

**BC Hydro Fiscal 2020 to Fiscal 2021
Revenue Requirements Application**

BC HYDRO UNDERTAKING NO. 26

HEARING DATE: February 24, 2020

REQUESTOR: BCUC Mr. P. Miller

TRANSCRIPT REFERENCE: Volume 10, Page 1730, line 17 to Page 1733, line 17

TRANSCRIPT EXCERPT:

MR. MILLER: Q So earlier when we discussed Schedule 4. You said that generation at Shrum and MICA was increasing from F'20 to F'21. So can you help me reconcile that graph against what we just discussed? Why does the graph indicate that generation from Shrum and MICA are decreasing when we just discussed how generation in Shrum and MICA is expected to increase from F'20 to F'21? Because the evidentiary update I asked you whether generation was increasing at Shrum and MICA and you said yes.

MS. MATTHEWS: A Right, so I think it goes to what I had said before though of under average water conditions, which is what is being projected, we have more generation than load, and so generation can be up, but we can still be storing into -- well, into storage, between the years.

MR. MILLER: Q I'm not sure I understand. Can you elaborate a bit?

MS. MATTHEWS: A So, let's just take Fiscal '21 because it is out in time, and what we are really doing is assuming average water conditions. Then, compared to let's say what happened in F'19, then if -- so they can be generating more than they did in F'19, but still have a net storage between years.

MR. MILLER: Q A net increase in storage?

MS. MATTHEWS: A Yes, a net increase in storage.

MR. MILLER: Q And as a result of what?

MS. MATTHEWS: A Well, as a result that there is more water coming in, and it is not just our storage, it is -- what ends up in storage is what happens on a whole other system. The rest of the system. So, if you assume that the rest of the system, which from the numbers, 50 percent of it is also producing a lot more. So you don't have the ability to store that across the year. So, if it is coming in that year, it is really going to be used in that year. So, the system storage is the part that takes the swing. So, we could still be generating more at those facilities, but so are all the other facilities. And all of those facilities are being used. So any difference shows up in the system storage. And then as I had said before, it is also going to depend on the imports and the exports.

THE CHAIRPERSON: The water throughput, so to speak, is the same? The fact that the peaks in the orange graph are at the same level, that is showing that the

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amount of water that is flowing through the system is the same in each year, correct? So that's not changing?

MS. MATTHEWS: A Yes. So --.

MR. MILLER: Q You may want to take it away as an undertaking. We're just not quite understanding what you're trying to tell us, I think.

MS. MATTHEWS: A Sure, and can I try to clarify the? Because maybe I am not quite understanding it. I think you're asking if these inflows in these years are the same, then why is the storage increasing?

MR. MILLER: Q Well, we started off with generation is increasing from 2020 to 2021. Which means you should be using more of the system storage, I think, because that's what the questions were directed to, the system storage. But yet the graph seems to indicate that the system storage levels are increasing, which then we can't understand how is it that generation is increasing at the same time as system storage is also increasing, because I thought there was an inverserelationship, because that's what we established initially.

MS. MATTHEWS: A And, again, I think I answered it by that if on average we're long, then that energy can be used to produce more and also going to system storage. But we could take an undertaking to try to lay that out more clearly in terms of what the generation is for those systems versus elsewhere.

MR. MILLER: Q Yeah.

MS. MATTHEWS: A Okay.

MR. MILLER: Q Could you do that?

QUESTION:

If inflows are constant, as indicated in the graph provided in BC Hydro's response to AMPC IR 3.1.2, and generation is increasing from fiscal 2020 to fiscal 2021, you should be using more of the system storage. However, the graph seems to indicate that the system storage levels are increasing. Considering that generation increases and storage increases have an inverse relationship when inflows are constant, how is it that generation and system storage can both be increasing at the same time?

RESPONSE:

The public version of this portion of the response has been redacted to maintain confidentiality over commercially sensitive information. The un-redacted version of this portion of the response contains information about BC Hydro's monthly System Storage and inflow information. Publication of this information would

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enable third-parties to model BC Hydro's system to estimate the depth of BC Hydro's energy need and to predict BC Hydro's import and export requirements. The un-redacted version of this response is being made available to the BCUC only.

The graph referred to by Mr. Miller, provided in BC Hydro's response to AMPC IR 3.1.2 contained a unit conversion error in the 'System Inflow Energy GWh' time series (orange colour) for June 2019 onward.

A corrected graph is provided below to reflect the expected System Inflow Energy as of the June 2019 Energy Study for the remainder of 2019 and beyond. As can be seen in the corrected graph, System Inflow Energy is expected to increase.

With the System Inflow Energy increasing, it was possible for BC Hydro to forecast an increase in generation while also increasing System Storage, as Ms. Matthews indicated. For clarity, Ms. Matthews evidence on this topic is correct.



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BC HYDRO UNDERTAKING NO. 27

HEARING DATE: February 24, 2020

REQUESTOR: BCUC Mr. P. Miller

TRANSCRIPT REFERENCE: Volume 10, Page 1734, line 17 to Page 1737, line 1

TRANSCRIPT EXCERPT:

MR. MILLER: Q Now, let's go back to the graph we were just looking at on page 9 of the witness aid and the orange dotted line. That's the forecast of system energy inflow from the June 2019 energy study that was used in the evidentiary update, correct?

MS. MATTHEWS: A Yes.

MR. MILLER: Q Now, between 2019 and 2021, annual system inflows appear to be similar, however, you confirmed that you have no evidence that suggests that the dry conditions are likely to continue beyond the summer of 2019. Can you reconcile the graph to this statement, because it appears to be that you're assuming that the dry conditions are -- the inflows are going to remain the same?

MS. MATTHEWS: A I mean for one, the graph is fairly small to pick out the differences of. In June Evidentiary Update, the system inflows, at that time the forecast was 87 percent and they would certainly have been higher for that, like around 100 percent average for the following year. So I think the -- in June we knew it had been dry, we knew snow pack was low, and because of that we anticipated that it all else being equal and you have average rain across the summer, your inflows across the summer would still be below average, but then anything beyond that going into the all and the winter, we don't have any other indication of ability of skill to say whether it's going to rain more Lasts, so that's what was trying to be answered by that question. And I guess we -- the differences in that you can see on the graph are probably too small to pick up with the eyes, is I guess how I would describe it.

MR. MILLER: Q Just if we go by order of magnitude, for 2019 and 2020, they're the lowest points of any of the previous years and they look almost identical, so it would seem to indicate that you are expecting another dry year coming up where inflows are going to be low, which appears to give to contradict the answer you gave above to Ms. Gjoshe.

MS. MATTHEWS: A Yes, I understand the -- so those two do look very similar and it does look smaller than the one before.

MR. MILLER: Q It may be something you need to take away as an undertaking. I'm not trying to pressure here, we're just trying to understand which is the right answer.

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MS. MATTHEWS: A Okay, so the question is?

MR. MILLER: Q Which one is it? Are you predicting another dry year because 2019, 2020 on the graph are pretty similar or is it the answer to Gjoshe that's right and the graph is probably not accurate. I mean there's both -- you can't reconcile them, at least on the face. There may be an explanation but on the face it appears that they don't reconcile.

MS. MATTHEWS: A I can -- I mean, again, these are too small to the difference of but then I'd have to go back and look at, for those previous years, how wet they were versus not. So I can do an undertaking to try to explain why these seem to be the same volume level compared to other years.

MR. MILLER: Q That would be satisfactory, thank you.

QUESTION:

Please reconcile the forecast of system energy inflow from the June 2019 energy study that was used in the evidentiary update, as shown in the graph provided in BC Hydro's response to AMPC IR 3.1.2, with the statement that BC Hydro has no evidence to suggest that dry conditions or lower inflows are likely to continue beyond summer 2019, as provided in BC Hydro's response to GJOSHE IR 3.2.0.

RESPONSE:

Please refer to BC Hydro's response to BC Hydro Undertaking No. 26, where we explain that the original graph provided as part of BC Hydro's response to AMPC IR 3.1.2 contained an error in the 'System Inflow Energy GWh' time series. The updated graph provided as part of that undertaking shows a return to average inflow energy during fiscal 2020 and beyond, which reconciles with BC Hydro's statement in response to GJOSHE IR 3.2.0 that there is no evidence to suggest that dry conditions or lower inflows are likely to persist.

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BC HYDRO UNDERTAKING NO. 28

HEARING DATE: February 24, 2020

REQUESTOR: BCUC Mr. P. Miller

TRANSCRIPT REFERENCE: Volume 10, Page 1739, line 14 to Page 1745, line 4

TRANSCRIPT EXCERPT:

MR. MILLER: Q The next issues I'd like to address is how do you manage the storage level versus trying to maximize consolidated net revenue. And if you can turn to page 19 of the witness aid? This is a response to BCUC Panel IR 2.5.2.1 in Exhibit B-31. And in the third paragraph, the first sentence, it say, "In the energy studies the storage at the end of the model time horizon as a sign of value." You see that?

MS. MATTHEWS: A Yes.

MR. MILLER: Q So can you explain the significance or the effect of assigning a lower versus higher value to storage at the end of the modeled time horizon and how that relates to the objective of maximizing consolidated net revenue?

MS. MATTHEWS: A So the impact of assigning a value has no impact, that's why we model out the extra two years so that how the optimization works is it starts at the end period and it does and optimization back and it's a bit more complicated than that. But essentially that's why we call it a boundary condition. When you're doing any sort of modeling, especially in optimization, you need to define a boundary condition and the reason we make sure we go longer out in time than the area that we're interested so that the number we assign on that boundary condition doesn't affect the results. So, I mean, it might if we took

You know, if we started the reservoirs empty or something, but we take something around the normal, and then by the time we've worked it back a year, it is not going to be affecting the results in the three year operation time period. So, that is why we call it the boundary condition.

MR. MILLER: Q So what methodology do you use to determine the appropriate value to assign to storage at the end of the modeled horizon? How is that number chosen? What method do you use?

MS. MATTHEWS: A You know, I don't know offhand, if I was guessing, I would guess it is just on average, but I would have to actually check with my modeling team. And again, the actual number chosen five years out is not the -- the number you choose out that time, by the time you're back within the year, it will have made no difference to where the model is that.

MR. MILLER: Q But there is a purpose in assigning a value to the end of the horizon, correct? Otherwise, why do you do it?

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MS. MATTHEWS: A You do it because the model requires a boundary condition to be able to start. Like, I guess in the model, you need to identify the different parameters, and that is one of the ones that is needed to start it.

Now, if we did it let's say 50 percent higher, or 50 percent lower, by the time you are back, the year that is not making as difference to as you are now coming in to the operating period. So it is not -- I mean that is why we model the extra two years, so that it is not important.

MR. MILLER: Q So if you are saying it is not that important, how do you know that the model maximizes consolidated net revenue?

MS. MATTHEWS: A Well the objective function of the model is set up to maximize consolidated net revenue. So, that is the calculation that is being done by the model between each of the time steps.

MR. MILLER: Q But you said that one of the inputs into the model is the value, so it has to have some significance? Maybe it may be easier to take it as an undertaking and go back to your team and maybe they can explain the methodology they use to assign a value?

MS. MATTHEWS: A Yes, I can do an undertaking to explain what value they use as the boundary condition.

MR. MILLER: Q Okay.

THE CHAIRPERSON: Could I just ask a question here please? So can you please tell me if my understanding is correct. So, what you do is you set a boundary condition at the end of five years, and then you run the model for five years, but you only use the first three years of modelling results. Is that correct?

MS. MATTHEWS: A Yes, the operations goes out further than that, but what we are using is the first three periods. Even within there, like there is different things that come out of the energy studies, and really the main one for us is also the basing pricing. So, the things that are most important for the basing pricing are things that happened earlier in time. What's happening out in the five years is not going to be relevant to your price now in this month.

THE CHAIRPERSON: So is my statement correct then? Or not correct?

MS. MATTHEWS: A Yes, it's correct.

THE CHAIRPERSON: Okay, so then are you saying it really doesn't matter what that number is at the end of five years, because it's not really going to affect the first three years that much, is that what you're saying?

MS. MATTHEWS: A Yes, that's correct.

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THE CHAIRPERSON: But presumably it would affect it somewhat, but its effect is muted on the first three years?

MS. MATTHEWS: A Yes, my understanding, and I can take an undertaking on this, is that by -- and again, they are probably choosing average. I can find out what they are actually choosing. But by the time you've gone back a year, what you've chosen there is muted to what the operations is, or what it is showing in the three year period, yes.

THE CHAIRPERSON: Okay, so I guess what -- I don't want to speak for Mr. Miller here, but what might be helpful is if you could give us an idea of how sensitive the first three years' results are to the chosen value of the boundary condition at the end of five years?

MS. MATTHEWS: A Okay. We can do that -- I'll take an undertaking to do that. I don't necessarily want them to be doing runs to show qualitatively on it. But --

THE CHAIRPERSON: No, no, no. Understood. They should have some idea.

MS. MATTHEWS: A Yeah, they should have an idea. Okay.

MR. MILLER: Q And Ms. Matthews, while you're doing or while your team is going to complete that undertaking, could they also let us know what value was assigned to storage at the end of the model time horizon in the June 2019 energy study?

MS. MATTHEWS: A Yes, we can find that out.

MR. MILLER: Q So the next question is, is how frequently does Hydro review the assigned storage value in the energy studies model?

MS. MATTHEWS: A How often do we?

MR. MILLER: Q Review the assigned storage value.

MS. MATTHEWS: A At the boundary condition?

MR. MILLER: Q Yes.

MS. MATTHEWS: A I would have to ask my team. I would actually assume that it stays the same.

MR. MILLER: Q Okay. Could you do that as an undertaking as well?

MS. MATTHEWS: A Yeah, they can add it to that same undertaking.

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QUESTION:

What methodology is used to determine the appropriate value to assign to storage at the end of the modeled horizon? How is that number chosen? How sensitive are the first three years' results are to the chosen value of the boundary condition at the end of five years?

What value was assigned to storage at the end of the model time horizon in the June 2019 energy study?

How frequently does BC Hydro review the assigned storage value in the energy studies model?

RESPONSE:

The public version of this portion of the response has been redacted to maintain confidentiality over commercially sensitive information. The un-redacted version of this portion of the response contains information about BC Hydro's System Storage. Publication of this information would enable third-parties to model BC Hydro's system to estimate the depth of BC Hydro's energy need and to predict BC Hydro's import and export requirements. The un-redacted version of this response is being made available to the BCUC only.

The valuation of storage at each of Williston and Kinbasket Reservoirs at the end of the optimization period is a not a single value, but rather is a function of the storage. The higher the storage, the higher the reservoir energy content and therefore, the higher the value. The valuation is based on forecast market prices for that end date.

This valuation function is applied on December 31, nine months after the end of the five fiscal-year forecast period. For the Evidentiary Update, this valuation date was December 31, 2024.

The storage value is based on the energy content of the reservoir, as a function of elevation, and the range of forecast market prices on the end date. The energy content of the reservoirs are rarely adjusted as this is a physical characteristic of the system. However, the market prices are updated each month, and the associated valuation of storage is updated based on these prices.

There is no set elevation or value target at the end of the five years. By specifying the ending value as a function of storage, the optimization is not bound to a specific reservoir elevation at the end of the period.

As the ending storage value is set nine months beyond the end of the five-year forecast horizon, it has no material impact on the first three years' results. This is

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because the variation in inflow and market price forecasts overwhelm any signal that may come from the ending value of storage.

The Energy Studies forecast the system operation using an ensemble of weather scenarios. As a result, there are multiple value-of-storage functions for the end of the forecast period. However, based on the forecasted ending elevations and price forecasts from the Evidentiary Update, the average ending value of system storage is projected to be [REDACTED] on December 31, 2024.

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BC HYDRO UNDERTAKING NO. 38

HEARING DATE: February 28, 2020

REQUESTOR: AMPC, Mr. M. Keen

TRANSCRIPT REFERENCE: Volume 12, Page 2163, line 1 to Page 2165, line 6

TRANSCRIPT EXCERPT:

COMMISSIONER FUNG: So, can I just ask then, how is it that SaskPower and Hydro One are able to set targets for implementation when BC Hydro is not able to do that?

MS. DASCHUK: A I can take -- let me take that and say that the implementation for a -- as an example, connecting a cannabis load in the Fraser Valley would be much shorter than connecting a mining company that is where we would need to build infrastructure.

So, for us to provide a target date for implementation is very difficult because the nature of the implementation requests are varied so greatly that providing an average might seem misleading, either to someone who had a simple request and might see that average and say "that's too long," or someone who had a very complex request and might see the average and have an unreasonable expectation about how much time would be required.

COMMISSIONER FUNG: But isn't the whole point of setting a target to manage expectations? And wouldn't your same argument apply to SaskPower and Hydro One in

terms of the types of interconnection requests that they get, and they are able to provide you with a target for implementation?

MS. DASCHUK: A I can't speak to why those organizations provide targets. What I can say is when we establish an agreement to move forward with an implementation plan with a customer, there is an expectation of what that timing is, but that timing that we provide to each individual customer is specific to them, to their requirements, and their needs, as opposed to an average.

MR. KUMAR: A Just to clarify, if you look at the Hydro One range, it says "one to two plus years." So they are recognizing the fact that some of the interconnections would be longer than two years. So, for example, if you have to build a new substation or a new line to interconnect a customer, it is not conceivable that we can actually build that within the 18 months that SaskPower has said is the upper. I think that is the reason why we've actually not chosen to provide timelines. Our timelines are provided as part of the facility study that we share with the customer, but depending on the complexity of the upgrades, it is very difficult for us to give a range of how long it is going to take for us to implement a project, because the scope of that

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project could be anywhere from a line to a simple tap. And that can vary from a few months to a number of years to implement.

MR. KEEN: Q Mr. Kumar, can you undertake to provide the source of the information and specifically the vintage of the information that you display here from ISO and -- sorry, the ISO, SaskPower, and Hydro One?

MR. KUMAR: A Yes we can.

MR. KEEN: Q Thank you, and within that, please specify where this is an average, and where this is a range?

QUESTION:

Please provide the source and vintage of the information found in the table in BC Hydro's response to AMPC IR 2.35.6. Specify if the information is an average or a range.

RESPONSE:

The information provided in the table in BC Hydro's response to AMPC IR 2.35.6 was compiled from information published on each individual utility's website as of April 2019.

The figures for BC Hydro, Sask Power and Hydro One are the ranges of their published target durations. The figures for AESO, as noted on their website, are the median durations of "Load Projects – GreenField" based on all stages that were completed in the previous two-year period (July 1, 2016 to July 1, 2018).

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BC HYDRO UNDERTAKING NO. 40

HEARING DATE: February 28, 2020

REQUESTOR: AMPC, Mr. M. Keen

TRANSCRIPT REFERENCE: Volume 12, Page 2189, line 13 to Page 2190, line 24

TRANSCRIPT EXCERPT:

MR. KEEN: Q Will you take, subject to check, that the City of Fort St. John's connection required infrastructure upgrades?

MS. DASCHUK: A This is where I just want to pause, because there are -- I don't want to debate the news in this forum. I think that there is an appropriate process for us to deal with this specific customer request. There were infrastructure requests that were made related to how the power was going to get to these facilities, and there were at least two different options that were being considered. And that's where one of those options was more expensive, and one of those options was less expensive. But I am not sure how we would want to have that discussion in this forum. It's at your discretion how you would like us to proceed with that.

MR. KEEN: Q Well I am trying to go step-by-step, and I haven't gotten into any debate about alternative choices, or what the costs were. I just asked you to confirm, subject to check, that BC Hydro had -- part of the customer connection process involved upgrades, infrastructure upgrades. Will you take that subject to check?

MS. DASCHUK: A It did require upgrades, yes.

MR. KEEN: Q And City of Fort St. John expressed concern that those upgrades were expensive. Will you take that subject to check?

MS. DASCHUK: A Yes.

MR. KEEN: Q All right. And so in terms of the dispute resolution mechanism that we talked about earlier for customers in dealing with concerns about costs and scope, and alternatives, there was no defined process here, was there?

MS. DASCHUK: A I would be happy to take an undertaking on behalf of Ms. Mitha to discuss the dispute resolution process that relates to these types of connections. I honestly don't know the answer to that question.

QUESTION:

What is the dispute resolution process for customer connections that would be available to the City of Fort St. John with regards to the concerns they expressed in a February 25, 2020 Alaska Highway News article?

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RESPONSE:

When customers, such as the City of Fort St. John, have a dispute with BC Hydro, there are a number of resolution processes they can utilize. They can escalate resolution through local Distribution Design management. They can also contact the BC Hydro call center at 1-800-224-9376, which is the process outlined on bchydro.com. The call center would engage local Design Management as required.

Alternatively, they can file a complaint with the BCUC. The BCUC will then work with BC Hydro Customer Relations and Design Management to ensure the dispute is resolved. This process is detailed on the BCUC website.

For the dispute outlined in the Alaska Highway News article, the concerns were brought forward to local Design Management. Given that the issues with the City of Fort St. John have not been resolved, we are attempting to arrange a meeting between BC Hydro's Director of Distribution Design and Customer Connection and City officials in order to resolve the concerns.