YUKON UTILITIES BOARD

Report to Yukon Minister of Justice

Yukon Energy Corporation Application for Energy Project Certificate

and Energy Operation Certificate

Regarding the Proposed

Battery Energy Storage System (BESS) Project

June 30, 2021

1. INTRODUCTION

On December 17, 2020, the Government of Yukon designated the Yukon Energy Corporation's (YEC's) proposed Battery Energy Storage System Project (BESS Project) as a regulated project under Part 3 of the *Public Utilities Act*.[1] On January 21, 2021, YEC filed an application for an energy project certificate and an energy operation certificate for the BESS Project (Application) with the Minister of Justice (Minister).

In a February 2, 2021 letter, the Minister referred the Application to the Yukon Utilities Board (Board) for a review and hearing pursuant to Part 3 of the *Public Utilities Act*. The letter included Terms of Reference, which set out the purpose and the specific aspects of the BESS Project to be reviewed, and stipulated that the Board hold a public hearing and submit its report and recommendations to the Minister no later than May 17, 2021.

On March 10, 2021, the Board requested that the Minister extend the reporting deadline to the end of July 2021. The Minister responded to the Board letter on April 16, 2021 and, pursuant to section 41(1) of the *Public Utilities Act*, granted the Board's request and required the Board to provide a report with its recommendations by June 30, 2021.

On February 18, 2021, the Board issued Board Order 2021-03, which gave notice of the Application, set out the process schedule for the Application up to the submission of intervener evidence, and stated that further process would be determined after April 9, 2021. Board Order 2021-03 also requested that parties intending to participate in the proceeding register in writing with the Board by March 1, 2021.

The Board received requests for intervener status from ATCO Electric Yukon (AEY), the Utilities Consumers' Group (UCG), the Yukon Conservation Society (YCS), and from John Maissan. All requests for intervener status were granted.

The Board issued further Board Order 2021-06 on April 16, 2021, which established the remaining process schedule, including the opportunity for the public to provide written comments on the Application by April 30, 2021. Board Order 2021-06 also set the virtual oral hearing process. The Board issued correspondence on April 27, 2021 providing the protocol for the virtual hearing.

All interveners were provided the opportunity to submit information requests (IRs), file evidence, cross-examine the YEC witnesses, and provide final submissions. No comments were received from the public on YEC's Application by the April 30, 2021 deadline.

Board comments on the timing of the Application

YEC's Application was submitted to the Board by the Minister on February 2, 2021 with the expectation that the Board complete its report by May 17, 2021. YEC supported that deadline by stating that work on the BESS Project must commence by the summer of that year.

[1] Order-In-Council 2020/180 – Designating the Battery Energy Storage System Project as a Part 3 *Public Utilities Act* regulated project.

The Board is concerned with short deadlines for Part 3 applications. Board members serve on a part-time, volunteer basis, with contracted supporting resources. The Board requires sufficient time to discharge its mandate, considering these constraints. For example, the established metric for this Board to produce a report or major decision is generally 90 days from the close of record. In this case, a general rate application (GRA) was already in front of the Board when the Minister imposed its timeline for this Part 3 application proceeding, raising additional resourcing concerns. In addition, the Board is concerned that a short deadline for a Part 3 application may not allow sufficient time for the administrative and regulatory procedures necessary to effectively and fairly process a Part 3 application.

For future Part 3 applications, YEC is expected to build time into the regulatory schedule for the Minister to review and refer the application to the Board and to provide a reasonable time period for any public sessions, a sufficient time period for record development before the Board, and 90 days for the decision report. Sufficient time for the review, referral, and Board hearing process allows for procedural fairness to parties to the proceeding and protects the integrity of the regulatory process. A shortened timeline should only be allowed in exceptional circumstances.

2. OVERVIEW OF THE APPLICATION

In its Application, YEC stated that the BESS Project consists of a containerized lithium ion battery energy storage system on a 1.5 hectare site that YEC will lease on undeveloped Kwanlin Dün First Nation (KDFN) Category B settlement land located northeast of the intersection of Robert Service Way and the Alaska Highway in the City of Whitehorse.

The BESS will be connected to the YEC Whitehorse Rapids facility by a new 1.7 kilometre, 34.5 kilovolt (kV) transmission line that runs north of the KDFN site, following existing easements through forested Crown land until it meets and follows the path of an existing AEY 34.5 kV line to the Whitehorse Rapids facility.

The proposed BESS Project involves a grid-sized BESS with 40 MWh of useful energy storage capacity and 20 MW of inverter and transformer capacity that together will provide 7.2 MW of dependable capacity to the Yukon Integrated System (YIS) for 20 years, starting in the winter of 2022-23.

YEC expects that 7.2 MW of dependable capacity provided by the BESS Project will reduce the need to rely on rental of diesel generators during the winter months and will displace four 1.8 MW diesel rental units to address capacity shortfalls. YEC argued that the BESS Project will also provide other benefits, including: operating reserve that reduces thermal generation requirements; enhanced black start capability; and opportunities for diesel peak shifting.

The BESS Project lies within the overlapping traditional territory of the Ta'an Kwäch'än Council (TKC) and KDFN. YEC stated that it engaged with both First Nations in Q2 of 2020 to form a trilateral committee for sharing BESS Project information and assessing three potential KDFN and TKC sites for the BESS Project. The BESS Project includes a debenture investment opportunity for both TKC and KDFN.

The preliminary capital cost estimate (in 2020 dollars, with a +/- 30% accuracy) for the BESS Project is $31.7 million. After $16.5 million in funding from the Government of Canada's Investing in Canada Infrastructure Program ("ICIP"), the preliminary net capital cost estimate to be borne by ratepayers is estimated at $15.2 million.[2]

3. TERMS OF REFERENCE

The Minister stated that the general purpose of the review and hearing of the Board was to "obtain the YUB's report and recommendations on the potential benefits, costs, risks and customer impacts that influence whether the BESS Project should proceed as proposed by YEC, and any terms and conditions which the YUB considers should apply."[3] In the Terms of Reference, the Minister requested that the Board review the following specific aspects of the BESS Project:

> The YUB shall report on, and make recommendations about, the necessity for the BESS Project and its timing and design, with particular regard to:
>
> a. The public need for the BESS Project under various reasonable electric load forecasts, including near term requirements related to industrial and nonindustrial loads, and the effect of the project on the rates of customers and the reliability of electricity service provided to customers.
>
> b. The capability of existing and currently committed and expected generation and transmission facilities, including thermal generation facilities to provide reliable electric power generation to meet the forecast load requirements and YEC's capacity planning criteria and the effect of the BESS Project on this capability.
>
> c. The risks for the BESS Project and their potential impacts on rates for customers and on the reliability of electricity service provided to customers.
>
> d. What, if any, reasonable alternatives exist to the BESS Project or what alternative ways of undertaking the BESS Project with its selected technology might be advisable given reasonable load assumptions and risk assessments.
>
> e. Impacts on YEC and ratepayers of the debenture investment opportunity that YEC is providing to TKC and KDFN in recognition of the BESS Project's location on the overlapping Traditional Territory of TKC and KDFN and the benefits of TKC and KDFN support for this Project's development at this time.
>
> f. Whether it is prudent to build the BESS Project as proposed at this time.[4]

The Minister stated that the Board shall provide a recommendation on whether YEC should be granted an energy project certificate and an energy operation certificate for the BESS Project and whether the certificates should be subject to any terms and conditions. The Minister also added

[2] YEC Application, PDF page 7.
[3] Minister of Justice's BESS Terms of Reference, February 2, 2021, PDF page 2.
[4] Minister of Justice's Terms of Reference, February 2, 2021, PDF pages 2 and 3.

that the Board may make any other recommendations or provide any other information that it considers advisable in the circumstances.

3.1 Public Policy and Ratepayer Costs

During the proceeding, YEC stated that its board of directors made the decision to not pursue a permanent thermal plant and instead to focus on renewable projects. YEC also stated that its board of directors has a deliberate strategy that the major capital projects, such as the BESS Project, are to involve economic opportunities for First Nations. Siting the BESS Project on settlement land was referenced as a mechanism to achieve that goal. As proposed, the BESS Project triggers public policy considerations that are in the jurisdiction of government.

The Board's recommendations for the BESS Project are based on the Board's jurisdiction under Part 3 of the *Public Utilities Act*, which gives the Board the authority to make recommendations about the approval of the energy project certificate and the energy operation certificate for a facilities project in Yukon. After receiving the Terms of Reference from the Minister, the Board holds a hearing and prepares its report, which includes any recommendations of the Board. The Board can recommend that the Minister approve the project, deny the project, or approve the project with conditions.

The Board is an administrative tribunal established by the Government of Yukon, responsible to ensure that the utility services in Yukon take place consistent with the public interest. The Board is an economic regulator that determines just and reasonable rates for Yukon utilities within its jurisdiction.

As part of discharging its mandate under the *Public Utilities Act* and considering the Minister's Terms of Reference for the BESS Project, the Board must look at the need for the project, the impact of the BESS Project, the cost implications to ratepayers, and system reliability.

The Board is not allowed to consider public policy that is beyond its mandate, such as climate action or the government's direction to advance economic development for First Nations. There may be externalized economic costs and benefits of these public policy considerations, but these items are not within the Board's determinations to be made under the Terms of Reference.

The BESS Project is proposed as part of a larger renewable electricity strategy to address climate change by reducing fossil fuel use, and may result in higher costs to the ratepayer than more traditional energy options. Similarly, the choice to require siting of the proposed project on First Nation land, including a sole-sourced investment opportunity, may also result in ratepayer impacts.

A portion of the total cost of the BESS Project will be covered by funding from the federal government. YEC confirmed in testimony that the focus of its board of directors, flowing from the policy direction of the territorial and federal governments, is on renewable energy. It is worthwhile for the Minister to consider how much of a project should be financed through government and paid for by the taxpayer and how much should be financed by ratepayers through utility rates if a proposed project seeks to achieve public policy goals.

The role of YEC, as a regulated utility, is to provide safe, reliable, and cost-effective energy services. In this case, YEC argues that, as proposed, there is an economic benefit to ratepayers of the BESS Project compared to the alternative it put forward, which is the current practice of renting diesel generators to meet capacity shortfalls.

However, as the project economics are based on preliminary estimates with many outstanding agreements, including battery procurement, land leasing, and the investment opportunities for the TKC and KDFN through debenture agreements, there will be variability in the actual costs from what is presented in the current Application and reviewed by the Board. The BESS Project, as a proposed renewable facilities project under Part 3 of the *Public Utilities Act*, attracts risk. Ultimately, ratepayers could bear the cost in excess of a least cost or more proven, conventional alternative.

The Board recommends that, if there is Ministerial approval of this project, there should be comment on the public policy issues considered with regard to climate change and First Nation economic development opportunities, as there are real cost drivers stemming from these public policy issues. This is particularly important because actual costs of the project after it is approved by government could be disallowed by the Board during its prudency review in a future GRA. Disallowed costs are ultimately paid by taxpayers and not YEC's customers, the ratepayers.

In response to Board questions during the hearing, YEC stated that, if there is a premium to going green, its approach is to pursue federal funding to reduce the costs of the BESS Project to ratepayers. As stated above, the consideration of the benefits expected from First Nation economic development, or from reductions in greenhouse gas emissions, are not factors which the Board can consider within its mandate.

4. NECESSITY FOR THE BESS PROJECT

4.1 Public Need for the BESS Project — Term of Reference 3.a.

In the Terms of Reference, the Minister requested the Board to report on and make recommendations about the necessity for the BESS Project and its timing and design, with particular regard to:

> 3.a. The public need for the BESS Project under various reasonable electric load forecasts, including near term requirements related to industrial and nonindustrial loads, and the effect of the Project on the rates of customers and the reliability of electricity service provided to customers.[5]

Yukon Energy Corporation

YEC provided a 2021-2030 forecast non-industrial peak load and a forecast dependable capacity, excluding mobile rented diesel units. YEC projected that load and capacity shortfall would continue to increase during that time period. YEC attributed the increase in load to the new

[5] BESS Terms of Reference, PDF pg. 2

industrial mine loads at the Minto, Alexco, and Victoria Gold mines[6] and to electrification policy initiatives, such as the Government of Canada's zero-emission vehicles sales target of 10% by 2025, 30% by 2030, and 100% by 2040.[7]

YEC's current method of mitigating the capacity shortfall is relying on rented diesel units. However, in YEC's view, these units introduce risks since there are uncertainties around their continued availability, their acceptable performance, and YEC's ability to spatially accommodate the units. YEC stated that these risks potentially expose grid customers to unreliable generation capacity.[8] For these reasons, YEC submitted that maintaining the status quo was not a feasible option in the circumstances and that permanent solutions were needed.

YEC indicated that, as provided for in its 2016 Resource Plan and 10-Year Renewable Electricity Plan, it continues to pursue new renewable energy development to reduce its reliance on thermal generation. Part of this renewable strategy is to develop the BESS Project.[9] YEC stated that the primary need for the BESS Project is to help meet its dependable capacity requirements under the N-1 criterion for the YIS. YEC defined "dependable capacity" as the maximum output that a resource can reliably provide over two consecutive weeks during the four winter months based on the inflows of the five driest inflow years in history.[10]

YEC anticipated that the BESS Project would provide 7.2 MW of dependable capacity in the near term, displacing the requirement to rent four diesel units rated at 1.8 MW. YEC considered other alternatives and indicated that these alternatives did not provide dependable capacity in the near term. For example, one of the options included the Whitehorse Hydro #4 (WH4) Uprate Project, which would increase the maximum water flow and provide 0.9 GWh of annual additional energy. However, due to the downstream Yukon River system ice flow restrictions, the WH4 Uprate Project would not provide additional dependable capacity.

YEC advised that the BESS Project would be required to close the gap in the capacity shortfall, even if the other major projects in the 10-Year Renewable Electricity Plan proceeded; namely, the Atlin Hydro Expansion and the Moon Lake Pumped Storage projects. YEC submitted that, after connecting the Atlin Hydro Expansion project, there would still be around 8.9 MW of capacity shortfall.[11] YEC indicated that if the Moon Lake Pumped Storage project connected and there was no BESS Project, there would be a slight capacity surplus in 2028-29, but then a capacity shortfall would exist in the following years.[12]

[6] YEC Application, Section 4.1.2, PDF page 29.
[7] YEC responses to YUB IRs, YUB-YEC-1-1, PDF page 7.
[8] YEC Application, Section 4.2, PDF page 33.
[9] YEC Application, Section 4.1.2, PDF page 29.
[10] YEC responses to YUB IRs, YUB-YEC-1-17, PDF page 46.
[11] YEC Application, Section 4.1.2, PDF page 32, Table 4-1.
[12] Transcript Volume 2, PDF page 8, lines 17 to 25, and PDF page 9, lines 1 to 9.

YEC indicated that the BESS Project would reduce ratepayer costs compared to rented diesels or any other option, citing the following unique features as contributing to ratepayer savings:

- A $16.5 million federal grant, which reduces the estimated capital cost (2020$) to $15.2 million;

- Displacement of diesel rental costs (or similar fixed capital and non-fuel O&M [operations and maintenance] costs for any other thermal option considered);

- Operating reserve use savings from the battery, displacing thermal generation driven by the current requirements to use hydro for operating reserve [footnote removed]; and

- Fuel cost savings from battery use for diesel peak shifting.[13]

YEC stated that net ratepayer savings would occur each year with the BESS Project and that there would be $12.7 million net present value ratepayer savings over the 20-year project life. The estimate of annual ratepayer impacts was provided in Table 4-3 in YEC's Application[14] and excluded additional thermal fuel cost-saving benefits from improved hydro unit efficiency, nonfuel thermal O&M cost savings, or updated thermal fuel prices.[15] In response to one of John Maissan's IRs, YEC provided updated versions of Table 4-3 based on the following conditions: March 2021 LNG and diesel fuel prices, the project coming in at 30% below the estimate, the project coming in at 30% above the estimate, and long-term avoided costs of diesel and LNG at $0.277 per kWh and $0.248 per kWh, respectively.[16] YEC stated that ratepayer benefits were demonstrated in each of the updated tables.[17]

Regarding the reliability benefits of implementing the BESS Project, YEC noted that the project would reduce the impact of outages on customers, improve overall reliability of service, and enhance the capability of the system to integrate new Independent Power Producer (IPP) renewable generation.[18] The BESS Project would primarily be used to contribute to the N-1 capacity reserve required to meet YEC's non-industrial peak load under the single largest contingency, which would be the loss of the Aishihik generating facility or the transmission line connecting the facility to the YIS.[19] The BESS Project would also provide operating reserve

[13] YEC Final Submission, PDF pages 6 and 7.
[14] YEC Application, Section 4.3.2, PDF page 43, Table 4-3.
[15] YEC Final Argument, PDF page 8.
[16] YEC responses to John Maissan's IRs, JM-YEC-1-33, PDF pages 43 to 46.
[17] YEC Final Argument, PDF page 8.
[18] YEC Final Argument, PDF page 8.
[19] YEC responses to YUB IRs, YUB-YEC-1-36, PDF page 138.

when excess water is available, allowing hydro generating units to operate more efficiently and meet system load and reduce the reliance on thermal generation.[20]

YEC stated that using the BESS Project could save up to 1,837 MWh of diesel and 17,043 MWh of LNG, or $3.374 million, based on 2021 fuel prices.[21] According to YEC, this estimate was conservative because it assumed one-third of the Hatch Engineering Utility Battery Feasibility Study Final Report (Hatch report)[22] estimated thermal fuel generation, did not include any nonfuel O&M cost savings or benefits for improved hydro unit efficiency, and used lower fuel prices from mid-2020.[23]

YEC identified that the BESS Project provided other reliability benefits, including diesel peak shifting, rapid black start and outage restoration, grid reliability and ancillary services (including frequency regulation, coverage of large generation unit outages, prevention of load shedding events and renewable integration), load loss stabilization, and reactive power support.[24] While YEC estimated a small net economic benefit of approximately $10,600 per year (estimated in 2022$) for diesel peak shifting, it could not quantify the economic benefits for the other reliability benefits.[25]

Yukon Conservation Society

YCS was in favour of the BESS Project, indicating that one of the primary benefits was the project's ability to integrate renewable generation onto the YIS. YCS agreed with the technical and ratepayer benefits provided by YEC in the Application. YCS indicated that the forecast in ratepayer savings in response JM-YEC-1-33(a)[26] was conservative, as it did not include volatility of future diesel fuel prices and application of a future carbon tax. If a federal carbon tax was implemented, YCS submitted that ratepayers would realize even further savings with the BESS Project.[27] YCS also noted that the project would allow the YIS to become more resilient to climate change and add "robustness" to the system in cold winters when there is a higher risk of ice build-up downstream of a hydro generating facility.[28]

John Maissan

John Maissan agreed that there was a public need for the BESS Project, indicating that the reliability of service would increase and that all customers would experience rate benefits.

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[20] YEC Application, Section 3.1.2.2, PDF pages 14 and 15.
[21] YEC Application, Section 4.2.3, PDF page 42.
[22] YEC Application, Appendix B: Hatch Engineering Utility Battery Feasibility Study Final Report – Phase 1, PDF pages 55 to 178.
[23] YEC Final Argument, PDF page 12.
[24] YEC Opening Statement, PDF page 5.
[25] YEC Application, Section 4.2.3, PDF page 42.
[26] YEC responses to John Maissan's IRs, JM-YEC-1-33(a), Table 1, PDF page 43.
[27] YCS Final Argument, PDF page 6.
[28] YCS Final Argument, PDF page 5.

Mr. Maissan stated that peak non-industrial load has been growing in recent years, mentioning the three grid-connected mines and increase in new residential housing. In Mr. Maissan's view, while YEC is increasing its renewable energy supply options, the YIS will not be able to meet the N-1 planning criterion without rented diesel generating units, until the Moon Lake Pumped Storage project connects a decade from now.[29]

Mr. Maissan stated that, to provide a unit of dependable capacity, a generating unit did not need to be running at capacity continuously and was only required to lower the peak load.[30] The peak load occurs over a short period of time, and smaller amounts of dependable capacity are required for the remainder of the day. The BESS Project could reduce the load by 7.2 MW during the peak load hours and then be recharged during the nighttime. Mr. Maissan added that YEC had been conservative in estimating the net present value of the project.[31]

Mr. Maissan agreed with YEC's assertions that the BESS Project could assist in operating reserve support, diesel and LNG peak shifting, grid reliability, load loss stabilization, black start and outage restoration, and ancillary services and reactive power support.

Utilities Consumers' Group

UCG had concerns with the certainty around system load levels presented by YEC in the Application. It stated that YEC acknowledged uncertainty around the changing plans of industrial customers. As a result, UCG concluded that YEC continued to make an error of applying sales growth rates experienced over past time periods to derive weather-normalized use per customer forecast.[32] UCG questioned why YEC was not pursuing installation of on-site generation with guaranteed upfront payment for interim mining loads, as on-site generation with guaranteed upfront payment by these industrial loads would protect the interests of other Yukon ratepayers.[33]

Finally, UCG submitted that YEC's board of directors' instruction to focus on renewable projects prevented YEC from completing a fulsome review of potential alternatives in closing the capacity shortfall gap, e.g., pursuing a large new permanent diesel plant instead of the BESS Project.

Board Views

The Board provides its report and recommendations about Section 3.a. of the Terms of Reference in the following three subsections:

(i) the public need for the BESS Project under various reasonable electric load forecasts, including near-term requirements related to industrial and non-industrial loads;

[29] John Maissan Final Argument, PDF page 2.
[30] John Maissan Final Argument, PDF page 3.
[31] John Maissan Final Argument, PDF page 8.
[32] UCG Final Argument, PDF page 8.
[33] UCG Final Argument, PDF page 8.

(ii) the effect of the BESS Project on the rates of customers; and

(iii) the reliability of electricity service provided to customers.

Public Need for the Bess Project

The Board finds that a need for the BESS Project in the near term has been established. The Board agrees with YEC's and Mr. Maissan's submissions that new load growth is anticipated due to: new industrial mine loads at the Minto, Alexco and Victoria Gold mines; an increase in residential housing in Yukon and an associated increase in demand for electric heat; and government electrification policy initiatives resulting in, for example, a projected increase in zero-emission vehicles.

In the circumstances detailed by YEC in its Application, supporting documents, and testimony, the Board finds sufficient evidence on the record to reasonably accept that load will continue to grow and that a large capacity shortfall gap will exist until YEC connects additional supply options. One of these options is the BESS Project, and removing it from the supply mix would keep the system at a capacity shortfall.

Currently and into the future, unless a permanent thermal option is pursued, YEC will need to continue relying on rented diesel units to address the capacity shortfall. The BESS Project is expected to operate in lieu of, and eliminate the need to rent, four 1.8 MW diesel units. In its Application, YEC mentioned the challenges of finding these rental units and locating and connecting these units safely to the YIS.[34] YEC provided the Board with its competitive process for sourcing rented diesel units in 2018-19, 2019-20, and 2020-21. During the years 2018-19, 2019-20, and 2020-21, YEC ran a one-year public competitive tender process for six 2-MW units for placement at the Whitehorse Rapids Generation Station, a three-year tender process for up to eight 2-MW units, and is searching the market for cost-effective options for rental units, respectively.[35] YEC also confirmed at the hearing that rented diesel units are not as reliable as more permanent solutions.[36] The Board is persuaded that only relying on rented diesel generators would be challenging and would not be a reliable way of closing the capacity shortfall gap.

YEC indicated that one alternative to meeting the capacity shortfall would be to connect a permanent thermal (diesel) plant. However, YEC stated that this option held less popularity with stakeholders in public consultation and was rejected by its board of directors.[37] While the BESS Project drew some stakeholder concerns, YEC indicated that the concerns were fairly manageable.[38] From that perspective, the Board considers that the BESS Project appears more favorable to stakeholders than a permanent diesel plant at this time.

[34] YEC Application, Section 4.2, footnote 40, PDF page 33.
[35] YEC responses to YUB IRs, YUB-YEC-1-17, PDF pages 46 and 47.
[36] Transcript Volume 1, PDF page 123, lines 21 to 23.
[37] YEC responses to YUB IRs, YUB-YEC-1-43, PDF page 159.
[38] Transcript Volume 1, PDF page 170, lines 10 to 14.

The effect of the project on the rates of customers

While the Board finds that there is a public need for the BESS Project, the ratepayer savings proposed by YEC are less persuasive to the Board. This is because the BESS Project is finishing the planning phase and moving to the procurement process stage, meaning that project costs are not firm.

While the Board agrees that the information provided on the record suggests ratepayer benefits, a significant part of the capital costs is associated with the battery, for which YEC is currently in the first stage of the procurement process.[39] In response to an information request from Mr. Maissan, YEC submitted that, over its predicted life, the BESS Project would break even in terms of no longer providing ratepayer savings if the capital costs increased by 42.5%.[40]

At the hearing, YEC mentioned that, over the next few months, it would receive details from the request-for-proposal (RFP) process for the battery, which would then confirm a substantial portion of the capital cost. YEC would then go to its board of directors to make a final investment decision.[41] As stated, the Board had no information on the selected vendors and the costs associated with these vendors because YEC has not finished the RFP and selection processes.

In addition, the Board is unsure whether the projected cost savings will remain for the 20-year project lifespan or if the BESS Project will last for 20 years. The long-term costs will likely be impacted by the vendor selected, obligations of the vendor, and any agreements with the First Nations for land lease and investment, as well as costs for mitigations required from YESAB, Nav Canada, and Transport Canada permits and any other currently unknown costs associated with outstanding permits, purchases, negotiations, and other agreements. It is for these reasons that the Board cannot fully accept the estimated economic benefits of the BESS Project provided by YEC for operating reserve support and diesel peak shifting, both in the short and long term.

Given the early stage of the project and the significant +/- range to the engineering estimates, the Board finds that there are too many uncertainties for it to make a recommendation on the effect of the BESS Project on the final rates of customers. As noted throughout this report, the final costs to be included in rates will be subject to a prudency review in YEC's future GRA.

Reliability of electricity service

With regard to reliability, the Board agrees that the BESS Project could provide operating reserve support and increase grid reliability. While YEC brings up additional reliability benefits for the BESS Project, the Board notes that these benefits are not significantly required to meet a

[39] YEC responses to YUB IRs, YUB-YEC-1-13, PDF page 37.
[40] YEC responses to John Maissan's IRs, JM-YEC-1-33, PDF page 43.
[41] Transcript Volume 2, PDF page 20, lines 13 to 19.

need at this time. The Board elaborates on its views around reliability in Section 3(b) of this report.

4.2 Capability of Existing and Expected Assets to Meet Forecast Load Requirements — Term of Reference 3.b.

The Minister's Terms of Reference requested the Board to report on and make recommendations about the necessity for the BESS Project and its timing and design, with particular regard to:

> 3.b. The capability of existing and currently committed and expected generation and transmission facilities, including thermal generation facilities to provide reliable electric power generation to meet the forecast load requirements and criteria and the effect of the BESS Project on this capability.

Yukon Energy Corporation

YEC stated that 84% of its 2021 forecast generation would be supplied by hydroelectric generation, with almost all of the balance supplied by diesel and LNG thermal generation.[42] Since Yukon's system is an isolated grid, YEC must supply its own capacity and energy, which includes securing reserve capacity in order to meet load during the winter peak periods. As mentioned in Section 3(a) of this report, YEC's generation capacity planning criterion is based on the single contingency dependable capacity criterion, which requires the YIS to have enough dependable capacity to supply the forecast non-industrial peak winter demand under the largest single contingency.

YEC stated that planning is based on non-industrial load since all major industrial customers maintain sufficient on-site generation for their own emergency purposes. YEC submitted that all of the renewable and thermal supply options identified in the Application are required to remove reliance on rented diesel units in order to address the existing and ongoing forecast capacity shortfall.[43] Added to this, YEC represented that the BESS Project would provide support in meeting the dependable capacity criterion. More specifically, the BESS Project would provide 7.2 MW of dependable capacity in the near term, displacing the requirement to rent four diesel units rated at 1.8 MW.

YEC explored a variety of energy storage technologies, including storage through pumped hydro, compressed air, flywheel, flow battery, lead acid battery and supercapacitors, and found that the lithium ion battery technology was best suited for meeting its generation capacity planning criterion. YEC planned to develop the project using construction technologies that it states are suited for northern climate conditions and using similar technology employed for battery projects installed in Northern Quebec, the Northwest Territories, and Alaska.[44]

[42] YEC Application, Section 4.1.2, PDF page 28.
[43] YEC Final Argument, PDF page 10.
[44] YEC Opening Statement, PDF page 6.

YEC indicated that the BESS would be designed to meet the following standards:

- UL 1642 Standard for Lithium Batteries
- UL 1973 Standard for Batteries for Use in Light Electric 1 Rail (LER) Applications and Stationary Applications
- UL 9540 Standard for Energy Storage Systems and Equipment
- NFPA 855 Standard for the Installation of Stationary Energy Storage Systems
- IEEE 1547 Standard for Interconnecting Distributed Resourced with Electric Power Systems
- UL 1741 Inverters Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources[45]

YEC added that it would take a number of proactive steps to ensure that fire and other safety risks were managed effectively. YEC indicated that fire suppression would be a key component of the battery system design and selection and that the design would use several automated mechanisms to prevent fires from starting. More specifically, YEC would install a fire suppression system and alarms in each battery container, check and maintain the fire suppression system routinely, use fire-retardant module containers to isolate a single pack of battery cells if a fire occurs, use containers with pressure relief valves that allow gas to escape and prevent a container explosion, space the containers apart to prevent a fire from spreading, develop a comprehensive fire and emergency response plan, and commit to providing the required training to local firefighters and emergency response staff.[46]

YEC advised that an essential requirement for reliable operation of the Yukon system is ensuring that there is enough operating reserve support to accommodate for variations in load. Currently, the operating reserve criteria are achieved by operating a hydro generating unit below its maximum capacity. Thermal generation is used to meet load that exceeds the available hydro generation. YEC indicated that if the BESS Project is used for operating reserve support, there would be a direct reduction in thermal generation and improved efficiency of hydro generating units by operating them at their most efficient output more frequently.[47] For example, if a modest efficiency gain of 0.5 to 1% was realized for the hydro generating units, 2.2 to 4.4 GWh of additional energy would be provided by the hydro generating units.[48]

YEC submitted that utilizing the BESS Project as an operating reserve was compatible with using the project in meeting the N-1 dependable capacity criterion. The first reason given was that both required the BESS to retain storage in different time periods. More specifically, the N-1

[45] YEC responses to YUB IRs, YUB-YEC-1-56, PDF pages 315 and 316.
[46] YEC responses to YUB IRs, YUB-YEC-1-46, PDF pages 168 and 169.
[47] YEC Final Argument, PDF page 12.
[48] YEC Application, Section 3.1.2.2, PDF page 16.

dependable capacity would be for events during the coldest period of winter, a time when using the BESS for operating reserve support provides minimal benefit in reducing net thermal generation.[49] The second reason given was that both use cases (meaning the N-1 use case and the operating reserve use case) would have minimal impact on battery life, with an estimate of one 30-minute operating reserve event per month and one two-week N-1 event every 10 years.[50]

In addition to providing support in meeting the N-1 dependable capacity criterion and operating reserve requirements, YEC indicated that the BESS Project would provide other reliability benefits, which included diesel peak shifting, rapid black start and outage restoration, grid reliability and ancillary services, load loss stabilization, and reactive power support.

YEC advised that the BESS Project could be discharged in lieu of diesel generation during peak hours and recharged overnight with LNG or hydro generation, thereby reducing thermal fuel costs and greenhouse gas emissions.[51] YEC indicated that the BESS had the potential to shift between 108 to 244 MWh per year of diesel generation between Whitehorse and Faro diesel. However, YEC noted that if the BESS Project was providing operating reserve during periods of peak diesel generation, a priority must be set for BESS operation,[52] since operating reserve support could not be provided at the same time as diesel peak shifting.

YEC described its current process for black start and outage restoration in its Application and submitted that the BESS Project could improve this process. When YEC is required to perform black start operation, it sectionalizes the YIS into smaller load segments that are re-energized sequentially using smaller individual generators. Because the system is segmented into numerous load blocks, and because some of the switching is of a manual nature, the process can take up to two hours depending on the extent and severity of the outage.[53] YEC submitted that the black start and outage restoration process would improve if the BESS was used for grid re-energization. The BESS Project would enable significantly larger load segments (more specifically, 20 MW) to be restored at once, meaning the project would enable rapid pickup of the grid.[54] However, YEC noted that this process accounted for more than half of the estimated BESS annual throughput, meaning the BESS Project would incur operating efficiency losses of 15% on the throughput.[55] YEC indicated that the overall savings from enhanced system restoration would offset any efficiency loss costs.

Regarding grid reliability and ancillary services, YEC stated the BESS Project could respond to large frequency excursions, cover the loss of large generating units, prevent load shedding events, and improve power quality and customer reliability.[56] More specifically, YEC advised

[49] YEC Final Argument, PDF page 12, footnote 17.
[50] YEC Final Argument, PDF page 12, footnote 18.
[51] YEC Application, Section 3.1.2.2, PDF page 18.
[52] YEC Application, Section 3.1.2.2, PDF page 18.
[53] YEC Application, Section 3.1.2.2, PDF page 17.
[54] YEC Application, Section 3.1.2.2, PDF page 17.
[55] YEC Application, Section 3.1.2.2, PDF pages 17 and 18.
[56] YEC Application, Section 3.1.2.2, PDF pages 18 and 19.

that the BESS could discharge prior to load shedding events or charge in the event of a significant load loss, both at a partial discharge or charge cycle.[57] YEC also highlighted that the BESS inverters could provide real and reactive power simultaneously to the YIS, since providing reactive power support did not deplete the energy stored in the BESS. However, significant reactive power compensation was not typically required on the YIS.[58]

Yukon Conservation Society

The views of YCS regarding this aspect of the project are similar to the views summarized in Section 3(a) of this report.

John Maissan

Mr. Maissan agreed that the BESS Project improved the capability of the Yukon system by providing reliable electricity service. More specifically, the BESS Project would support meeting the N-1 dependable capacity criterion, provide operating reserve support which would improve hydro generating unit efficiency and decrease reliance on thermal generation, improve grid reliability, improve the black start and outage restoration process, and provide ancillary service and reactive power support.[59] In Mr. Maissan's view, utilizing the BESS Project for operating reserve would allow for more efficient utilization of hydro generation and could reduce the amount of thermal generation required whenever load surpassed the reduced output of the hydro generating units.[60] Due to its instantaneous nature, the BESS Project could improve grid reliability by starting and supplying load a tripped generating unit was carrying within 150 to 200 milliseconds.[61] Mr. Maissan also supported the fact that the BESS Project could act as load and charge in circumstances where there is more generation on the YIS.

Utilities Consumers' Group

UCG was less inclined to support the BESS Project's effect on the system's capability of providing reliable electrical service. In its final submission, UCG stated that it was not clear whether the forecasts used to justify the need for the BESS Project were significantly influenced by climate change impacts. It submitted that the forecasting models were proven to be very costly for Yukon ratepayers and that there continued to be a lack of evidence that showed the models provided accurate forecasts.[62] UCG mentioned the YECSIM model[63] and stated that

[57] YEC responses to YUB IRs, YUB-YEC-1-61, PDF page 362.
[58] YEC Application, Section 3.1.2.2, PDF page 14.
[59] John Maissan Final Argument, PDF page 6.
[60] John Maissan Final Argument, PDF page 4.
[61] John Maissan Final Argument, PDF page 4.
[62] UCG Final Argument, PDF page 10.
[63] UCG explained that the YECSIM model is a power benefits simulation model developed in 2007 by KGS Ground Consulting Engineers and that it is used by YEC to forecast its long-term average hydro generation for different load scenarios. UCG indicated that the YECSIM model is custom-made to consider all significant factors affecting the operation of YEC's system, including complex rules of operation and regulatory demands on YEC. See UCG's Final Argument, PDF page 10.

there was a lack of comparing actual with forecasts made with using the model to verify accuracy.[64]

Board Views

The BESS project supports YEC in its capability of providing reliable electric power supply to meet the forecast load requirements in future years. From the information that has been presented on this record, the Board is satisfied that the project will not hinder existing and currently committed (and expected) generation and transmission facilities.

For example, the Board asked YEC questions regarding the transmission requirements for the BESS Project.[65] YEC responded that the BESS Project would be connected under the Whitehorse Interconnection Project, which was currently in preliminary stages. YEC advised that the Whitehorse Interconnection Project would be required regardless of whether the BESS Project proceeded. Accordingly, the BESS Project fits within YEC's already existing plans for upgrading the YIS.

At this stage of project development, YEC is considering requests-for-proposals from vendors for the following lithium ion battery chemistries: nickel manganese cobalt lithium (NMC), nickel cobalt aluminum lithium (NCA), and lithium iron phosphate (LFP). While there are some variations in battery chemistries,[66] based on the information before it, the Board finds sufficient evidence to suggest that any of the battery chemistries are likely suitable for the BESS Project. However, the Board expects YEC to follow all applicable design standards and take all of the steps necessary to ensure that fire and other safety risks are managed effectively, as was outlined in the Application.

The BESS Project provides N-1 capacity support in the winter season. By definition, this is idle capacity waiting for a catastrophic event (the N-1 event) to activate and operate. Currently, the rented diesel units meet this requirement, and the BESS would likely displace the future need for four additional rented diesel units. An economic and system benefit of the BESS is that it also supports the operating reserve requirements of YEC and, in doing so, could allow for gains in efficiency for hydro generating units. Currently, a hydro generating unit must operate at less than its full capability in order to provide operating reserve to ramp up to address a loss in generation.[67] This means that there is more likelihood of load exceeding the available hydro generation, which will then require thermal generation to provide additional energy to meet the system load.[68] Using the BESS Project as an operating reserve allows hydro generating units to run at a higher output and reduces reliance on thermal generation. While YEC could not quantify the efficiencies gained by the hydro generating units connected to the YIS,[69] the Board agrees at

[64] UCG Final Argument, PDF page 10.
[65] YEC responses to YUB IRs, YUB-YEC-1-3, PDF pages 11 to 14.
[66] Transcript Volume 1, PDF page 161, lines 19 to 25, and PDF page 162, lines 1 and 14 to 17.
[67] YEC responses to YUB IRs, YUB-YEC-1-20, PDF page 55.
[68] YEC responses to YUB IRs, YUB-YEC-1-20, PDF page 55.
[69] YEC responses to YUB IRs, YUB-YEC-1-20, PDF page 54.

a conceptual level that the units will be used more efficiently since they will not be saving generation for operating reserve.

The Board also observes that YEC may choose on a given day in the winter not to use the BESS Project for other services, such as diesel peak shifting or responding to frequency events.[70] The Board interprets this to imply that the secondary reliability benefits of the BESS Project cannot be realized at all times. While the Board does not currently consider this to be a major concern, the number of times the BESS is used for secondary reliability benefits might increase as more renewable supply options connect to the YIS. For example, YEC stated that frequency excursion events are likely to increase as more intermittent renewables are added to the grid,[71] which would increase the use of the BESS for the secondary benefits. The Board foresees that there could be conflict between the secondary benefits of the BESS Project as more intermittent renewables are added to the grid and the addition of the BESS to assist YEC with meeting the N-1 dependable capacity criterion and providing operating reserve support in the future.

YEC's proposal to meet these reliability requirements with the BESS is more favorable compared to the alternative of using rented diesel units, as it would automatically maintain system frequency and assist with automatic voltage control on the grid. In contrast, the purpose of rented diesel units was primarily for peaking generation and N-1, and was not intended to deal with YEC's system as a whole.[72] Additionally, the BESS Project would increase the size of load segments that could be picked up during the black start process, thereby reducing the time required for grid restoration. More specifically, YEC stated that 20 MW of load could be brought up immediately.[73] YEC also noted that the BESS Project could be started instantaneously, whereas rented diesel units take approximately five minutes to start.[74] However, utilizing the BESS Project for black start and outage restoration would account for more than half of the estimated BESS throughput, resulting in operating efficiency losses.

The Board is unable to provide a recommendation as to whether overall savings from enhanced system restoration will offset any efficiency loss costs at this time because the BESS Project is in its preliminary stages. It is likely that the BESS Project will have to be operational before data will be available to inform the savings and the costs.

[70] YEC responses to YUB IRs, YUB-YEC-1-67, PDF page 371.
[71] YEC Application, Section 3.1.2.2, PDF page 19.
[72] Transcript Volume 1, PDF page 176, lines 18 to 20, and PDF page 178, lines 22 to 24.
[73] Transcript Volume 1, PDF page 180, lines 4 to 7.
[74] Transcript Volume 1, PDF page 180, lines 18 to 20.

4.3 Risks for the BESS Project and Impacts on Rates for Customers — Term of Reference 3.c.

The Minister's Terms of Reference request that the Board make recommendations about the necessity for the BESS Project, among other matters, with particular regard to:

> 3.c. The risks for the BESS Project and their potential impacts on rates for customers and on the reliability of electricity service provided to customers.[75]

YEC identified project risks in Section 4.3 of the Application. Project risks are categorized into two groups, as follows:

1. Group 1 – Project technical risks, design risks, and capital cost risks.
2. Group 2 – Risks related to timing delays from the Board, *Yukon Environmental and Socio-economic Assessment Act* (YESAA), NavCanada, and Transport Canada regulatory or permitting processes.

In YEC's view, the Group 1 risks were manageable through selection of an experienced vendor, use of an owner's (YEC or its designate) engineer with experience procuring battery vendors, and the ability to select the specific project solution based on both technical compliance and price and taking into consideration Whitehorse climate conditions.

Ratepayer impacts for Group 1 were tied to ultimate capital costs for the project, project performance and timing that affect the expected BESS benefits of reduced thermal generation, and improved reliability.

Group 2 risks related to the timelines that would delay the project from proceeding in mid-2021, resulting in an extended need and related costs for diesel rentals past the winter of 2022/23.

For Group 2, YEC stated that impact to ratepayers would relate to delays in the project proceeding and the added costs related to such delays.[76]

Yukon Conservation Society

YCS stated that the project has benefits from a technical standpoint and the benefit to ratepayers is a positive when compared to renting diesel generators. YCS added that the forecast benefit to ratepayers is conservative because it does not include volatility in diesel fuel prices in the future nor the potential of a carbon tax being applied to northern jurisdiction electricity providers.[77]

John Maissan

From a technical perspective, Mr. Maissan noted that BESS systems were being utilized globally using technologies similar to that proposed by YEC. He provided several examples of BESS projects in Canada. He added that the heating, ventilating, and air conditioning (HVAC) or

[75] Minister of Justice's Terms of Reference, PDF page 3.
[76] YEC Application, PDF pages 43 and 44.
[77] YCS Final Argument, PDF page 6.

temperature management systems required to meet local ambient conditions exist in Whitehorse and should not pose any problems for the BESS Project. Mr. Maissan's view was that the technical risk was low.[78]

For reliability, Mr. Maissan stated that all the planned functions of the BESS have positive results on either the YIS costs or on power reliability and quality.[79] Mr. Maissan noted that the Application demonstrated a financial benefit, with a net present value of $12.676 million. It was his view that this estimate was conservative and that the following benefits should also be considered:

- Avoided diesel rental costs
- Annual savings from operating reserve
- Annual savings from peak shifting
- Financial savings due to updated fuel prices
- Variable operating cost savings are not presently included in thermal generation savings
- Modest efficiency gains of 0.5 to 1% in the hydro generator operation with the BESS providing the operating reserve
- Reduced diesel generation due to a reduction in grid outages and faster restoration from outages
- Consumer benefits and cost savings due to fewer unscheduled outages
- Savings from avoided potential carbon taxes[80]

Mr. Maissan provided the following summary points to support his opinion that:

1. Operating reserve benefit is conservatively underestimated.
2. Diesel and liquefied natural gas (LNG) peak shifting benefit is very likely underestimated.
3. Present fuel costs are not included, net present value (NPV) increases by $1.85 million.
4. Variable operating cost savings are not included, and there is a $94,000 annual benefit for operating reserve only.
5. Hydro operating efficiency gain is not included, and there is an NPV of over $2 million.

[78] John Maissan Final Argument, PDF pages 6 and 7.
[79] John Maissan Final Argument, PDF page 7.
[80] John Maissan Final Argument, PDF page 9.

6. Reduction in Yukon Energy's [YEC's] or customers' costs of outages, not considered.

7. Taxpayer subsidy for carbon tax savings, not considered.[81]

Utilities Consumers' Group

Despite the direction from the government in the Terms of Reference, UCG commented that it was surprised that YEC witnesses at the hearing were not prepared to talk about the ultimate impact on ratepayers.[82] UCG also expressed concerns regarding ineligible costs and the "transfer payment agreement".[83] Further, UCG stated that project costs have significantly increased since the project was first reviewed by the Board in 2018, that costs have changed since the project cost was evaluated by the federal government, and that the current cost range to ratepayers is between $15.2 million and $24.71 million.[84]

The project was not supported by UCG. UCG pointed to the response to JM-YEC-1-33(d) to inform its position that the project puts ratepayers at risk and will likely exceed current cost estimates. In that response, where YEC used a high estimate for project costs, negative benefits were identified for the initial seven years of the project (nearly half the project life).[85]

UCG noted that there was no formal agreement between AEY and YEC for the proposed route, creating the possibility of further unidentified costs for the project.[86]

UCG cited concerns regarding the 25-year site lease, and it noted the option for a further 25-year renewal. It identified additional concerns about the cost impact of such a lease on ratepayers.[87]

UCG submitted that there is no evidence on the record of this proceeding that quantifies or justifies adding the BESS to the YIS or that the BESS Project will result in the hydro generation units being operated more efficiently. YEC confirmed during the hearing that they will have to pay City of Whitehorse taxes on any development on the Kwanlin Dün site and that municipal taxes are on the rise. UCG stated that the property tax impacts of this proposed project over its productive life are another unknown risk that ratepayers are being asked to absorb.[88]

Finally, UCG stated that a 20% overbuild of the BESS Project is a cost component that has not been adequately justified given the uncertainty related to pending proposals from vendors.[89]

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[81] John Maissan Final Argument, PDF page 10.
[82] UCG Final Argument, PDF pages 10 and 11, paragraph 56.
[83] UCG Final Argument, PDF page 11, paragraph 57.
[84] UCG Final Argument, PDF page 11, paragraphs 59 and 60.
[85] UCG Final Argument, PDF pages 11 and 12, paragraphs 61 to 64.
[86] UCG Final Argument, PDF page 12, paragraph 66.
[87] UCG Final Argument, PDF page 12, paragraph 67.
[88] UCG Final Argument, PDF pages 12 and 13, paragraphs 69 to 73.
[89] UCG Final Argument, PDF page 13, paragraph 74.

Yukon Energy Corporation

YEC qualified its assessment of risks by stating that the assessment must be based on existing information and estimates, taking into account that final decisions on the BESS Project are still to be made.[90]

The following risk categories were discussed by YEC:

- Technical
- Regulatory
- Capital cost

Technical risks

As discussed in Section 3.2, the first technical risk discussed was operating experience in northern climates. To address this risk, YEC cited similar technology being used in northern Quebec, the Northwest Territories and Alaska. It stated that the size of the system does not impact the ability to operate in the Arctic. By using a self-contained system suited for northern climate conditions and appropriate HVAC systems, implementation issues are reduced.[91] YEC also noted that no issues were raised regarding the lithium ion technology. YEC did add that it will "work with vendors to assess options for ensuring end-of-life capacity".[92]

Regulatory risks[93]

From a regulatory perspective, YEC stated that it does not anticipate material design modifications resulting from the regulatory approvals and review process, no special added costs are expected in order to comply with approvals and permits required, and the key terms for the lease agreement with KDFN have been resolved.

YEC stated that the project followed a public engagement process and public concerns were taken into consideration. The YESAA project proposal was filed with the Whitehorse Designated Office on April 29, 2021. NavCanada and Transport Canada assessment processes review timelines and permitting requirements are well understood and any cost impacts related to required mitigation are expected to be minimal.

Capital cost risks[94]

As stated earlier, YEC's preliminary estimated total capital cost of $31.7 million (2020$, +/-30% accuracy) for the BESS Project includes $16.5 million in funding from the federal government's ICIP, leaving a net capital cost to YEC of $15.2 million to be recovered from ratepayers.

[90] YEC Final Argument, PDF page 14
[91] YEC Final Argument, PDF pages 14 and 15.
[92] YEC Final Argument, PDF page 15.
[93] Taken from YEC Final Argument, PDF page 16.
[94] This section is summarized from YEC's Final Argument, PDF pages 17 to 19.

YEC added that the capital cost estimates provided in the Hatch report were class 4[95] cost estimates, which include a 15% contingency on non-owner costs such as planning. The benchmarks used by Hatch were based on public information or Hatch's in-house data developed through other projects involving Hatch. The Hatch cost estimates were derived based on benchmark pricing of batteries of similar projects, with allocations for project-specific considerations like cold weather, transportation, allocation for installation, and allocation for other electrical and communication components within the BESS. Other capital expenditures were based on engineering costs as well as site preparation costs, which were derived based on estimates from Hatch's civil engineering team.[96]

YEC reiterated that the project would still break even with a 42.5% increase in capital costs, assuming the most recent actual fuel prices. YEC submitted that the BESS Project's capital cost risks will be largely resolved prior to the final stage-gate decision by YEC's board of directors expected in August 2021. YEC submitted that the evidence confirms that the BESS Project has a low level of capital cost risk once that stage is reached.

Board Views

The Board will review the risks associated and impacts to ratepayers regarding the BESS Project for each of the three risk categories identified by YEC.

Technical risks

YEC identified that the technical risk is operating a new technology in a northern climate. YEC submitted that this risk is not large and it cited several examples of BESS-type projects operating in northern climates. As discussed in Section 3.2, the Board notes that generally those projects are of a scale smaller than YEC's proposed BESS Project, they have been in service for three years or less, and they are not planned to be utilized in the manner YEC proposes for the BESS Project.

The Board accepts that BESS-type projects in self-contained units with proper HVAC systems should be able to operate as planned in Yukon. But there are risks; YEC noted certain risks in the hearing.

The YEC witness, Ms. Zuliani, stated that no lithium ion battery has exploded in the Arctic but noted there had been a few fires. She later added that those fires have been reviewed and strategies are ongoing to develop safety protocols, and those are included in Hatch's specifications. [97]

A few fires over a small population size is statistically significant.

[95] Class 4 is a level of engineering estimate with an accuracy of +/- 30%. By comparison, a class 5 engineering estimate has an accuracy of +/-50%. (See Transcript Volume 3, PDF page 16, line 19, to PDF page 17, line 3.
[96] Transcript Volume 2, PDF page 52, line 18, to PDF page 53, line 1.
[97] Transcript Volume 3, PDF page 40, line 21, to PDF page 41, line 19.

Although discussed in Section 3.2 of this report, given that there are a limited number of BESS-type projects in northern climates, it appears that there may be a real risk of a fire for a BESS-type project. Hatch has stated that it has developed safety protocols in its specifications, but without the provision of further evidence on the causes of those fires and specifically how Hatch's safety protocols address those causes, this is a risk that YEC, the Minister, the Yukon government, and ratepayers should be aware of.

Further, when questioned by Board counsel regarding thermal O&M costs, Ms. Zuliani stated that Hatch was relying on an experience of less than five projects.[98] Such limited experience introduces technical risk to, and operating costs for, this project.

Another technical concern is the life of the lithium ion batteries proposed for the project. YEC has carefully stated the project has an expected life of up to 20 years with either a modest overbuild at the beginning or an enhancement at the midpoint of the expected life. The Board considers that there is a risk if the life of the batteries fails to sustain for the expected 20 years, and that risk has not been proven abated as none of the battery installations in northern climates have existed beyond 8 years.[99] To mitigate this risk, the Board is of the view that YEC should ensure that there are sufficient safeguards from the vendor to ensure that key performance indicators for such items as battery life, battery failures, and warranties are accounted for in the vendor's obligations in supplying the batteries.

If any of the above technical risks occur, the impact to ratepayers will be higher rates and arguably less reliable service. Such risks, to the extent that they can be reduced by prudent management by YEC of external parties, for events such as battery fires and the service supplied by the battery vendors, will be essential to mitigating the technical risks.

Regulatory risks

YEC stated that it does not anticipate material design modifications resulting from the regulatory approvals and review process. At the hearing, YEC stated that the key terms for the lease agreement with KDFN had been resolved. The BESS Project will be located on land zoned for utility use within an existing environmental and socio-economic setting. The Yukon Environmental and Socio-economic Assessment Act (YESAA) project proposal was filed April 29, 2021. NavCanada and Transport Canada assessment processes are understood, and YEC expects that any cost impacts related to required mitigation would be minimal and within the current cost estimate.

YEC stated that the YESAA, NavCanada, and Transport Canada processes are underway. YEC stated that no further costs with respect to the various regulatory approvals are expected and any cost variances would likely be minimal. However, the regulatory processes are not complete, and

[98] See, e.g., the exchange from Transcript Volume 2, PDF page 60, line 20, to PDF page 62, line 23.

[99] See, e.g., the exchange from Transcript Volume 3, PDF page 40, line 21, to PDF page 42, line 6. YEC identified the oldest project from Alaska which started operation in 2015.

the Board does not have any reliable evidence by which to assess whether there would be any significant ratepayer impacts arising from costs associated with regulatory risks and approvals.

Capital cost risks

YEC provided the following testimony with respect to the estimate of its capital costs for the BESS Project:

> We talked at length this morning about the variability or uncertainty at this time in the capital costs. So the capital cost estimate is provided with a range of plus/minus 30 percent. But then maybe to jump ahead to probably what's the next question is, you know, we've also presented and discussed analyses which then evaluated the ratepayer benefits at the bookends of that risk range, and demonstrated that, even in that plus 30 percent capital cost scenario, there was still a net benefit to ratepayers. So that's one of the -- probably the principal financial risk at this time.[100]

As this is a class 4 estimate (+/- 30% accuracy), there is certainly a risk that the costs for the BESS Project may exceed the $31.7 million estimate. In the past 15 years, YEC has not completed a major capital project that was below the class 4 cost estimate with respect to a Part 3 application, except for when the scope of the project was reduced.[101]

Included in the capital costs are $3.7 million to provide a modest overbuild.[102] YEC has stated that the primary driver for this project is to provide capacity to meet the N-1 criterion in the near term. The N-1 criterion is a one-in-10-year event. Further, YEC has stated that this is a capacity issue and that the YIS does not have an energy shortfall. The theory for this added capacity is that it is there in case of a catastrophic N-1 event. If an event does not occur, then for purposes of the primary criteria, the asset is idle. It is used for backup or other short-term planning purposes.

Therefore, assets used primarily to provide capacity to meet the N-1 criterion are likely to be idle until the N-1 event occurs. YEC is proposing to include an additional 20% to its battery capacity to cover off future degradation of the battery. This seems redundant, as it appears the overbuild is a backup to the backup asset providing N-1 capacity.

YEC has not made a case that justifies spending $3.7 million to overbuild the BESS Project to provide or maintain capacity 10 years down the road. Such costs should be removed from the project unless YEC can provide economic justification for those costs to be included up front.

Nonetheless, as presented in the Application, the submissions of YEC and Mr. Maissan state that several savings opportunities have been either estimated conservatively or have not been included in YEC's financial analysis. The Board believes that some probability exists in regard to potential savings. The Board is satisfied that, with the 15% contingency included in the cost

[100] Transcript Volume 1, PDF page 124, line 21, to PDF page 125, line 7.
[101] See, e.g., the Carmacks-Stewart Transmission Project, Phase 1, where a substation included in the Part 3 application was subsequently removed from that phase of the project.
[102] YEC responses to YUB IRs, YUB-YEC-1-11(b), PDF page 32.

estimate, unknown items arising from other regulatory processes should be covered within the current estimate.

If YEC's testimony that the prices for containerized batteries are reducing is borne out, that will be shown in the results of the procurement process which will be competitively tendered. If YEC is able to achieve the savings as noted in the Application and elsewhere on the record of this proceeding, then the capital cost risks for this project can be managed by the utility using reasonable judgment.

However, given the margin of error in the class 4 estimates, any recommendations in this report are not a finding of prudency, and in a subsequent GRA when more accurate information is provided, the granting of an energy project certificate and an energy operation certificate will not deem the final project costs prudent. Further, if this project is approved by the Minister and there are changes to the scope of this project, YEC should notify the Minister and the Board about any scope changes that would result in cost increases beyond the 15% contingency or that would materially decrease the capital costs expected for the BESS project.

4.4 Alternatives to the BESS Project — Term of Reference 3.d.

The Minister's Terms of Reference require the Board to make recommendations about the necessity for the BESS Project, among other matters, with particular regard to:

> 3.d. What, if any, reasonable alternatives exist to the BESS Project or what alternative ways of undertaking the BESS Project with its selected technology might be advisable given reasonable load assumptions and risk assessments.[103]

In its Application, YEC referred to its 10-Year Renewable Electricity Plan to address forecast energy and capacity shortfalls, noting that new resources will provide dependable capacity and will generally not displace what the BESS Project option can provide, i.e., the identified permanent resource capacity options are generally all needed to remove reliance on rented diesels and for addressing the forecast capacity shortfall. For example, the Moon Lake Pumped Storage project, when it is developed, is the only identified resource option aside from default new thermal fossil fuel generation, that has the capability to remove the forecast N-1 dependable capacity shortfall.[104]

YEC identified the following alternatives to the BESS Project:

- Standing Offer Program (SOP) and Micro-Generation Program: The SOP is included in the 10-Year Renewable Electricity Plan, which forecasts 40 GWh/year of energy delivered by the IPP sector by the year 2024. The Micro-Generation Policy envisions 6.5 GWh/year of delivered energy by the year 2024. However, no dependable capacity is available from SOP and micro-generation projects because they will be comprised of intermittent renewable resources, such as wind and solar.

[103] Minister of Justice's Terms of Reference, PDF page 3.
[104] YEC Application, PDF page 33.

- Whitehorse Hydro #2 (WH2) and Whitehorse Hydro #4 (WH4) Uprate Projects: These projects increase the efficiency and maximum capacity of the two Whitehorse generation units. However, the capacity increase for WH2 is less than 1 MW, and due to downstream Yukon River system ice flow restrictions, the WH4 does not provide additional dependable capacity.

- Potentially Available Near Term Enhanced Hydro Storage Projects: The Southern Lakes Enhanced Storage Project (SLESP) will expand the storage range on the Southern Lakes system, and the Mayo Lake Enhanced Storage Project (MLESP) seeks to enhance water storage at Mayo Lake. However, both hydro storage enhancement projects would not affect YIS requirements for new dependable capacity.

- Demand Side Management (DSM): DSM involves using incentives, electricity rate structures, and building and appliance codes and standards to encourage customers to reduce the amount of electricity they use. YEC's current focus of the DSM programs is on measures that deliver peak capacity savings (i.e., reductions in peak electricity consumption).

- Diesel Replacement: By replacing retired diesel generator units at existing generation facilities, YEC stated that it can reduce the need for added rental diesel generators. The total replacement diesel currently assumed is 12.5 MW. However, it noted that diesel replacement does not fully address the capacity shortfall.

- The Atlin (Pine Creek) Hydro Expansion Project: In 2020, YEC engaged in discussions with Xeitl Limited Partnership (Xeitl LP) (Taku River Tlingit development corporation) regarding the Atlin project being planned by Xeitl LP and key principles and terms for an Agreement-in-Principle (AIP) for an electricity purchase agreement. Federal funding has been identified as a key requirement for this project to proceed. The objective is for this project to provide 8.5 MW of dependable capacity by 2024/25.

- Tutshi-Moon Pumped Storage Project – Phase 1: This project would provide renewable capacity to address the existing and forecast capacity shortfall under the N-1 planning criterion. YEC stated that this project could potentially provide 35 MW dependable winter capacity starting in the 2028-29 winter season. Federal funding was identified as a critical requirement for this to be affordable for ratepayers and to minimize risks.

- New 20 MW Wind Project: YEC submitted that this project could provide a new 20 MW wind resource in 2025/26 to meet the higher energy requirements over the planning period. This resource option would not provide dependable capacity.

YEC summarized its position by stating that no feasible renewable resource alternatives to the BESS Project have been identified within the expected time period for completion of the project and that the temporary rented diesel option or permanent new diesel development remain the only feasible alternatives to provide dependable capacity to meet the utility's requirements.[105]

Yukon Conservation Society

YCS did not discuss this aspect of the Minister's Terms of Reference.

John Maissan

John Maissan stated that the only reasonable alternative to the BESS Project is a 20 MW or larger diesel thermal generation plant as noted in the past LNG project proceeding. In Mr. Maissan's view, in the public consultation on a proposed new thermal plant, the public opposition to such a project would be significant. Mr. Maissan added that a thermal alternative is also contrary to Yukon government policy, citing YEC's response to information request YUB-YEC-1-1 (f) and (g). Further, Mr. Maissan noted that a thermal plant must be diesel rather than LNG because diesel generators have a much better ability to restore the grid from outages, and that a thermal plant would not provide ratepayers with the savings from reduced thermal generation the way that the BESS Project can. Nor would a thermal plant provide the reliability, load loss stabilization, and black start and outage restoration benefits that the BESS Project provides. Mr. Maissan concluded that a diesel thermal plant is not an advisable alternative to the proposed BESS Project given that a thermal plant would lack the financial and other benefits that the BESS will provide.[106]

Utilities Consumers' Group

UCG stated that YEC confirmed it was YEC's board of directors that decided not to pursue a permanent solution to the capacity gap on the YEC system (i.e., a large new permanent diesel) and instead instructed management to focus on renewable projects. UCG submitted that this direction prevented the consideration of diesel- or LNG-fueled generation alternatives to the BESS Project.[107] UCG added that a capacity shortfall arose because YEC did not previously establish a plan to pursue overhauling all of their diesel generators as they were retired. If YEC had established an efficient plan of thermal plant overhaul and replacement, UCG argued that YEC would not find itself in the position of having to use and replace rented diesel generation equipment and having N-1 capacity backup issues.[108]

[105] YEC Application, PDF pages 33 to 35.
[106] John Maissan Final Argument, PDF page 10.
[107] UCG Final Argument, PDF page 14, paragraph 78.
[108] UCG Final Argument, PDF page 14, paragraph 79.

Yukon Energy Corporation

In its final submission, YEC stated that the BESS Project provides 7 MW of dependable N-1 capacity on a timely basis, with benefits not available through other alternatives.[109] Couching its position in terms of not relying on new fossil fuel alternatives and near-term renewable resource alternatives, YEC said there were no reasonable alternatives to the BESS Project and that a new 20 MW thermal plant is not a viable option.[110] YEC added that maintaining the status quo is also not a viable option and permanent solutions are needed.[111] Aside from the Atlin Hydro and Moon Lake Pumped Storage projects, temporary rental diesels or a permanent new thermal development remain the only feasible alternatives that would provide the dependable capacity required to address the N-1 dependable capacity shortfall. The BESS Project's operating reserve use benefits enable it to provide material ratepayer cost savings relative to both the diesel rental and permanent thermal alternatives.[112]

YEC stated, with respect to longer term projects, that the two dependable capacity hydro renewable projects identified for development within 10 years are each subject to securing material federal grant funding and, even if they are developed, they will not remove the ongoing need for the other dependable capacity projects such as the BESS Project.[113]

Board Views

The Terms of Reference require recommendations on reasonable project alternatives or alternative ways of undertaking this project. It is clear from the submissions of all parties that some form of diesel generation is the only viable alternative to the BESS Project, at least in the near term. In the oral hearing, two YEC witnesses noted that the benefit to the BESS Project is operating reserve, as demonstrated by the following testimony:

> … N-1 is a one-in-10-year event. So it's really important to keep in mind, you have to look at the costs of the alternatives, where they're spending most of their time just sitting there not doing anything, as well as other use cases, which we presented in that table when we talk about the operating reserve, used savings, and the peak shifting uses. So it's not just the N-1 that justifies the project.[114]

In the Application, YEC submitted its alternatives to the BESS Project but stated that no feasible renewable resource alternatives to the BESS Project have been identified within the relevant time period and that the temporary rental diesel option or permanent new diesel development remain

[109] YEC Final Argument, PDF page 19.
[110] YEC Final Argument, PDF page 20.
[111] YEC Final Argument, PDF page 20.
[112] YEC Final Argument, PDF page 19.
[113] YEC Final Argument, PDF page 20.
[114] Transcript Volume 3, PDF page 31, lines 6 to15.

the only feasible alternatives.[115] YEC identified some of the facilities projects in its 10-Year Renewable Electricity Plan as alternatives.

YEC has been renting diesels to cover its capacity shortfall. A YEC witness stated in testimony regarding the planning respecting the capacity shortfall: "So we plan, essentially, for N-1 once every 10 years. That's what we anticipate the frequency to be."[116]

The rental option to cover capacity shortfall is the status quo option. YEC started renting diesels for the 2018-19[117] winter peak and it expects to continue renting diesels up to and including the 2028-29 winter peak.[118] YEC expects diesel rental costs to continue for 10 years.

Rental or purchased diesel units

The issue of rental or purchased diesel units is also discussed in Section 3.1 of this report. YEC compared the BESS Project to the rented diesel alternative, and based on this comparison, YEC concluded that the BESS Project was economically superior[119] and met the primary criteria N-1 capacity shortfall.

When asked whether there were any operational concerns with the continued use of rented diesel fuel generators and the economics of the two alternatives, YEC stated that it looked at the capacity gap, the expected length of the capacity gap, and future plans to bring capacity additions online. In YEC's view, through that assessment, the rental of diesels was a viable solution. Operationally, however, since that assessment, YEC has learned that the rental units are not always available, and so two additional spares are required. [120]

YEC witness testimony provided additional insight into the utility's reasoning, and some of these reasons are summarized below:

- The rental diesel units are not as reliable as YEC would like them to be.[121]
- Rental units are not perfectly configured for utility service. The decision for rental of diesel units versus the decision for permanent purchase are quite different.
- If YEC were investigating the specifications for something to place on the YIS that it absolutely needed to have because they're there for the N-1, it would not look at something that had the kind of use history that the rental units have.
- The alternative would be to look at a permanent diesel facility, i.e., larger facility options.[122]

[115] YEC Application, PDF page 35.
[116] Transcript Volume 3, PDF page 55, lines 23 to 25.
[117] YEC consolidated responses, YUB-YEC-1-17(c), PDF page 158.
[118] Transcript Volume 1, PDF page 173, lines 4 to 10.
[119] E.g., see YEC Application, PDF page 43, Table 4-3, Annual Ratepayer Impacts from BESS.
[120] Transcript Volume 1, PDF page 86, lines 3 to 23.
[121] Transcript Volume 1, PDF page 123, lines 18 to 23.

YEC's Application and testimony support that the rented diesels are not a preferred alternative to the BESS Project. The BESS Project has a higher levelized cost of capacity than rented diesel units.[123] However, YEC states that the BESS results in a net present value benefit to ratepayers and the BESS is expected to offset the use of four diesel units. On review of the record, YEC has sufficiently demonstrated that the BESS Project is a preferred alternative to rental diesel units.

Diesel (thermal) plant

Another alternative to BESS is to construct a new diesel plant. This is also discussed in Section 3.1 of this report. In a previous Board Order, the Board found that YEC has supported its case that added capacity is needed to meet system reliability needs under the N-1 criterion and that a greenfield thermal generation plant is one of the preferred methods to add the needed capacity.[124]

In response to an IR in this proceeding, YEC stated:

> The YUB reviewed planning for the new 20 MW diesel plant project during the 2017/18 GRA, and noted in Appendix A to Order 2018-10 that it was not persuaded that the project was the only way to address the predicted capacity shortfall, and that YEC should not proceed with the project without a detailed business case that considers the alternatives to the project.[125]

YEC did not correctly summarize the Board's views. The Board's comments were not a condemnation of building a 20 MW diesel plant project; rather, the Board was reminding YEC that it should provide a business case with adequate support for the project.

In the Board's view, YEC did not fully consider the acquisition of purchased diesel as an alternative to compare with the BESS Project, partly because of direction from its board of directors to focus on renewable options. Some social license considerations were engaged as well. As a result, the benefits and costs of purchased diesel were not examined in detail to discount a new diesel plant as an equal or preferred alternative. YEC noted that one particular advantage of the BESS Project over diesel was that "it has almost instantaneous ability to ramp to full output; whereas a new diesel plant can take several minutes to ramp up. And so, a BESS has a much greater ability to keep the grid stable and operating versus a diesel engine."[126]

Although it is not YEC's preferred alternative, YEC confirmed in testimony the ability of diesel to mitigate loss from N-1 events. YEC confirmed that both the BESS and a diesel alternative are appropriate solutions to meet N-1 criterion, but the BESS provides a faster solution to prevent a blackout. Both would work equally well over a longer duration event. [127]

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[122] Transcript Volume 2, PDF page 43, line 21, to PDF page 44, line 2.
[123] YEC Application, PDF page 21.
[124] Appendix A to Board Order 2018-10, PDF page 94.
[125] YEC consolidated responses, YUB-YEC-1-37(b), PDF page 255.
[126] Transcript Volume 1, PDF page 159, lines 3 to 14.
[127] Transcript Volume 2, PDF page 38, line 3, to PDF page 40, line 8.

Further, in response to an IR, YEC showed that the levelized cost of capacity for the purchase of a diesel plant was less than that of the BESS option.[128]

If diesel is to provide capacity for a one-in-10-year event (N-1), then the generation unit would likely be idle most of the time. This means there should be less environmental implications from an emissions perspective as compared to diesel that is always running. YEC also did not investigate or state whether government funding would be available for a new diesel plant.

Despite these limitations, it is the Board's recommendation that the Minister can consider that YEC explored alternatives to the BESS Project, and YEC has provided a sufficient economic basis for the BESS Project to proceed compared to the alternatives identified by YEC. The Board has provided its views on a diesel plant for additional capacity because there are benefits to this alternative, particularly from an economic perspective, and considers that a diesel plant should not be disregarded by YEC's board of directors as a viable alternative to meet future system capacity. In reviewing the totality of the evidence, the Board is satisfied that the Minister can accept that the BESS Project is an acceptable and economic alternative as part of YEC's system planning for generation.

Location

In addition to reasonable project alternatives, the Terms of Reference ask about alternative ways of undertaking the project. The Board considers alternative siting to fall under this category. The Board notes that requiring the project to be located on settlement land, and having only one option outside city limits which ultimately was not selected, may have resulted in additional and material costs to the ratepayer. The selected location within municipal boundaries includes approximately $6 million to $7 million[129] in municipal taxes over the life of the project.

Alternatively, there may have been appropriate locations that do not involve lease costs or tax costs that were not sufficiently explored — for example, the unoccupied Crown land adjacent to the Takhini substation. Choosing a location on First Nation settlement land within the City of Whitehorse may have eliminated lower cost options.

[128] The table in response to YUB-YEC-1-30 (PDF page 231 shows the estimate LCOC of a diesel purchase to be $186/MW compared to $235/MW for BESS. YEC provided an update to this in undertaking #7, however those costs and assumptions were not tested nor did YEC explain why such scrutiny was not provided for the original IR response given that a comparison between BESS, rented diesel and purchased diesel were requested. Nor did YEC consider the sale of the purchased diesel when N-1 capacity criteria is met through other renewable energy projects identified by YEC to occur in subsequent periods.

[129] Transcript Volume 3, PDF page 36, line 12, to PDF page 37, line 1.

4.5 Impacts of the Debenture Investment Opportunity on YEC and Ratepayers — Term of Reference 3.e.

The Minister's Terms of Reference requested the Board to report on and make recommendations about the necessity for the BESS Project, among other matters, with particular regard to:

> 3.e. Impacts on YEC and ratepayers of the debenture investment opportunity that YEC is providing to TKC and KDFN in recognition of the BESS Project's location on the overlapping Traditional Territory of TKC and KDFN and the benefits of TKC and KDFN support for this Project's development at this time.[130]

YEC's Application noted that YEC engaged both First Nations (TKC and KDFN) in quarter 2 of 2020 and a trilateral committee was formed:

> "…for sharing Project information, assessing three alternative KDFN and TKC sites for the Project, and negotiating benefits for both First Nations from the Project. The Project Committee met regularly thereafter in 2020 with a particular focus on the work required to recommend a preferred site and to review a draft Term Sheet that evolved to include a debenture investment opportunity for both TKC and KDFN based on 25% of the equity portion of YEC's net rate base cost of the BESS project."[131]

YEC stated that First Nation debenture investment for facilities projects have occurred for past facilities. However, in the past, the debenture investment opportunities were made with Yukon Development Corporation and were therefore not subject to Board review.

For the BESS Project, the investment opportunity is being made directly with YEC. YEC added that, although there is no legal requirement to provide any First Nation with an investment opportunity related to the specified YEC facilities projects, past investment opportunities have been, or are currently, generally provided as part of First Nation engagement, involvement, and support for the project's development.

The debentures or details of the agreements with KDFN and TKC were not available for the Board's review because not all negotiations and agreements with the First Nations had been finalized. YEC expected that the debenture agreement itself would be a straightforward document.[132]

In addition, YEC summarized the key terms to the First Nation debenture investment in the Application as:

> 1. KDFN and TKC will each be offered the opportunity to provide a loan to YEC in accordance with the following principles:
>
> > a. YEC's Net Rate Base Cost for the Project is YEC's final capital cost for developing the Project less any funding contributions to YEC for the Project and any costs disallowed by the YUB from inclusion in rates.

[130] Minister of Justice's Terms of Reference, PDF page 3.
[131] YEC Application, PDF page 22.
[132] Transcript Volume 2, PDF page 82, line 20, to PDF page 83, line 2.

b. The BESS Equity Cost is 40% of the Net Rate Base Cost and reflects the portion of the Net Rate Base Cost that is financed by YEC equity.

c. KDFN and TKC will each be offered the opportunity to provide a Loan Investment of up to 25% of the BESS Equity Cost. The following example outlines the process, assuming a final BESS net rate base cost of $15.2 million after grants:

i. Assuming YUB approval of these costs, YEC's Net Rate Base Cost would be $15.2 million and this would be funded by 40% equity [the BESS Equity] of $6.1 million and by 60% long-term debt of $9.1 million.

ii. KDFN and TKC would each have the opportunity to provide a Loan Investment of up to $1.52 million, i.e., each up to 25% of the $6.1 million BESS Equity Cost.

2. The Loan Investment opportunity will be available for a specified period after the Project is in service and YEC's final net rate base (after contributions and YUB review) is determined by YEC and communicated to KDFN and TKC.

3. The term for each Loan Investment will be based on the remaining portion of the expected asset life.

4. YEC will provide the following annual payments to KDFN and TKC with regard to each of KDFN and TKC's Loan Investment:

a. Repayment of principal at equal annual amounts over the Term; and

b. An annual return on the Loan Investment balance then applicable times YEC's actual final rate of return on equity (actual percentage return for a completed fiscal year) for YEC's utility regulatory income for the completed fiscal year most recently filed with the YUB (YEC's last approved equity return included in rates is 8.70%).[133]

YEC added that the debentures would be treated as long-term debt given the nature of the financial instrument. Noting that the equity return paid on this instrument is well above the market rate for long-term debt, for the purposes of rate-making, YEC would treat this investment as equity to maintain the 60:40 debt-to-equity capital structure for YEC that the Board has previously approved. To maintain YEC's debt-to-equity ratio, YEC committed to execute the necessary transactions with YDC to maintain the 60:40 ratio on an annual basis.

YEC advised that any rate applications to the Board will show this debenture as a component of equity for revenue requirement determination, thereby causing no net impact to ratepayers from this transaction.[134]

[133] YEC Application, PDF pages 22 and 23.
[134] YEC Application, PDF page 23.

Yukon Conservation Society

YCS did not provide submissions on this issue.

John Maissan

John Maissan stated that the evidence indicates that the debenture investment opportunity has no impact on YEC or on the ratepayers of Yukon. He submitted that he was in full support of this opportunity and YEC decisions to contribute to these efforts by locating the BESS Project on a very suitable parcel of KDFN land. He recommended that the Board support this debenture investment opportunity in its report to the Yukon government.[135]

Utilities Consumers' Group

In its final submission, UCG expressed several concerns with the debenture investment opportunity.

UCG was concerned that YEC only considered First Nation land with the goal to create an opportunity for a land lease with the First Nations.[136] It submitted that YEC failed to do a proper market review of available locations and properly consider the costs of such decisions on ratepayers.[137] UCG disagreed with YEC's position that the land "is not a factor because YEC is using market-based costs so ratepayers would be indifferent because they would pay the same whether it was on settlement land or not."[138] UCG submitted that, given that YEC does not know what costs will ultimately be imposed by the First Nations or what type of longer term commitments will be put in place, there will be a cost burden to ratepayers due to this decision by YEC.[139]

Regarding the debenture investment opportunity, UCG stated:

> UCG questions YEC's claim that the First Nation debenture investment proposed for this project will enable Yukon First Nation investment without any impact to ratepayers. The fact that the net benefits to Yukon ratepayers could easily be negative for the majority of the life of the proposed BESS is obviously a negative impact on ratepayers no matter how YEC spins the form of Yukon First Nation investments.[140] (Footnote removed)

UCG also submitted that YEC implied that the cost of the First Nations' benefits will be in excess of the $100,000 identified in the project budget outlined in Schedule B of the Transfer Payment Agreement because the project budget far exceeds the $25 million assumed in the Transfer Payment Agreement.[141]

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[135] John Maissan Final Argument, PDF pages 10 and11.
[136] UCG Final Argument, PDF page 15, paragraph 87.
[137] UCG Final Argument, PDF page 15, paragraph 88.
[138] UCG Final Argument, PDF page 15, paragraph 89.
[139] UCG Final Argument, PDF page 15, paragraph 89.
[140] UCG Final Argument, PDF page 16, paragraph 94.
[141] UCG Final Argument, PDF page 16, paragraph 95.

UCG finalized its position on this issue by concluding:

> While YEC testified that it is "very hard" to find a development site that's actually better situated or on Crown land, that doesn't mean that more time shouldn't be put into keeping site-related costs as low as possible. It appears YEC is trying to avoid taking the time necessary to fully examine all options available. The unknown impact over the next couple of decades of property taxes (starting at $7 million) is a significant issue for ratepayers.[142] (Footnotes removed)

Yukon Energy Corporation

In its final submission, YEC stated that "First Nations' support for the Project is important given its location and YEC's desire to provide economic benefits to First Nations."[143] YEC also added that the "BESS Project is the first time when Yukon Energy - rather than Yukon Development Corporation - is providing a debenture investment opportunity in a YEC project"[144] and that the opportunity closely aligns with YDC's precedent on other Yukon projects such as Mayo B and the Whitehorse LNG.

YEC added that the debenture is a loan and that the return to the lender will be based on YEC's actual return on equity and will be included in YEC's equity return for rate setting purposes. YEC witnesses testified that there will be no impact on ratepayers.[145] Finally, YEC submitted that there will be an opportunity for the Board to review BESS Project costs including the debenture costs prior to those costs being included in rates.[146]

The nature of the debenture investment opportunity is best described as:

- Not a traditional loan in that YEC would not normally require a debenture with a rate based on its return for equity.
- Structured as a traditional loan instrument. Equity components are normally provided by the shareholder, YDC, through direct investment or accumulated earnings.
- The debenture investment opportunity does not create an ownership interest for the two First Nations.
- Historically, YDC entered into these kinds of transactions with First Nations on prior YEC projects. YDC did not have the ability to enter into this type of transaction this time.

[142] UCG Final Argument, PDF page 16, paragraphs 96 and 97.
[143] YEC Final Argument, PDF page 24.
[144] YEC Final Argument, PDF page 25.
[145] YEC incorrectly referenced page 125 of the transcripts, whereas the testimony from Mr. Mollard started at Transcript Volume 1, PDF page 135, lines 7 to 12. Further testimony occurred at Transcript Volume 2, PDF page 86, lines 2 to 13.
[146] YEC Final Argument, PDF page 25, and Transcript Volume 2, PDF page 85, line 24, to PDF page 87, line 22.

- The YEC board of directors made the decision for YEC to enter into this type of transaction with the understanding that the Board would approve this type of transaction.[147] [148]

Board Views

The Minister asked the Board to assess the impacts on YEC and ratepayers of the debenture investment opportunity that YEC is providing to TKC and KDFN in recognition of the BESS Project's location on the overlapping traditional territory of TKC and KDFN and the benefits of TKC and KDFN support for the BESS Project's development at this time.

During the hearing, the Board asked questions about the selected location and possible impacts on ratepayers. The Board agrees that situating the BESS Project on First Nation land, from a cost perspective, may lead to higher costs for ratepayers than would otherwise occur through obtaining land competitively in the market or situating it on Crown land outside of the limits of the City of Whitehorse. Situating it within the City of Whitehorse will result in additional tax costs.

The Board notes that UCG was the only participant that raised concerns about YEC considering only First Nation settlement land or the debenture investment opportunity for the BESS Project. It did so from an economic and ratepayer perspective.

YEC also stated that, from its perspective, structuring the arrangement as debenture is a benefit to the First Nations and that ratepayers will be indifferent, i.e., the debenture agreement will not harm or benefit ratepayers.[149]

With YEC as the counterparty to the debenture agreement, YDC is still directly impacted by such an agreement.[150] The Board would highlight to the Minister that it does not have transparency into the agreement with the KDFN and TKC and is relying on YEC's summary of key terms of the arrangements with the two First Nations for a debenture investment for the purpose of this report.

In general, a debenture is a debt instrument that pays interest at a higher rate than YEC's average long-term debt. The Board considers that the reasonable consequence of YEC's willingness to allow for adjustments that would be approved by YDC may result from a lower return on YEC's other net rate base to enable this debenture agreement to ensure that YEC maintains a 60:40 debt/equity ratio. From a purely regulatory perspective, it would be more accurate and simpler to treat the return on the debenture in excess of YEC's average cost of long-term debt as a disallowed expense, effecting the same net result to YDC's return while maintaining the overall integrity of YEC's accounting. It appears from the Application that YEC is willing to take on the

[147] Transcript Volume 2, PDF page 81, line 8, to PDF page 82, line 7.
[148] Transcript Volume 1, PDF page 135, lines 5 to 12.
[149] Transcript Volume 1, PDF page 135, lines 5 to 12.
[150] As noted by Mr. Mollard, YDC would be affected by either direct investment or accumulated earnings.

risk of a lower return on the other assets in order to undertake the BESS with TKC and KDFN involvement.

The accounting treatment of the debenture investment opportunity and associated costs to ratepayers are issues best addressed in a GRA. Based on the testimony of YEC's witnesses, the Board accepts YEC's commitment that ratepayers will not be adversely impacted by the debenture investment opportunity. On balance, the Board does not object to the debenture agreements, nor will it recommend any conditions on the debenture agreement, but it will carefully scrutinize YEC's commitment that the debenture agreements will not impact YEC's ratepayers, i.e., that the costs from the debenture arrangements are rate neutral. Conversely, the effect of only situating the BESS Project on First Nation land, from a cost perspective, may lead to higher costs for ratepayers than would otherwise occur through obtaining land competitively in the market.

The cost or benefit to ratepayers as a result of using First Nation land compared to privately procured land (outside municipal boundaries) or Crown land is unknown at this time. The Board is of the view that, since the land has not been openly procured, any potential premium paid for the use of the land, or additional costs for the transaction beyond a competitive market range, should be borne by the shareholder, YDC.

The costs for the land lease part of the project are not as significant as the other capital costs for the BESS Project, and as stated above, further review of the costs will occur in a future GRA before the Board. In these circumstances, the Board accepts the use of a debenture agreement between YEC and First Nations; however, YEC is expected to reflect the fact that it is a debt instrument in any regulatory filing with this Board. Further, YEC shall separately show the premium it is paying for this long-term debt relative to its other existing long-term debt in its future GRA applications and shall also show that the premium is not being recovered from ratepayers. The Board is of the view that, for future facilities projects, it is preferred that Yukon Development Corporation — as YEC's parent — be the contracting party for debenture agreements, as has been done for past Part 3 applications.

4.6 Building the BESS Project at this Time — Term of Reference 3.f.

The Minister's Terms of Reference requested that the Board report on and make recommendations about the necessity for the BESS Project and its timing and design, with particular regard to:

> f. Whether it is prudent to build the BESS project as proposed at this time.

Yukon Energy Corporation

YEC submitted it was the right time to build the BESS Project because it had secured government funding, reducing the costs that will be required to be recovered from ratepayers. YEC also highlighted the need for the BESS Project in mitigating capacity shortfall concerns and avoiding the rental of four diesel units. YEC submitted that ratepayer benefits would accrue starting in year 1 of the project. YEC advised that the BESS Project would contribute to meet the growing dependable capacity requirements, directly reduce YEC's reliance on thermal

generation, provide cost savings for ratepayers, and increase the reliability of electricity service to customers.

Yukon Conservation Society

YCS agreed that building the BESS Project is prudent at this time because it would eliminate the need to rent four diesel units and make the YIS more capable of delivering lower emission electricity to customers. YCS also stated that the ratepayer savings forecasted by YEC was conservative in nature, as it did not include volatility in diesel fuel prices in the future and the potential of applying a carbon tax to northern jurisdiction electricity providers.[151]

John Maissan

Mr. Maissan also agreed with the prudency aspect of the BESS Project, indicating that the information provided on the record strongly supported completing the project at this time. Mr. Maissan reiterated that YEC was conservative in its estimation of the benefits and agreed that the project would provide ratepayer benefits starting from year 1. Mr. Maissan also submitted that the reliability benefits were significant, even though they were not accounted for in the financial information for the project.[152]

Utilities Consumers' Group

UCG did not believe building the project was prudent at this time. It referred to Board Order 2018-10 in which the Board noted several risks and concerns with pursuing a grid-scale BESS Project, including concern that the technology had not been demonstrated in a northern climate. While UCG acknowledged that YEC made reference to BESS-type projects operating in northern Quebec and the Northwest Territories, UCG expressed concern that YEC did not address how successful these projects had been in achieving anticipated benefits and if any issues had arisen with these BESS installations. UCG submitted that YEC had not provided specific information regarding these other northern projects. UCG disagreed with YEC's position that information regarding costs, alternatives considered, or operating experience with these other projects would not provide any material assistance to the Board in its review of this Application.[153]

Board Views

Consistent with the Board's views provided in Sections 3.1 and 3.2 of this report, the Board finds there is a need for the BESS Project. In addition, YEC's funding procured from the federal government for the BESS Project makes it more affordable for ratepayers.

However, the Board does not consider it appropriate at this time to respond to the Minister's request for a recommendation on whether it would be prudent to build the BESS Project as proposed. The question of prudence is a key criterion that the Act requires the Board to apply in

[151] YCS Final Argument, PDF page 6.
[152] John Maissan Final Argument, PDF page 11.
[153] UCG Final Argument, PDF pages 16 and 17.

considering GRAs, and if the Board were to comment on the prudence of the BESS Project outside of GRA proceedings, any such comments could be challenged as prejudging matters that are best left for a GRA decision.

In any event, and as discussed earlier in this report, the uncertainties and insufficiency of information upon which the BESS Project proposal is predicated do not provide the Board with sufficient evidence on which to make an assessment of prudence, even absent the constraint mentioned above.

For these reasons, the Board declines to make any recommendation in response to subparagraph 3.f. of the Terms of Reference.

5. BOARD FINDINGS AND RECOMMENDATIONS

Specific aspects of the project to be reviewed

The Terms of Reference required the Board to report on, and make recommendations about, the necessity for the BESS Project and its timing and design (Section 3). A summary of the Board's findings on specific aspects of the project to be reviewed, as identified in the Terms of Reference, are as follows:

> 3.a. The public need for the BESS Project under various reasonable electric load forecasts, including near-term requirements related to industrial and non-industrial loads, and the effect of the Project on the rates of customers and the reliability of electricity service provided to customers.
>
> - The Board finds a near-term need for the BESS Project.
> - Given that the BESS Project is in a preliminary stage, there are too many uncertainties for the Board to make a recommendation on the effect of the BESS Project on final rates.
> - The BESS Project can provide operating reserve for the grid when excess water is available.
>
> 3.b. The capability of existing and currently committed and expected generation and transmission facilities, including thermal generation facilities, to provide reliable electric power generation to meet the forecast load requirements and YEC's capacity planning criteria and the effect of the BESS Project on this capability.
>
> - The Board accepts that the BESS Project would contribute to reliable electric power supply to meet the forecast future load requirements.
> - From the information that has been presented on this record, the Board is satisfied that the project will not hinder existing and currently committed (and expected) generation and transmission facilities. The BESS Project will provide N-1 capacity support, operating reserve support, and increased grid reliability.

3.c. The risks for the BESS Project and their potential impacts on rates for customers and on the reliability of electricity service provided to customers.

- The technical risks include a real risk of fire and a risk that the battery life of the lithium ion will not last 20 years.
- The Board does not find sufficient evidence to support YEC's assertions that there would be no significant ratepayer impact from costs associated with YESAA, NavCanada, and Transport Canada regulatory risks and approvals.
- As the BESS Project is a class 4 estimate (+/- 30% accuracy), there is a risk that the costs for the BESS Project may exceed the $31.7 million estimate.

3.d. What, if any, reasonable alternatives exist to the BESS Project or what alternative ways of undertaking the BESS Project with its selected technology might be advisable given reasonable load assumptions and risk assessments?

- Diesel generation is the only viable alternative to the BESS Project in the near term.
- The Board finds that the BESS Project is a preferred alternative to rental diesel units and an acceptable alternative to a new diesel plant.
- An alternative way of undertaking the BESS Project would include considering locating the project outside the City of Whitehorse.

3.e. Impacts on YEC and ratepayers of the debenture investment opportunity that YEC is providing to TKC and KDFN in recognition of the BESS Project's location on the overlapping traditional territory of TKC and KDFN and the benefits of TKC and KDFN support for this Project's development at this time.

- The Board accepts YEC's commitment that ratepayers will not be adversely impacted by the debenture investment opportunity.
- The effect of YEC's decision to only consider situating the BESS Project on First Nation settlement land, may lead to higher costs for ratepayers than would otherwise occur through obtaining land competitively in the market.

3.f. Whether it is prudent to build the BESS Project as proposed at this time.

- Any comment or recommendation the Board may make about the prudence of the BESS Project at this time could, in effect, prejudge what it is statutorily required to be considered at GRAs. Therefore, the Board declines the opportunity to make any such comments at this time.

Recommendation respecting certificates

The Terms of Reference state that the Board shall provide a recommendation on whether YEC should be granted an energy project certificate and an energy operation certificate for the BESS Project and, if so, whether the certificates should be subject to any terms and conditions and what these terms and conditions should be (Section 5).

Based on the above findings, the Board recommends that YEC be granted an energy project certificate and an energy operation certificate. There is a public need for the BESS Project, and the project would allow YEC to install new capacity with some other potential system benefits. The Board notes that the evidence that the BESS Project would result in savings to ratepayers is incomplete and inconclusive. As such, all estimates must be treated as preliminary. Any resultant savings and ratepayer impact cannot be determined at this time.

Making a recommendation about ratepayer impact at this stage in a process, with so many outstanding costs, is difficult. This is why the Board has put a great deal of emph asis on the prudence review of costs at future GRAs. The Minister will have to consider whether requiring additional transparency to the government, such as quarterly reporting to the Minister, is warranted before the final costs of the project are submitted to the Board for review in a GRA.

Other recommendations

The Terms of Reference state that the Board may make any other recommendations or provide any other information that it considers advisable in the circumstances (Section 6). As noted in Section 2.1, the Board recommends that Ministerial approval of this project, if granted, is informed by governmental and other public policy issues outside of the Board's jurisdiction as an economic regulator. Specifically, decision-making criteria related to First Nation economic development opportunities and climate change concerns are beyond the Board's authority set out under the *Public Utilities Act*.