Practical Solutions to Decarbonize Mining Operations: A Case Study of a Copper Mine in British Columbia Using Renewable Diesel

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Introduction

- Critical minerals are essential for the energy transition, and mining has notable environmental impacts, with 40%–50% of GHG emissions from diesel use in mobile equipment.
- Diesel consumption is the largest contributor, accounting for about 36% of total impact, hence the need for cleaner alternatives.
- Renewable diesel offers a lower carbon footprint and can directly replace conventional diesel in haul trucks engines without modification.

Research Question

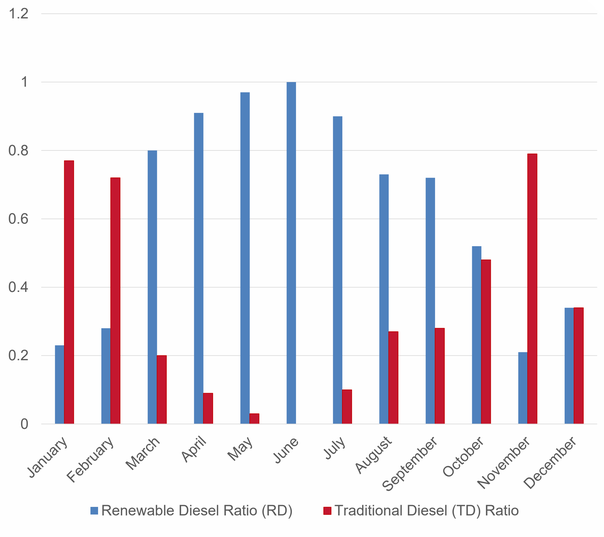
- How feasible is using renewable diesel to decarbonise haul-truck fleets at a Copper mine?

Methodology

- Monthly comparative evaluation of renewable vs. traditional diesel, focused on haul and emission intensity
- Emission assessment comparing GHG from (a) blended fuel with varying renewable and conventional diesel ratios, and (b) pure conventional diesel.
- Economic analysis estimated carbon tax savings ($80–$170/tCO$_2$e) over six years (2024–2030) to determine financial impacts and break-even point.

Results

Figure 1
Fuel Ratio in Blended Diesel



Results

Figure 2
Haul Intensities of Blended Fuel and Conventional Diesel

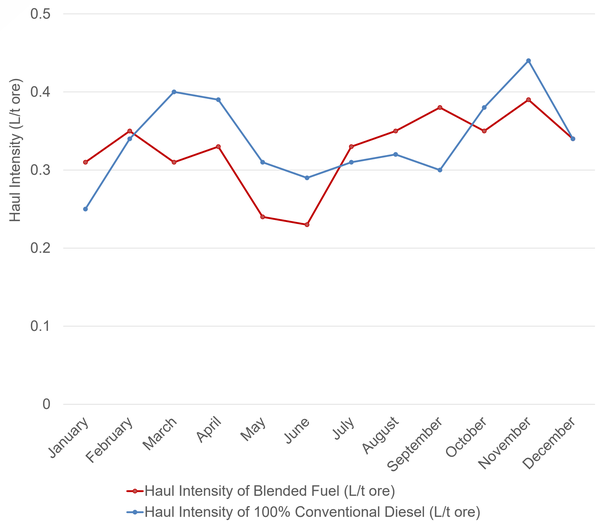


Figure 3
Emission Intensity of Blended Fuel and Conventional Diesel

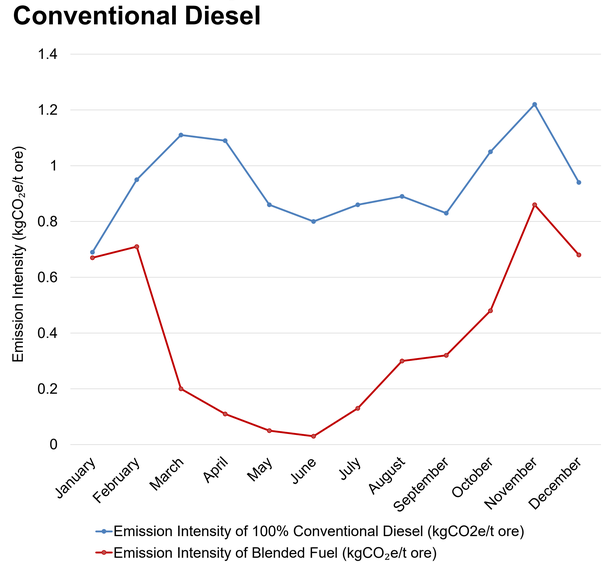
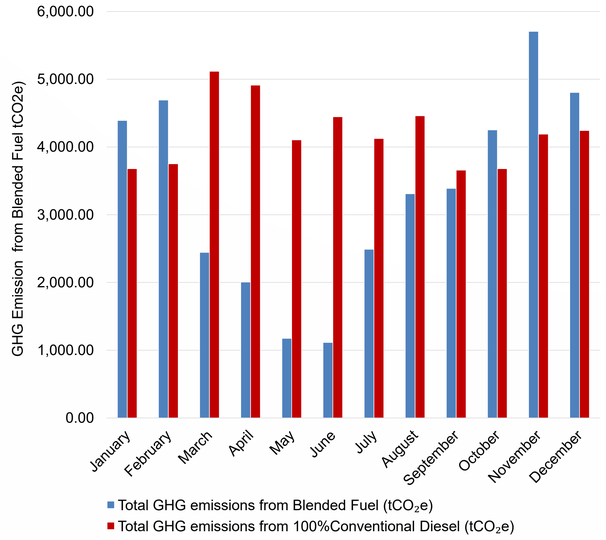


Figure 4
GHG Emissions from Blended Fuel and Conventional Diesel



Results

Figure 5
Emission Intensity of Fuel Types

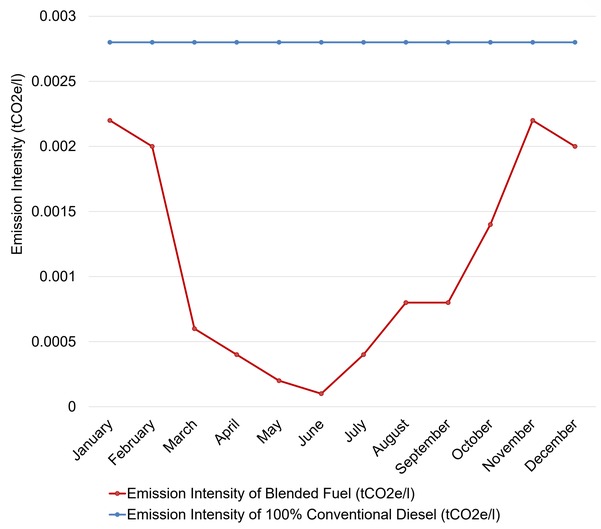
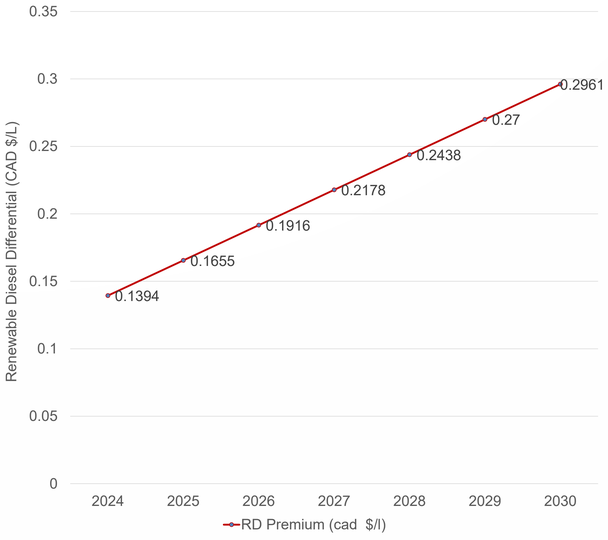


Figure 6
Liabilities Paid and Avoided from Fuel Types

Year	100%Traditional Diesel (Tax Paid - $CAD)	Blended Fuel (Tax Avoided $CAD)	(Tax Savings - $CAD)
2024	3,217,067.24	-400,567.07	3,617,634.31
2025	3,852,932.28	-443,008.46	4,295,940.74
2026	4,498,734.34	-475,512.84	4,974,247.18
2027	5,154,322.97	-498,230.64	5,652,553.61
2028	5,819,549.78	-511,310.26	6,330,860.04
2029	6,494,268.33	-514,898.14	7,009,166.48
2030	7,178,334.17	-509,138.75	7,687,472.91

Figure 7
Break-Even Point



Conclusion

- Renewable diesel use in haul-truck fleets is practical, offering similar technical and operational performance.
- The use of renewable diesel results in significantly lower emission intensity, making it an effective solution for decarbonizing haulage operations.
- Emission levels below the OBPS benchmark enable tax savings from renewable diesel while supporting financial gains in Canada's carbon pricing system.

Recommendation

- Increase the renewable diesel proportion in the blend in the winter months, using additives to improve cold flow properties instead of increasing traditional diesel content.
- Increase renewable diesel levels to 80–100% (RD80–RD100) for spring and summer seasons

References

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