THE NEED OF MODERN APPROACH IN MANUFACTURING PROCESSES FOR AUTOMOBILE ENGINES

Bharat Raj Singh[1] & Onkar Singh[2]

[1]*Prof.Bharat Raj Singh is Head of Department-Mechanical Engg. & Dean-Admin, Sagar Institute of Technology & Management, Barabanki-225001, UP, INDIA e-mail: brsinghlko@yahoo.com*

[2]*Dr.Onkar Singh is Addl. Examination Controller, UP Technical University, IET Campus,, Near Sitapur Road, Lucknow-226016, UP, INDIA e-mail : onkpar@rediffmail.com*

ABSTRACT: *The fast depletion of fossil fuel has now days become worldwide problem. Technology has generally led to a greater use of hydrocarbon fuels for about 150 years, making civilization vulnerable to decrease in supply. US oil geologist* ***Marion King Hubbert****, in 1956 predicted that US oil production would peak in 1970 and decline thereafter. The "Hubbert Curve" illustrated practical availability of a region's oil reserves over time describes a bell-shaped curve. After exploration and initial growth in output, production plateaus and eventually declines to zero. On other hand use of large number of vehicles for transport is contributing to about 70% of total air pollution and India's vehicular pollution has reached 8 times than it was 20 years before. Now India is the fifth country which produces higher rate of emission and creating environmental & ecological imbalance after rating to USA, China, Russia & Japan. This necessitates the manufacturing of* ***high fuel efficient & low pollution automobile vehicles*** *for transport and lighter vehicles for private use. This paper covers technological developments, use of modern techniques for manufacturing, unconventional machining processes, use of CAD / CAM in designs, development of alternative fuel efficient & low pollution automobile engines, tapping all other resources of nature to develop energy efficient engines and energy conversion engines, with new dimensions.*

Keywords: *fossil-fuel, pollution, fuel-efficient, environmental, automobile-engines*

1.0 INTRODUCTION

Over the last 75 years, significant technological development has taken place, changing and reinventing how motor vehicles are produced. Technology has increasingly altered the manufacturing process for motor vehicles. While cars are produced at faster rates, automakers must continue to balance increased productivity and efficiency with quality and innovation.

As civilization is growing, transport becomes essential part of life. The biggest problem is the growing population & depiction of fossil fuel. About 150 years ago, the major source of energy shifted from recent solar to fossil fuel (hydrocarbons). Technology has generally led to a greater use of hydrocarbon fuels, making civilization vulnerable to decrease in supply. US oil geologist [8.1] *Marion King Hubbert*, in 1956 predicted that US oil production would peak in 1970 and decline thereafter. The "Hubbert Curve" [8.2] illustrated practical availability of a region's oil reserves over time describes a bell-shaped curve. After exploration and initial growth in output, production plateaus and eventually declines to zero. The current study made in the year 2004, predicts that if the oil is consumed at the current rates, then by 2020, we will be consuming 80% of the entire available resource.

It is estimated that India's vehicular pollution has increased eight times over the last two decades. This source alone is estimated to contribute about 70 per cent to the total air pollution [8.5]. With 243.3 million tons of carbon released from the consumption and combustion of fossil fuels in 1999, India ranked fifth in the world behind the U.S., China, Russia and Japan. India's contribution to world carbon emissions is expected to increase in the coming years due to the rapid pace of urbanisation, shift from non-commercial to commercial fuels, increased vehicular usage.

This necessitates the search for alternative of oil as energy source or preserving it by tapping some other alternatives such as Non-conventional energy like battery operated vehicles, wind mills, photocells etc. and to convert their output into mechanical energy, which may alternatively preserve oil source.

Thus main emphasis is required to be given to overcome the current worldwide problems of depletion of fossil fuel & higher rate of emission which is creating global heating and ecological imbalances, by applying **modern trend of manufacturing processes** to produce *most efficient & low pollution* motor vehicles engines. This will necessarily make sustainability to the energy resources.

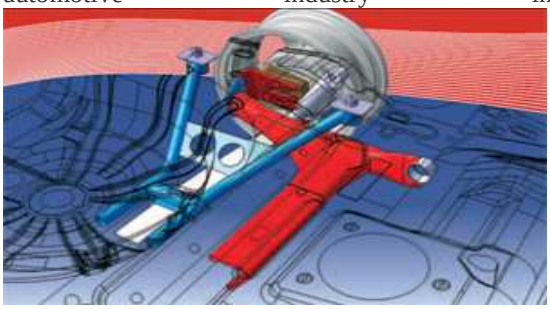
.

2.0 NEED OF MODERN TREND IN MANUFACTURING PROCESSES:

With current scenario of civilization, transport becomes essential part of life and hence use of higher rate of vehicular transport is causing high pollution as well as fast depletion of fossil fuel. Now it is worldwide problem tobe looked into, thus necessitates adopting modern trend in manufacturing process for automobile engine. The need of modern trend in manufacturing processes for automobile engine is to develop high fuel efficient, which consumes low fuel and create least pollution to satisfy the limits of pollution act.

While the automobile is a commonly used product, its manufacturing is an extremely complex and technologically sophisticated one. Manufacturing new cars requires state-of-the-art technological methods and processes. In addition, supplier industries of the automotive manufacturing industry, such as steel and other parts as well as electronic instrumentation, are vital in providing the necessary supplies and components for assembling motor vehicles.

Now automakers invest a large amount of time and money into **developing and improving the manufacturing process, and rely heavily on research and technological innovation** to improve product quality and efficiency in production. Modern technologies used in advancing manufacturing for the automotive industry include:



- **Virtual manufacturing and complex visualization techniques**- Modeling & evaluating by CAD, [8.4]CAM, CATIA and PRO-Engineers
- **Programmable machines and tools**- Robots & Cobots. [8.6]
- **High speed data communication and data management**- Use of NC & CNC[8.3] Machines
- **Supercomputing**- Development of Process & Product
- **Advanced Techniques**-Unconventional Machining, forming and forging

Over the last 25 years, automation technology has become an essential part of automobile assembly plants. A typical assembly plant uses several hundred robots to build and paint the vehicle frame. While robotic technology continues to grow in assembly plants, the technology does have limitations, especially in performing more delicate tasks. The advent of Intelligent Assist Devices, in particular Cobots (Collaborative robots), aided in reducing ergonomic concerns, while also improving safety, quality and productivity. Cobots, developed by Northwestern University and General Motors Corporation, are designed to work in collaboration with human operators to move objects and perform physically demanding tasks on vehicle assembly lines.

3.0 ELEMENTS OF AUTOMOBILE ENGINE MANUFACTURING:

Keeping in view of global competitiveness of market, the manufacturing processes requires the major aspect to be looked for:-

3.1. Cost effectiveness

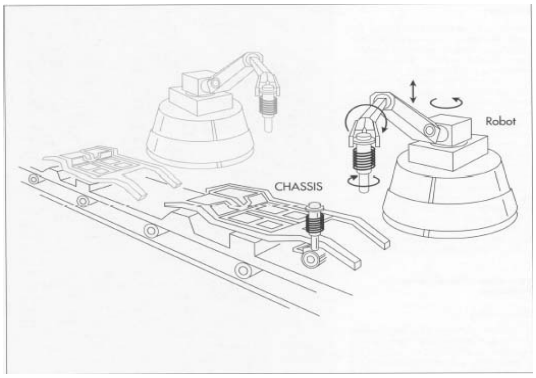
3.2. Durability

3.3. Process & Product developments-ergonomics

3.4. Flexibility to change the new models

3.5. Facilities of tools & advanced equipments – electro-magnetic welding, Unconventional Forging & Machining [8.13]

3.6. Technological & process balancing- use of ROBOTIC [8.6] & COBOTIC



3.7. Motivation to workforce and to have adequate organizational setup

3. 8. Sufficient flow of raw material and inventory control,

3.9. Researches and Engg.

3.10. Implementation programmes to match with global developments and new area to be looked into for further scope.

To day Design Science uses Design Research and [8.12] **Trend—Design Research cuts** product development costs, while gathering vitally needed design data.

In looking at trends in global automobile manufacturing, ***Japanese automakers have been leaders in stream-lined manufacturing process systems.*** These methods have been adopted by manufacturing plants worldwide.

4.0 SIGN OF SUCCESS- ENGINEER TO ORDER MANUFACTURING: [8.14]

Several years ago, it has been realized that any business can not grow without a clear perspective on potential orders and available capacity. In recent years, the most of automobile companies have grown dramatically in revenue without adding personnel; in fact, technology solutions implemented have provided a competitive advantage and allow the companies to look for additional profit centers and to continue an aggressive lean process.

It is revealed from current studies that there are **four key issues** [8.14] for the selection of a new information system:

1.0. Proposal management.
2.0. Scheduling
3.0. Material management
4.0. Standardization

New Technology Selection Process

From detailed report writing to parse the data of each project to profitability, the *efficiencies from an aggressive adoption of technology* solutions have allowed the organization to expand other areas of the operation from significant growth in the interior sign division to expensive Project Management expertise. The ability to conduct a detailed analysis of estimated versus actual costs has allowed historical projects to guide the profitability of current and future projects.

When the ERP (Enterprise Resource Planning) system was implemented, a new culture of lean manufacturing and continued process improvement began. When there is staff attrition, company does not leap to replace personnel, but rather examines how to reallocate current resources and allow the head count to be reduced, increasing profit, and maintaining excellence and efficiency.

5.0 LATEST TECHNOLOGY & INNOVATION TO AUTOMOBILE MANUFACTURING:

The product life-cycle for automobiles continues to shorten due to competitive market pressures. Competitive market forces have caused automakers to dramatically redesign car models every four to five years.

Alternative fuel technologies, such as electric hybrids and fuel cell cars, have received considerable attention, and demonstrate attempts to design vehicles that are more energy efficient and greatly reduce engine propulsion reliance upon fossil fuels.

Future Automobiles Engines:

5.1 Electric Powered Vehicle Engines

The movement towards electric powered vehicles began as a result of the 1973 Oil Embargo, in which efforts were made to utilize electric battery technology to power engine propulsion. However, problems and limitations regarding driving range, speed and a very small market, all led to automakers GM, Ford, Honda and Toyota discontinuing their electric vehicle programs during the late 1990's.

5.2 Hybrid Powered Vehicle Engines

Hybrid vehicles combine two or more sources of power, which are able to operate using a rechargeable battery and gasoline. Production of gas-electric hybrids signifies the first significant move away from total reliance on the internal-combustion engine in nearly a century. [8.7]

Hybrid vehicles are highly fuel efficient and present the first major step toward fuel cell vehicles, according to industry specialists. Japanese automaker Toyota is one of the auto industries leaders in hybrid vehicle research and production With their prior models many companies have been involved in producing hybrid vehicles, will be introducing and mass producing its hybrid model by 2007 [8.7]. Most major automakers plan to introduce hybrid vehicles to the market within the next five years.

5.3 Fuel Cell Vehicle Engines

Another automobile technology that is presently viewed as the latest catalyst in future automobile technology, is fuel cell powered vehicles, in particular **hydrogen fuel cell powered engines**. Fuel cell systems operate by compressing hydrogen made from natural gas and gasoline, which is then converted to hydrogen by on-board systems. [8.8]

There are, however, problems associated with hydrogen fuel systems which consist of:

- Fuel cell vehicles will be more expensive
- Fuel cell cars will require a new infrastructure for vehicle manufacturing and maintenance
- Developing a system for producing and distributing hydrogen fuel

Many uncertainties remain regarding the development and use of hydrogen fuel cell technology, as how to create a viable infrastructure that supports the use of fuel cell vehicles.

"E.J. Honton" an USA based inventor in April'2004 presented the Hydrogen Fuel Cell Car at 15th Annual US Conference & Hydrogen Expo, USA and projected the scope of its market in different country. [8.17]

5.4 Compressed Air Light Vehicles

Korean inventor "Beau de Rocha" (Otto) developed zero pollution cars using Quasiturbine with a set of 14-engines parameters and disclosed on Sept'2005 using gasoline. [8.15]

"Guy Negre", a French Scientist , in 1998 developed compressed air- 4- cylinders engine run on air and gasoline, claims zero pollution cars and got 52- patents registered since 1998 to 2004.The car was demonstrated in Oct.'2004 publically.[8.16]

6.0 FUTURE PRODUCT DESIGN AND OPERATING SYSTEMS TO AUTOMOBILE MANUFACTURING:

Modern automobiles are increasingly relying upon more advanced electronics, computer, and wireless communication systems to assist drivers and enhance safety. Most vehicles have several computers, with high-end models having a half dozen or more that control functions of steer and brake, which also range from shifting gears to operating GPS navigational systems.[8.11]

For future vehicles, Voice activation systems is another technology and expected to operate internal climate controls, open doors, and respond to navigational request by the driver.

The next step in automobile electronic and communications technology is vehicle sensor technology. Sensor technologies use radar or laser technology to control systems that detect vehicles in front which then automatically slow down the vehicle. Companies are using sensor technology to serve as collision-avoidance systems that operate and control vehicle safety systems and on-board equipment.

7.0 CONCLUSION:

In view of competitive market forces, depletion of fossil fuel and high rate of emission causing global heating due to reduction in ozone layer, following conclusions are drawn from above study:-

- Automobile manufacturer are dramatically redesigning new models of automobile vehicles every four to five years.
- Day by day, improvements in engines are taking place which ultimately satisfy the pollution limits and gives considerable fuel economy which adds to the fossil fuel sustainability.
- The most fuel efficient, greater reduction in propulsion and cost effective engines are being redesign with the help of CAD, CAM & CATIA, developed and manufactured adopting line balancing in manufacturing area with the use of ROBOTIC, COBOTIC, NC & CNC machines.
- Apart from the aspects of aesthetic, aerodynamic and interior comfort, the uses of unconventional machining processes are considerably reducing manpower & ultimately cutting down the cost.
- Future technological developments are aggressively being done to develop electric powered vehicles engines, hybrid powered vehicles engines, fuel cell operated engines and compressed air engines for automobile vehicles.
- Operating system of future automobiles are looked with GPS, Computer controlled, voice activation system to make automobile vehicles risk free.

8.0 REFERENCES:

8.1. King Hubbert US Geologist-Peak Oil Curve - http://www.hubbertpeak.com/de/lecture.html

8.2. K. Aleklett and C.J. Campbell - "The Peak and Decline of World Oil and Gas Production" – Oil Production, Feb.2004.

8.3. CDC CNC Design Consultant- http://www.cdcza.co.za/index.htm & http://www.cdcza.co.za/catia.htm

8.4 CAD, CAM, CAE – Daytona Prototype Racing Car Internet: http://www.caddigest.com/subjects/solid_edge/select/success_daytona.htm

8.5. US Environment Protection Act - http://www.epa.gov

8.6. "Robotics and Machine Perception. Cobots: A New Generation of Assembly Tools for the Line Worker." *SPIEWeb OE Reports*, May 1997. Internet: http://www.spie.org/app/Publications/magazines/oerarchive/may/may97/robotwg.html

8.7. Farley, Peter. "Hybrids' Rising Sun." Technology Review, April 2004, p. 36. 6. Ibid, p. 36. - http://www.loc.gov/rr/business/BERA/issue2/manufacturing.html

8.8. Weiss, Malcom A., and Heywood, John B. *Comparative Assessment of Fuel Cell Cars*, February 2003. Cambridge, MA: Massachusetts Institute of Technology Laboratory for Energy and the Environment, p. 1.

8.9. Fine, Charles H., Lafrance, John C. and Hillebrand, Don. "Meeting the Challenge: U.S. Industry Faces the 21st Century." *The U.S. Manufacturing Industry*, December 1996. Washington, D.C.: U.S. Dept. of Commerce Office of Technology Policy, p. 44.

8.10. Industry and Trade Summary: Motor Vehicles. U.S. *ITC Publication 3545*, September 2002. Washington, D.C.: U.S. International Trade Commission, p. 37. 1.2. Internet: ftp://ftp.usitc.gov/pub/reports/studies/PUB3545.PDF

8.11. Jerome, Marty. "Smart Cars." LookSmart, website. Internet: http://www.findarticles.com/p/articles/mi_zdzsb/is_200104/ai_ziff8458

8.12 IDSA 2003 **DESIGN TRENDS** REPORT- www.cesaroni.com

8.13. I. V. Belyy, S. M. Fertik & L. T. Khimenko- ELECTROMAGNETIC METAL FORMING HANDBOOK - VISCHA SHKOLA, KHARíKOV STATE UNIVERSITY, KHARíKOV, USSR.

8.14 Thomas R. Cutler- "Signs Of Success: Engineer-To-Order Manufacturing Technology" Manufacturing.Net - July 24, 2006

8.15. APUQ zero Pollution QT Pneumatic Car- Disclosed on 25th September'2005- ww.quasiturbine.com

8.16. Guy and Cyril Negre- "Compressed Air: The Most Sustainable Energy Carrier for Community Vehicles"– Speech in front of assembly at Kultur gathered for "Fuel Cells World" Tuesday29th June '2004.

8.17. Robert Rose, William Vincent- "Fuel Cell Vehicle World Survey 2003"- Break through Technologies Institute, Washington, D.C. 20006-february' 2004