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Review Paper on a Fuel Cell Scooter

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Abstract:
Air pollution is of serious concern in many Asian countries, especially in densely-populated cities with many highly-polluting two-stroke engine vehicles. The present value of health effects have been estimated at hundreds of dollars or more, over each vehicle's lifetime. Four-stroke engines and electric battery-powered scooters are often proposed as alternatives, but a fuel cell scooter would be superior to both by offering both zero tailpipe emissions and combustion-scooter class range (200 km).Unlike 50 kW automobile-sized fuel cell stacks, the vehicular 5 kW fuel cell needed here has not received much attention. This niche is examined here with a conceptual design and consideration of the issues of water, heat, and gas management. The application is extremely sensitive to size, weight, and cost, so a proton exchange membrane fuel cell using hydrogen stored in a metal hydride is best. Hydrides also act as sinks for waste heat due to the endothermic hydrogen desorption process. Pressurized operation is found to be ineffective due to high parasitic power demands and low efficiencies at the low powers involved. These paper reflected different source of fuel cell for improving energy saving and utilization.

Keywords: Air Pollution, Two-Stroke Engine, Fuel Cell, Size, Cost, Hybrids, Power, Heat.

I. INTRODUCTION

After an initial flowering of radically different ideas and concepts, including electric vehicles, cars since the nineteenth century have almost universally burned gasoline and run on the four-stroke Otto cycle. The majority use spark plugs for ignition. However, the two-stroke Otto cycle is still widely used for applications like lawnmowers, outboard motors, and scooters, where simplicity, low cost, and high power per weight are more important than fuel efficiency or minimized air pollution. However, as more and more attention is paid to emissions, these two-stroke cycle engines (heretofore abbreviated "two-stroke engines") are becoming less and less acceptable. Why are two-stroke engines so polluting, and what can be done to improve them? The answer will be clear after a brief tour through the workings of a four-stroke car internal combustion engine.

II. LITERATURE REVIEW

Manoj Pudukudy, Zahira Yaakob, Masita Mohammad, Binitha Narayana, Kamaruzzaman Sopian (2014) [1] had represented more attention due to the depleting nature of non-renewable fossil fuels. Increasing global warming, caused by the combustion of fossil fuels, triggered the intense research in finding out better energy options with low emission. Among the potential energy options, hydrogen is a clean fuel candidate as it simply produces water as by products when burning. Hydrogen can be generated from different renewable sources and Asia is one of the continents which is rich in renewable energy resources. There sources, safety parameters, public acceptability, and proper government incentives are the major factors affecting the implementation of hydrogen as an economical energy source in Asian countries. The present review deals with the necessity of employing hydrogen as an alternative fuel, its production paths, storage issues, transportation and the available sources. Special emphasis has been given to the discussion of renewable hydrogen economy in some Asian countries like, Japan, Korea, China, India and Malaysia. The challenges in the execution of hydrogen as an economical fuel in Asia are also highlighted.

Dr.R.T.Naik and Prof.G.K.Anathasuresh (2013) [2] had represented In large cities in Asia particularly in India millions of auto-rickshaws operated under taxi-services. But, these three-wheelers cause lot of air pollution and produce large amounts of green house gasses. The drivers of these vehicles shown in the figure.1constitute mainly the lower income groups in society who earn around Rs 100–150 per day. Locally people will address these three wheeled rickshaw as Auto.

Alex Bell and Andres Pacheco (2009) [3] had represented to design and build a hydrogen fuel cell powered motorcycle to provide efficiency data as well as increasing knowledge and interest in fuel cell based propulsion. Presented are details on the structural components, the fuel cell stack, the metal hybrid hydrogen storage tanks, the power electronics drive and the data acquisition system. Waste heat from the fuel cells is used to significantly improve the storage capacity of the metal hydride tanks. Data and analysis of bench and road tests are presented. Lastly information on the test stand is included for future student lab work.

Jamil Jawdat Jum'a Al Asfar (2007) [4] had represented hydrogen absorption capacities in local sand materials namely: Sweileh sand, Mahis clay, dead sea sand, china clay and oil shale were determined experimentally. The flow characteristics such as temperature, pressure, density and velocity profiles were calculated by solving the governing equations of two-dimensional compressible flow in solid porous media. These equations include continuity, momentum and energy, which were solved using finite volume method incorporated in MATLABTM. The local sand materials absorption capacities of hydrogen were investigated experimentally, and were found to be applicable for storing hydrogen for different applications. Sweileh sand and oil shale of 90-180 μm diameter- particle size have the highest hydrogen storage capacities when compared with other local sand materials and other oil shale particle sizes.

Chi-Chao Wan and Robert Rose (2015) [5] had represented An evaluation of the current status of fuel cell technology and potential for commercialization in Taiwan is timely. Taiwan is already ahead of many countries in establishing public-private partnerships for fuel cell research and commercialization. For such partnerships to become successful, governments must take the lead and create the infrastructure (e.g., establish safety codes, share risk of initial investment, and provide market entry support) to make future commercialization possible. Despite years of government and industry collaboration on fuel cell technology development, Taiwan is somewhat behind other countries in coordinating strategic planning for fuel cell infrastructure and commercialization. This paper is meant to spark new discussion on how the government and industry sectors in Taiwan—as well as potential overseas partners and investors—could come together to stimulate the development of markets in Taiwan for fuel cell technology.

Nathan J. English and Ramesh K. Shah (2004) [6] investigates fuel cell based propulsion has emphasized larger vehicles, with most manufacturers demonstrating a car, van or truck. However, the transportation market in many countries is dominated by smaller two and three wheeled vehicles. A fuel cell motorcycle could replace two stroke scooters that proliferate emissions, as well as, their electric counterparts that require long recharges for short ranges, and also four stroke motorcycles. This paper is a review and assessment of literature relating to the design and analysis of hybrid electric fuel cell motorcycle engines. The engine design is intended for a specific demonstration motorcycle, but should be able to scale down to a scooter size, or be adapted to work in other small vehicles. The proton exchange membrane fuel cell system utilizes an ambient air blower, pure hydrogen storage in metal hydrides, a control system, active liquid cooling, a radiator, power conditioning and water management systems.

T. Lipman and D. Sperling (2003) [7] had represented the fuel cell traces its roots all the way back to William Grove's famous experiments on water electrolysis in 1839, but the commercialization history of fuel cell technologies remains rather limited over 150 years later. Throughout the later part of the 19th and early part of the 20th centuries, attempts were made to develop fuel cells that could directly convert coal or some other carbon material into electricity, but these attempts were unsuccessful because scientific knowledge of material properties and electrochemistry was lacking. The first fuel cell capable of producing significant quantities of electricity was developed by Francis Bacon in 1932. This system used an alkaline electrolyte and nickel electrodes to produce electricity using hydrogen and oxygen. By 1952, Bacon had produced a 5kW system, and this provided much of the basis for further work on fuel cells in the 1950s and 1960s.

Shaheerah Fateen (2001) [8] had represented Fuel cells are devices that electrochemically convert fuel, usually hydrogen gas, to directly produce electricity. Fuel cells were initially developed for use in the space program to provide electricity and drinking water for astronauts. Fuel cells are under development for use in the automobile industry to power cars and buses with the advantage of lower emissions and higher efficiency than internal combustion engines. Fuel cells also have great potential to be used in portable consumer products like cellular phones and laptop computers, as well as military applications. In fact, any products that use batteries can be powered by fuel cells. In this project, we examine fuel cell system trade-offs between fuel cell type and energy storage/hydrogen production for portable power generation. The types of fuel cells being examined include stored hydrogen **PEM** (polymer electrolyte), direct methanol fuel cells **(DMFC)** and indirect methanol fuel cells, where methanol is reformed producing hydrogen. These fuel cells systems can operate at or near ambient conditions, which make them potentially optimal for use in manned personal power applications. The expected power production for these systems is in the range of milli watts to 500 watts of electrical power for either personal or soldier field use. The fuel cell system trade-offs examine hydrogen storage by metal hydrides, carbon nano tubes, and compressed hydrogen tanks. We examine the weights each system, volume, fuel storage, system costs, system peripherals, power output, and fuel cell feasibility in portable devices.

David Chung-Hsing Chao, Peter J. van Duijsen, J.J. Hwang and Chin-Wen Liao [9] had represents the importance of a simulation study of the Taiwan Electrical Fuel Cell Power Scooter. This study applies a more detailed modeling which is complex as existing modeling methods, yet not more difficult to solve numerically. In most simulation studies, the influence of non-linearity (for example, saturation, losses, reluctance effects) of the power electronics and electrical machine are neglected. Therefore the simulation results are only valid in the ideal case. Especially the influence of losses, harmonics, saturation, reluctance and time delay in the control, can be a decisive factor in the design. Therefore in this simulation study, it is shown to include these details. The conduction and switching losses in the power electronics during the drive cycle are simulated. Also the temperature stress on the semiconductors will be calculated in order to give a prediction of the life time of the semiconductor modules. Influence of the saturation and reluctance in the electrical machine and the impact on the overall system performance as well as the influence in the field oriented control. Detailed modeling of the field oriented control is discussed. Finally the implementation of the digital control in hardware directly from the simulation control model will be explained.

Dr. Chunto Tso (2014) [10] had represents to probe into the current development and prospect for fuel cell scooters, this article commences with the technical feasibility for fuel cell scooters, including the introduction of fuel cells, the critical technologies of fuel cell stacks, hydrogen storage in scooters, hydrogen distribution infrastructure and the system integration of fuel cell scooters. Taiwan's accomplishments of fuel cell scooters presently are introduced as well. Secondly, the market potential for fuel cell scooters is well discussed. The famous "Zero Emission Scooter Policy" of Taiwan includes "Electric Motorcycle Development Action Plan", more strict air exhaust standard, subsidy for purchasing electric scooters, and encouraging R&D. The policy impact will thus affect the scooter market's structure in Taiwan. Furthermore, Taiwan's and global scooter markets are also analyzed. Finally, the theory of industrial competition is provided to analyze the strengths, weaknesses, opportunities and threats for Taiwan to develop fuel cell scooters. In conclusion, with the fuel cell technique for scooters in its mature stage and the solid foundation of Taiwan's scooter industry, Taiwan is suitable for developing fuel cell scooters. In addition, since Taiwan has proven on account of developing prototype fuel cell scooters-ZES I and ZES II, it has the technical capability for fuel cell scooters. Fuel cell scooters are supposed to replace current gasoline engine scooters, which make much pollution, in Taiwan and global markets with significant potential.

III.CONCLUSION

The research survey was reflected different research done on fuel cell such as renewable hydrogen economy, Bio- Hybrid Fuel, Hydrogen, Hydrogen Storage, competing technique, portable powered application, technical feasibility etc. The research had survey on their design and analysis of fuel cell. There is possibility of work on fuel cell.

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