

CASE STUDY REGARDING THE TATA MOTORS CONTRIBUTION IN SAVING THE ENVIRONMENT

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ABSTRACT

Global Warming has become a great concern in today's world. The Earth's temperature is rising due to many human & non-human activities. But one of the major contributor to the rising pollution level is the emissions released from the automobile sector. There is a need to control such rising emissions level in the atmosphere which occurs in the form of Nitrogen dioxide (NO₂), Carbon dioxide (CO₂), Carbon Monoxide (CO) etc. which can be prevented or can be reduced to a certain extent by producing Green vehicles such as Electric vehicles, Hybrid vehicles, Plug-In Hybrid Vehicles & by making the changes in the technology of Engines as well & one of such move has been taken by TATA MOTORS by bringing up the improvements in its engine technology such as Revotron, Revotorqengines and Cummin engines etc. Moreover, Tata Motors has come up with the various eco-friendly vehicles as well such as Smart Buses, Hydrogen fuel cell-based buses, Star bus etc. which are based on the Green Technology concept. More than 4,500 Engineers, Researchers & Scientists have been employed by the Tata Motors that undertakes the decisions to make its products eco-friendly & have been looking up for collaborations & Joint Ventures to bring on the Green Technology in its Vehicles. Thus, the Automobile Companies need to take the voluntary actions for making their environment Cleaner & Greener.

KEYWORDS: *Global Warming, Pollutants, Technological Developments, Green Technology.*

Introduction

The sea levels are rising, wildlife is reaching to extinction level, forests are dying, glaciers are melting, and many plants and animal species are being migrated etc and all this is happening because of global warming. All these activities are taking place because of the rising amount of Carbon dioxide (CO₂) and other pollutants in the atmosphere. Global Warming can be defined as the rising temperature of Earth's surface, oceans and atmosphere that leads to green house effect being caused by increased level of carbon dioxide and the other air pollutants. As per the study conducted in US Approximately 2 billion tons of CO₂ emissions is being revealed burning of fossil fuel which is done to produce electricity there and the other one is the Transportation sector that releases 1.7 billion tons of carbon emissions per year. It is becoming a great concern to people because the climate is changing at faster pace than the living things may be able to adapt it to. Apart from the transportation sector and carbon power plants, there are various other causes such as use of chlorofluoro carbons (CFCs) as refrigerants and propellants, production of harmful methane gas while mining, mass raising of livestock etc, deforestation as the trees used to be the home for Carbon dioxide (CO₂) etc leads to global warming.

The automobile Industry has been considered as the highly polluting industry and releases various harmful pollutants such as:

- **Carbon Dioxide (CO₂):** in large quantity which traps up the earth's heat and leads to global warming.
- **Hydrocarbons (HC):** they release when the partially burnt fuel molecules blends with nitrogen oxide and sunlight.
- **Carbon Monoxide (CO):** it is released when a vehicle is driven at high altitudes or the improper tuning of the vehicle. Generally, it is being released in large amount from Commercial vehicles.
- **Nitrogen Oxides (NO):** plays major role in forming acid rain.

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There is a need for government to Intervene and should take the measures to control pollution being caused by automobile sector. In this regard:

- Government should try to reduce its dependency level on fossil fuels.
- Limiting the CO₂ emissions from polluting industries
- Promoting more use of Wind Power, Solar power and Bio diesel etc
- Encouraging Afforestation activities amongst people.
- People prefer cars having best fuel economy and uses the car when required.

Objectives of the Study

- To study the impact of automobile industries on the environment.
- To study the contribution made by the automobile industries in saving the environment.

Review of Literature

- **R C Sharma & Niharika Sharma (2014):** Interpreted that the automobile industry directly and indirectly effects the environment .On one hand, the production activities and the usage of vehicles puts a direct impact on the environment whereas the on the other hand, uncontrollable activities like production and distribution of raw material etc are the ones that indirectly effects the environment. Moreover, the paper emphasizes on the problems created from CO₂(carbon emissions) of vehicles, the green house gases being released from the transportation sector and the measures that need to be taken by the automobile industries level on government level and individual level to protect the environment .

- **Harish M (2012):** He conducted a study on the Air pollution being caused by the vehicles in the Bangalore city which is the only metropolitan city of Karnataka having the highest population of 94 lacs (in 2011) and demography . It has 41 lacs registered vehicles as per 2011 census. The study has tried to identify the number of vehicles that exist in the city, pollutants that emits from the vehicles and the measures that could be taken to control the pollution level. Thus, the **Remote Sensing Technology** that measures the pollutant level, car pooling concept , day without car or 2 wheelers ban of vehicles older more than 15 years and 2 stroke vehicles etc were certain vehicles that were suggested to prevent the rising pollution level in the city.

- **Ali Rashid (2011):** He has tried to explain about the harmfulness which can be created by diesel engine usage to human health. Diesel engine contains such pollutant that causes the formation of green level ozone, acid rain, climate changes and many health-related problems or diseases. Headaches, nausea, cough, itching of eyes, cancer and respiratory problems etc are certain health diseases that can occur due to diesel emissions. Thus, the use of cleaner alternatives like CNG,LNG(Liquidified Natural Gas), Bio diesel have been emphasized.

- **Mubashir Tamboli (2016):** He has given a way out to reduce the dependency on fossil fuels and the rising carbon emissions from the vehicles by introducing with the concept of "GREEN ENGINES". Green engines can also be termed as TURBO COMBUSTION GREEN ENGINES. As compared to the conventional piston engine, the green engines contains the technical features like complete burning, high combustion efficiency level, super air fuel mixing, high expansion ratio and direct fuel injection etc. Such engines can be used widely for transportation, engineering, military purposes, in automobiles, ships, tractors, generators, tanks, aircrafts etc. moreover, any type of fuel can be used in the engines and is far superior than the conventional IC engine on cost, efficiency and operation basis etc. Currently it is being used in ships, locomotives, Aircrafts and the research is still going on for making its use in wide range of transport vehicles.

- **Reddy S Satti & Tharnn S Kola (2013):** They discussed about the global warming being a major problem globally which is being caused by the CO₂ emissions into the atmosphere. Automobile sector plays a major role in creating the Air pollution. The estimate says about 17-18 % CO₂ emissions has been caused by this sector. The author has given the best way to reduce this emissions level by introducing HYBRID ELECTRIC VEHICLE. This vehicle is a combination of 2 things ie Conventional IC engines and electric propulsion. Such vehicle's system makes use of regenerative breaking concept (kinetic energy into electric energy), Start Stop System(IC engine Starts and Stops when needed), smaller gasoline engine etc. Such engines are being used currently in the automobiles, trucks, buses , military vehicles etc. Though, Hybrid electric vehicles being on expensive sides than the conventional ones but provides 30 % better fuel economy 20 % reduction in usage of fuels in case of diesel one and 10 % in case of CNG.

- **Lohit V and Verrabahu V (2012):** They explained about the concept of green engines in their study. As per this study, green engines have been considered as the "Engines of the future" and are far better than the contemporary engines. Green Engines are specialized with respect to high expansion

ration, direct intake, strong swirling etc. they have almost zero emission level, high efficiency ratio and are based on 6 phase IC engine with high expansion ratio

- **Prof. Joshi Nitin & Rao P.S. (2013):** They argued the concept of green car is not new to the people rather such cars have been produced in the other developed countries with a good response from the customers there. Similarly, the Indian manufactures have also tried to serve the customers with this concept but could not achieve success. So, the author has tried to explore the problems that why green cars did not receive much response from the Indian market. Author emphasizes on 2 reasons for non acceptance of green cars ie unawareness among the customers about the availability of green cars and unawareness among the policy makers too about the same. Data was collected via secondary sources and the hypothesis was taken. Null hypothesis says that the significance difference exist in the awareness level of customers belonging to different age groups about the availability of Green car while the alternate hypothesis considers the income level of customers. However, it was concluded that the awareness among the customers belonging to different age groups, income level was same and thus, the government and the marketer needs to take the effective measures in order to inform the public about environment problems being created from the use of cars.

- **Ravi Pooja and Beloor Vanishree (2016):** They explained about the Green marketing in detail manner covering the various aspects like its meaning, how it evolved, why firms are going green, the marketing mix of Green marketing, the problems faced while adopting green marketing etc. The changing lifestyle and the attitude of consumers and the pollution level, to create an edge over the competitors etc are the reasons that the firms are going green in nature. APPLE, IBM, SONY, DELL etc are the companies who have been able to adapt the green marketing strategy in their environment. The study concluded that the green marketing would not generate benefits in short run rather it will be beneficial in long run, so firms need to keep patience. Moreover, it is not the sole duty of government to protect the environment rather the firms, individuals all have to come together to protect the environment by going green.

Theoretical Base

- **Engines- Concept**

The term engines could be described as those devices which absorb fuel to perform the mechanical work by applying force to them. Engines could be considered as the steam engines and the internal combustion engines (IC) used in case of automobiles. Thus, engines can be defined as the machines that transfer the heat energy into motion.

Automobile gasoline engines, diesel engines, turbo fans, rockets etc are certain examples of engines. Initially the term engine was distinguished from the word motor. Both of them technically had different meanings

On one hand an engine is referred to a machine that absorbs fuel to produce heat whereas on the other hand the motor does not make use of fuel rather it is driven by the electricity, air or hydraulic pressure. But later on, both the terminologies were started using interchangeably.

STEAM ENGINES were the first engines that came up in 1700 and converts the heat into mechanical motion by making use of boilers for making steam. Stanley steamers is one of the automobile based on steam engine concept that provided less pollution, power and speed and use to take upto 45 minutes as start up time. Due to its complexity, unreliability and longer duration taken for its start up gave rise to the introduction of electric engines which came up in early 1800's.

These electric engines based cars provided soundless ride and less pollution as compared to steam engines based cars. These engines run on the batteries storing electricity for powering electric motor and contain components like crank shafts that provides power much faster than the gasoline engines but because of its range issue, the electric engines did not become successful.

In order to cover up the shortcomings of electric and steam engines, a new variant of engines namely the internal combustion engine were introduced. Etienne Lenoir invented the first commercial internal combustion engine around 1859 whereas Nikolaus Otto invented the first modern IC in year 1876. The internal combustion engine is based on the concept of burning the fuel in a space known as combustion chamber. This fuel in coming in contact with the oxidizer release the high temperature and high pressure gases which expand and causes the movement in the entire engine.

The IC engine terminology is reminded when reciprocating engines. 2 and 4 stroke piston engines and Wankel engines are being referred to. As in these engines also likewise the IC engine the combustion process is intermittent (not steady) whereas the rockets, jet engines and gas turbines makes use of the continuous combustion which is an another category of IC engines. IC engines are being used

for transportation purposes, in electric generators , electric tools powered aircrafts etc. Such engines offers convenience over the electricity and charges the battery too in the hybrid vehicles .These engines are compact and lighter in weight and safe to use.

- **Improvement Made in the Engines of Tata Motors**

Tata motors have been on fore front in maintaining its stability and competitiveness in the industry and that is why it has introduced the green technologies and the engine enhancement in its vehicles. In order to become a global leader in the technology area , Tata motors has employed around 4500 engineers , technicians and scientists who are working aggressively so as to bring innovation in its vehicles. It is having it Research and Development centers in countries like India, U.K., South Korea, Europe and US. Moreover, Tata motors have moved on in collaboration with international brands like Bosch, Vibracoustic, Good year etc.

There are certain improvements that have been made in the engines which can be described as follows:

- **New GEN DICR Engines:** Tata Motors has decided to invest its money in new generation diesel engines having the capacity of 3 litre and 5 litre. These engines will be used in the commercial vehicles & would provide better fuel economy, reliability & durability to its customers. They both are indigenous engines & contains unique features like rear gear train, top -down cooling, cylinder block having bed plate etc. These engines are being developed in the Pune plant of Tata Motors & are involving the technology leaders like Browarner, Delphi etc.

- **Tata Cummins Engines:** Tata Motors made an agreement with Cummins Inc. for the Signa engines which are to be used in its medium & heavy commercial vehicles segment. These engines have been produced with best facilities at the Phalton & Jamshedpur plants.

The following are the variety of engine types of Cummins Inc. :

- **Signa 4923.S:** It has reliable Cummins and provides the fuel efficiency.
- **ISBe5.9:** It delivers the power of 230Ps with torque of 850 Nm.
- **Signa3118.T & Signa 2518.K:** These engines contain best in class B_{5.9} L-6 cylinder engine of Tata Cummins with the power of 180 Ps and flat torque of 675 Nm. These engines provide the better fuel efficiency and provide the highest engine life too.

Some of the other engine parts like turbo chargers fuel systems filters etc that have been derived from Cummins have also added on to reliability and performance of Tata Motors Vehicles.

Cummins has been a technological leader and provide the best ranges of engines having characteristics of reliability, durability , fuel economy etc .

Cummin engines are based on techniques like gear down protection, vehicle acceleration management , head based speed control etc . that plays a major role in bringing down the production cost and produces the optimal output. These engines fulfill the emission norms that exist globally.

- **Revotron:** Revotron is an indigenous engine made by Tata Motors that delivers the superior fuel economy , optimized performance and refinement . It had a 1.2 litre turbocharged multi point fuel petrol engine which offers the three driving modes namely sports, city and eco .The stiffened crank case in the engine makes it less noisy & reduces the vibration and harshness too. Bosch, Honeywell etc are the technological partners who contributed in the designing of Revotron engine.

- **Revotorq:** The Revotorq engine of Tata Motors made its debut in the Indian market with brand Tiago. This 1.05 litre diesel engine aimed at providing superior fuel economy & refined road performance. This engine also offers the multi drive mode of sports, city and eco which is being provided by Revotron too.

Revotorq based Tiago on conducting the endurance test was able to complete 50,000 kms with high stress conditions and provided 120kmph average for both diesel & petrol variants when a test was conducted by Federation of Motor Sports clubs of India for 18 days on high speed drive .

- **Jaguar Land Rover's New Powertrains:** The Jaguar Land Rover of Tata Motors was aimed at making it lighter in weight, right sizing of its power train and electrifying its propulsion systems so as to make it environmental friendly. It makes its vehicles light in weight by using the aluminum in its models. It also makes use of Ingenium engines which are being manufactured at Wolver Hampton of U.K. in order to improve the performance of its engines.

Jaguar Land rover has been taking up green initiatives by adding on new power train technologies like plug in hybrids, battery electric vehicles etc in its products range & is providing diesel hybrid-based variants of Range Rover & Range Rover sport currently.

- **Tata 697 Engines:** Tata 697 engines are being used in its commercial vehicles and are providing fuel efficiency, superior performance and contain modern electronic control injection and rail technology that makes these engines eco friendly. Such engines of Tata motors provides high reliability , low operating costs and contains proper water separation system which protects the fuel injection system of its vehicles.

In the year 2002, the Prime minister "Atal Bihari Vajpayee" wrote a letter to TELCO extending the warm greetings to all the team members of TELCO for bringing the successful innovation in the form of an indigenously designed car named "INDICA" in the mid size segment and car achieved success not only in the Indian competitive market but beyond that too. Tata motors was able to make its space in the international market by taking up various initiatives like setting up assembly bases in South Africa, China, Thailand etc., takeover of Korean company named Daewoo commercial vehicles limited and supply of passenger cars to MG Rover of UK etc.

- **Technological Developments**

Tata in the period of last 70 years has been contributing a lot more towards the understanding of the customer needs and the economy needs too and has been working thoroughly in order to convert these needs into the offerings or products form by providing the best – in – class technology. It has been the first brand who introduced a complete indigenous passenger car namely Indica and thereafter launched the other varieties of cars too such as Nano, Zest Bolt, Tiago etc.

Prima, Signa and Ultra trucks falls in the head of its medium and heavy commercial vehicle segment (M & H CV) whereas Starbus electric 9m, Starbus Hybrid 12m buses etc are its latest innovations developed for the public transportation. Moreover , it has launched a new series of Smart buses designed and developed by alternate fuels. The company has also been able to bring in the economically viable fuel Cell bus 12 m, Articulated Bus and LNG powered buses 12m which is a step towards implementing the Green technology and that provides mobility solutions.

The REVOTRON 1.2 T ENGINE AND REVOTORQDIESEL ENGINE are the award winning series engine for their optimum mix of fuel economy, performance and refinement .Furthermore, in year 2010, Tata motors introduced the 2 types of technologies in the Indian market named as:

- SCR (Selective Catalytic Reduction)
- EGR (Exhaust Gas Recirculation)

These technologies covers the BS IV range of commercial vehicles segment of Tata motors and aims at reducing the Nitrogen emissions from the engines , providing better Power and Fuel efficiency.

The AMT Technology (Automated Manual Transmission) is an another technology introduced by TATA MOTORS for its Starbus & Ultra brand of buses that ranges from 12m & 9m dealing specifically with cities having heavy traffic . This technology comes in manual automatic forms with the two modes namely economy & power one.

The AGD (Automatic Gear Detection) in case of power mode consumes sufficient engine torque for maintaining easy & quick movement of a vehicle while the optimal fuel consumption takes place in the economy mode.

TATA MOTORS believed in "MAKE IN INDIA" slogan as per which the TATA GROUP used to launch vehicles which were indigenously developed in India. Moreover, it has its research centre namely Engineering Research Centre(ERC) in Pune which was established in year 1966 & is considered to be a hub of young engineers & designers who are working on 20 different engine platforms having 250 variants of vehicles. This centre contains the best-in-class equipments & facilities like Noise, Vibration & Harshness lab (NVH) etc. Pune centre is the largest research centre while the research centers at Jamshedpur, Lucknow & UK are the smaller ones. The ERC centre of Pune had its beginning in TELCO , JAMSHEDPUR & after the few months a similar facility was then settled at Pune campus. The Pune research centre initiated with the establishment of 1210 semi forward control cab & 1516 SFC cab for Tata Trucks.

Later on, the ERC introduced TATA 407 that belonged to Light commercial vehicle (LCV) segment in the markets. This vehicle got huge success in the Indian Market which could be released or seen as more than a million units of 407 were being produced & sold in the market. Tata 407s success gave rise to 207 platform through which the company was able to move into passenger vehicle segment & added on Tata Estate, Tata Sumo & Tata Sierra in its passenger vehicle's segment. Furthermore, ERC has added on Tata Safari, Nano, 49 tonne Prima trucks etc to the Indian market.

The company's varieties of cars like Tiago, Hexa, Nexon , SUV , Kite & its Signa range of trucks etc are based on the advanced vehicle architecture & contains the various innovative capabilities . Its

Zest, Bolt & Tiago segment of cars offers the multi drive mode (City, Eco & Sport) to the customers. Moreover, the company has tried to serve not only the Business & Customer Segment but has tried to cater to defence sector too for which it developed the KESTREL (Futuristic Combat Vehicle) with the help of Defence' Research & Development department. Company was able to complete this project in 18 months period.

- **Climate Change / Green Technology**

Tata Motors has been working intensively updating or in bringing the green technology in its products & environment. In this regard, it has developed Hydrogen Fuel Cell Technology which powers up the both passenger & commercial vehicles & reduces dependency on non-renewable sources like fossil fuels. The Hydrogen Fuel Cell Technology compresses the hydrogen with oxygen & thereby, produces electricity in the fuel cell, due to which the battery gets charged up & powers up the motor to operate & releases the water vapor only as a discharge.

Moreover, Tata Motors has also manufactured "Magic Iris Electric" which is green fuel based commercial vehicle, uses the solar energy as a supplementary charger & has a zero emission level. Hybrid Star bus is also another commercial vehicle that provides clean fuel solution for public transportation.

The launch of Ingenium engines in the company's Jaguar Land Rover models has left a positive effect on environment. The Ingenium engines had made more use of aluminium & has reduced not only the emissions level among vehicles but has also reduced the running cost of a vehicle & thereby, making a car an efficient one. The Ingenium engines launched in Jaguar Land Rover (JLRs) XF model has successfully reduced 99g/km of CO₂ emissions whereas 104g/km of CO₂ emissions has been reduced by its JLR's XE model.

The Tata Motors "RANGE ROVER HYBRID" has also contributed towards the saving the environment. It is the 1st diesel hybrid SUV that featured both an electric motor & the conventional power train too. The energy flow smoothly between its 3 litres turbo diesel V6 engine & 35 KW (47 hp) electric motor. Such contribution of battery & engine was able to reduce CO₂ emissions by 14% i.e. 27g/km by its SDV6 diesel engine & 169 g/km by its TDV6 engine.

Conclusion

Thus, TATA MOTORS being an Indigenous Automobile Company has been participating actively in saving the Environment especially for India & has been divesting its profits for the betterment of the society & for taking up the Green Initiatives as well that reduces the pollution level in the atmosphere. It has tried to upgrade the technology used in its engines which provides the better fuel economy, burns the fuel completely & thereby, giving the optimal performance & lesser emissions as well. Moreover, Tata Motors has been looking up for the Joint Ventures as well in order to get the eco-friendly technology imported in the country such as the agreement of Tata Motors with Cummin Engines of US in order to get the engines technology to be used in its Commercial Vehicle segment. As a part of the Green Technology, Tata Motors came up with the Hydrogen Fuel Cell Technology which makes use of the Hydrogen & Oxygen to generate electricity which charges up the battery thereby, making an engine in operation & releases water vapor in return. Thus, framing & implementing such type of technologies should be the aim of all the Automobile manufacturing companies no matter to which they nation they belong to. Companies need to set aside a proportion of profits for the Research & Development Activities. They need to make people aware about the positive effects attached on using the Green technology-based vehicles, they should be motivated to buy such products even if they cost a little bit costlier than the normal regular products.

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