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The Impact of Vehicles in Transport and Logistics Services in Green Supply Chain Management

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Abstract - *This paper is focused on the importance of Vehicles in transportation & logistics services in green supply chain management (GSCM).It is very important and plays a crucial role in protection of the health of our planet Earth and reduce Green House Gases (GHG), Fuel Consumption . This paper suggests some important methodologies viz. Exhaust Gas Re-Circulation (EGR), Fuel Additives, Proper Design of Tires, Using pure Nitrogen Inflation Tires and Proper Re-Cycling of End of Life Vehicles.*

Key Words: Green Supply Chain Management (GSCM), Exhaust Gas Re-Circulation (EGR), Fuel Additives, Nitrogen Inflation.

1. INTRODUCTION

Green supply chain management (GSCM) is an emerging field that stands out of the traditional supply chain perspective. [1] This may have occurred due to various factors like global warming, scarcity of resources, growing social pressure due to increase in awareness among people, governmental laws, etc. which is adding weight to the importance of implementing environment friendly strategies in managing the supply chain. In addition, the recent economic global crisis has accelerated the need for sustainable growth where better usage of natural resources creates the potential to develop a greener economy. The quality revolution in the late 1980‟s and the supply chain revolution in the early 1990‟s" have sparked businesses to become environmentally conscious. GSCM has gained popularity with both academics and practitioners to aim in reducing waste and preserving the quality of product-life and the natural resources.

Eco-efficiency and remanufacturing processes are now important assets to achieve best practice Global market demands and governmental pressures are pushing businesses to become more sustainable. Walton, Hand field and Melynyk even claim that "increasing government regulation and stronger public mandates for environmental accountability have brought these issues into the executive suites, and onto strategic planning agendas." But hardly, very few of them have actually started working towards greenification of the supply chain and most of them still continue to use toxic substances & transportation practices that produce greenhouse gases. Accordingly, greening the supply chain has become a major challenge in today's competitive business operations.

This paper primarily deals with the role of Transportation and Logistics in greenification of the supply chain. It also Emphasizes how companies dealing with transportation and logistics can implement certain strategies towards the cause. In logistics systems, Transportation is the single main source of environmental hazards. The vehicles used for transportation not only emit toxic green house gases like Co2 but also cause noise pollution.

Therefore, in order to meet the challenges of energy conservation, pollution abatement, waste reduction, etc., firms should also consider their supplier's environmental performance. Consequently, in order to reduce the environmental risks passed on through suppliers, firms are trying to green their supply management activities which ultimately enable them to purchase environmentally superior products as well as build common approaches to waste reduction and operational efficiencies. Thus Green Supply Chain Management is becoming an integral part of an environmentally conscious firm. [14]

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2. DEFINING GREEN SUPPLY CHAIN MANAGEMENT

Supply chain management has a variety of definitions varying from author to author and so does GSCM. Here are a few of the well-known definitions:

Supply chain management has traditionally been viewed as a process where in raw materials are converted into final

products, and then delivered to the end-consumer. This process involves extraction and exploitation of the natural resources (Srivastava, 2007).

Managing supply and demand, sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, and delivery to the customer (The Supply Chain Council)

The planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. It also includes coordination with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. (Council of Supply Chain Management Professionals) Green Supply Chain Management:

GrSCM is defined as „integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life".(Shrivastava,2007)

From a broader perspective, this paper defines GSCM as "implementing any practice that is environment friendly into the supply chain."

3. THE IMPACT OF VEHICLES FOR ACHIEVING GREEN LOGISICS FOR BETTER GSCM

Supply chain management has a variety of definitions varying from author to author and so does GSCM. Here are a few of the well-known definitions:

3.1.EXHAUST GAS RE-CIRCULATION (EGR):

EGR is a useful technique for NOx formation in the combustion chamber. Exhaust consists of CO2, N2 and water vapor mainly. When a part of this exhaust gas is re-circulated to the cylinder, it acts as dilatants to the combusting mixture. This also reduces the O2concentration in combustion chamber. The specific heat of the EGR is much higher than the fresh air, hence EGR increases the capacity of (specific heat) of the intake charge, thus decreasing the temperature rise for the same heat release in the combustion chamber.[12]

%EGR = (Volume of EG ÷ total intake charge in to the cylinder)×100

EGR= {[CO2] Intake – [CO2] ambient} ÷ {[CO2] Exhaust – [CO2] Ambient}

Three popular explanations for the effect of EGR on NOx reduction are increased ignition delay, increased heat capacity and dilution of the intake charge with inert gases. The ignition delay hypothesis asserts that because EGR causes an increase in ignition delay, it has the same effect as retarding the injection timing. The heat capacity hypothesis states that the addition of the inert exhaust gas into the intake increase the heat capacity (specific heat) of the non-reacting matter present during the combustion. The increased heat capacity has the effect of lowering the peak combustion temperature. According to the dilution theory, the effect of EGR on NOx is caused by increasing amount of inert gases into the mixture, which reduces the adiabatic flame temperature (Pierpont et al 1995).

At high loads, it is difficult employ EGR due to deterioration in diffusion combustion and this may result in an excessive increase in smoke and particulate emission. At low loads, unburnt hydrocarbons contained in the EGR would possibly re burn in the mixture, leading to lower unburnt fuel in the exhaust and thus improved break thermal efficiency. Apart from this, hot EGR would rise the intake charge temperature, there by influencing combustion and exhaust emission.

With the use of EGR, there is a tradeoff between result in reduction in NOx and increase in soot, CO and unburnt hydrocarbons. A large number of studies have been conducted to investigate this. It is noticed that 50% EGR, particular emission increased significantly, the change in oxygen concentration causes change in structure of the flame and changes the duration of combustion. It is suggested that flame temperature reduction is most important factor influencing NO formation.

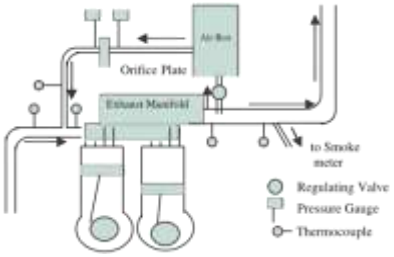


Figure 2. Line diagram of the proposed EGR system.

3.2 NITROGEN INFLATION TIRES:

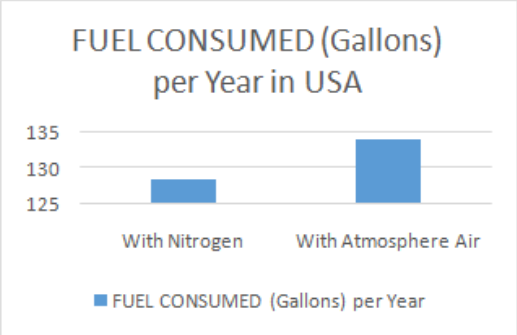
Our atmospheric air contains 78% of Nitrogen and 21% of Oxygen and 1% Miscellaneous.[15] Oxygen has reactive nature so this Gas expands when it is heated up and contracts when cooled when it is used in tires. So it loses pressure when reacts with other atmospheric gases.

Nitrogen gas has a non-reactive nature with other matter. Pure Nitrogen has been used in inflate critical fire application for years. It doesn't support moisture or combustion. This is mainly being used in Racing tires (Formula 1), Aircraft tires (Military and Domestic), Heavy Duty Equipment (Mining Equipment and Earth Movers). When this Nitrogen gas is filled in the tires it doesn't reacts with atmospheric air pressure conditions and doesn't lose the pressure inside the tires. Nitrogen has temperature of -

227°C so when it is filled in the tires, the tires don't get heated up when they are travelling long distances.

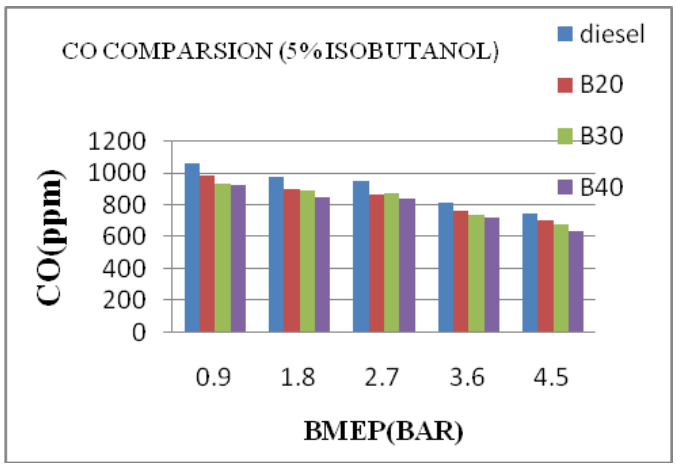
Hence, with nitrogen tire inflation, improvements can be noted in a vehicle's handling, fuel efficiency and tire life through better tire pressure retention, improved fuel economy and cooler running tire temperatures. So, Nitrogen provides consumers, over-the-road truckers, fleet managers and others information about the benefits of using nitrogen in tires.

It is estimated that, if everyone in the US had the correct pressure in their tires, almost 4 billion gallons of fuel would be saved each year! That's 79 billion tons of carbon dioxide that wouldn't go into the air we breathe.[16]



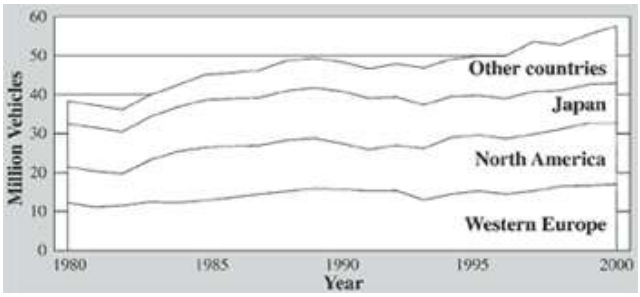
3.3 FUEL ADDITIVES:

Fuel Additives are used in the fuel to increase the efficiency and decrease the emission percentage into the atmosphere. Isobutanol is used as a fuel additive. Combustion characteristics results are shown in Figures 4 to 11, which show that cylinder pressure increased slightly with the blends when compared to the conventional diesel fuel and decreased with increasing isobutanol percentage. Pmax with diesel was 8.9 Mpa, while Pmax with B20 was 9.0 and 8.4 Mpa, Pmax with B30 was 9.2 and 9.0 Mpa, and Pmax with B40 was 9.5 and 9 Mpa with 5% and 10% Isobutanol respectively. The reason for decrease in cylinder pressure with increase in isobutanol was due to the fact that Isobutanol has lower cetane number and lower heating value which lowers the combustion pressure. It can be observed from heat release graphs that heat release increases with both the blends and isobutanol. The reason for this tendency was due to ignition delay of oxygenate blends which results in increased amount of fuel in diffusion combustion which increases heat release and consequently oxygenate blends have controlled premixed combustion. [17]



3.4 Re-CYCLING OF END-OF-LIFE VEHICLES:

Automobile manufacturing has increased in the last 20 years, reaching about 58 million units (excluding commercial vehicles) in 2000 (see Figure 1). According to estimates by the Organization for Economic Cooperation and Development (OECD), the total number of vehicles in OECD countries was expected to grow by 32% from 1997 to 2020. Automobile production is more or less equally distributed between North and South America, Europe, and Asia.



According to the available data,1 about 160 million cars were in use in the European Union in 1995, and in 2001, that number exceeded 180 million units. More than 80% of these cars were concentrated in the five countries previously mentioned as major producers. The increasing car production and use data indicate the importance of the automobile industry in society. [13]

However, that industry is facing a number of serious challenges related essentially to its impact on the environment. Vehicles affect the environment through their entire life cycle. Consumption of energy and resources, waste generation, greenhouse gases, hazardous substance emissions, and disposal at the end of their lives are burdens created by automobile production and use.

Today, recycling of ELV is driven not only by economic and technological factors but also by social and environmental concerns. In other words, the automobile industry is shifting toward sustainable waste management.

Collecting and dismantling companies focus on removing valuable spare parts and other components such as engines, batteries, oils and fuels, and airbags. Although these companies are essential to the reduction of ELV waste, they are small companies that are mostly interested in ELV parts that are suitable for reuse, recycling, or sale. The ELV dismantling is often done improperly, increasing the amount and toxicity of ELV waste. After dismantling, the remainders of the ELV, so-called "hulks," are processed by shredding companies. Considerable national policies and voluntary agreements by major automobile manufacturers have been developed concerning the environmental impact of vehicles over their lifetimes.

Member States shall take the necessary measures to encourage the reuse of components which are suitable for reuse, the recovery of components which cannot be reused and the giving of preference to recycling when environmentally viable, without prejudice to requirements regarding the safety of vehicles and environmental requirements such as air emissions and noise control.

According to the ELV directive, removing pollutants from the vehicle becomes an important task of the dismantler business. This involves the draining of liquids and removing of environmentally harmful constituents such as the battery.

The producer links the upstream (supplier) and downstream in the ELV chain (collector, dismantler, and shred-der). On the other hand, collaboration between collector, dismantler, and shredder are necessary to successfully meet the directive goals.

The vehicle produced has to at least meet the following goals: low energy consumption, easy dismantling, suitable recycling, and less toxic metals. To fulfill these goals, the producer has to know the technical and economical facilities, recyclability rate, and efficiencies of the downstream ELV chain. On the other hand, the producer will provide the dismantling information for each new type of vehicle put on the market. The design of vehicles appropriate for dismantling, recycling, and re-use, and free of some hazardous substances [Pb, Hg, Cd, and Cr (VI)] will significantly improve the cooperation of the supplier-producer chain.

3. CONCLUSION

It measures the effectiveness of national environmental protection efforts in 132 countries. Reflecting our belief that on the-ground results is the best way to track policy effectiveness, EPI indicators focus on measurable outcomes such as emissions or deforestation rates rather than policy inputs, such as program budget expenditures. Each indicator can be linked to well establish policy targets. The 2012 EPI ranks 132 countries on 22 performance Indicators that capture the best worldwide environmental data available on a country scale. India Ranks at 125 of 2012 Environmental Performance Index, which is worst rank. They should realize that GSCM can reduce the ecological impact of industrial activity without sacrificing quality, cost, reliability, performance or energy utilization thus leading overall economic profit.. Optimizing transportation in the logistics system, which is the biggest contributor towards environmental pollution with the discusses methodologies, especially through EGR, Fuel Additives, Nitrogen Inflation tires & re-cycling of End of Life Vehicles(ELV) can make a huge difference to the environment.

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