TOWARDS SUSTAINABLE TRANSPORTATION: THE DEVELOPMENT OF HYDROGEN TRAIN IN SAUDI ARABIA

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ABSTRACT

Saudi Arabia has planned to depend on the clean fuel sector in the coming decades, which is in line with Vision 2030, as well as to become a global supplier of Hydrogen and to play a leading role in all areas of energy, not just oil. Moreover, a series of hydrogen-based programs are aimed at making the transportation sector more sustainable, including the use of technologies based on hydrogen fuel cells for trains. In this case, the Hydrogen train fuel cells convert hydrogen-rich fuel into electricity through a simple chemical process, which consists of a positive electrode (anode) in electrical circuit that has a negative electrode (cathode) and an electrolyte or conductive medium. The stored hydrogen passes through the anode, where it splits into electrons and protons. Then, the electrons enter through a circuit that generates an electric charge and may be stored in lithium batteries or sent directly to the train's electric motor. The remaining part of the hydrogen molecule reacts with oxygen at the cathode and turns into the only waste product, which is water. The Oxygen can be separated from water by using an electric current, which can be generated from renewable energy sources such as wind and solar energy. This paper is aimed to determine the operator cost of constructing a Hydrogen train line through a mathematical calculations based on Microsoft Excel, which includes the infrastructure and rolling stock costs. In this case, a gravity demand model will be used to determine the forecasting travel demand for the case study of the North-South Rail line, connecting Riyadh to Qurayyat for a distance of 1,257 kilometres. It is a function of independent variables such as population, GDP per capita, mean travel speed, mean fare, etc.

Keywords: Hydrogen Train, Operator Costs, Renewable Energy Resources, Gravity Demand Model, Sustainable Transportation; Saudi Arabia.