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# Emission Norms in United Kingdom & India

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FAIZ IQBAL<sup>1</sup>

## ABSTRACT

*In 1972, the United Nations Conference on the Human Environment held in Stockholm brought the industrialized and developing nations together to delineate the 'rights' of the human family to a healthy and productive environment. A series of such meetings followed, e.g. on the rights of people to adequate food, to sound housing, to safe water, to access to means of family planning. The concept of sustainable development was formalized in 1987 at the same time with the publishing of the Brundtland Report by the World Commission on Development and Environment as follows: "Humanity has the ability for sustainable development – to ensure the needs of the present without compromising the ability for future generations to satisfy their needs". The definition of sustainable development is based on 2 concepts. Firstly, the concept of needs and secondly, The idea of confinement of the environment capacity to respond to current and future needs. Sustainable Development (SD) implies economic growth together with the protection of environmental quality, each reinforcing the other. Sustainable Development, thus, is maintaining a balance between the human need to improve lifestyles and feeling of well-being on one hand, and preserving natural resources and ecosystems, on which we and future generations depend. The 3 dimensions of sustainable development are that the environment is the necessary basis for sustainable development, the economy is the tool to achieve sustainable development and the good life for the entire social dimension is the target of sustainable development. In this paper the author is studying the Environmental Policies of Europe and India and their effect on Environment. Emission Standards limits the amount of gases released by from industry, power plants, small equipment such as lawn mowers and diesel generators. Frequent policy alternatives to emissions standards are technology standards. In this paper researcher is focusing on the Emission Standards of Developed Countries like European Union and Developing like India.*

## I. INTRODUCTION

The everyday customer who is yet to buy themselves a vehicle or is planning to get one could soon have to shell out more for their purchase. "On top of that, the fuel costs also need to be

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taken into account. But above all of this, there is a bigger target to be achieved. India has some of the most polluted cities in the world and automobiles are often considered as one of the biggest factors responsible for it. The need of the hour is to control the pollution levels by all means possible and since globally, countries are implying Euro 6 levels of emission regulations, India needs to step up its game and hence the BS IV to BS VI emission norm implication. As of now, BS VI will be implemented from April 1, 2020, 3 years after BS IV was implemented in 2017. Those looking to purchase a vehicle will have to spend a higher amount than before to own one. The larger aim for the automotive sector as a whole is to implement BS VI emission regulation by the year 2020 in India. Yes, BS VI and yes, BS V will be skipped. This will require a huge amount of investments to make the oil refineries capable of producing a better quality of fuel and also investments in the infrastructure to make that fuel available across the country. Then, the automakers will have to make investments on their end too in order to speed up the research and development process and improve their own infrastructure – like the manufacturing plants – to make their offering BS VI compliant. This, eventually, will make owning an internal combustion engine powered car more expensive to own, and maintain. To sum it up, India is making an effort to reach the global standards and hence, a lot of changes in the trends, sales and choices made by customers are expected in the coming years.

#### **(A) Scope of the Study**

The newly introduced BS-VI norms are going to bring a radical change in the Indian automobile sector industry. India will also get low emission producing and more fuel-efficient vehicles soon. Diesel engines will be more expensive as compared to that of petrol engines because they need more adjustment and after-treatments in order to stay clean. So, this will make sure to attract the original equipment manufacturers (OEM) towards hybrid fuels and another environment friendly alternative technology solution providing companies are also going to benefit a lot from the transition. In case of fuel specifications in terms of BSVI the main understanding is that the consequence of the fuel effects on the emission of controlled air pollutants has reduced because of the recent advancements in the engine-after treatment technologies. The modern age engines usually require very low sulphur content in the fuel in order to maintain a strong performance during their need. The efforts put in for the transition from BSIV to BSVI can incredibly help in the reduction of air pollution from automobiles. This will bring a substantial enhancement in the air quality of highly populated cities as exhaust emission from vehicles are the primary source of air pollution in cities. The researchers

could find out more on the strategies adopted by the foreign car manufacturers in order to cope up with the transition from BSIV to BSVI. Researchers can further investigate on the sale strategies adopted by top car manufacturers in order to sell their BSIV compliant vehicles existing in their inventory.

### **(B) Hypothesis**

Environment Policies of Developed and Developing countries compliment for Environmental Protection.

### **(C) Sample Method:**

For this Research work Convenient Sampling Method, the Research area is concentrated on two regions i.e. Europe & India. The period of research is considered as from 1990 – 2012.

### **(D) Research Methodology:**

Exploratory research aims at identifying, exploring and analysing the various reasons of the problem. It further helps researcher in forming research hypothesis and related variables through wide literature review. Flexibility comes in an exploratory research with new ideas, exposures and perceptions. For the purpose of this research Secondary Data was collected from different Indian and International journals, articles, newspapers, commentaries, thesis, reports etc. It also includes information collected by various international organizations relating to commerce and trade. It also has publications done by the State and Central govt. from time to time.

### **(E) Review of Literature**

**Govindaraj, Elavarasan & Karthikeyan, Duraisamy & Muthu, Kannan. (2019).** <sup>2</sup>History of Emission standards in India - A Critical survey. 6. 28-35. “As of now, there are more than 1.2 billion automobiles present in the street which are the essential wellsprings of contamination that bring about genuine harm to the climate. In this way, it is important to screen and control the different emissions of Automobile. It is noticed that the specific hurtful gases were shaped as a result because of the variety in the motor burning cycle and were delivered to the climate through the fumes pipe makes genuine impact the human wellbeing; they were Hydrocarbons (HC), Nitrogen Oxides (NO), Carbon monoxide (CO) and Particulate Matter (PM). Aside from these side-effects, because of amazing burning Carbon Dioxide is delivered in the motors and this is one of the significant ozone depleting

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<sup>2</sup> Govindaraj, Elavarasan & Narayanan, Sethuraman & Karthikeyan, Duraisamy. (2020). COMBUSITON AND EMISSION ANALYSIS OF OXYGENATED MUSTARD OIL BIODIESEL WITH EXHAUST GAS RECIRCULATION IN COMPRESSION IGNITION ENGINE. IIOAB Journal. 11. 9-15.

substances which lead to an Earth-wide temperature boost. To control the arrival of these destructive fumes gases into the climate different nations have started and executed distinctive contamination standards to the Automobile makers as indicated by the vehicle type to keep the air quality clean. For instance, Environmental Protection Agency (EPA) in United States government, European Union Research Organization (EURO) in Europe has outlined severe guidelines for the vehicles to restrict the poisonous fumes emissions delivering into the climate. By taking EURO emission standard as reference Central Pollution Control Board in India has actualized Bharat emission standards and it is refreshing its guideline in normal time frame. In this paper, a total audit of different phases of Bharat emission standards and the purpose behind creation the emission rules and guidelines rigid as of late were examined in this paper.”

**Kumar, R. & Govindaraj, Elavarasan & Kannan, M & Karthikeyan, Duraisamy. (2020).** <sup>3</sup>Standards For Environmental Protection In India. *Worldwide Journal of Scientific and Technology Research*. 9. 319-323. “There is a basic circumstance hanging tight for our group of people yet to come about the utilization of the multitude of assets of globe to deliver power that our planet took billions of years to make. Over a brief length of shut down or an on-request power source to enhance a sustainable power framework, unrefined petroleum based motor driven generators can give a practical mechanical arrangement. The ICE generator is an experienced innovation that has been utilized with incredible achievement the world over. Surely, it is questionable that this achievement and the universal idea of the innovation have driven straightforwardly to a considerable lot of the ecological emergencies confronting our planet today. By the by, the inconveniences of the motor driven generator are many, and in certain applications, it is the proper innovation for the work. Indeed, even today, the significant force wellspring of automobile is unrefined petroleum based ICE which are should be changed bit by bit by an elective wellspring of energy. By taking EURO emission standard as reference Central Pollution Control Board in India has executed Bharat emission standards and it is refreshing its guideline in normal timespan. In this paper, a total survey of different phases of Bharat emission standards and the purpose behind creation the emission rules and guidelines tough as of late were examined in this paper.”

**Chen, Bohong & Wang, Long & Wang, Feng. (2019).** <sup>4</sup>Study on methane steam transforming coupling high-temperature exhaust heat usage for hydrogen creation. *Global*

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<sup>3</sup> Kumar, R. & Govindaraj, Elavarasan & Kannan, M & Karthikeyan, Duraisamy. (2020). Standards For Environmental Protection In India. *International Journal of Scientific & Technology Research*. 9. 319-323.

<sup>4</sup> Chen, B., Wang, L., & Wang, F. (2019). Study on methane steam reforming coupling high-temperature exhaust heat utilization for hydrogen production. *International Journal of Green Energy*, 16(12), 867-877.

Journal of Green Energy. “Methane steam changing coupling high-temperature fumes gas as warmth hotspot for hydrogen creation in an incorporated reactor made out of the improving channel and fumes gas channel was concentrated with Computational Fluid Dynamics reenactment. In this paper, the reactor execution, for example, methane transformation rate, hydrogen yield, temperature, warm effectiveness, and response rate dispersion were gotten with the advancement of delta boundaries and liquid stream in the two channels. Results indicated that the bay temperature and speed of the fumes gas importantly affected the reactor execution. Notwithstanding, its presentation was not essentially influenced by liquid stream modes and delta feed reactant temperature. The response rate and warmth motion were the most elevated at the reactor channel, and afterward diminished along the stream heading. Reproduction results could be utilized in the plan and enhancement of methane changing reactors coupling waste warmth usage for hydrogen creation.”

**Pettersson, Fredrik & Maddison, David & Acar, Sevil & Söderholm, Patrik. (2014).** <sup>5</sup>Combination of Carbon Dioxide Emissions: A Review of the Literature. *Global Review of Environmental and Resource Economics*. 7. 141-178. 10.1561/101.00000059. “The goal of this paper is to survey past examination on intermingling of carbon dioxide emissions among nations. We talk about the critical discoveries in this work, how the decisions of model, information, factual tests, and so on impact the outcomes, and feature some approach suggestions. The experimental examination on intermingling in per capita carbon dioxide emissions shows some proof of union between created (OECD) nations, while at the worldwide level there have all the earmarks of being generally diligent holes or difference. These outcomes are anyway touchy to the decision of econometric methodology and informational collection (e.g., the length of the time arrangement). In any case, the exact reason for a populist rule of equivalent per capita emissions in the plan of worldwide atmosphere strategy isn't strong; it overlooks the particular primary qualities of nations, for example, atmosphere, normal asset blessings, and so on” The examination consequently focuses to a requirement for additional inside and out investigations of the underlying determinants of carbon force (efficiency) at the nation level, just as to extra research on the financial results of various sorts of value standards (counting mixes of such standards).”

**Overview of Clean Automotive Thermal Propulsion Options for India to 2030 Dhrumil B. Gohil , Apostolos Pesyridis and Jose Ramon Serrano (2020):**<sup>6</sup> This paper presents the

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<sup>5</sup> Pettersson, F., Maddison, D., Acar, S., & Söderholm, P. (2014). Convergence of carbon dioxide emissions: a review of the literature. *International Review of Environmental and Resource Economics*, 7(2), 141-178.

<sup>6</sup> Pettersson, F., Maddison, D., Acar, S., & Söderholm, P. (2014). Convergence of carbon dioxide emissions: a review of the literature. *International Review of Environmental and Resource Economics*, 7(2), 141-178.

evaluation of near-future advanced internal combustion engine technologies to reach near zero-emission in vehicles with in the Indian market. “Extensive research was carried out to propose the rationalise the most promising, new ICE technologies which can be implemented in the vehicles to reduce CO<sub>2</sub> emissions until the year 2030. A total of six technologies were considered that could be implemented in the Indian market. An initial market survey was carried out on the Indian automotive industry and electric vehicles in India, followed by an in-depth analysis and understanding of each technology through literature review. The main aim of the paper was to construct methods for a successful implementation of clean ICE technologies in the near future and to, also, predict a percentage reduction of CO<sub>2</sub> tailpipe emissions from the vehicles. To do this, different objectives were laid out with a view to reducing the tailpipe CO<sub>2</sub> emissions. Especially with the recent and legitimate focus on climate change in the world, this study aims to provide practical solutions pathway for India. Widespread research was carried out on all six technologies proposed within the automotive market in India and a set of main graphs represent CO<sub>2</sub> emission reduction starting from 2020 until 2030. A significant reduction of CO<sub>2</sub> was observed in the graph plot at the end of the paper and the technologies were successfully implemented for the Indian market to curb tailpipe CO<sub>2</sub> emissions. A methodology based on calculating the vehicle fuel consumption was implemented and a graph was plotted showing the reduction of CO<sub>2</sub> emissions until 2030. The starting point of the graph is 2020, when BS-VI comes into effect in India (April 2020). The CO<sub>2</sub> limit taken into consideration here has been defined by the Government at 113 CO<sub>2</sub> g/km. The paper fulfilled the aim of predicting the effects of implementing the technologies and the subsequent reductions of CO<sub>2</sub> emissions for India.”

#### **(F) Euro Emission Standards**

“Euro” terminology should be used exclusively to describe European emission standards for vehicles, although often it is used also with reference to fuel quality requirements, which is incorrect. “Euro” standards are regulated in the EU legislative acts (regulations) stating the progressive introduction of gradually more stringent requirements for nitrogen oxide (NO<sub>x</sub>), hydrocarbons (HC), carbon monoxide (CO) and particulate matter (PM).

#### **(G) Bharat Stage Emission Standards**

These Emission Standards are established by Government of India to control the yield of contaminations noticeable all around from inward ignition motor gear, including engine vehicles. The standards and the timetable for usage are set by the Central Pollution Control Bo Automobiles are one of the significant donors of air contamination due to its harmful

fumes gases Hydrocarbon (HC), Carbon Monoxide (CO), Nitrogen Oxides (NOX) from Spark Ignition (SI) motor and Particulate matter (PM) notwithstanding those in the event of Compression Ignition (CI) motor on account of the non-homogeneous air fuel combination and the less span for oxidation of the burning items.

The Nitrogen di Oxide (NO<sub>2</sub>) emission is entirely irrelevant if there should arise an occurrence of direct infusion gas motor however high in the event of diesel motor, Likewise CO and HC emissions will be more in the SI motors contrasted with CI motors. The development of Nitrogen oxides and its utilization in ignition were obviously talked about by Hill S.C and Smoot L.D. The arrangement of residue emissions in Diesel fuelled motors were clarified by Pickett, L.M and Siebers, D.L utilizing miniature openings. NO<sub>x</sub> and PM were considered as the wellspring of contamination to the climate and in view of its arrangement impact the emission standards for these two were made severe step by step.

Emissions must be controlled distinctly in the accompanying three phases, First is pre-treatment measure like Exhaust gas recirculation(EGR) measure which is utilized to control the NO<sub>x</sub> emissions and supercharger or turbocharger for expanding the bay temperature for lessening HC and CO emissions, second is the treatment in chamber adjustments like shifting pressure proportion, Injection pressure and so on, and the third is the post treatment measure like Three way reactant convertor for expanding the oxidation cycle of CO and HC into Carbon di Oxide(CO<sub>2</sub>) and Water fume (H<sub>2</sub>O) and the decrease cycle of NO<sub>x</sub> into Nitrogen (N<sub>2</sub>) and Oxygen (O<sub>2</sub>). The restricting of the hurtful fumes emissions from an automobiles and its impact on the powertrain plan , the progressions that must be made on the post treatment strategies, and the nature of the fuel were examined by Bielaczyc, P et al.,

These unsafe fumes gasses can cause present moment just as long haul wellbeing impacts when breathed in by people like when carbon monoxide was breathed in it can make harm cerebrum and focal sensory system, Nitrogen dioxide can cause antagonistic change in the cell structure of lung divider, etc. As the number of inhabitants in the automobiles continues expanding step by step the contamination from it is likewise expanding which diminishes the air quality which builds the danger of coronary illness, stroke, cellular breakdown in the lungs and ongoing and intense respiratory sicknesses including asthma. It has been discovered that 97% of urban communities (having populace of more than 1 lakh) that has a place with the low and centre pay nations have surpassed the world wellbeing association's (WHO) air quality rules, and this makes the public authority of different nations to venture forward to rigid the emission standards to keep their current circumstance clean.



As indicated by WHO air quality information base 2018, it has been seen that the East Mediterranean Region is encountering the most noticeably terrible air nature of 167 PM<sub>10</sub> (size under 10  $\mu\text{m}$ )  $\mu\text{g}/\text{m}^3$  and the least was seen in the Europe of around 22 PM<sub>10</sub>  $\mu\text{g}/\text{m}^3$ , India has the air quality norm of around 94 PM<sub>10</sub>  $\mu\text{g}/\text{m}^3$ . The execution of "BHARAT STAGE" (BS) emission standards in India and the current emission standard that is by and by and the motivations to make the guidelines more rigid in emission standards of India were examined in this paper. Johnson.T have summed up the significant executions in the vehicle emission standards from the year 2015 including that the numerous nations like India, China and Beijing were moving towards EURO 6 emission standards. Limiting of the emissions of CO, NO<sub>x</sub>, HC and PM towards the EURO 6 and other progressed emission standards have become the significant need for the biggest car areas like Europe, Japan, China, India etcard under the Ministry of Environment and Forests.

## **II. DATA ANALYSIS**

### **Emission Standards Implementations In India**

Table 1 shows the historical backdrop of emission standards execution in different stages in India. As both the state and local government need to participate for the usage of the emission standards and furthermore the need in the different areas of the nation the emission standards were actualized in different stages. At first the emission standards were executed for fuel vehicles from 1991 and for diesel vehicles in 1992. Later from the year 2000 India have begun to adhere to the EURO emission standards, and Bharat Stage I (EURO 1) emission standard was executed cross country from the exact year. BS II emission standard emission standard were actualized in three phases from 2001 to 2005 and BS III emission standards were executed in two phases from 2005 to 2010 to cover entire country. The National auto fuel strategy 2003 have built out the guide for the usage of BS IV sort emission standards up to the year 2010 and later the auto fuel strategy was refreshed by Mr.Prahlal Joshi, chairman, the standing advisory group on Petroleum and Natural gas on May, 2015 to made the proposals to execute the emission standards up to the year 2025. The BS V emission standards were at first proposed to actualize from the year 2015. In light of the refreshed Auto fuel vision strategy and helpless air quality in India particularly in the National Capital Region (NCR), Gwalior in India represents 176 $\mu\text{g}/\text{m}^3$  of PM and it is realized that the PM level of more than 36  $\mu\text{g}/\text{m}^3$  will have high danger of mortality.

Table.1 History of emission standards implementation in India

<b>Standard</b>	<b>Date</b>	<b>Implemented Region</b>
BS-I	2000	Nationwide
BS-II	2001	NCR*, Mumbai, Kolkata, Chennai
BS-II	2003.04	NCR*, 11 cities#
BS-II	2005.04	Nationwide
BS-III	2005.04	NCR*, 11 cities#
BS-III	2010.04	Nationwide
BS-IV	2010.04	NCR*, 13 cities^
BS-IV	2015.07	Above plus 29 cities mainly in the states of Haryana, Uttar Pradesh, Rajasthan and Maharashtra
BS-IV	2015.1	North India plus bordering districts of Rajasthan (9 States)
BS-IV	2016.04	Western India plus parts of South and East India (10 States and Territories)
BS-IV	2017.04	Nationwide
BS-V	Skipped	Skipped Nationwide
BS-VI	2020.04	Nationwide

**TABLE 1: Vehicle Registration Worldwide**

Historical trend of worldwide vehicle registrations 1960-2010 (thousands)									
Type of vehicle	1960	1970	1980	1990	2000	2005	2009	2010	
Car registrations *	98,305	193,479	320,390	444,900	548,558	617,914	684,570	707,764	
Truck and bus registrations	28,583	52,899	90,592	138,082	203,272	245,798	295,115	307,497	
World total	126,888	246,378	410,982	582,982	751,830	863,712	979,685	1,015,261	

• Cars registrations do not include U.S. light trucks (SUVs, minivan and pickups) that are used for personal travel. These vehicles are accounted among trucks.

**Euro Emission Standards for Light Duty Vehicles (Lcv)****Table 2 Weight < 2.5 tonne 6 seater.**

Standard	CO	HC	NOx	HC+NOx
Pre-E1	Upto 10.0	-	-	Upto 2.55
Euro I	2.72	-	-	.97
Euro II	2.2	-	-	.70
Euro III	2.3	.20	.15	-
Euro IV	1.0	.10	.05	-

EU Emission standards for gasoline light-duty vehicles (between 1251 and 1700 kg reference weight), g/km, including heavy passenger cars (> 2500 kg laden) or 6-9 seats for Euro I and II standards

**Table 3: Weight 1251 – 1700kg**

Standard	CO	HC	NO <sub>x</sub>	HC+NO <sub>x</sub>
Euro I	6.90	-	-	1.70
Euro II	5.00	-	-	.07
Euro III	5.22	0.29	.21	-
Euro IV	2.27	0.16	.11	-

2. EU Emission standards for gasoline light-duty vehicles (> 1700 kg reference weight), g/km, including heavy passenger cars (> 2500 kg laden) or 6-9 seats for Euro I and II standards

**Table 4: > 1700 kg**

Standard	CO	HC	NO <sub>x</sub>	HC+NO <sub>x</sub>
Euro I	5.17	-	-	1.40
Euro II	4.00	-	-	.60
Euro III	4.17	0.25	.18	-
Euro IV	1.81	0.13	.10	.30

The above table shows the Different Norms of Light Duty Diesel Vehicles as regards to their weight and this category includes vehicles up to 8.5 tonne. As we have seen European Emission Standards follow a very strict Emission norms for LCV by reducing their emission year by year and following strict measures to implement it.

#### **Bharat Stage Emission Standards for Light Duty Vehicles (Lcv)**

1. “Light-duty diesel vehicles (GVW ≤ 3,500 kg) are summarized in Table5. Ranges of emission limits refer to different classes (by reference mass) of light commercial vehicles; compare the EU light-duty vehicle emission standards page for details on the Euro 1 and later standards. The lowest limit in each range applies to passenger cars (GVW ≤ 2,500 kg; up to 6 seats).”

**Table 5: LCV GVW ≤ 3,500 kg**

Year	Reference	CO	HC	HC+NO <sub>x</sub>	NO <sub>x</sub>	PM
1992	-	17.4-32.3	-	-	-	-
1996	-	4.0-8.0	-	2.0-4.0	-	-
2000	Euro I	2.68-6.8	-	.97-1.7	0.14-0.25	-
2005	Euro II	1.1-1.4	-	0.7-1.2	0.08-0.17	-
2010*	Euro III	0.73	-	0.56	0.50	0.05
		0.79	-	0.72	0.65	0.07
		0.89	-	0.86	0.78	0.10
2020 *	Euro IV	0.49	-	0.30	0.25	0.025
		0.53	-	0.39	0.33	0.04
		0.67	-	0.47	0.39	0.06

\*Mumbai, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad, Pune, Surat, Kanpur, Lucknow, Sholapur, Jamshedpur and Agra

2. “Emissions standards for gasoline vehicles (GVW ≤ 3,500 kg) are summarized in Table 6. Ranges of emission limits refer to different classes of light commercial vehicles (compare the EU light-duty vehicle emission standards page). The lowest limit in each range applies to passenger cars (GVW ≤ 2,500 kg; up to 6 seats).”

**Table: 6 Gasoline Vehicles**

Year	Reference	CO	HC	HC+NO <sub>x</sub>	NO <sub>x</sub>
1992	-	14.3-27.6	2.0-2.9	-	-
1996	-	8.86-12.4	-	3.0-4.36	-
2000	Euro I	2.72-6.90	-	0.97-1.70	-
2005	Euro II	2.72-5.0	-	0.5-0.7	0.08-0.17
2010*	Euro III	2.3	0.20	-	0.15
		4.17	0.25	-	0.18

		5.22	0.29		0.21
2020 *	Euro IV	1.0	0.1	-	0.08
		1.81	0.13		0.10
		2.27	0.16		0.11

\*Mumbai, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad, Pune, Surat, Kanpur, Lucknow, Sholapur, Jamshedpur and Agra

Bharat Stage Emission norms is basically derived from European Emission norms with a time lag to 1-2 year for implementing it. BS Emission Standards somehow granted discount as we seen in Table 5 & 6 in CO, HC, HC + NO<sub>x</sub> and NO<sub>x</sub>.

### 3. European Emission Standards for Passenger Cars (Category M\*), G/Km

**Table: 7: Diesel**

Standard	CO	NO <sub>x</sub>	HC+NO <sub>x</sub>	PM
Euro I	2.72(3.16)	-	.97(1.13)	.14(0.18)
Euro II	1.0	-	0.7	0.08
Euro III	0.64	0.50	0.56	0.05
Euro IV	0.50	0.25	0.30	0.025
Euro V	0.50	0.180	0.230	0.005
Euro VI	0.50	0.080	0.170	0.005

**Table 8: Petrol**

Standard	CO	THC	NMHC	NO <sub>x</sub>	HC+NO <sub>x</sub>	PM
Euro I*	2.72(3.16)	-	-	-	.97(1.13)	-
Euro II	2.2	-	-	-	0.5	-
Euro III	2.3	0.20	-	0.15	-	-
Euro IV	1.0	0.10	-	0.08	-	-
Euro V	1.0	0.10	0.068	0.060	-	0.005**

Euro VI	1.0	0.10	0.068	0.060	-	0.005**
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\* Before Euro 5, passenger vehicles > 2500 kg were type approved as light commercial vehicles N<sub>1</sub>-I

\*\* Applies only to vehicles with direct injection engines

\*\*\* A number standard is to be defined as soon as possible and at the latest upon entry into force of Euro 6

† Values in brackets are conformity of production (COP) limit.

Bharat Stage Emission norms are somehow same as the above norms shown in Table 5 & Table 6 for LCV's and passenger cars differs only by some fractions as regards to certain decimal points.

### European Emission standards for Lorries and buses

**Table 9: Lorries and Buses**

Standard	Test Cycle	CO	HC	NO <sub>x</sub>	PM	Smoke
Euro I	ECE	4.5	1.1	8.0	0.612-.36	-
Euro II	R-49	4.0	1.1	7.0	0.36-25	-
Euro III	ESC & ELR	2.1-1.0	0.66-.25	5-2	0.13-.10	0.15 – 0.8
Euro IV		1.5	0.46	3.5	0.02	0.5
Euro V		1.5	0.46	2.0	0.02	0.5
Euro VI		1.5	0.13	0.4	0.01	-

### Emission standards for Large Goods Vehicles

**Table 10: Large Heavy Goods Vehicles**

Standard	Date	CO (g/kWh)	NO <sub>x</sub> (g/kWh)	HC (g/kWh)	PM
Euro I	1992-1995	12.3	15.8	2.6	-
Euro II	1995-1999	4.9	9.0	1.23	0.40

Euro III	1999-2005	4.0	7.0	1.1	0.15
Euro IV	2005-2008	2.1	5.0	0.66	0.1
Euro V	2008-2012	1.5	3.5	0.46	0.02

### Bharat Stage Emission Standards for Trucks and Buses

**Table 11: Truck and Buses**

Year	Reference	Test	CO	HC	NO <sub>x</sub>	PM
1992	-	ECE R49	17.6-32.9	2.5-3.5	-	-
1996	-	ECE R49	11.43	2.39	14.67	-
2000	Euro I	ECE R49	4.8	1.0	8.09	0.37*
2005†	Euro II	ECE R49	4.3	1.0	7.7	0.16
2010†	Euro III	ESC	2.2	0.56	5.03	0.19
		ETC	5.54	0.89	5.3	0.15
2010‡	Euro IV	ESC	1.8	0.34	3.9	0.05
		ETC	4.6	0.66	3.9	0.04

\* 0.612 for engines below 85 kW

† earlier introduction in selected regions, see Table 5 ‡ only in selected regions, see Table 6

In this Section of Heavy Goods vehicle we Bharat Stage Emission need a lot of improvement because majority of pollution is caused by this Heavy Good Vehicle. EE Standards are pretty cleaner in the Emission side and with the introduction of Euro VI they are far ahead than us.

After analysis of the Emission Norms of Europe and India. We can come to know that European Emission Standards compliment for Environment Protection by reducing emission to a very great extent and it keeps changing year by year. They had already planned for Euro VI effective from 2014, whereas Bharat Stage IV is still in growing stage.

Hence, **Hypothesis is proved.**



### III. CONCLUSIONS

Surge Standards are a significant thought in itself. However, as a result of limitation of paper simply Automobile Emission are thought of. We have seen the Emission Standards of Europe and India. People of Vehicles of Europe is significantly greater than India. Regardless, their Emission are far low than India. The clarification since they have taken a veritable thought of Emission Standards and makes them extremely Stricter when stood out from India. Also, in India we are up 'til now in execution of their 2005 standard in 2010 for instance BS IV in only 13 metropolitan networks and all over India we are in BS III of Euro 2000. There is a certified postponement among determination and utilization of standards in India. CPCB needs to take a note of it.

### IV. RECOMMENDATIONS

#### **(A) For Europe:**

There Emission Standards are at standard with different pieces of nation. Be that as it may, some improvement should be possible especially in the Light Duty Vehicles by decreasing the measure of Carbon Monoxide level.

#### **(B) For India.**

1. "There is a veritable postponement between executions of new standards. As we are developing speedy and our standards must be changes to control the proportion of pollution perceptible in general.
2. Proper and reasonable law approval must be there against defaulters. Customarily it is seen than dirtying vehicles are there in the road particularly in the nation similarly as metropolitan domains also.
3. For BS IV is up 'til now in only 13 metropolitan networks, for this we can skip BS IV and can move towards BS V which is yet to be pronounced by CPCB."
4. In India we are not keeping up the vehicles effectively happening to dull smoke from exhaust. If vehicles are kept in proper condition by standard changing, fixes then the proportion of smoke will be reduced for the most part.

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