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IN THE MATTER OF AN ELECTRICITY PURCHASE AGREEMENT BETWEEN YUKON ENERGY CORPORATION

AND

TLINGIT HOMELAND ENERGY LIMITED PARTNERSHIP

Heard before the

YUKON UTILITIES BOARD

JULY 19 - 20, 2022

WRITTEN FINAL ARGUMENT OF JOHN MAISSAN

Introductory comments

In the preparation of this final written argument the transcript is referenced by page and line numbers whenever possible. This reference will appear in brackets as Tr for transcript, p for page number, and Lx-y for line numbers. For example, a reference to the transcript at page 128 lines 17 to 19 would appear as (Tr p128 L17-19). The Yukon Utilities Board is referred to as "the Board". Interrogatory responses (IR) will be referenced by their identifying letters and numbers.

In this argument I address the six points in part 3 the Board's Terms of Reference as specifically requested by the Board Chair, Mr. Buchan, in his opening comments in the virtual hearing. I have also addressed some other issues that in my opinion required or deserved comment. My silence in this submission on matters raised by any other party in this proceeding are not to be interpreted as agreement with, or disagreement with, the other party or parties' positions. I leave these matters to the Board to address based on all the information on the record.

In this document Yukon Energy Corporation is referred to as "YEC" or Yukon Energy and Tlingit Homeland Energy Limited Partnership is referred to and "THELP" and the THELP - YEC Electricity Purchase Agreement is referred to as the "EPA". The Yukon Integrated System is referred to as "YIS" or "the grid". The Yukon Utilities Board is referred to as "the Board".

Section A The public need under various reasonable load forecasts

1. Yukon Integrated System load forecasts

Yukon's peak non-industrial electrical load has been growing in recent years (YEC 2021 GRA pages 2-1 to 2-4. There are three grid-connected mines operating driving the economy and another (non-grid connected) has been recently given a green light by the Yukon and federal governments. Housing is in short supply and home construction (including apartments and condominiums) is continuing at a rapid pace. Virtually all new homes are heated by electricity rather than fossil fuels, thus the peak non-industrial electrical loads that the N-1 criterion requires that the grid must be able to supply will continue to increase steadily (Exhibit B-5 amended EPA submission Table 4-1, page 21).

Adding to the pace of both peak and energy electrical load growth will be the policies of all levels of government as they begin to tackle climate change by further discouraging the use of fossil fuels (in transportation and home heating for example) and promoting lower greenhouse gas (GHG) emitting forms of energy, electricity in particular (Yukon government's *Our Clean Future* and the *Clean Energy Act* which is in development, as referenced in the hearing).

The electrical energy forecast used in the development of the EPA stems from Yukon Energy's 10-Year Renewable Electricity Plan (Exhibit B-5 amended EPA submission Table A3, page A-3; Tr p21 L9-24; and elsewhere). This forecast for 2024 is 527.9 GWh (453.3 GWh non-industrial). Yukon Energy indicated that this represents about 2% per year load growth from the 2021 GRA non-industrial load forecast of 426.7 GWh (with losses) contained in the Yukon Energy 2021 GRA (JM-YEC-1-17). The actual 2021 non-industrial load was 428.7 GWh with losses (JM-YEC-1-17), close to 0.5% above forecast. Yukon Energy's 2021 GRA generation forecast was 536.7 GWh exclusive of IPP generation (YEC 2021 GRA Table 2.2 page 2-17). Yukon Energy's website (last accessed July 17, 2022) has shown that the sum of the monthly generation numbers for 2021 add to 537.02 GWh and that the first 6 months of 2022 are trending slightly higher than the first 6 months of 2021.

The present grid-connected mines are operating in a favourable economic climate with robust demands for their products and it appears unlikely that there will be shut-downs in the near term. As mentioned earlier, non-industrial loads are growing steadily.

This information all supports Yukon Energy's load forecasting as being sound and that the EPA forecast for the years 2024 to 2034 is reasonable. This includes both the non-industrial energy and peak load required to meet the N-1 planning criterion.

The EPA period starting in 2035 and continuing to the end of the 40-year agreement assumes no industrial sales. This is an ultra-conservative forecast, in my view. Industrial customers do come and go and there have been periods of time without connected mines, but to not have any mining load from 2035 to the end of the EPA period is not realistic.

However, the EPA does balance this aspect of the forecast for 2035 and thereafter with provision for up to 68 GWh per year of additional electrical load during the winter period with provision for additional payments to THELP for 12.9% of this energy (Exhibit B-5 amended EPA submission Table 3-1, page 15 and JM-YEC-1-16 AMENDED). The forecasted annual average energy available from the THELP project during the defined winter period is 34.0 GWh per year and the forecasted annual thermal displacement is forecasted to be 24.2 GWh up to and including 2034 (Exhibit B-5 amended EPA submission page 6). The thermal displacement by the project when the grid winter load is increased by 68 GWh per year to 456 GWh (388 plus 68) increases to about 33 GWh per year (24.2 GWh plus 12.9% of 68 GWh).

In my opinion this is a reasonable forecast for the purposes of negotiating this EPA and from a ratepayer perspective is conservative in their favour.

Yukon Energy's 2021 GRA forecasted a long-term average (LTA) annual thermal generation requirement of 84.3 GWh (YEC 2021 GRA Table 2.2 page 2-17) or about 15.65% of the total generation requirement. Any incremental load growth beyond 535 GWh per year will require 84% or more LTA thermal generation (YEC 2021 GRA Table

2.1-1, page 2.1-2). Even with an additional 38 GWh per year of (predominantly summer) IPP energy generation added (total 40 GWh as there was about 2 GWh forecasted for 2021), the need for significant thermal generation will persist and even a modest a 1% per year load growth in non-industrial sales from 2021 will increase annual generation requirements by over 12 GWh in 2024.

In summary:

1. ***The non-industrial load is growing steadily.***
2. ***The industrial loads appear to be secure for the near future.***
3. ***The load forecast used in negotiating the EPS is conservative in the ratepayer's favour.***

Conclusion: There is a public need under for the EPA reasonable load forecasts.

Section B The effect on rates and reliability

2. Rates

Yukon Energy's amended submission to the Board (Exhibit B-5) states that the EPA energy pricing is based on a price of $0.19 per kWh for displaced thermal generation (Exhibit B-5 amended EPA submission page 12). The origin of this cost figure is explained in Footnote 39 on page 26 of Exhibit B-5 as being a blend of 90% LNG at $0.1846 per kWh and 10% diesel at $0.3024 per kWh. Yukon Energy's response to JM-YEC-2-3 (a) and (b) says that the weighted average costs from January 1 to May 31, 2022, was $0.2141 for LNG generation and $0.3061 for diesel generation. At 90% LNG and 10% diesel this is a blended price of $0.2233 per kWh. The actual thermal generation over this period was 10.4 GWh of LNG and 7.1 GWh of diesel so the actual average cost year to date was $0.2514 per kWh. Both of these latter per kWh cost numbers are well above the thermal displacement cost of $0.19 per kWh used in the EPA. This suggests that the EPA provides a cost advantage and are much more likely to lower the rates than increase them. Furthermore, Yukon Energy acknowledges that there are non-fuel cost savings that will accrue to Yukon Energy (and its ratepayers) in response to CW-YEC-1-3. In the Yukon Energy 2021 GRA these non-fuel O&M costs were described, in part at least, in section 3.3.1 under labour costs in operations and section 3.3.2 under consumables in production costs. In my view Yukon Energy has, in selecting the per kilowatt-hour thermal displacement benefit, underestimated the real cost of thermal generation that consumers are now paying through their power bills. This provides a significant added margin of conservatism in favour of rates and ratepayers.

The price paid for energy escalates at 1/2 of the Consumer Price Index (Exhibit B-5 amended EPA submission Table 3-1 page 15) which over the 40-year term of the agreement is a fairly substantial reduction from CPI and will keep the cost trend downward in favour of ratepayers.

3. Reliability

The electrical reliability of the YIS with the THELP amended project involving a single 9.3 MW generator in place was explored in some detail by the author. The stated concern was that of a generator trip at full load (8.75 MW being delivered at Jake's Corner). From the Yukon Energy response, the system impact study has shown that the BESS will prevent trips in the YIS (JM-YEC-2-8, Exhibit B12), but that voltage support is required at Teslin. This is to be provided as part of the system upgrades funded by THELP. There is thus no negative impact on YIS reliability thanks in part to the BESS which will be in service by the time the THELP project is complete.

On either side of the summer period in spring and fall (late and early in the EPA "winter" period) having another hydro generator on the grid (in addition to the BESS) instead of one or more LNG generators will, in my opinion, make the YIS a bit more robust.

Having about 5 fewer rental diesels on the grid will reduce the fixed infrastructure costs that Yukon Energy would otherwise incur in order to enable rental diesel units to connect to the grid year after year and the related operating costs.

In summary:

1. ***Rates will be lower than with the thermal generation alternative.***
2. ***Grid reliability, with the implementation of the system upgrades, will not be degraded quality.***

Conclusion: The EPA will reduce rates compared to thermal generation and thereby benefit ratepayers.

<u>Section C The capability of the existing facilities and the effect of the EPA on this capability</u>

4. Capability of existing facilities

The grid has three hydro generating stations that provide, on a LTA basis, at Yukon Energy's 2021 forecast loads, between 84% and 85% of the energy requirement. The remainder is supplied by Yukon Energy's LNG and diesel generating plants, by ATCO Electric Yukon's diesel generator plants and by rental diesel generators. The rental diesel generators are used to meet the peak load generating requirements and to provide enough installed capacity to meet the N -1 capacity planning criterion. In recent years with fairly rapidly growing peak load demands during the coldest winter days (peak loads are driven by electric heating requirements). As more and more rental diesel units are required Yukon Energy incurs costs to install the infrastructure to connect these rentals to the grid, both in Whitehorse and Faro (and possibly in other locations in future). Yukon Energy could continue on this path and meet the grid requirements. However there could come a time that the required number of rental diesel generators will not be available.

The EPA would reduce the need for rental diesel generators by an expected 8.75 MW, close to 5 typical rental units of 1.8 MW capacity each (YUB_YEC-1-13 AMENDED). However, as discussed in YUB -YEC-1-31 and in the hearing on at least two occasions (Tr p21 L9-24, and p81 L2-20), there is a coming Yukon government requirement for Yukon Energy to provide 95% of its energy from renewable sources on a LTA basis by 2030. As mentioned earlier, the LTA renewable based on the 2021 load forecast is between 84% and 85% (15.65% thermal: 84.306 GWh / 538.726 GWh (YEC 2021 GRA Table 2.2 page 2-17)), so well shy of the 93% requirement. With the THELP EPA providing 24.2 GWh per year of LTA renewable energy and if, in addition, the Independent Power Producer (IPP) policy standing offer program (SOP) displaces 20 GWH of thermal energy the LTA percentage renewable energy would increase to 92.58% (7.42% thermal), close to the specified 93% requirement. This 20 GWh IPP SOP thermal displacement is a speculative number from the author based simply on taking 50% of the maximum SOP allowable energy of 40 GWh).

In summary:

1. ***Yukon Energy is meeting its energy needs with LNG and diesel generation as required.***
2. ***The N -1 planning criterion is met with the addition of rental diesel generators to the grid each winter. There could come a time when an inadequate number will be available.***
3. ***At 2021 GRA grid loads the LTA renewable energy generation may come close to the 93% renewable requirement if the IPP SOP provides about 20 GWh of thermal energy displacement each year.***

Conclusion: It will be hard for Yukon Energy to achieve the 93% renewable energy target without the EPA.

<u>Section D The risks with the agreement including on rates and reliability</u>

5. Risks on Rates

There are various risks to the EPA that can affect rates. Each will be discussed in turn in the sub-sections below.

a) The ability of the project to deliver the modelled energy or to deliver the modelled energy under some conditions due to technical problems with the plant or due to actual water supply being different than modelled. The actual water supply to the project will vary year by year as discussed extensively on the record in IRs and in the hearing (Tr p213 L5 to p216 L7). The end result is that each year Yukon Energy will only pay for the actual energy delivered to YIS at Jake's Corner (YUB-YEC-1-51 AMENDED). So if the modelled results overestimated the amount of hydro energy available, Yukon Energy will not be paying for that difference, and the reverse would be true if

the modelling underestimated the hydro energy available. Given that three professional firms have modelled the water availability for THELP, this risk is low.

b) With respect to the dependable capacity the project can deliver it is based on an annual test in the month of December. This deals with the technical risk of the plant not performing as it should, as Yukon Energy would be paying for the capacity the plan can actually deliver with adjustments for subsequent inability to deliver the full capacity. This is discussed in the transcript (Tr p57 L5 to page 60 L15). The amended project with a penstock replacing the previously proposed canal also reduces the risk related to icing (Tr p57 L15-20 and elsewhere). We know that hydro turbines are dependable (Tr p57 L7-10) and in my view the risk here is low too.

c) The YUB and the author both asked in IRs about the correlations between the THELP project and the Yukon Energy's hydro plants (YUB-YEC-1-14 AMENDED, and JM-YEC-1-5 AMENDED). In my view there is some modelling / correlation risk with the EPA. In JM-YEC-1-5 AMENDED Yukon Energy, as part of its response, provides a graph that plots both Marsh Lake winter inflows (to Whitehorse Rapids hydro plant) and the THELP project winter generation. Visually there is a noticeable correlation between the two. Whitehorse Rapids supplies close to 60% of the YIS annual average hydro energy (but a lower portion in winter). In the hearing (Tr p213 L5-15) there is the comment that during low water years there is a higher level of thermal displacement and during high water years there is a lower level of thermal displacement. My concern with this statement is that the result when 51 Atlin water years are randomly compared to YIS hydro the results may well be different than if the THELP project in Atlin dry years were compared to the YIS during corresponding Marsh Lake dry years because they are likely to occur together and similarly for wet years. This seems to me like a "no-brainer" thing to do and wonder why it was not done. In my opinion there is some risk here that has not been explored by Yukon Energy.

d) The actual cost of thermal generation on the YIS compared to the EPA cost could impact YIS electricity rates, either pushing them lower or higher. This matter was discussed at some length in Section B, item 2 Rates above and will not be repeated here. In response to JM-YEC-1-10 REVISED AMENDED, Yukon Energy provides detailed information on year-by-year costs for the EPA term under the EPA assumptions (no mining load in 2035 and beyond) and under a revised forecast with mining load continuing on to 2044. A levelized cost of energy (LCOE) of $0.166 per kWh and $0.174 per kWh for each of the two cases respectively. My conclusion is that the EPA terms are significantly stacked in the "lower rates" favour, and I view the risk here to be very low.

e) Electrical load risk is also present in the EPA. Should electrical loads (especially industrial loads) not continue at their present levels until 2034 the risk is that Yukon Energy will be paying THELP more than a smaller amount of thermal generation would cost (Tr p168 L 10-19). But the opposite is also

true, if electrical loads are higher than forecast then costs will decrease further. Load forecasts were discussed in Section A above and I have nothing further to add here, in my view the overall EPA load forecast is sound.

f) Capital costs for the project are going up from $206 million in the original submission to $240 million in the amended submission (Exhibit B-5 amended EPA submission page 7) and likely more (Tr p87 L19-25). Furthermore, to try to minimize cost increases THELP has deferred completion to 2025 (Exhibit 15 page 3). THELP is continuing to pursue funding from the government of British Columbia to support their project and the added costs. The delay of one year will add some GHG emissions that would otherwise have been avoided and add some costs for rental diesels and thermal generation, but beyond that I do not see a material risk. With respect to THELP capital cost increases I cannot assess the risks, for example I do not know if the project is in jeopardy of becoming uneconomic to THELP.

6. Risks on reliability

The possible impacts of the THELP project on reliability in the YIS was discussed in Section B item 3 above. The conclusion is that the only issue was with voltage in Teslin after a THELP generator trip and that with the system impact study recommendation of voltage support this would be corrected. In my view there is very low risk on reliability to the YIS if Yukon Energy enters into the EPA.

7. Other risks

a) In response to an IR (JM-YEC-1-3) Yukon Energy provided information on the 4 of the 31 years in which days below -30°C outside of the peak winter period (PWP) were experienced in Whitehorse. All of these days were in November or December before the start of the defined PWP in the EPA. The records for the most recent 3 of these 4 years (there are no records for the first) indicate that a new grid system peak load was set in one of them. We thus know of 1 year in 31 when a grid peak was established and at most there can only be 2. So while there is some risk of a grid peak being set before the winter capacity test of the THELP project, this does not mean that the plant will be unable to meet its designed dependable capacity, and further offsetting that is that the YIS typically has a somewhat higher hydro capacity available before mid-December than later in the winter (Tr p27 L7 -10). I would judge this risk to be low.

b) In a discussion in the hearing on JM-YEC-1-6 REVISED AMENDED the presence of the BESS project and the Moon Lake pumped hydro storage project in the modelling for 2024 and 2035 respectively was questioned. The conclusion was that neither was used in this modelling (Tr p29 L9 to p31 L10). This makes me uncertain if the potential benefits of the BESS project to thermal displacement were modelled for the EPA. We know that the benefits of Moon Lake Pumped hydro storage were not modelled for the EPA (JM-YEC-1-14 (c)). In my view the absence of these (potential) projects in the

modelling reduce the risk of the EPA in that they can only improve the thermal displacement.

In summary:

1. ***A shortfall in energy supply based on modelling – low risk.***
2. ***A shortfall in dependable capacity – low risk.***
3. ***There is some unexplored risk in thermal displacement during THELP project and Marsh Lake low inflow (dry) years.***
4. ***The potential for thermal generation costs to be lower than provided for in the EPA – very low.***
5. ***Lower YIS grid load than forecast in modelling – the forecast is sound (conservative).***
6. ***Delays to project completion will add some costs to Yukon ratepayers to the extent that thermal generation is more costly than the EPA and will result in increased GHG emissions for the period of delay.***
7. ***THELP capital cost increases provide a risk that I cannot assess such as increases jeopardizing the project entirely.***
8. ***The possibility of the YIS grid reliability decreasing – very low risk.***
9. ***The possibility of a YIS peak load before the PWP and the THELP project being unable to deliver required capacity – low risk.***
10. ***The absence of the BESS project and the Moon Lake project in EPA benefit modelling – their inclusion can only improve the benefits.***

Conclusion: The overall risk profile of this THELP project and the EPA is low but there are some unknown factors such as the capital cost increases jeopardizing the project.

<u>Section E Consideration of reasonable alternatives to the EPA</u>

8. Alternatives to the THELP project and the EPA

a) A new thermal generating plant is one possible alternative. However, the public has been very strong in its opposition to new thermal generating plants, including the LNG plant and more recently a Yukon Energy proposed new 20 MW thermal plant. There is simply no social license for a thermal generating plant when society (and the governments) are demanding reductions in greenhouse gas emissions to try to stem the climate change that is being experienced. In my view this is an unacceptable alternative.

b) In YUB-YEC-1-57 alternative hydro projects previously identified were explored. However, as stated in the response to the IR, none of these potential projects was/is as far advanced as the THELP Surprise Lake – Pine Creek project and would take many more years to develop (Tr p266 L15-19). This potential project has been examined by Yukon Energy in the past (personal involvement for Yukon Energy in the 1990s, and I think there is a reference to this on the record), but this was not favourably received by the people of Atlin. I would add further that cost estimates tend to go up as hydro projects are advanced. Yukon Energy has stated that the THELP project is basically an unsolicited proposal (Tr p36 L1-3),

but Yukon Energy has, to date, not issued a Request for Proposals (RFP) under the IPP Policy to explore other options (Tr p35 L16-25). While there is quite a long history to this project that justifies it being a top priority future projects would benefit from Yukon Energy exploring possibilities through a Request for Proposals.

c) In Yukon Energy's submission on the EPA the Yukon Government's IPP policy SOP portion is held up at the price and performance comparison (Exhibit B-5 amended EPA submission page 27, YUB-YEC-1-1 AMENDED, YUB-YEC-1-57 AMENDED, and others). However, the THELP project does not fit within the SOP portion of the IPP policy because the project cap for the SOP is 2 MW and the aggregate energy cap is 40 GWh (Tr p35 L5 to p36 L20). The SOP also does not provide for a capacity payment (YUB-YEC-1-57 page 5 of 6) and provides no winter energy production incentives nor summer energy production dis-incentives (see full discussion Tr p33 L 11 to p41 L17). In my view one cannot seriously compare the THELP project and EPA to the IPP SOP program simply because it is the only alternative that is providing the YIS with new renewable energy generation. The SOP portion of the IPP policy is not designed to fill the role of a larger hydro project designed to meet the YIS winter peaking needs. In my view responses to a Yukon Energy RFP would provide a more serious and fair comparison. I suggest that Yukon Energy do this for future projects.

Yukon Energy has stated that if it were building and owning a project the levelized cost might be the same as a private development but there would be higher costs in the initial years but a lower cost in the later years (CW-YEC-1-4, YUB-YEC-1-27). This aspect of the difference between Privately owned and utility owned assets has not bee assessed by the author, but others may have views on this matter.

In summary:

1. ***A new thermal plant is not a realistic alternative.***
2. ***Other new hydro projects are not viable at this time as they would require at least several years to advance to a similar level of certainty as the THELP project.***
3. ***The comparison of the EPA to the IPP SOP is not really appropriate as the SOP is not designed to provide this kind of project.***
4. ***Yukon Energy should consider issuing an RFP when planning to consider other similar projects.***

Conclusion: There are no real alternatives in the same category that THELP is for a meaningful comparison. It is the only alternative of this scale and use available today.

Section F Prudency of entering into the EPA at this time

9. Prudency of entering into the EPA

There are no viable or cost-effective alternatives to the THELP project and the EPA that would be available at this time. The risk, in my estimation is low, and this EPA will provide valuable winter energy and capacity while significantly reducing GHG emissions. Without this project Yukon Energy will find it hard to meet the 93% renewable electricity target by 2030.

I recommend that the Board in its report to the Yukon government recommends that it is prudent to enter into this EPA at this time.

Section G other matters

10. Secondary sales

Yukon Energy has stated that it does not promote adding secondary sales customers to the YIS (JM-YEC-1-12 (d)). Yet YEC has also stated that it has "substantial surplus renewable energy generation forecast in the summer period" (YUB-YEC-1-2 and Exhibit B-5 amended EPA submission page B2 footnote 4 and elsewhere,) and that the IPP SOP generation results in summer surpluses (JM-YEC-1-12 (a)). Yukon Energy seems only reluctantly to concede that it will consider expanding its secondary sales program (Tr p32 L4 to p33 L4), a sentiment that was not in evidence in the IR responses. The EPA once the project is operational will add, on average, about 9.8 GWh of surplus generation to the winter period (34.0 GWh less 24.2 GWh thermal displacement).

11. IPP SOP

Under questioning about possible alterations to the IPP SOP, Yukon Energy admits that the IPP SOP is not well designed to the YIS needs and that it could be made to fit better (Tr p37 L11 to p41 L17).

Conclusions:

1. ***Yukon Energy should be encouraged to promote secondary sales as a source of revenue to the benefit of ratepayers.***
2. ***The Yukon government should be encouraged to re-design the IPP SOP program to better fit with the YIS needs.***

Respectfully submitted,

John Maissan
July 28, 2022