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A Study on Fuel Economy in Indian Passenger Cars as compared to the US and European Cars

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ABSTRACT
The measure of Fuel Economy is important as the Carbon dioxide emission is a direct function of the fuel consumed. In India, Fuel Efficiency of the Passenger Cars is declared by the manufacturers through Society of Indian Automobile Manufacturers of India (SIAM). Unlike in the US or Europe, the testing process behind this declaration is not available. Hence an attempt has been made to compare the Fuel Economy of Indian Passenger Cars with reference to Fuel Economy Data available for other countries. This comparative study has analysed the Fuel Economy Data (2019) published by an independent agency for the US & Europe with the Declared Fuel Economy of Indian Automobile Manufacturers. It is observed that in the case of Indian Vehicles – both Petrol and Diesel, the declared Fuel Economy of Indian Cars is higher than the Fuel Economy of cars in the US and Europe. There is a need to examine and standardize the process of arriving at the Fuel Economy data in India, as it is important not only for the consumers but also for controlling emission.
Keywords - Fuel Economy, Fuel Efficiency, Mileage, Indian Passenger Car, WLTP

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I. INTRODUCTION

Vehicles are one of the contributors to air pollution and there is a need to reduce vehicular emissions on a continuous basis. The emission norms have been progressively tightened, and the automotive industry responded by developing new engines, new technologies and after treatment devices such as catalysts. In the early stages, Carbon Monoxide, Hydrocarbons and Oxides of Nitrogen were identified as harmful pollutants and targeted for control. When global warming was identified as a serious issue, Carbon Dioxide was identified as one of the contributors. In the case of automobiles, be it cars or two-wheelers or any other vehicle, CO_2 is a direct function of the fuel consumed.

. In India, Fuel Efficiency of the Passenger Cars is declared by the manufacturers and notified by the Society of Indian Automobile Manufacturers (SIAM). This paper attempts to analyse the Declared Fuel Economy of Indian Passenger Vehicles with the Fuel Efficiency Data relating to the US and European vehicles by EQUA Index, powered by Emission Analytics which provides an easy and independent assessment of vehicle performance in real-world driving[1].

The Fuel Economy of a vehicle is inversely related to the engine capacity in a conventional design. The automobile manufacturers have to strike a balance between power and Fuel Economy and meet the customer expectations and emission norms. This analysis considers Engine Capacity for drill-down analysis.

II. PRESENT STUDY

The present study covers the specifications of Passenger cars – both Petrol and Diesel and the Fuel Economy of the vehicle models listed in the 9th SIAM FE Declaration 2017-18[2]. It covers 238 models of Indian Passenger Cars, both Petrol and Diesel put together. Fuel Economy of Indian vehicles has been converted to Miles per Gallon (US) or MPG for easier comparison. For this analysis, we have taken only models of the Year 2019 listed by EQUA Index (powered by Emissions Analytics) under both Petrol and Diesel categories. Our analysis covers 3264 Diesel models and 3846 Petrol Models, totalling 7110 Passenger Vehicles in the US & Europe, extracted from EQUA Index. According to Emissions Analytics[1], it has found an overall shortfall of 25%, with some vehicles as much as 40% below manufacturers' fuel economy claims. It is an independent agency which tests cars in real-world conditions and has test locations both in US and European countries. Its independence comes from how it sources vehicles, conducts tests and is funded by agencies which are not within the direct control of any interested party, including manufacturers, governments and regulators. The

data gathered from EQUA Index has been referred to as 'US & Europe' in the Analysis. The Fuel Economy figures in EQUA Index are in Miles per Gallon (Imperial). The figures have been converted to Miles per Gallon (US) for the purpose of this analysis, in order to have the same basis for comparison.

III. ANALYSIS & KEY OBSERVATIONS:

Analysis of the models by Engine Capacity is given the Figures 1 & 2 below:

Figure 1:

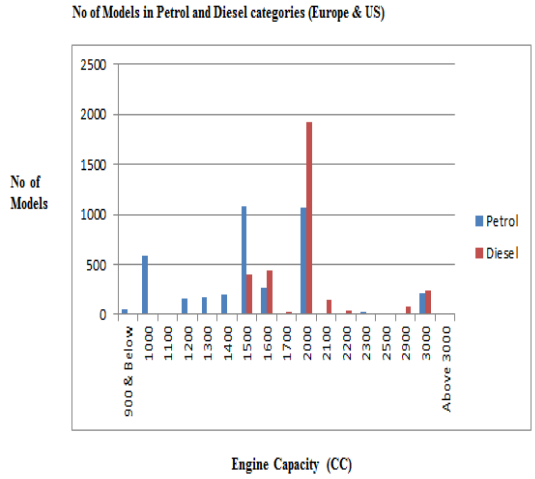
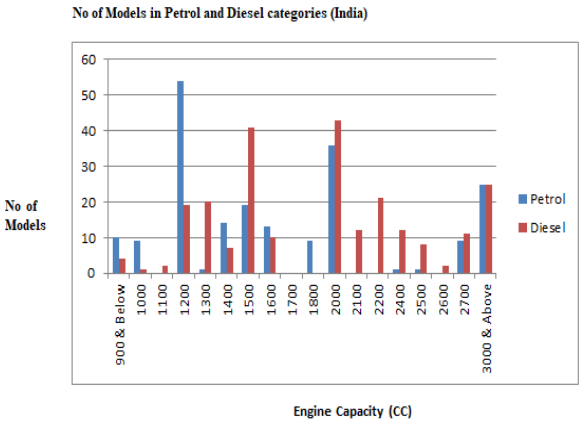


Figure 2:



Key Observations: (Figure 1 & 2)

(1) In case of Europe & US, 63% of Petrol models and 84% of Diesel models are in the range 1.5 L to 2.0L Engine Capacity. In India 39% Diesel models and 32% Petrol Vehicles fall under 1.5 L to 2.0 L category.

(2) No Diesel Models up to 1.4 L Engine Capacity found in case of US & Europe. In case of India, 22% of Diesel models relate to Engine Capacity up to 1. 4L

Relationship between Engine Capacity and Fuel Economy for Diesel & Petrol models are given in Figure 3 and 4 below:

Figure 3:

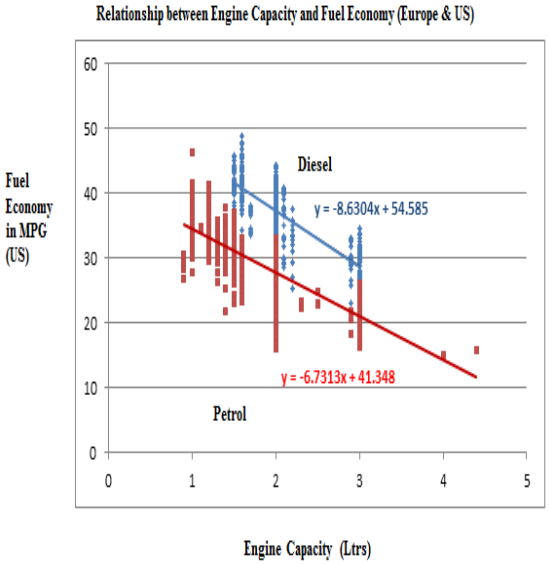
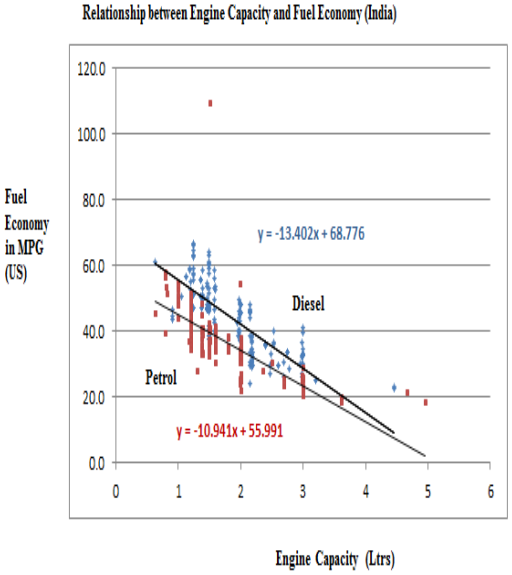


Figure 4:



Key Observations: (Figure 3 & 4)

(1) Impact on Fuel Economy on account of increase/decrease in Engine Capacity is more in case of India.

(2) The Fuel Economy gap between Petrol and Diesel vehicles is less in case of India compared to US & Europe.

Analysis of Fuel Economy level for Petrol and Diesel for different segments is given Table 1 & Table 2 below:

Some of the Engine Capacity segments are not available in both India and EQUA index. Hence, the cumulative average of the Fuel Economy has been considered to compare the Fuel Economies.

Table 1 below gives the analysis of Petrol Vehicles. The same is reflected in the form of a graph for easier understanding. (Refer Figure 3)

Table 1:

Cumulative Average Fuel Efficiency in MPG in Petrol Vehicles

Engine Capacity (CC)	India		US & Europe		Variation in MPG (Indian FE is more by)
	No. of Models	MPG	No. of Models	MPG	
Up to 900	10	51.7	47	29.1	44%
Up to 1000	19	51.7	638	35.7	31%
Up to 1100	19	51.3	648	35.4	31%
Up to 1200	73	45.2	812	34.9	23%
Up to 1300	74	45.0	982	34.6	23%
Up to 1400	88	44.0	1184	34.0	23%
Up to 1500	107	43.7	2262	32.5	26%
Up to 1600	120	43.0	2526	32.3	25%
Up to 1700	120	43.0	2526	32.3	25%
Up to 1800	129	42.5	2526	32.3	24%
Up to 2000	165	40.0	3592	31.0	23%
Up to 2100	165	40.0	3592	31.0	23%
Up to 2200	165	40.0	3592	31.0	23%
Up to 2400	166	39.9	3612	30.9	22%
Up to 2500	167	39.9	3622	30.9	23%
Up to 2600	167	39.9	3622	30.9	23%
Up to 2700	176	39.1	3622	30.9	21%
Up to 3000	196	37.5	3840	30.4	19%
Up to 4951	201	37.0	3846	30.4	18%

Figure 5:
Petrol Car - Average Fuel Efficiency

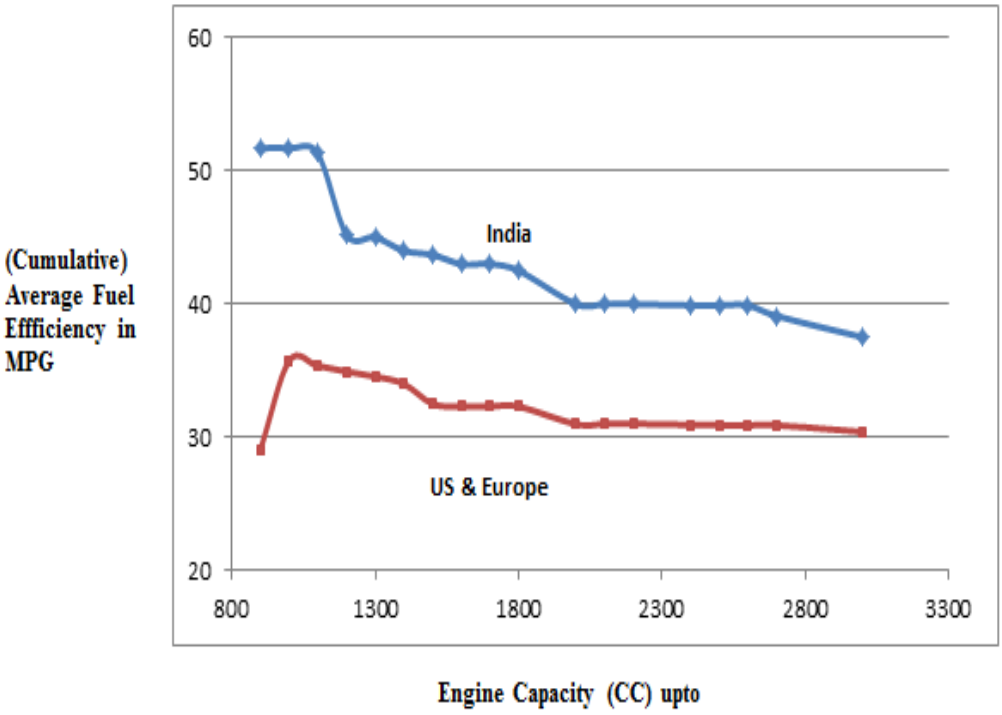
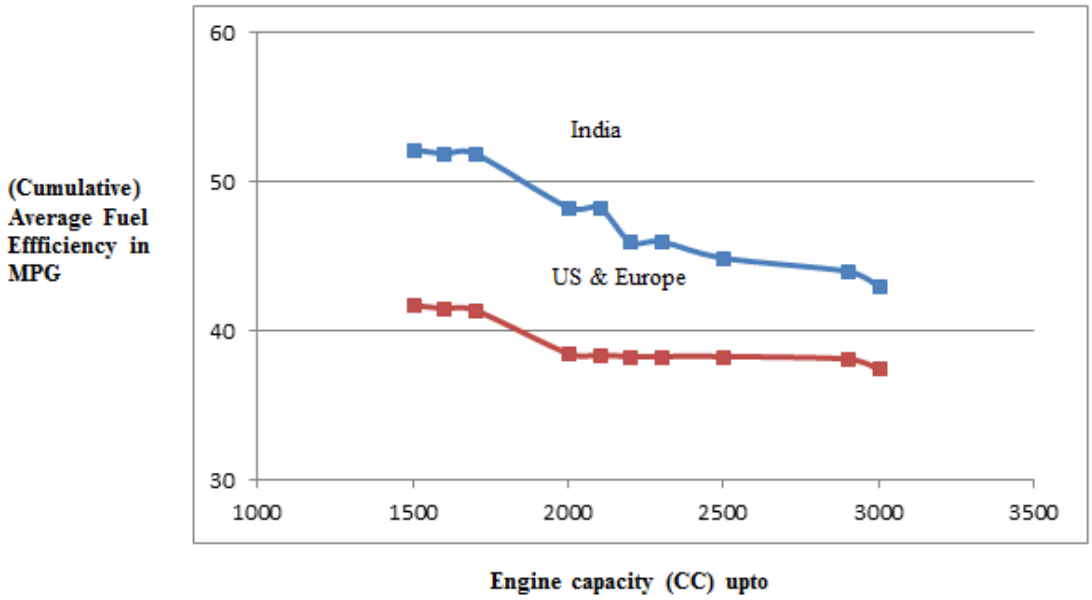


Table 2 and Figure 4 below give the similar analysis for Diesel Vehicles.

Table 2: Cumulative Average Fuel Efficiency in MPG in Diesel Vehicles

Engine Capacity (CC)	India		US & Europe		Variation in MPG
	No. of Models	MPG	No. of Models	MPG	(Indian FE is more by)
Up to 1500	94	52.2	395	41.7	20%
Up to 1600	104	51.9	829	41.5	20%
Up to 1700	104	51.9	849	41.4	20%
Up to 2000	147	48.3	2777	38.5	20%
Up to 2100	147	48.3	2918	38.4	20%
Up to 2200	180	46.0	2952	38.3	17%
Up to 2300	180	46.0	2952	38.3	17%
Up to 2500	197	44.9	2952	38.3	15%
Up to 2900	213	44.0	3030	38.1	13%
Up to 3000	234	43.0	3264	37.5	13%

Figure 6:
Diesel Car - Average Fuel Efficiency



Key Observations: (Table 1, Table 2 Figure 5 and Figure 6)

1. Table 1 and Figure 5 clearly establish that the Fuel Economy declared in the case of Indian Petrol Vehicles is higher (18% to 44%) than Europe & US.
2. Table 2 and Figure 6 shows that the Fuel Economy declared in case of Indian Diesel vehicles are higher (13% to 20%) than Europe & US.

IV. LIMITATIONS:

The analysis is limited to the Petrol/Diesel models given in the data published in the declarations. Also, this analysis has not considered the volume of vehicles produced under each model. CNG/LPG fuel model cars have not considered for this exercise.

V. CONCLUSION:

Fuel Economy can be computed while Emission Testing is done. However, this testing may not reflect the real world conditions. The Test Procedure adopted for FE Declarations in India is not clear. Economic Commission for Europe (ECE) was following an urban driving cycle for emission measurement in the 1980s, and the regulations were known as ECE 15-01, 15-02, 15-03 and 15-04. The cycle had a very low average speed of 19 kph and a maximum speed of 50 kph. After studying the changes in the driving conditions, ECE modified the driving cycle to include an Extra Urban driving cycle so that the average speed was 62.6 kph and the maximum speed 120 kph. This was called the New European Driving Cycle (NEDC) and the same came into force from 1994. The norms introduced using NEDC were called Euro I, Euro II and so on.

Indian Regulatory authority for Emission Control has adopted the New European Driving Cycle (NEDC) procedure for emission testing with the maximum speed limit of 90 kph, from the year 2000 and adopted Euro I norms. The norms were subsequently revised every five years to Euro II, Euro III etc. Now India will follow Euro VI norms from 2020.

According to a Study report (August 2017) submitted in Europe, there is a need for further studies and investigation on real-world emissions[3]. Europe is now moving to a new Testing procedure called Worldwide Harmonised Light Vehicle Test Procedure (WLTP). While the old NEDC test determined test values based on a theoretical driving profile, the WLTP cycle was developed using real-driving data, gathered from around the world. WLTP, therefore, better represents everyday driving profiles. The WLTP driving cycle has been split into four parts with different average speeds: low, medium, high and extra high. Each part of driving cycle contains different driving phases, stops, acceleration and braking phases. For a given car model, each powertrain configuration is tested with WLTP for the car's most economical and the least economical version[4]. Only WLTP homologated cars can be sold in Europe from September 2018. There is a need for India to examine and standardize the process of arriving at the Fuel Economy data as

it is important not only for the consumers but also for controlling emission.

REFERENCE:

[1]. EQUA Index powered Emission Analytics website: https://equaindex.com/equa-fuel-economy-index/

[2]. 9th SIAM FE Declaration 2017-18 - http://www.siamindia.com/

[3]. Real-world emissions testing on four vehicles – Study Report dated 28th August 2017 by Emisia SA to ICCT, Germany

[4]. WLTP Website: https://wltpfacts.eu/what-is-wltp-how-will-it-work/

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