Investigating the Feasibility of Hydrogen to Reduce Diesel Reliance in Remote Communities

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As Canada looks to reduce greenhouse gas emissions, hydrogen is considered to be a viable replacement for fossil fuels[1, 2]. When produced through electrolysis from renewable energy, hydrogen is a zero-emission fuel source and utilized in a fuel-cell to create electricity[3]. This study explored wind energy to generate hydrogen power for remote communities in Nunavut, where aging-diesel generators are the principal source of electricity[4]. While the Nunavummiut people residing in these communities are accustomed to limited accessibility during the winter, consistent access to reliable and affordable energy is essential for survival.

A techno-economic model was developed for a wind-hydrogen coupled project for the communities of Rankin Inlet, Iqaluit, Baker Lake, Whale Cove, and Sanikiluaq. These communities were selected based on their daily electricity demand, proximity to water and potential to produce energy from wind[5]. The calculated levelized cost of electricity (LCOE) is between CAD $0.26 to $0.46/kWh, which in comparison to the current rate of electricity[6] (CAD $0.59 to $0.91/kWh) in these communities is significantly lower (Figure 1). Moreover, diesel-fired electricity rates have increased by 25% in the last decade[7], and are expected to continue on this trend. Whereas wind-hydrogen rates are expected to drop by about 60% (Figure 2) [8, 9]. By comparing the current rate of electricity with the future of electricity generated from hydrogen, it can be concluded that wind-hydrogen projects are favourable.

Nunavut's Independent Power Producer (IPP) program would support community-owned large-scale renewable energy projects; however, this program is still in development and the final details of the IPP program have not been released[10, 11]. Based on a comparative analysis of existing IPP programs in Alaska and Canadian jurisdictions, this study attempts to inform the Government of Nunavut of the approach that should be taken to allow for the installation of a wind-hydrogen coupled project in Nunavut communities.

FOOTNOTES:
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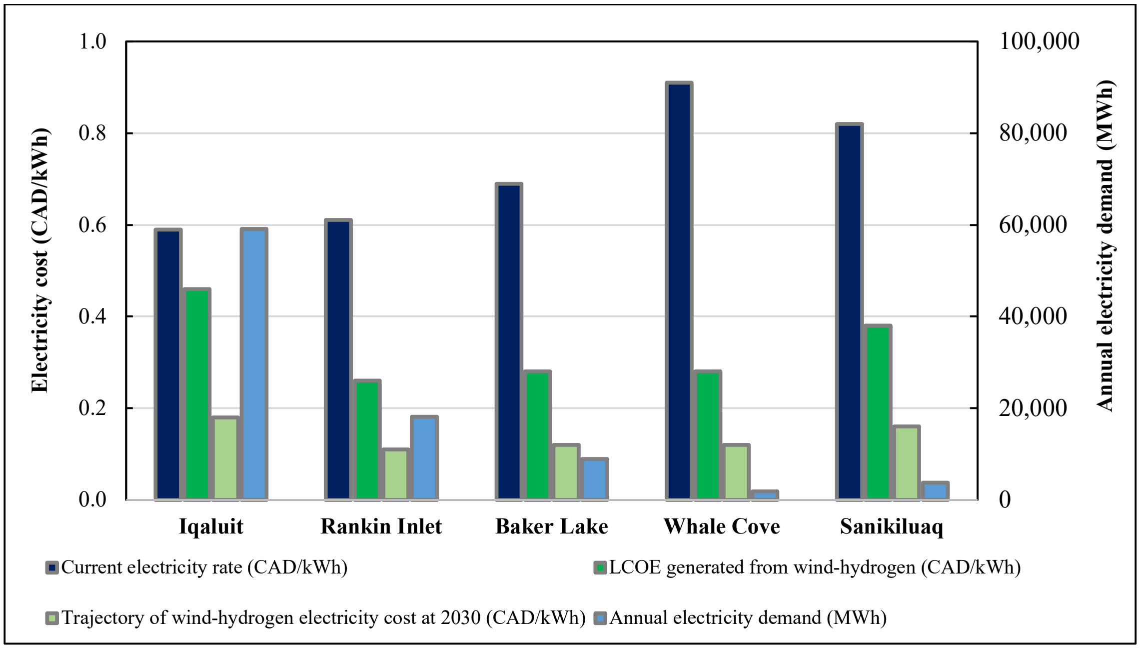

Figure 1. The summary of results for the selected communities showing the comparison of current electricity price and the LCOEs generated from wind-hydrogen, as well as the trajectory of wind-hydrogen electricity cost at 2030. The communities were selected based on their annual electricity demand to show the benefits of wind-hydrogen regardless of the size of the community.

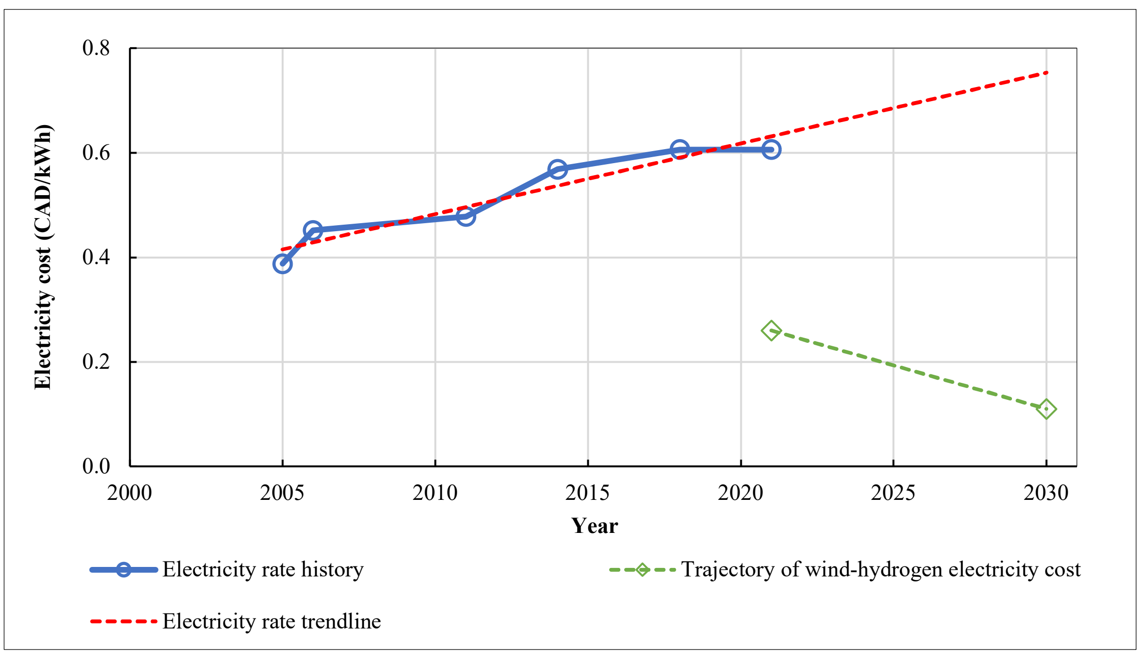

Figure 2. The comparison of historical electricity rates generated from diesel with the future cost of electricity generated from hydrogen. The data of Rankin Inlet is presented here as an example.

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