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Alternative Fuels: Need of the Hour

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The beginning of the 21st century witnessed a well-established automotive industry with various types of vehicles to benefit mankind. An increased usage of vehicles, however, drained the natural reserves of oil, making it a major economic factor worldwide. Automobiles, one of the major consumers of oil reserves, can reduce the dependency on oil to a significant extent through these alternative fuels. This article focuses on alternative fuels that can power automobiles efficiently, similar to that of conventional vehicles. The most popular alternative fuels are batteries, fuel cells, ultracapacitors and biofuels. However, biofuels require gas for blending purposes; it is unlikely to tackle the dependency on gas effectively on a long-term basis.

Batteries go hand-in-hand with automobiles for starting, lighting and ignition purposes. Although in recent years, battery-powered vehicles have been developed successfully and are on the road with zero emission. Normally, lead acid batteries are used in automobiles for auxiliary applications, but when batteries need to power a vehicle, the nickel metal hydride (NiMH) or lithium-ion batteries offer better viability. Surging demand for alternative vehicles lured many battery manufacturers to enter into the automotive battery market, most of them with recent battery chemistries such as lithium-ion and NiMH.

Currently, electric vehicles (EVs) are powered by lead acid and NiMH batteries; however, EVs powered by lithium-ion batteries are in the testing process. The commitment to develop a battery that offers alternative vehicles a performance similar to the conventional vehicle increases through various R&D activities involved in geographic regions such as North America, Europe, Asia Pacific and others. Additionally, government research organizations are taking a step toward this initiative by funding these manufacturers.

Some of the significant and promising technological advancements made to the lithium-ion battery include the nanophosphate technology developed by A123Systems, and the nanostructured lithium titanate spinel oxide electrode developed by Altair Nanotechnologies, Inc. Nanotechnology and thin-film technology offer much to the advancement of lithium-ion chemistry. EVs, powered by batteries, are becoming the trend in the European region, some countries of the Asian region, such as Japan, China, South Korea and some Southeast Asian countries.

Fuel cells have always remained an area of interest in the alternative fuels market. Fuel cell vehicles (FCVs) are similar to battery powered vehicles. Battery EVs use electricity for propulsion from an external source (batteries), while FCVs generate electricity required for propulsion. Although FCVs are in the testing stage, cost factor and affordability remains a challenge. Automakers, fuel cell developers, component suppliers, government agencies and other organizations are working hard to combat this challenge.

Recently, General Motors launched the test fleet of hydrogen-powered fuel cell Equinox SUVs in New York City, Washington D.C and Southern California. Similarly, Honda is having its own fuel cell division launch its FCV. Although fuel cell technology is adapted in forklifts and other high-priced heavy duty vehicles, mass acceptance of this technology is expected to take some time.

Viability of FCVs would be revealed in the next couple of years, and mass acceptance of this technology is likely to take longer. Normally, the proton exchange membrane (PEM) fuel cells are employed in automobiles. This type of fuel cell could offer 100 watts to 500 kW of power that makes it suitable for a wide range of applications. However, the cost of the catalyst plays a major role, making fuel cells expensive. Since platinum is used as a catalyst in many fuel cells, the cost of cells increases dramatically. Research is in progress to develop a catalyst that uses less quantity of platinum and makes fuel cells economically viable.

Ultracapacitors offer high-pulse power capability, fast transient response, high efficiency during charge and discharge cycles and more thermal stability than batteries; full charge is achieved for more than 500,000 cycles. This technology offers an efficiency of 98 percent, while 84 percent is offered by NiMH chemistry. These advantages make ultracapacitors an attractive option in hybrid electric vehicles (HEVs) in the short term, and EVs are in the

process of adapting this technology. Ultracapacitors offer high energy within a very short duration, which is ideally suited for acceleration with the electric drive, but they occupy larger size than a battery to hold an equivalent amount of energy. However, physical constraints such as electrode surface area, which increases the size of the ultracapacitor, coupled with low-energy storage capacity, is a major challenge for the utilization of this technology in automobiles. Ultracapacitors have the potential to replace batteries when major challenges are overcome successfully. Time is required to prove and establish this technology.

Biofuel is another alternative to combat the surging oil crisis. It includes several types of fuels such as biodiesel, biooil, biobutanol and the like. Although biofuels reduce dependency over gas, it still requires gas for blending. Hence, this alternative fuel has limited viability on a long-term basis. Since biofuels have the same properties as their petroleum-based counterparts, these fuels are fully compatible with the existing engine pipelines and fuel pumps. These alternative fuels significantly reduce dependency on gas for a short-term period. Additionally, this blending could reduce the price of fuel for the conventional vehicle, which would effectively ease the burden of vehicle operators.

Although practical implementation of alternative fuels in alternative vehicles would take a few years, the process for change has begun. An increased awareness of these fuels and active participation in developing vehicles powered by these fuels is ongoing across different geographic regions. Many governmental organizations look forward to promoting these fuels, and different governments lean toward organizing promotional campaigns and taking initiatives to create market appeal for these vehicles. This trend is likely to increase, leading to an environment that is driven by zero emissions, environment-friendly vehicles. This measure offers twin advantage of reducing dependency over oil and makes fuels more affordable. Mass production of the discussed alternative fuels would lead to the decline in the pricing structure of the battery and automobile in the long term.

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