



Bsc Automotive Engineering

Research Method and Project

Seminar

Automotive Manufacturers response to Greenhouse Gas Emissions

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1. Abstract (a)

The vehicles manufacturers are discussing how to reduce CO₂ emissions that have an effect on climate change, the primary debate on CO₂ reduction in the automobile industry, a lot of evidence indicates that GHG emissions are, in large part, due to the automobile industry.

The analysis and evaluation of the current processes to reduce the emissions and create new processes with different strategies and techniques, such as reduction of emissions by emission systems like a catalytic converter, EGR, EVAB air, and fuel ratio.

Ecological driving means a new style of driving focusing on saving fuel, reducing environmental contamination particularly more on acoustic contamination, extra comfortable travel.

Managing the vehicle emissions results in saving costs of maintenance and increases the vehicles safety while driving.

Looking at GHG and their characteristics, the Euro emission specifications and Regulations from Euro1, 2, 3,4,5,6 and 7 in EU and UK, looking at the percentage of GHG emissions from transport, road to zero emissions, where the T charge located is always in centre cities like London and other capital cities around the world.

EU emissions standards for passenger cars is assessing the diesel engine performance from Euro 1 until Euro 6 looking at CO₂ more precisely.

Future enhancements and developments such as vehicle weight reduction like engine size, filters, tire pressure, stop and start technique.

1.1 Abstract (B)

Nowadays you can see a lot of natural catastrophes because of changes in atmospheric conditions, the main source of which is an increase in CO₂ which results in increase in global average temperature.

The most beneficial thing is the internet and our developing the global economy as the world becomes smaller, you can see the amount of pressure by the media on the manufactures as they are work hard with highest efforts to renew the investments to provide good solutions to reduce CO₂.

The manufacturer looking at how to find new energy sources such as the sun, wind and sea waves.

Destroy the forest, the earth response variation like the change in the way to use the land for burning some chemicals or others.

2. Acknowledgment

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3. Introduction

Manufacturer's response to Green House Gas Emissions GHG is important, also looking at atmospheric change have moved extremely over two decades ago, until the first of the 1990s, industry totally neglected the problems and emissions issues. Although few corporate oil firms and transportation firms check the increasing scientific attention around this issue particularly in the mid of 1990s.

3.1 Aims

we are looking precisely at the emissions and its impact on a universal scale. As the world realizes the significance of the crisis that the world will face in the next two decades, it is important to look at this investigation from the beginning of the impacts.

The primary aim of this project is to understand and concentrate on the current impact of automotive emissions and regulations that are used to govern and control it.

The first step forward was to create a group known as the Global Climate Coalition (GCC) and the atmosphere council, in which their role to stop negligence in regards to atmospheric pollution internationally and to control, by enforcing caps, on (GHG) emissions, preventing America with connection to the Kyoto Protocol 2003.

The second aim is to investigate and analyse the strategy that the manufacturer and automotive industry may work to reduce the limit of emissions further.

(PINKSE, 2008)

3.2 Objectives

the first goal and objective are to create and establish fundamental of Euro 7 standards and procedures to work more effectively on the industry.

Current processes used to manage the emissions in advanced countries are setting goals and firm legislation to let the industry work precisely and firmly change its political response into preparation for NOx and carbon neutral future, creating different strategies and analysis of technologies with investigation to approach to low emission products.

The second objective is to see the current technology and future changes to keep growing to reduce emissions further.

In Germany, some manufacturers have already designed some models to work in future with biodiesel and Ethanol, the example Elsbett made huge modifications at diesel engines to work with vegetable oil that amazing.

(Vicente Díaz, 2009)

4.Greenhouse Gas Emissions

It is a heat trap the impact of which increases the heat retention of the planet, which has taken place over the last one hundred and fifty years, the first priority for the government and environment agencies has been to discuss the origin of the greenhouse gas. To gain a better understanding of such a large topic we will specifically look at the following compounds:

1. CO₂, carbon dioxide and carbon monoxide.
2. N₂O which is Nitrous Oxide.
3. CH₄ which refer to Methane.
4. Group of Fluorinated gases.

4.1 Greenhouse Gases and their characteristics

Table (1)

Greenhouse gas	How its provide	Life time average in the weather	100-years global warming potential
Carbon Dioxide	• Burning of fossil fuel. • Changes in land use. • Deforestation and soil degradation.	12.4 years	1
Methane	• Production and transport of oil and natural gas. • Livestock and agricultural practices. • Anaerobic decay of organic waste	12.4 years	28-36
Nitrous oxide	• Combustion of solid waste and fossil fuels. • Industrial and agricultural activities.	121 years	265-298
Fluorinated gases	• Come from different activities such as industrial processes, household uses and commercial. • Substitutes for ozone. • Chlorofluorocarbons (cfc's)	Thousands of years and a few weeks	varies

(epa.gov, 2018)

4.2 Greenhouse gases issues

In sectors of North American businesses which are related to increasing the CO₂ from burning fossil fuels have begun to take extra attention to atmospheric change, which means extra risk and threat causing a substantial increase of greenhouse gases (GHG's).

4.3 Greenhouse gases Sources

These days, a lot of effort is being made to reduce the high percentages of GHG's the sources of which are:

1. **Energy (Electricity)**
 2. **Transportation**
 3. **Industry**
 4. **Residential and commercial**
 5. **Agriculture**
- (epa.gov, 2018)

4.4 USA Total GHG in 2016

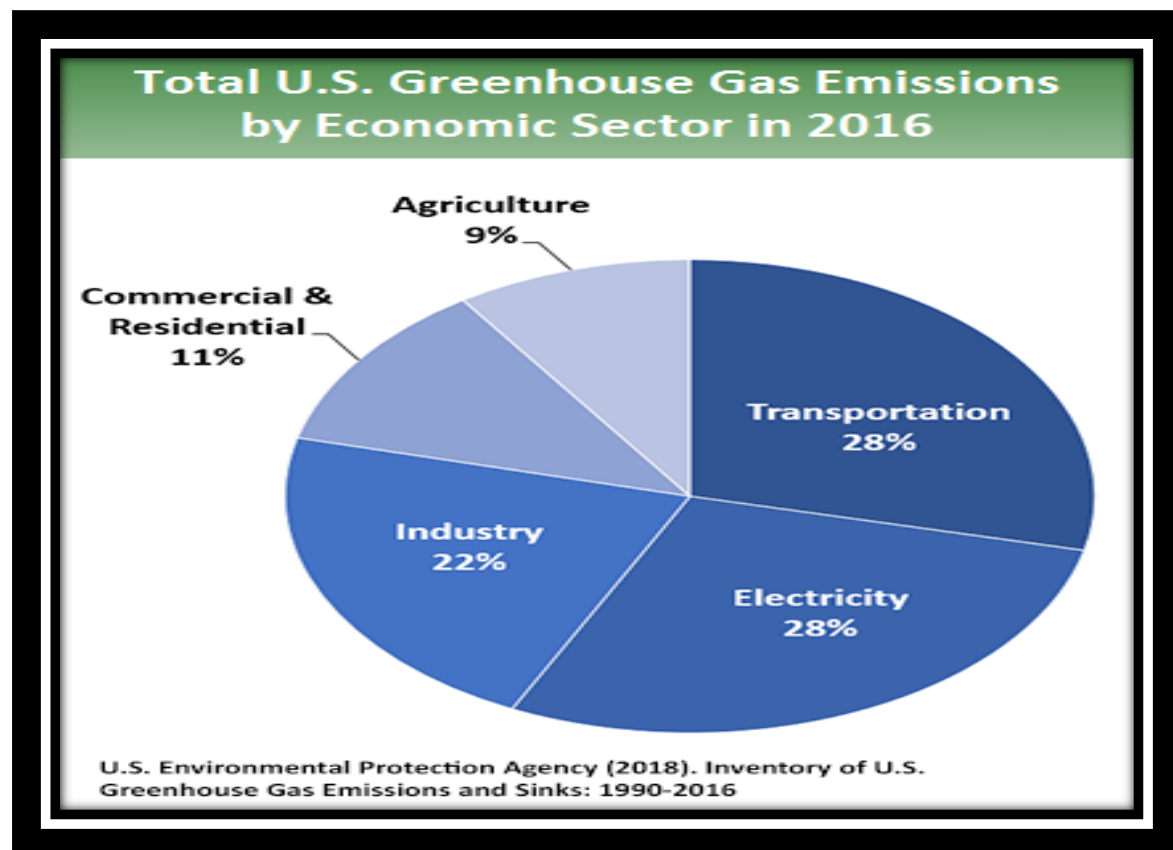


Figure 1. The figure shows the highest greenhouse gas emissions come from transportation 28%, Electricity 28%, industry 22%, Commercial & residential 11% and Agriculture is 9%.
(epa.gov, 2018)

5. Transportation percentages

in 2016, 91% GHG emissions came from transport which gives very important sign to look how to reduce this problem.

Percentage of greenhouse gas emissions from transport in UK

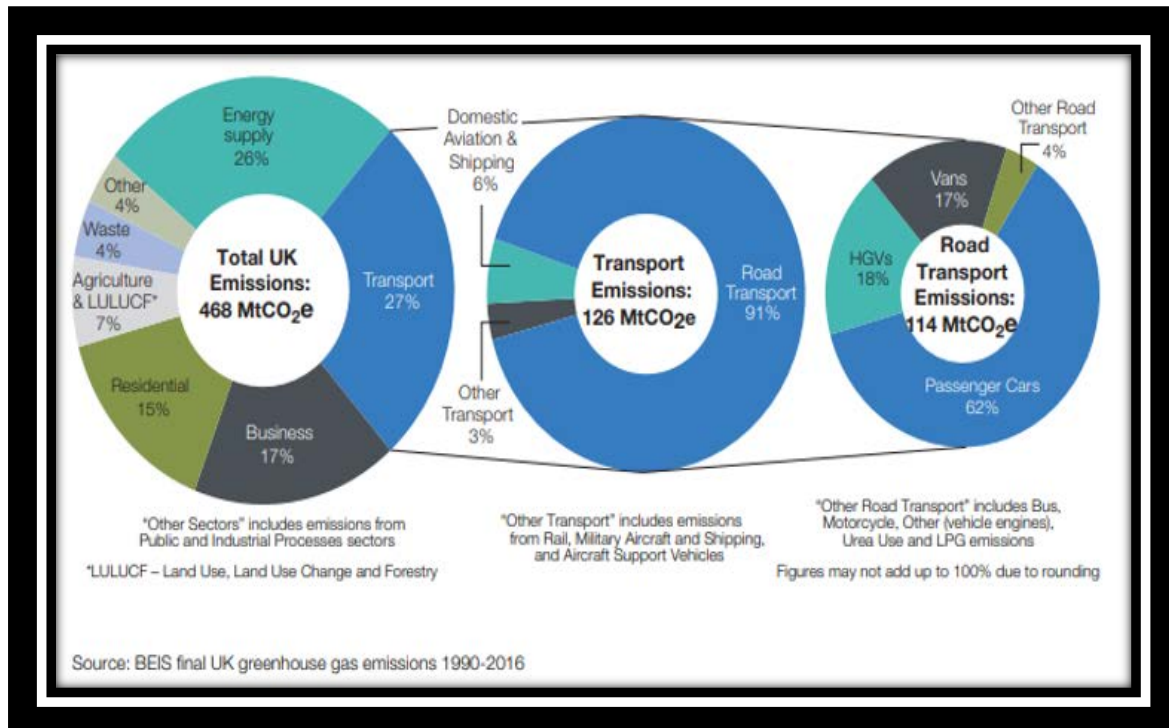


Figure (2)

(epa.gov, 2018)

Major air pollutants from transportation

Transport has a huge impact on GHG emissions. The key air pollutants that come from road transport consists of:

(CO)Carbon monoxide, (NOX) Nitrogen oxides, (HC) Hydrocarbons, (PM) Particulate matter, (NMVOC) Non Methane Volatile Organic Compounds.

6. Euro Emissions Standards



Emissions standard	Applied to new passenger car approvals from:	Applied to most new registrations from:
Euro 1	1 July 1992	31 December 1992
Euro 2	1 January 1996	1 January 1997
Euro 3	1 January 2000	1 January 2001
Euro 4	1 January 2005	1 January 2006
Euro 5	1 September 2009	1 January 2011
Euro 6	1 September 2014	1 September 2015 - but see important note below

Figure (3)

(thesun.co.uk, 2018)

As the figure shows, the SMMT, which is the society of motor Manufacturers and Traders, the euro emissions standards have had significant impact and influences in decreasing the emissions percentages.

From 1993 the number for carbon monoxide percentages has been going down by 63% in petrol cars engine and 82% for diesel, from 2001 particulate matter percentage has started to go down to 96 %, hydrocarbons in petrol engines is 50%, nitrogen oxide has approached 84% also in petrol cars.

7. EU emission standard for passenger cars

Table (2)

Stage	Date	CO	HC	HC+NOx	NOx	PM	PN
		g/km					#/km
Positive Ignition (Gasoline)							
Euro 1†	1992.07	2.72 (3.16)	-	0.97 (1.13)	-	-	-
Euro 2	1996.01	2.2	-	0.5	-	-	-
Euro 3	2000.01	2.30	0.20	-	0.15	-	-
Euro 4	2005.01	1.0	0.10	-	0.08	-	-
Euro 5	2009.09 ^b	1.0	0.10 ^d	-	0.06	0.005 ^{e,f}	-
Euro 6	2014.09	1.0	0.10 ^d	-	0.06	0.005 ^{e,f}	6.0×10 ¹¹ e,g
Compression Ignition (Diesel)							
Euro 1†	1992.07	2.72 (3.16)	-	0.97 (1.13)	-	0.14 (0.18)	-
Euro 2, IDI	1996.01	1.0	-	0.7	-	0.08	-
Euro 2, DI	1996.01 ^a	1.0	-	0.9	-	0.10	-
Euro 3	2000.01	0.64	-	0.56	0.50	0.05	-
Euro 4	2005.01	0.50	-	0.30	0.25	0.025	-
Euro 5a	2009.09 ^b	0.50	-	0.23	0.18	0.005 ^f	-
Euro 5b	2011.09 ^c	0.50	-	0.23	0.18	0.005 ^f	6.0×10 ¹¹
Euro 6	2014.09	0.50	-	0.17	0.08	0.005 ^f	6.0×10 ¹¹
* At the Euro 1.4 stages, passenger vehicles > 2,500 kg were type approved as Category N ₁ vehicles							
† Values in brackets are conformity of production (COP) limits							
a. until 1999.09.30 (after that date DI engines must meet the IDI limits)							
b. 2011.01 for all models							
c. 2013.01 for all models							
d. and NMHC = 0.068 g/km							
e. applicable only to vehicles using DI engines							
f. 0.0045 g/km using the PMP measurement procedure							
g. 6.0×10 ¹² 1/km within first three years from Euro 6 effective dates							

(swatchina.com, 2018)

7.1 Changes between Euro 5 and Euro 6

Euro 5 Standards is applied to new vehicles registered at the beginning of 1/2011, which specification is direct fuel injection for petrol cars engines.

Euro 6 Standards is applied to new vehicles registered in the beginning of September /2015.

The benefits of Euro 5 is PDF which is diesel particulate filter for all new diesel vehicles

The benefits of Euro 6 is changed to 67% reduction in the allowable limits of particle number in petrol engines and permissible limits of nitrogen oxides in diesel engines.

Euro 5 applied from 1 January 2013 diesel engine add permissible levels on the particles numbers.

Euro 5 emissions allowable levels diesel is NO_x: 0.18g/km, HC + NO_x: 0.23g/km, CO: 0.50g/km, PM: 0.005g/km and PM: 6.0×10^{-11} /km.

Euro 6 allowable limits for diesel engine emissions is HC + NO_x: 0.17g/km, PM: 0.005g/km, CO: 0.50g/km, NO_x: 0.08g/km and PM: 6.0×10^{-11} /km.

Euro 5 permissible emissions levels in petrol engine cars is NO_x: 0.06g/km, PM: 0.005g/km, HC: 0.10g/km and CO: 1.00g/km.

Euro 6 permissible emissions levels in petrol engine cars is NO_x: 0.06g/km, PM: 0.005g/km, HC: 0.10g/km and CO: 1.00g/km and PM: 6.0×10^{-11} /km

8. T charge

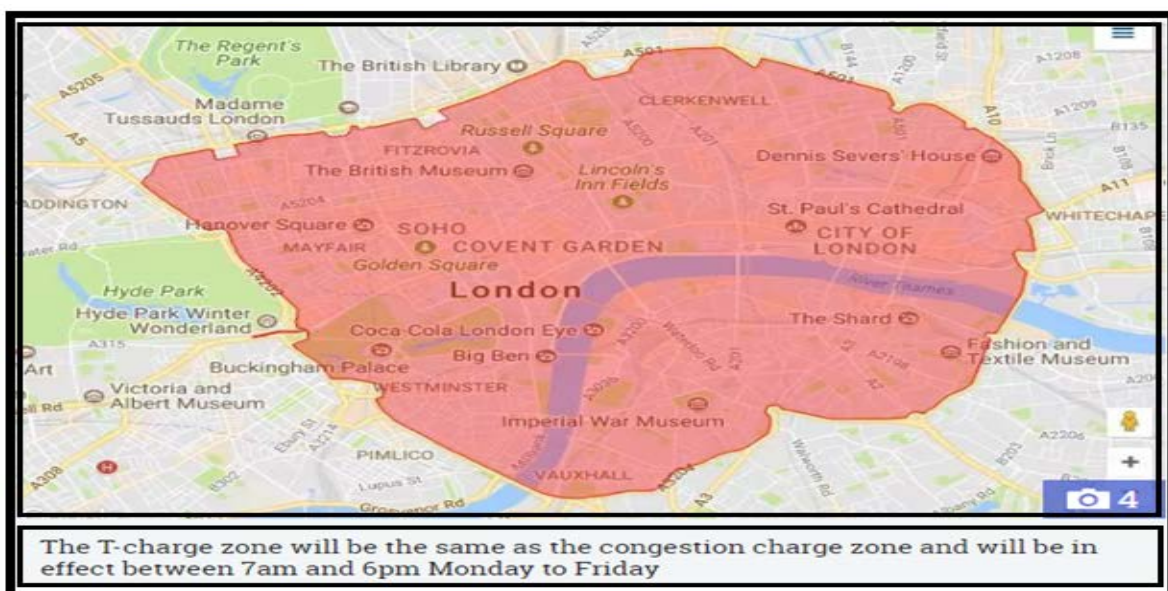


Figure (4)

(thesun.co.uk, 2018)

Brief

T charge is a daily fee or surcharge for vans, coaches, minibuses and other types of vehicles, which is located and operated in central London, the reason is, if your vehicle does not meet the TFL which is the minimum emissions standards plus paying the congestion charge for driving the vehicle in the appointed area.

(thesun.co.uk, 2018)

9. Current Emission Technologies

The current technology deals with the emissions and employing methods to manage and control the exhaust gases which the motor vehicles produce from different components when it is operational, if we take, for example an internal combustion engine, there are three main sources that produce the by-products discussed previously, they are the engine exhaust, fuel tank, and crankcase.

The gas emissions flowing inside the exhaust pipe, do not always fully combust depending on the conditions of the reaction, and this also can apply with different gases such as nitrogen, carbon monoxide, and different acids.

(Encyclopaedia Britannica.Inc, 2018)

Fix fundamental measures to manage the emissions, (PEMS) Portable Emissions Measurement Systems, is used currently to test the emissions and will be developing onward European car Emissions roles and Legislation, generally will focus on the expected benefits and principles.

Common and best types of emission control devices are:

9.1Catalytic Converter

A catalytic converter is a common system used for reducing the gas emissions, the strategy of the catalytic converter is taking the harmful gases that come from the internal combustion engine and pass them through a structure designed to limit and control the by-products. A “catalyst” chemically supports the initial stage of a chemical reaction.

Catalyst material must have the ability to deal with the chemical reaction, in order to help to reduce the gas emissions and to reduce their harmful effects.

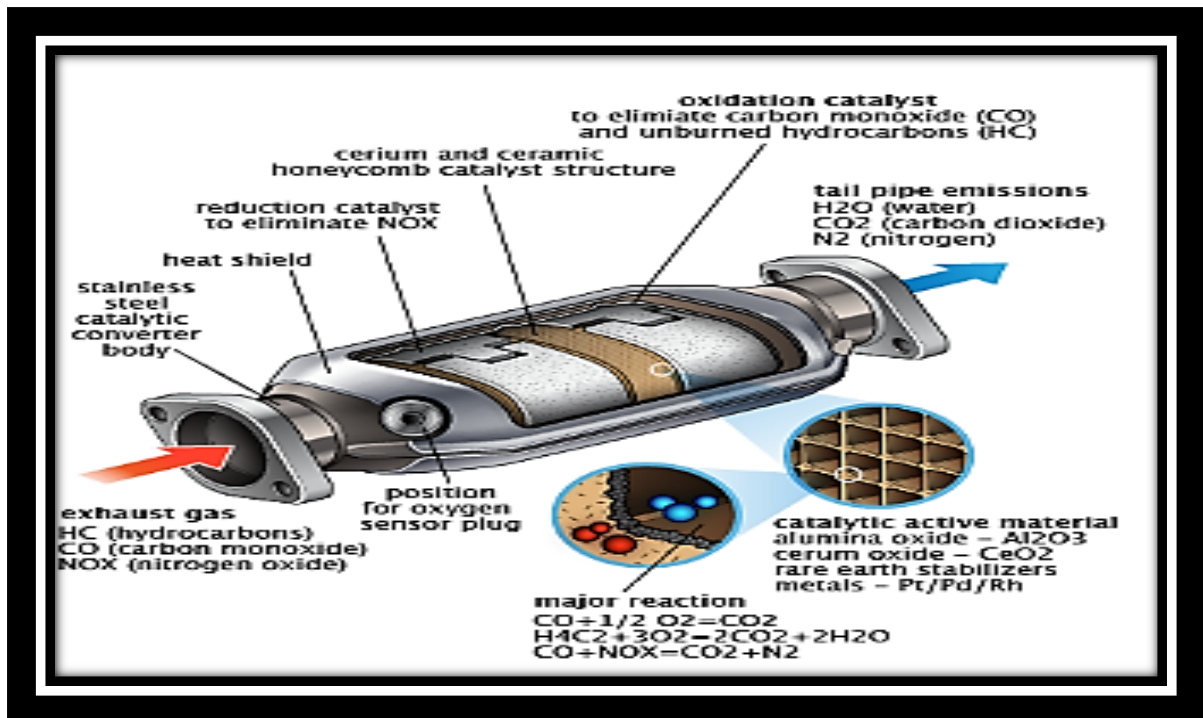


Figure (5)

(repairpal.com, 2018)

9.2 EVAP System

EVAP emission system employed to trap and hold gasoline vapours, which is VOCs volatile organic compounds, EVAP function with charcoal canister, valves and pipes.

The vapours direction going throughout first charcoal canister then intake airflow, which this area is known as a combust area in the engine better than send it back to the ambient

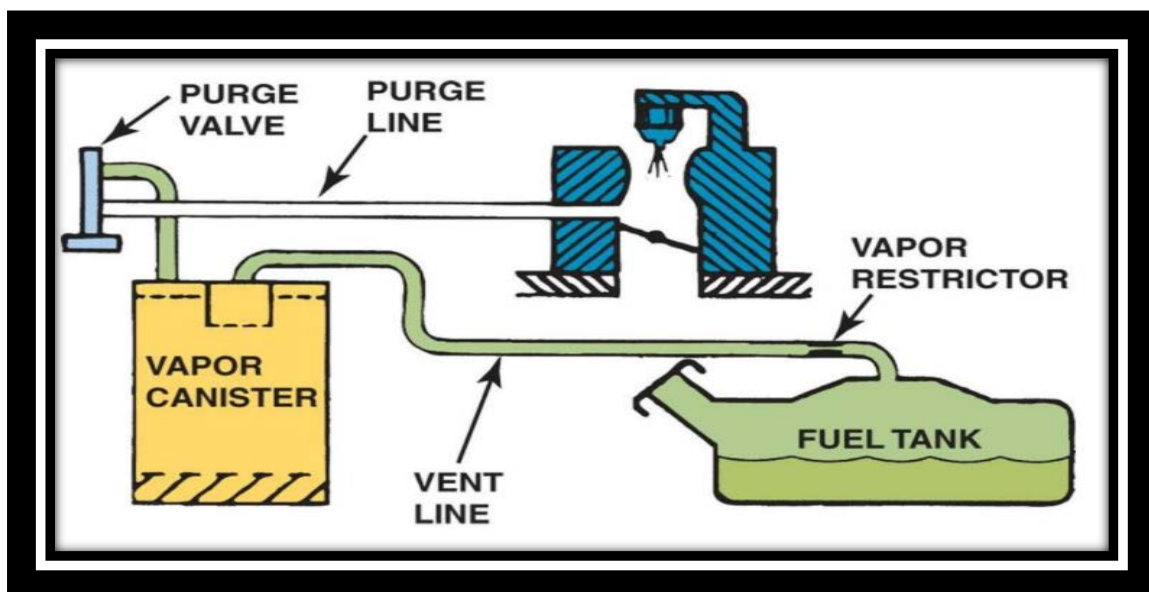


Figure (6)

(D.HALADERMAN, 2016)

10. Future Enhancements and developments

In this chapter we will focus at different strategy and different options for addressing emissions, find new technology such as stop and start, work with the engine size and capacity, design new styles of filters, dealing with car dynamics like Aerodynamic resistance and it is effecting on the engine performance which produces the emissions, Tyre pressure, the different temperature and effect in different pressures.

Modern exhaust emission control devices, Fuel, different sort of fuel, new energy like electricity in electric hybrid cars, lubricant materials and its impact on different loads crating friction forces.

10.1 Changes strategies

1. Change the number of cylinders and the total engine size.
2. Find good lubricant materials that help to decrease emissions
3. Post combustion performance of exhaust control systems.
4. Reduce the emissions by filters
5. Reduce the emissions by tyre pressure
6. Reduce the emissions by stop and start technology

10.2 Investigation at Euro 7 Emissions Standards

Critic expectation around Euro 7 because is focusing at

1. Core developments from the past to the future around the permissible emissions limits in different gases like NO_x, HC, CO, and PM.
2. New designs of cylinder pressures and fuel injectors pressure capacity.
3. Exhausting effort turbines capabilities to recovering thermodynamic energy.

10.3 Effect of emissions standards on the vehicle prices.

We will at the emissions regulations impacts on the vehicles market and what the future market and what the sort and what it is a specifications (ELV) which is end of life vehicle directive.

11. Conclusion

To conclude, after a very short introduction showing and explaining the aims and objectives of the project to understand the large-scale emissions impact, this project has counted the various strategies that some of the manufacturers use currently to reduce the massive amount of carbon dioxide and other toxic gases released into the atmosphere. To alleviate the issues and problems of emissions is to find sustainable energy sources and invest to produce a zero carbon emission future.

This paper provides a fundamental bases in understanding how manufacturers should respond to greenhouse gas emission policy.

It is also important to look further into work investigating possibilities for Euro 7 emissions standards precisely, which will be the next stage of this project. It will include research into Euro 7 techniques on the engine specifications and what the challenges will face with the motor vehicle industry. It will also include research into stop/start technology which aims to reduce emissions by switching off the engine when the car is idle.

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