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Hydrogen Energy as a Fuel in Future- A Review

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***Abstract*— As we all know that we all are living in the age of science and science had made our life so simpler and easier that we can't imagine a few decade ago. As in the earlier time we took a couple of days or more to travel from one place to another. But now we can travel or can do any work in a second or in hours. But with the development of science we all are losing are fossil fuels. Which is going to create a serious problem in the upcoming generation? Burning of petrol coal and other harmful fuel is causing a tremendous effect on our environment.**

Many see Hydrogen as a clean fuel of the future, because it is the only by-product in water. Before Hydrogen can become a significant part of the energy economy many fundamental technological issue must be addressed.Government, research institute and businesses, including the oil- and gas industry, must play important role in solving problem related to hydrogen production, transport,storage and distribution.

In the ideal, albeit distant, future is a world of renewable, pollution free energy sources for everything from electrical power grid to personal vechical.The path to that futuristic, technological speaking steep uphill climb.

Hydrogen is likely to be a part of this idealistic future, and possibly a important part. Hydrogen is a very efficient fuel its combustion will produce no greenhouse gasses, no ozone layer depletion chemical, no acid rain ingredients and pollution.

***Index Terms*— Environment impact, Reduce Green House effect, Ozone layer Depletion**

I. INTRODUCTION

Hydrogen is the fuel of the future. As an avid researcher of alternative fuels and an ambitious chemistry student, this researcher understands the importance of a shift to a hydrogen economy. Hydrogen is an energy carrier that can be used in internal combustion engines or fuel cells producing virtually no greenhouse gas emissions when combusted with oxygen. The only significant emission is water vapor. Hydrogen production and storage is currently undergoing extensive research. A solar-hydrogen system can provide the means of a totally emissions free method of producing hydrogen. Although steam reformation of methane is currently the major route to hydrogen production, the emissions involved can also be controlled much more efficiently than our current system of transportation fuel. Climate change is a serious issue becoming increasingly evident to much of the population. Rising CO2 levels have directly contributed to the global warming phenomenon. As shown in Figures 1 and 2, the CO2 levels have rising dramatically in the past 200 years, along with the global average temperature.

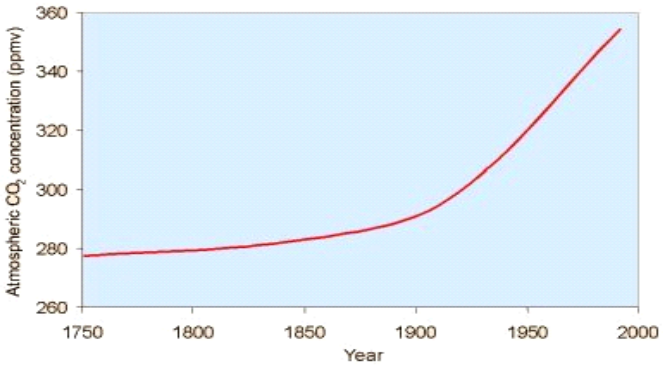

Fig.-1

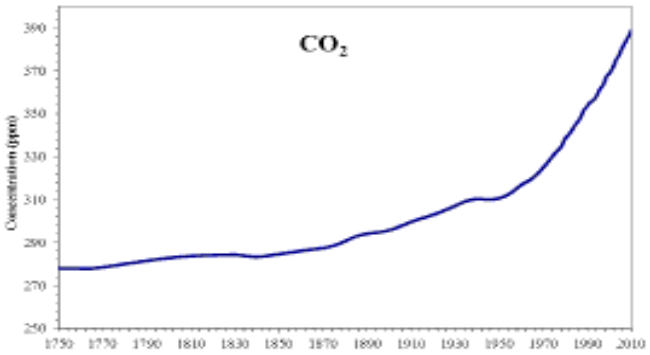

Fig-2

II. OVERVIEW

This section contains personal views on steps that should be taken to achieve Hydrogen Fuel as a Energy Carrier and the remaining sections provide evidence to support. Hydrogen is both the most abundant and the lightest element in the universe. While it exists pretty much everywhere- in the air, in space, in the ground- it is rarely alone. This means that it is usually combined with another element, making it necessary to extract and convert it to make it a usable energy source.

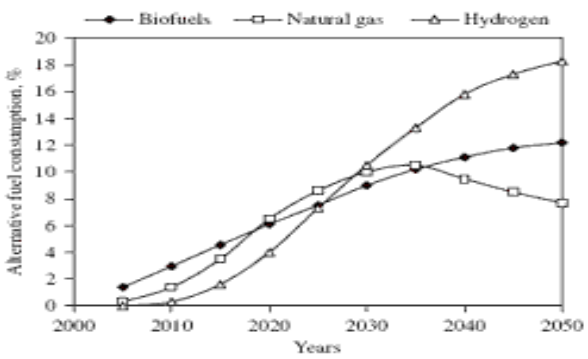

Fig-3

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III. CAN HYDROGEN BE A FUTURE FUEL

YES, Hydrogen can be a future fuel because Hydrogen is only an energy carrier that can transform our fossil-fuel dependent economy into a hydrogen economy, which can provide an emissions-free transportation fuel. Literature reviews and independent research were the main methods of research. Hydrogen storage and transport are issues of intense research due to hydrogen low density.

When it comes to looking to the energy source that will replace fossil fuels, there is no shortage of options. Solar power, wind energy, ethanol and biofuels are typically used to replace petroleum-based combustion engines and coal-fired power plants.
But hydrogen stands apart as a promising alternative energy source. Although the idea of hydrogen as a widely used fuel source to power cars and generate electricity is a relatively new concept in response to seeking an alternative to oil, hydrogen fuel cells actually predate the internal combustion engine, which was invented in the middle of the 19th century.

Hydrogen is odorless, colorless, and tasteless, and thus undetectable by human senses. By comparison, natural gas is also odorless, colorless, and tasteless, but industry adds a sulfur-containing odorant to make it readily detectable by people. Odorants are not added to hydrogen because currently, there is no known odorant light enough to "travel with" hydrogen or disperse in air at the same rate. Odorants also contaminate fuel cells. Industry considers these properties when designing structures where hydrogen is used or stored and includes redundant safety systems that include leak detection sensors and ventilation systems.

Hydrogen burns with a pale blue, nearly invisible, flame. Hydrogen flames also have low radiant heat compared to hydrocarbon flames.

IV. HYDROGEN FUEL AS A BOOM IN FUTURE

Yes, we can say hydrogen as a boom in the upcoming generation because as we all are using our fossil fuel in a huge amount so it is sure that we one day they are going to be finish so to overcome this thing. And as our fossil fuel on combustion produce carbon that effect our enviournment due to which global warming is effecting our surrounding. Hydrogen is the only element which is in abundant amount in the atmosphere and in water. As it is a clean fuel it doesn't cause any type of pollution.

Hydrogen can power cars, trucks, buses, and other vehicles, as well as homes, offices, factories, and even portable electronic equipment, such as laptop computers. As the research says Hydrogen as a future fuel is the only best and easy financial option in the future as it can be used in Industry as a fuel and in vehicals.We can use many other energy sources such as Solar Energy, Wind energy, thermal process etc. and also produce energy but we are giving preference to hydrogen fuel because it bombardment energy level is much more than other energy sources. That's why also Hydrogen fuel as a boom in future.

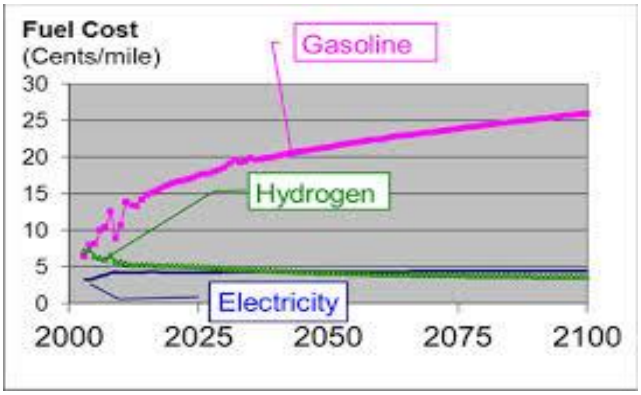

Fig-4

V. HOW HYDROGEN FUEL CAN BE PRODUCED

Hydrogen can be produced in many different ways, using a wide range of technologies. Some of these involve established industrial processes while others are still at the laboratory stage. Some can be introduced immediately to help develop a hydrogen energy supply system; while others need considerable research and development.

Current hydrogen production is mostly at a large scale. Before a hydrogen energy system is fully proven and fully introduced, many regional demonstration and pilot projects will be required. Aside from large-scale industrial equipment, small-scale production technologies, including electrolyses and stationary and on board reformers, which extract hydrogen from gaseous and liquid fuels like natural gas, gasoline and methanol, will be needed. Many organizations are developing technologies specifically for this scale of operation.

VI. STORAGE OF HYDOGEN FUEL

One of the major problem occur use Hydrogen as fuel is that How to store Hydrogen in the form of a fuel?
Hydrogen can be stored as a compressed gas, as liquid or chemical hybrid. Of these, liquid hydrogen has the highest density. However it is still about one-third of the volumetric value compared to gasoline and one-quarter of gasoline of gasoline's gravimetric energy density.
Hydrogen also can be stored within the structure or on the surface of certain materials, as well as in the form of chemical compounds that undergo a reaction to release hydrogen. Hydrogen atoms or molecules are tightly bound with other elements in a compound (or storage material), which may make it possible to store larger quantities in smaller volumes at low pressure and near room temperature. Storing hydrogen in materials can occur via absorption, in which hydrogen is absorbed directly into the storage media; adsorption, in which hydrogen is stored on the surface of storage media; or chemical reaction. Materials used for hydrogen storage can employ one or more of these mechanisms and may be grouped into four general categories:

- Metal Hydrides.
- Carbon-based Materials or High Surface Area Sorbents.
- Chemical Hydrogen Storage.
- New Materials and Process.

Delivery and vehicle storage systems require advanced technologies to compensate for the low volumetric energy density of hydrogen. Current hydrogen storage systems for vehicles are inadequate to meet customer expectations for driving range (greater than 300 miles per fill) without intrusion into cargo or passenger space. Furthermore, durability of the storage system over the expected life of the vehicle must also be verified and validated. To meet these challenges, scientists and engineers in government, industry, academia, and at national laboratories are researching a wide variety of storage systems, with particular emphasis on materials-based technologies.

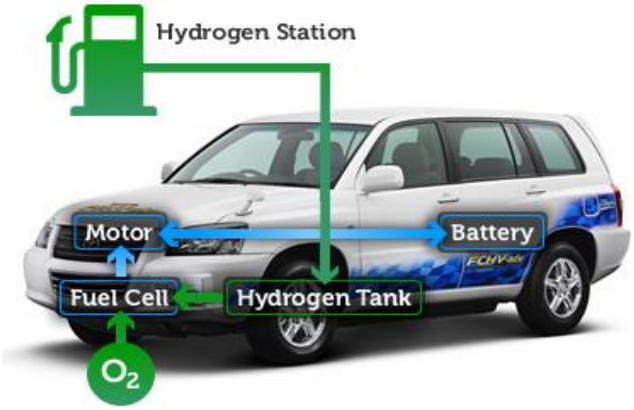

Fig.-5

Shown in fig.1&2, compressed gaseous hydrogen storage is at room temperature in a high-strength pressure tank. Including the weight of the tank, compressed gas storage holds about 1 to 7% hydrogen by weight, depending on the type of tank used. Lighter, stronger tanks, capable of holding more hydrogen with less weight, are more expensive. Compressing the hydrogen gas at the filling station requires about 20% as much energy as is contained in the fuel.

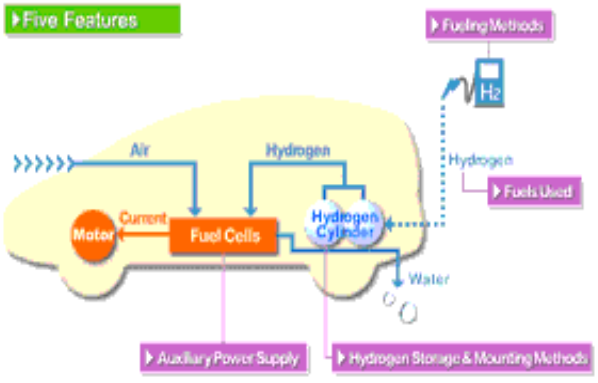

Fig.-6

The carbon adsorption technique stores hydrogen under pressure on the surface of highly porous super activated graphite. Some varieties are cooled; others are operated at room temperature. Current systems store as much as 4% hydrogen by weight. It is hoped to increase this efficiency to about 8%, even for the room temperature variety. Carbon adsorption is very similar to compressed gas storage except that the pressure tank is filled with graphite; the graphite adds some weight but allows more hydrogen to be stored at the same pressure and tank size.

VII. 21ST CENTURY HYDOGEN ENERGY SYSTEM

Fossil fuels (i.e., petroleum, natural gas and coal), which meet most of the world's energy demand today, are being depleted fast. Also, their combustion products are causing the global problems, such as the greenhouse effect, ozone layer depletion, acid rains and pollution, which are posing great danger for our environment and eventually for the life in our planet. Many engineers and scientists agree that the solution to these global problems would be to replace the existing fossil fuel system by the hydrogen energy system. Hydrogen is a very efficient and clean fuel. Its combustion will produce no greenhouse gases, no ozone layer depleting chemicals, little or no acid rain ingredients and pollution. Hydrogen, produced from renewable energy (e.g., solar) sources, would result in a permanent energy system, which we would never have to change.

However, there are other energy systems proposed for the post-petroleum era, such as a synthetic fossil fuel system. In this system, synthetic gasoline and synthetic natural gas will be produced using abundant deposits of coal. In a way, this will ensure the continuation of the present fossil fuel system. The two possible energy systems for the post-fossil fuel are (i.e., the solar-hydrogen energy system and the synthetic fossil fuel system) are compared with the present fossil fuel system by taking into consideration production costs, environmental damages and utilization efficiencies. The results indicate that the solar-hydrogen energy system is the best energy system to ascertain a sustainable future, and it should replace the fossil fuel system before the end of the 21st century.

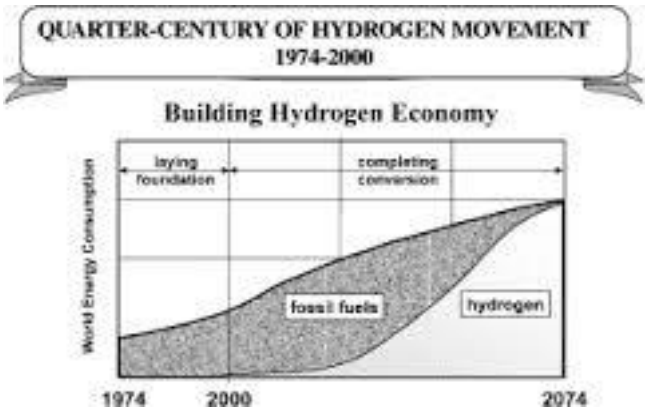

Fig.-7

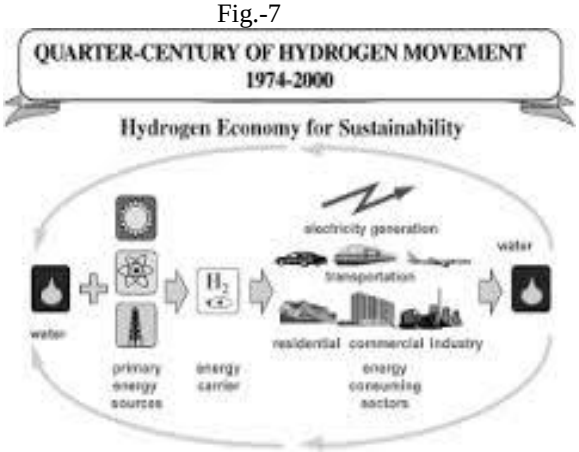

Fig.-8

VIII. COST & SALE VALUE ANALYSIS

This section provides publicly available information regarding mergers and acquisitions in the industry, fuel cell company revenues, cost of revenue, and other key data for selected publicly traded fuel cell companies that have fuel cells as their primary business. The focus is on public companies because many private companies do not release financial information. Finally, venture capital, private equity, and other investment activity within the industry are discussed in this section.

While there are barriers to overcome, the benefits outweigh the costs. Developing and expanding the use of hydrogen, along with other domestic energy resources and energy-efficient technologies, will ensure that the United States has an abundant, reliable, and affordable supply of clean energy to maintain the nation's prosperity throughout the 21st century.

We should be very clear that for the sale value of Hydrogen fuel equipment we should kept the minimum financial range so that everyone can easily afford the equipments as compare to the present.

IX. CONCLUSION

Hydrogen storage is still a major research problem. While progress has been made, current systems are inadequate or marginal. On-board storage of sufficient H2 most likely will be as compressed gas. Demonstration vehicles have used 5000-psi carbon-fiber wrapped tanks, and tanks have been certified recently at pressures of 10,000 psi. Liquid hydrogen and storage are almost certainly not practical for vehicle use. Metal hydridation and metal-N-H systems show some promise, but much research is still required for these systems.

Advanced carbon materials are intriguing, but contradictory research results, with relatively low reproducible storage capacities, have been discouraging and much remains to be done. Unresolved research questions, such as hydrogen storage, make the fuel cell vehicle approach a long-term issue.

Sustainable development requires a sustainable supply of energy resources that, in the long term, is sustainable available at reasonable cost and can be utilized for all required tasks without causing negative societal impacts. Energy resources such as solar, wind, hydro, and biomass are generally considered renewable and therefore sustainable over the relatively long term.

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