

# Viability analysis of underground mining machinery using green hydrogen as a fuel

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The processes and logistics of the mining industry have continually undergone transformations in order to deal with rigorous regulations, economic considerations, safety and the social burden regarding environmental conditions (i.e. every sustainability pillar). In underground mines, the use of diesel-powered machinery has been increased in the past decades. The combustion of diesel fuel produces a great quantity of pollutants (i.e. gas emissions, particulate matter, etc.). Thus, a constant ventilation is required to satisfy the regulations on health and safety of miners. One of the innovative transformations that underground mining processes have adopted is the use of electrical Load Haul Dumps (LHDs) to reduce the in-mine emissions and the ventilation burden and to improve in-mine working conditions, among other benefits. Electric mobile LHDs could be further improved by replacing battery-based energy supplies with hydrogen fuel cells. The present work focuses on the techno-economic assessment of modifying electrical LHDs by incorporating different processes and equipment (i.e. fuel cell stacks, storage tanks, DC/DC converters). The base case considers the modification of the whole mining fleet of diesel-based LHDs. As a result, a positive Net Present Value (for the project time span under consideration) and a payback period of 7.78 years were observed. The sensitivity analysis showed that considerable modifications of the current states of diesel price are required so that modifications are not feasible (diesel prices of 0.53 €/l). A tight

electricity cost of 70 \$/MWh was obtained as a breaking point (considerably safe for several industrial conditions). © 2019 Hydrogen Energy Publications LLC

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