of vehicle has been around for over 1 hundred years. The premise of electrifying a vehicle came from a company from the united states called "The Electric Carriage & Waggon Company". This company released 12 taxis cabs in the streets of New York. (Kirsch, 2000) This is the first instance of taxi cabs being used on a commercial scale. Unfortunately, the fossil fuel vehicles were favoured due to the simplicity of the vehicles and the cheapness of the fuel itself and due to the battery technology, range was limited.

There are approximately 1.2 billion vehicles on the roads around the world which is one of the main contrition of global warming emissions. More than half of the NOx emissions are emitted by vehicles. These emissions can impact on climate change which is driven by global warming emissions which also can affect people wellbeing and health thought the world. Global warming leads to more frequent and intense heat waves and can contribute to sea levels raising due to the ice caps melting. This can cause flooding the loss of coastal areas which jeopardised millions of people. The increased temperatures due the increased ozone layer can also have a negative effect to dryer countries, causing drought on the land which jeopardises the drinking water as well as the lack of crops that can grow. Due to these factors, measures can be taken on the vehicle industry to have more environmentally stable solution to the air pollution. Actions can be taken to reduce the effects of climate change by using electric vehicle to reduce the amount of pollution being exhausted. By changing the vehicle population system to electric can drastically reduce the pollutants being created in the atmosphere.

Arguments for Vehicle Electrification

There are approximately 1.2 billion vehicles on the roads around the world which is one of the main contributors of global warming emissions. More than half of the NO_x emissions are emitted by vehicles. These emissions can impact on climate change which is driven by global warming emissions which also can affect people wellbeing and health thought the world. Global warming leads to more frequent and intense heat waves and can contribute to sea levels raising due to the ice caps melting. This can cause flooding the loss of coastal areas which jeopardised millions of people. The increased temperatures due the increased ozone layer can also have a negative effect to dryer countries, causing drought on the land which jeopardises the drinking water as well as the lack of crops that can grow. Due to these factors, measures can be taken on the vehicle industry to have more environmentally stable solution to the air pollution. (Hunter, 2010) Actions can be taken to reduce the effects of climate change by using electric vehicle to reduce the amount of pollution being exhausted. By changing the vehicle population system to electric can drastically reduce the pollutants being created in the atmosphere.

The electric battery technology is under allot of research and development becoming smaller and increasing in capacity. For example, a south-Korea biased Samsung battery factory developed a battery 20% smaller but increasing the capacity by 50%. (Point, 2018) For the automotive industry, a smaller and lighter battery is ideal to decrease the net weight of the vehicle which intern increases the range of the vehicle significantly and the addition of the 50% increase in

capacity can results in a vehicle that can possibly go twice the distance.

By utilizing this battery technology, electric vehicles are on the rise in popularity. Its estimated in the end of 2018 there was 3 million electric vehicles on the road and counting. (EV, 2019). With this increase in battery technology, the range has increased substantially, and electric vehicle are becoming a viable for the majority of car owners. One of the main contributions of vehicle pollution is the goods vehicles. There are approximately 3.8 million vans on the roads of the UK and the majority of those vehicles are driven by fossil fuels and these vans produce a vast amount of pollution. Each year the amount of vans that are on the road increases and subsequently the number of miles the vans undergoes increases.

Summary statistics					
The summary table below shows patterns in vehicle traffic across a range of years.					
	Vehicle Miles 2017	Percentage change from:			
		Last Year 2016	5 Years Ago 2012	10 Years Ago 2007	20 Years Ago 1997
All Motor Vehicle Traffic	327.1 billion	1.3%	8.1%	4.2%	16.9%
Cars and Taxis	254.4 billion	1.1%	5.9%	2.9%	11.9%
Light Commercial Vehicles (LCV)	50.5 billion	2.7%	22.4%	20.7%	67.4%
Heavy Goods Vehicles (HGV)	17.0 billion	1.2%	9.6%	-6.4%	2.0%
Buses	2.4 billion	-3.4%	-11.4%	-28.2%	-24.7%
Motorcycles	2.8 billion	-0.3%	-2.2%	-18.6%	12.3%
Pedal cycles	3.3 billion	3.1%	5.2%	28.2%	28.9%
Motorways	68.7 billion	1.4%	10.0%	9.8%	34.6%
'A' Roads	146.5 billion	1.1%	7.9%	4.8%	13.6%
Minor Roads	112.0 billion	1.4%	7.2%	0.1%	12.2%
Strategic Road Network (SRN)	94.1 billion	2.1%	11.0%	10.8%	

Figure 1 Table from the .gov website illustrating the miles each vehicle undergoes (.GOV, 2018)

In the table (Fig 1) from the .gov website illustrates a 20.7% mileage increase of light goods vehicles. This mans that there is a subsequent increase in road pollution in the UK. To combat this, electrifying light goods vehicles might be beneficial in terms of the pollution generated.

For this study, the adaption of multidrop light goods vehicles is ideal due to the repeatable routes, base to base operations and consistent loads. Tesco delivery service is the

main target in this study due to the additional challenge of dealing with the freezer and chiller constraints. There is an approximately 2,800 Home delivery Tesco vans on UK roads (Reed, 2011). All these vehicles don't usually exceed 100 miles per day and experience the same duty cycles. These vans also are stationed in store where there is infrastructure already in place for electric power outlets, making it ideal for the fleet to be electrified. If each van on the fleet outputs 213 g/km in carbon dioxide (EV, 2019), that can equate to a total of 596,400 g/km in carbon dioxide. With this factor alone of reducing the carbon impact on the environment is an ideal star.

Aims of the research:

- Investigate the environment the Tesco van is subjected to including e.g. Van loads, maximum hill gradients, distance, top speed etc.
- Identify the pollution output of the fleet of Tesco vans.
- Specify an electric powertrain to meet the demands of the Tesco van.
- Specify the amount of energy required and the carbon footprint associated and identify if this a viable solution.

Conclusion

In conclusion, the adaption of fossil fuel vehicles into electric vehicle isn't unheard of but carried out in certain operations can result reduced amount of carbon dioxide from the preliminary research. By identifying the problem first and hand and gaining an understanding of the type of environment the vehicle would be subjected to can give an understanding of the appropriate system that can be used and utilised for the drivetrain to compete with fossil fuel system. Allowing the system to become economically viable is key for the adoption to be viable for companies to

convert to a fully electric fleet. Hopefully in completion of this study can highlight the flaws in the fossil fuel vehicles and hopefully conclude if the electric drivetrain is viable and most importantly reduces the carbon footprint.

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