



*Federal University Of Technology,  
Minna.*

**EMISSIONS CONTROL TECHNOLOGY  
BY AUTOMOTIVE INDUSTRY:  
TRENDS AND CHALLENGES**

by

**Kazeem Adebayo Salami**

[Ph.D, FNATT, MIAE, TECH (CEI)]

Professor of Industrial And Technology Education.

DEAN  
Sch. of Sci. & Tech. Education  
Federal University of Technology  
Minna

**Inaugural Lecture Series 10**

**16<sup>TH</sup> AUGUST, 2007**

**FEDERAL UNIVERSITY OF TECHNOLOGY,  
MINNA.**

**EMISSIONS CONTROL TECHNOLOGY  
BY AUTOMOTIVE INDUSTRY:  
TRENDS AND CHALLENGES**

**BY**

**KAZEEM ADEBAYO SALAMI** [Ph.D, FNATT, MIAE, TECH (CE)]  
Professor of Industrial And Technology Education.

DEAN  
Sch. of Sol. & Tech. Education  
Federal University of Technology  
M i n n a

**Inaugural Lecture Series 10**

**16<sup>th</sup> August, 2007**

## PREAMBLE

Bismillahi Rahaman Raheem. In the name of Allah the Beneficent, the merciful, the Lord of the World. The chairman of the occasion, The Vice Chancellor, Deputy Vice-Chancellors, Principal officers of the University, Deans and Directors, Members of Academic Community, Invited Guests, Friends of the University, Gentlemen of the press, Dear students, Distinguished ladies and gentlemen, you are mostly welcome to this unique occasion. I feel highly delighted to stand before you today to deliver the 10<sup>th</sup> Inaugural Lecture of the Federal University of Technology Minna and the first in the series from the Department of Industrial and Technology Education.

The lecture is titled **"Emissions Control Technology by Automotive Industry: Trends and Challenges"**.

As awareness of the need to protect the global environment grew world wide and more importantly in Nigeria there was an increasing demand to re evaluate the automotive industry. This is necessary because internal combustion engines burn fuels which produce emissions in the combustion process. The purpose of emission control is to reduce the amount of harmful combustion gases released into the atmosphere.

Vehicle emissions are the by products of burning automotive fuels. To this end, emission has become one of the most complicated environmental challenges. Hence, there is need to use quality fuel and improved automobile technology. The automobile industry is an engine of growth whose establishment serves as an important stimulus to other types of manufacturing industries.

Development of new technologies and mechanisms that have been taking place in automobile industry to reduce emission are discussed. The design and production and principles of operation of emission control systems as related to automobile fuel were also discussed.

## KEEPING UP WITH TECHNOLOGY

Today's automobile technologists are constantly being challenged with new technology. As a result good technologists are always striving to improve their

knowledge and skills to keep up with new car designs. The auto-mechanic must keep up with the advanced technology being used in new cars. Recent innovations include: computers, electronic ignitions, gasoline/petrol injections and front-wheel drive. Therefore, a good mechanic must constantly study service manuals, service bulletins and other literature to learn how new components work and how to repair them. Avoid the pitfall of ever thinking you know every thing about your job. This only leads to trouble. You will soon be left behind by the new technology (Salami, 2004).

#### VOCATIONAL AND TECHNOLOGY EDUCATION AS:

A comprehensive term referring to the educational processes it involves, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills and knowledge relating to occupations in various sectors of economic and social life (UNESCO, 1986, p.23)

## TABLE OF CONTENTS

Introduction	1
Evolution of Automobile Industry in Nigeria.	3
Vehicle emissions	6
Sources of Vehicle Emissions	7
Engine Modifications for Emission Control	8
Internal Engine Modifications and Control	13
External Engine Controls	14
Automobile Emissions Control by Automotive Industry	15
Cleaning up the Emissions	17
Evaporative Emissions Control	18
Automobile technology and innovation	20
Standards for Fuels and Vehicles	24
Towards a Radical Transformation	25
Globalization: the automobile industry's quest for "a world car"	30
What You Can Do About Car Emissions	33
Conclusions	38
Recommendations for Advanced Automobile Technologies and Challenges	37
Recommendations for Fuel and Emission Standards	39
Recommendations for Enhancing Environmental Performance of In-use Vehicles	39
Recommendations for all stakeholders	39
Bibliography	40

# **EMISSIONS CONTROL TECHNOLOGY BY AUTOMOTIVE INDUSTRY: TRENDS AND CHALLENGES**

## **INTRODUCTION**

The automobile is a commonly used product but it is an extremely complex and technologically sophisticated one. Automobile plays a major role in people's lives whether it is used for daily transportation or used for pleasure. In this regard, the development of the vehicle industry is instrumental to personal life as well as to the development of the nation's industry.

When automobile first appeared, the world's population was relatively small, and few. Automobiles on the road then were not recognised as a cause for environmental concern or climate change. Photo-chemical smog first became a nuisance in the 1950's causing people to view the effects of air pollution as a problem. Although air pollution was mostly attributed to industrial emissions rather than exhaust emissions from automobiles (Duffy and Smith, 1992, Salami, 2000)

A more serious problem emerged in the second half of the 1980's. The concentration of carbon dioxide in the atmosphere had increased leading to global warming. During this time automobiles are thought to be responsible for under 20 percent of total carbon dioxide emissions.

As awareness of the need to protect the global environment grew world wide and more importantly in Nigeria there was an increasing demand to re-evaluate the automobile industry. This is necessary because internal combustion engines burn fuels which produce emissions in the combustion process, including water vapour and carbon dioxide as well as carbon monoxide, hydrocarbons and nitrogen oxides.

Experts on safety and emission management of vehicles/automobiles stated that vehicular emission has become one of the most complicated environmental challenges. Hence, there is need to use quality fuel and improved automobile technology.

Following the robust development of automobile industry and production of a wide range of vehicles, emissions that caused air and other kinds of pollution became a serious burning issue. Regulating vehicular emission became a top

priority in the western world in the early eighties. Developments of new technologies and mechanisms have been taking place along with development in automobile industry, which has made it very useful to reduce emission. For instance, in recent past, the problems of carbon dioxide and hydrocarbons have been largely overcome by various techniques used to clean engine emissions.

Efforts need to be geared towards resolving the problem of carbon monoxide emission in the world and Nigeria in particular since it is noted that the protection of the global climate change is clearly a major concern that the automobile industries cannot ignore in this millennium. It has now become a complex issue that combines multiple factors, including environment resources, traffic congestion and safety. The automobile industry is regarded as an engine of growth whose establishment serves as an important stimulus to other types of manufacturing activities. This is so because the industry has capabilities to create many job opportunities and generate acquisition of technology.

The main sources of technological improvement on vehicles are design and production. The process and product technologies develop increasingly and Nigeria must be prepared to join the race now or remain underdeveloped.

There is also the need for law regulators to work with automobile manufacturers to ensure a "green" environment. However, automotive companies cannot bear the burden of building technologies that adhere to environmental regulations all by themselves. It has also been realised that making internal combustion engines that run cleaner will require efforts beyond the automobile industry; the oil industry could help by supplying lower-sulphur fuels.

It is to be noted that apart from ecological issues, sustainable development is also a long-term strategy in the automobile industry. The three dimensions of sustainability include: economic, developmental protection and social process. The automotive industry in North America and the Asia Pacific has been showing sustainable development with a vengeance. Germany, the United Kingdom and Luxembourg have set strict standards in adherence to environmental policies and are always a step ahead of legislation. Through their globalization activities, manufacturers and suppliers also export excellent environment protection, safety and technological and managerial expertise. This actually helps promote sustainable development in other countries. **What is the position of Nigeria? This is a million naira question to answer.**

The main thrust of this paper, therefore, is to re evaluate the present and re-construct the future role of the automobile industries in this century in the context of the needs of Nigeria in particular and the entire world due to climate change and future transport systems.

### **Early history of automobile industry**

The history of the automobile, its development with an analysis of the problems and prospects cannot be over emphasized. Its contribution to health and prosperity, its influence on engines, its effect on personal efficiency, and its service and mission to humanity as the latest and greatest phase of transportation is a pointer to that fact. Therefore, advances in automobile technologies are out to pursue these to logical conclusion. In the nineteen-seventies much effort was devoted to the development of various stratified charge engine e.g. the Gas turbine

By the nineteen-eighties, however, high-compression lean-burn systems had been the main practical outcome. With increasing pressures for fuel economy as a means of reducing CO<sub>2</sub> output, interest in stratified charge began to surface again in the early 1990s.

(May, 1989; Flink, 1988; Cusumano, 1985)

### **EVOLUTION OF AUTOMOBILE INDUSTRY IN NIGERIA.**

The automotive industry is the central agent of creating and managing patterns of technology change or innovation. In Nigeria, the 1970's was a turning point in the development of automobile industry. By this time, government had become aware of the importance of the industry as an engine of growth in economy. Given this strategic importance, government become involved in the sub-sector essentially to aid its early integrated development that will stimulate the growth of the indigenous automobile know-how. This led to establishment of Peugeot automobile of Nigeria (PAN) and the Volkswagen of Nigeria (VON). The third National development plan (1975 - 1980) provided for the establishment of commercial truck plants. They are Leyland Nigeria Ltd., Anambra Motor Manufacturing Co. Ltd., National Trucks Manufacturing Ltd. and Steyr Nigeria Ltd. The assembly plants performed fairly well in the 1970's as the country's economy was relatively good. The decade was the boom period when the products of the assembly plants were affordable by government and the citizens alike. The #3, 000 could buy a Volkswagen beetle car and # 5,000 was enough to buy a brand new Peugeot 504 car on the road. All these meant increased demand and boom for the assembly plants. But unwillingly, the attendant effect of these good times was the neglect of essential requisites of the partnership agreements by the Federal