

## INTRODUCTION

Eagle's Nest is a high-grade nickel-copper-platinum group element (PGE) deposit located in Northern Ontario's Ring of Fire [3]. Owned by Noront Resources, the mine will begin production in 2023 for a minimum of 11 years [3].

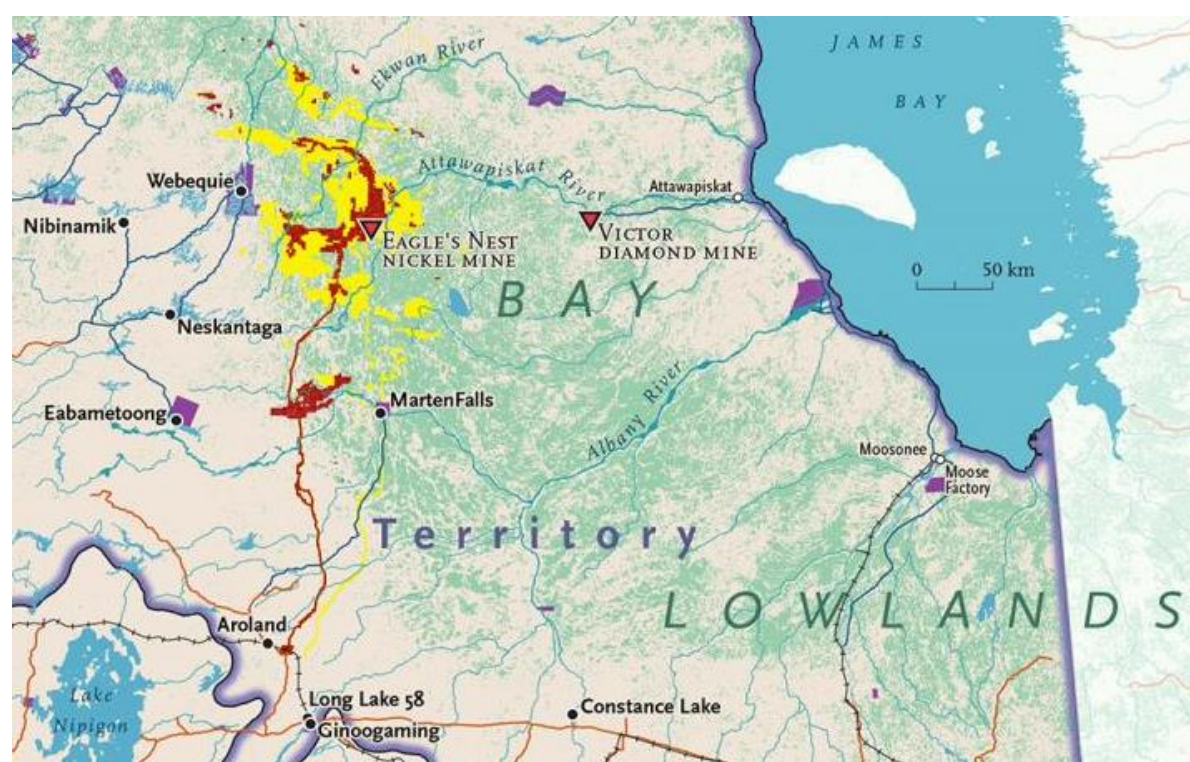


Figure 1 – Northern Ontario's Ring of Fire in the James Bay Lowlands [2]

This research builds on previous studies for SMRs in remote applications, e.g., [6], [7]. Many off-grid mines are powered by large diesel generators, which are expensive to operate and pollute heavily via greenhouse gas emissions. Numerous off-grid communities in Northern Ontario also rely on diesel generating stations for electricity.

## OBJECTIVES

1. To investigate if SMR technology would be financially competitive with diesel generators at Eagle's Nest.
2. To analyze a scenario in which the Eagle's Nest SMR is used to distribute power to local communities when mining efforts reach completion.

## METHODS

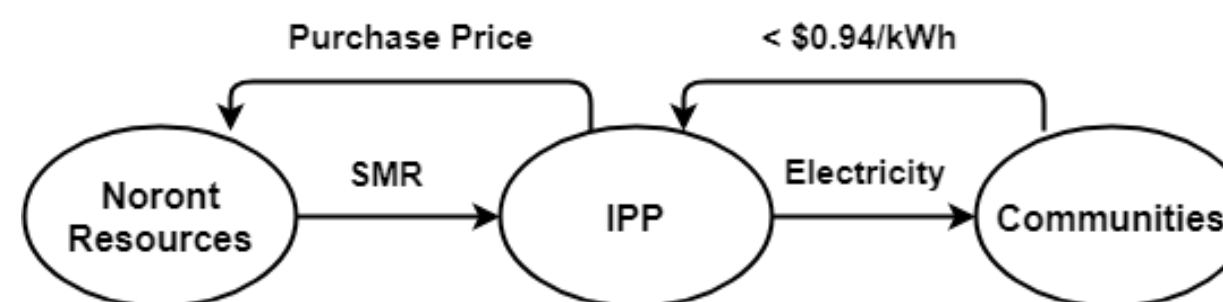
1. Using data from published estimates e.g., [4], [8], the energy demands of the mine were evaluated in order to estimate the lifecycle costs of the diesel power plant and SMR alternatives through the projection period. Levelized cost of energy calculations (LCOE) were made to compare the two technologies.

$$LCOE = \frac{I_0 + \sum_{t=1}^n \frac{A_t}{(1+i)^t}}{\sum_{t=1}^n \frac{M_{t,el}}{(1+i)^t}}$$

Equation 1 – Levelized cost of energy formula [1]

## METHODS CONT'D

- Using data from published estimates e.g., [4], suitable SMRs were filtered by size and compatibility with the environment
  - Price of diesel was estimated through to 2033 via the EIA's Annual Energy Outlook (2018) with crude oil projections to 2050
  - Carbon pricing was estimated through to 2033 for a Cap and Trade program and carbon tax model
  - Interest accrued during construction was considered for both technologies
  - First of a kind cost estimates converted to 8<sup>th</sup> of a kind [5]
2. A scenario was considered in which Noront could sell their reactor to an independent power provider (IPP) at the end of the Eagle's Nest project. Selling the reactor would reduce Noront's LCOE and allow local off-grid communities to eliminate their dependence on diesel generators.



## RESULTS

1. Eight SMRs were deemed technically compatible with the Eagle's Nest project, but only three are expected to be financially competitive with diesel generators based on this analysis. The cost of energy of each alternative was calculated for a range of discount rates.

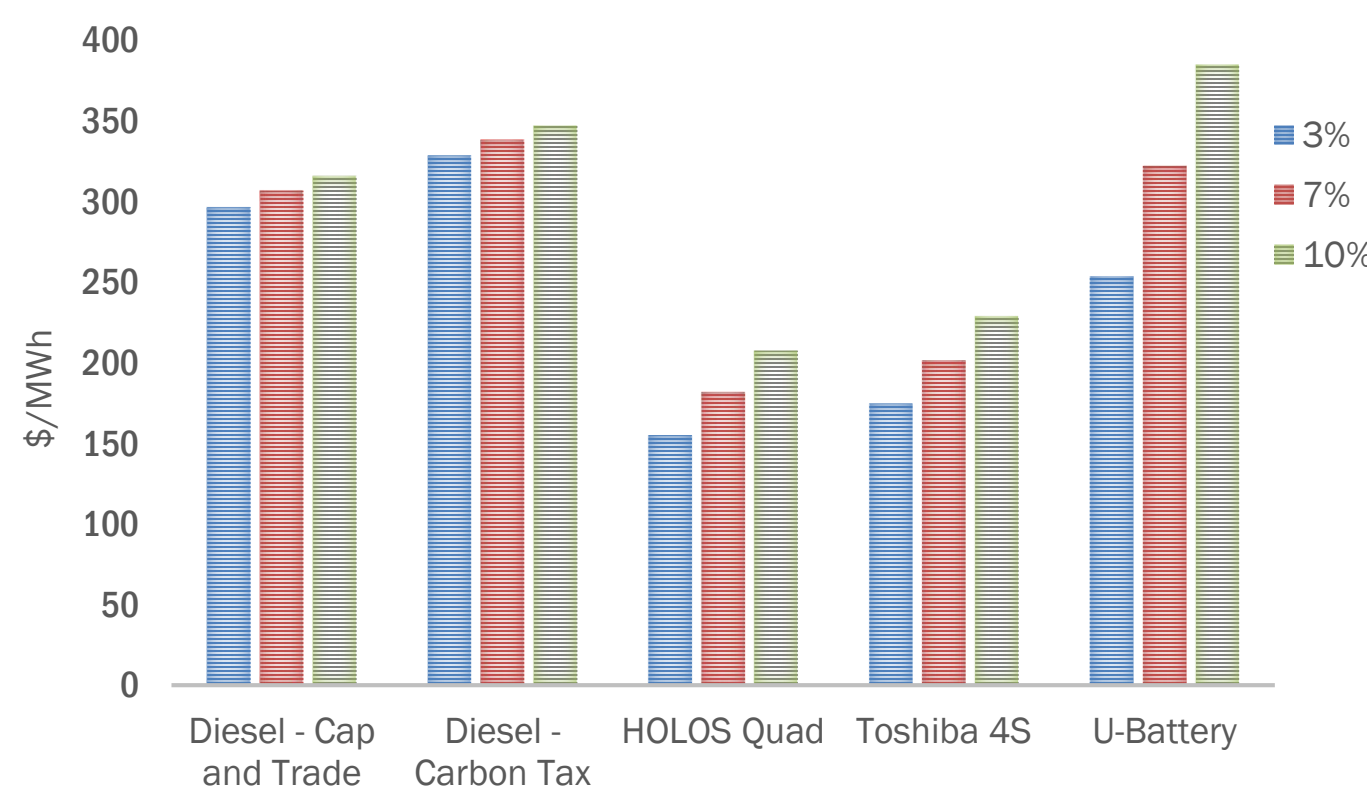


Figure 2 – Levelized cost of energy of each alternative under various discount rates through the projection period

## RESULTS CONT'D

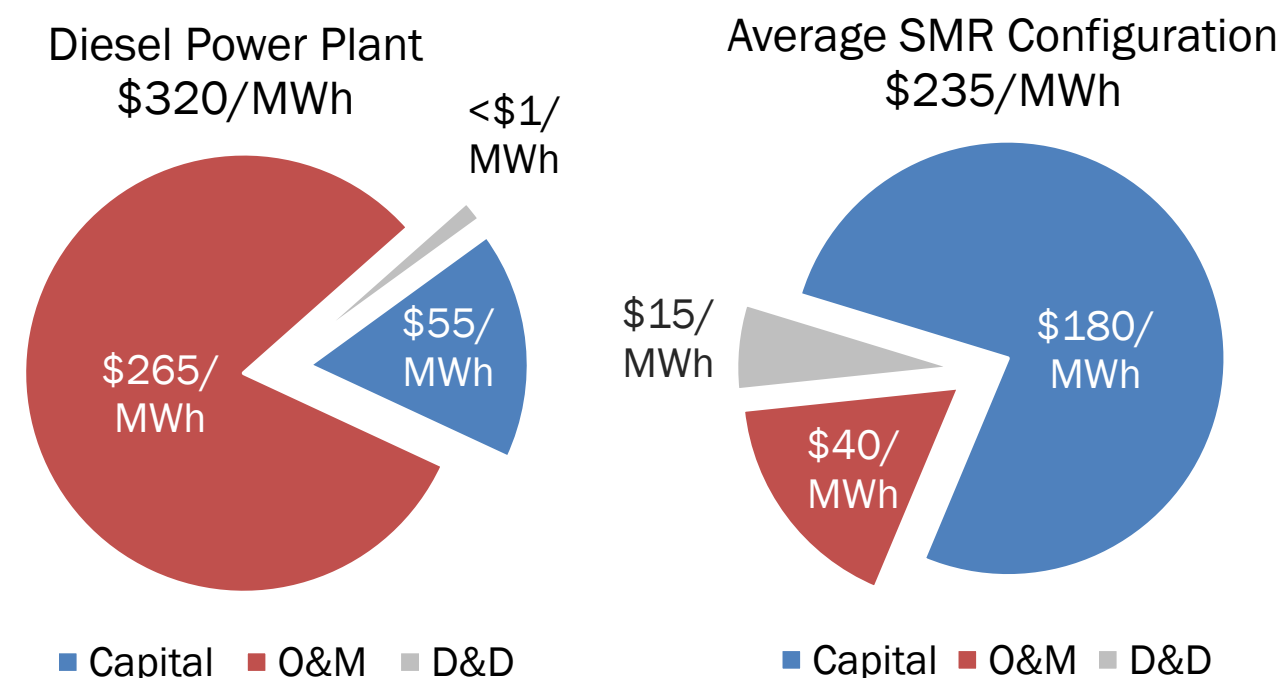


Figure 3 – LCOE breakdown of nuclear and diesel configurations

2. Noront's LCOE to operate each SMR is reduced if they sell the reactor at the end of the Eagle's Nest project.

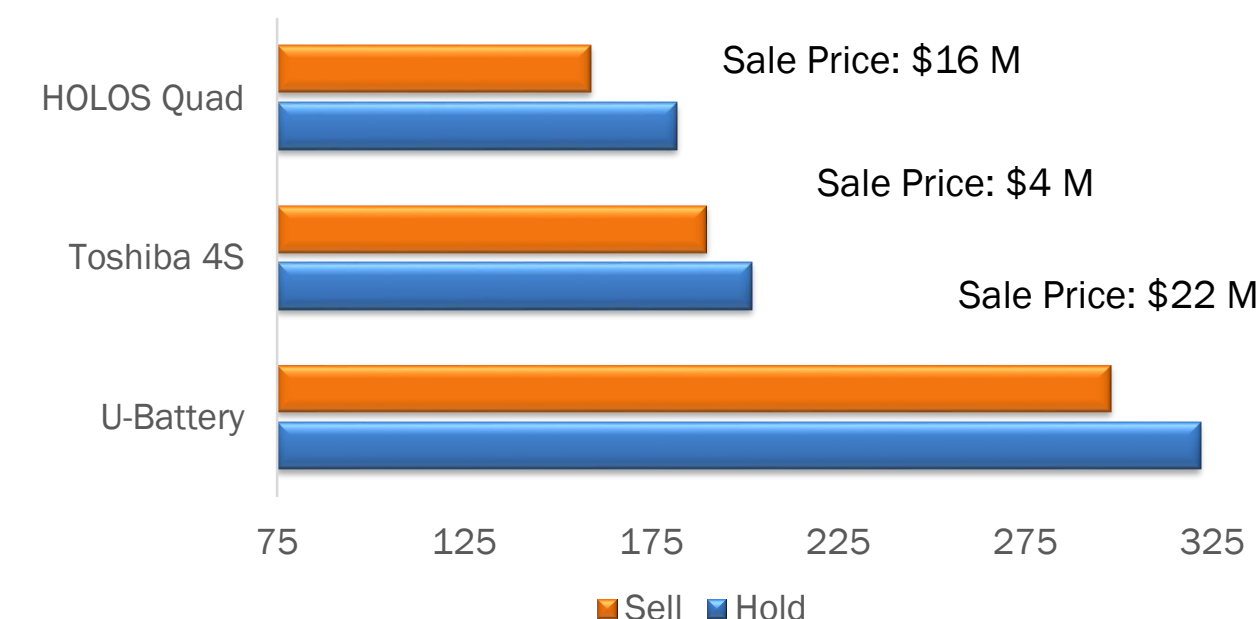


Figure 4 – Potential LCOE reductions should Noront sell reactor at the end of the project

## CONCLUSION

As a developing technology, the costs associated with SMRs remain uncertain, however an SMR configuration appears to be a more affordable alternative to diesel generators at the Eagle's Nest mine. Furthermore, it seems economically feasible to use the SMR for power distribution to local off-grid communities at completion of the project.

## ACKNOWLEDGEMENTS & REFERENCES

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