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YUKON UTILITIES BOARD  
  
YUKON ENERGY CORPORATION 20 YEAR RESOURCE PLAN  
  
APPLICATION TO THE YUKON UTILITIES BOARD

Held at Gold Rush Inn  
  
Whitehorse, Yukon  
  
November 15th, 2006  
  
Volume 4 - P.M. Session  
  
Page 315 - 407

BEFORE BOARD MEMBERS:

- |                  |               |
|------------------|---------------|
| Wendy Shanks     | A/Chairperson |
| Brian Morris     | Member        |
| Richard Hancock  | Member        |
| Michael Phillips | Member        |

BOARD COUNSEL:

Renee Marx

BOARD STAFF:

- |              |                       |
|--------------|-----------------------|
| Pat Wickel & |                       |
| Dwayne Ward  | Technical Consultants |
| Deana Lemke  | Executive Secretary   |

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APPEARANCES:

Yukon Energy Corporation	John Landry
	David Morrison
	Cam Osler
City of Whitehorse	Wayne Tuck
Utilities Consumers' Group	Michael Buonaguro
	Roger Rondeau
Yukon Conservation Society	J.P. Pinard

TRANSCRIBER:

Doug Ayers Reporting Services

1 (Proceedings resumed at 1:15 p.m.)

2 THE CHAIR: Mr. Landry, do you have  
3 some comments.

4 MR. LANDRY: Yes, Madam Chair,  
5 I have one more undertaking to respond to, and  
6 hopefully we will have -- I think there is one  
7 other besides this one, we will have something  
8 today, later on. But it is the undertaking in  
9 relation to the question concerning Gartner Lee and  
10 Marsh Lake. Mr. Morrison is going to provide the  
11 response, and I do not have a page number yet. So,  
12 Mr. Morrison.

13 A MR. MORRISON: Thank you, Madam  
14 Chair. Just in reference to the question, the  
15 undertaking from late this morning, I had answered  
16 a question about the cost of consultation, and  
17 I had indicated that it wasn't a very significant  
18 amount of money, and I think, later on, was asked  
19 by counsel for UCG if I had a cost for the Gartner  
20 Lee, or the study work that was done on the Marsh  
21 Lake Storage Project. I would refer everyone to  
22 UCG-YEC-2-29, and in answer to that question, we  
23 indicated that the field work, which was done by  
24 Gartner Lee in reference to the Marsh Lake project,  
25 was estimated at a \$45,000. We still have not been  
26 invoiced for that work, but I will tell you that it

1 is the \$45,000 or less.

2 THE CHAIR: Thank you,  
3 Mr. Morrison.

4 A Thank you.

5 THE CHAIR: On that, Ms. Marx, are  
6 you prepared to proceed?

7 MS. MARX: Yes, I am, thank you.

8 YEC PANEL EXAMINED BY BOARD STAFF:

9 Q MS. MARX: I have a couple of  
10 areas I would like to follow up on that  
11 Mr. Buonaguro discussed with you, and then I will  
12 turn my attention to the planning criteria.

13 First, with regard to the load forecasts, you  
14 have filed some information regarding the load  
15 forecasts, and the expected continued growth in the  
16 forecast. What I would like to know -- it appears  
17 to me, that over the past number of years, or in  
18 the recent past, there has been a fair bit of  
19 growth in Whitehorse in terms of commercial growth,  
20 and, specifically, I am thinking of the facilities  
21 that have been built for the Canada Games next  
22 year. There is, I believe, an athlete's village  
23 and the recreational complex, and there might be  
24 another facility as well. There are some of the  
25 big box stores, Wal-Mart, et cetera. And I  
26 understand that these new loads will, you know,

YEC Panel  
Marx (Ex.)

1 provide some increase to your load forecast, but in  
2 terms of significant, new commercial growth like  
3 that coming on, do you expect that trend to  
4 continue?

5 A MR. MORRISON: I think, when we look  
6 at the load forecast, we expect the trend to  
7 continue for different reasons. We have gone  
8 through a period where we have seen some  
9 significant capital expenditure, which would be  
10 institutional; as you mentioned, the Canada Games  
11 facilities, those kind of things. We have also  
12 gone through a period where there was an increase  
13 in commercial development. I think if you look,  
14 you know -- if the weather wasn't quite as cold,  
15 and we all had an opportunity to get out a little  
16 more, you would see, around Whitehorse, that there  
17 is a significant number of new, and significant for  
18 Whitehorse, you know, I preface my comments, but  
19 significant number of new condominium units being  
20 built, including, I mentioned earlier, this  
21 building behind us. I think there are two, at  
22 least two others. My understanding is they are all  
23 on electric heat.

24 Q Go on.

25 A I just have a couple more points. We have also not  
26 seen any of the real impact, yet, of the growth in

1 resource development. So the current resource  
2 development growth has been in the exploration  
3 sector, and we have seen exploration spending, you  
4 know, expand quite a bit. And that certainly has  
5 added to the growth in Whitehorse. But we are  
6 about to see, at least one if not more, new mines  
7 come in, which then provides a steady base of  
8 employment and income that should add to the  
9 already existing growth in the commercial sectors  
10 here. There are a number of new buildings planned,  
11 from the commercial side of things, over the next  
12 several years as well, so there is further  
13 development still coming on stream in the area  
14 where Wal-Mart is, and a few of those new  
15 developments. So for the next several years, we  
16 see this growth continuing.

17 Q With what you just mentioned about commercial  
18 growth that you are expecting in the area where  
19 Wal-Mart is, would you expect that it would be to  
20 the same magnitude as what has been seen in the  
21 past couple of years?

22 A I am not certain that -- if you mean magnitude,  
23 I do not think that we will get very many more  
24 single developments the size of Wal-Mart. You  
25 know, the Canadian Tire development is bigger than  
26 Wal-Mart, and it is due to come on stream sometime

YEC Panel  
Marx (Ex.)

1 next year, and I would think early next year, there  
2 is another large development down there. I think  
3 what it will turn to is more smaller developments.  
4 A lot of them, again, related to the internal  
5 economy. When we have the mine, and the salaries  
6 from the mine, and the suppliers of goods and  
7 services to the mine, those types of activities  
8 will create further employment, which will create  
9 further demand in the commercial sector. So our  
10 forecast is, in the next few years, that we see  
11 that trend continuing fairly strongly. All of it  
12 will depend on whether or not the resource  
13 development sector and/or other developments come  
14 along in behind the single mine that we now have.

15 Q Okay. With respect to the residential growth that  
16 you mentioned, the new condo complex or complexes  
17 --

18 A Yes.

19 Q I would not expect -- and I think this is what you  
20 were getting at, is that that is not going to  
21 contribute a significant amount to the load  
22 growth. It is going to contribute to load growth,  
23 and it is going to, maybe partly, make up for, as a  
24 trade-off, some of the commercial growth that has  
25 been seen recently. Is that a fair assessment?

26 A No. Not quite. I think what I was trying to say

YEC Panel  
Marx (Ex.)

1 is that, on the commercial side of things, we will  
2 see more developments of a smaller size than we  
3 have in recent years, so not so much the Super  
4 Store, Wal-Mart size developments, but smaller  
5 businesses that will either be -- that are either  
6 existing and expanding, or coming in to provide  
7 goods and services, you know, in a competitive  
8 marketplace as Whitehorse grows. And Whitehorse is  
9 growing, and has substantially, over the last few  
10 years. There is no immediate indicator, from our  
11 perspective, that there is a slowdown in government  
12 spending, which is a huge part of our economy; as a  
13 matter of fact, over the last few years, government  
14 spending has increased beyond what we would even  
15 have anticipated. So the City, as it grows, as a  
16 municipality, but the primary, you know, spender at  
17 the government level, is the territorial  
18 government. All of this creates the high level of  
19 activity that we have not seen, and we anticipate  
20 will continue to see for several years.

21 Q So would I be fair to say, then, that it is the  
22 continued small commercial growth, residential  
23 growth, and that is going to, essentially, equal,  
24 continue the trend, that you have seen over the  
25 past few years?

26 A I think it is going to -- it is going to at least

YEC Panel  
Marx (Ex.)

1 equal the forecast that we have in the Plan. The  
2 difficulty I have with just saying yes to your  
3 answer, simply is that we are starting to see some  
4 really big spikes, and I think what we are looking  
5 at in the Plan is even some smaller levels of  
6 growth than what these actual spikes in the last  
7 couple of years are. And if this year is an  
8 example, given that we are going through a fairly  
9 continuing period of colder weather, our sales,  
10 again, are going to be -- they are going to be  
11 higher than we even forecast, again. And so I  
12 think when we come back to the 2.2 percent that we  
13 talked about earlier, and Patrick, you can  
14 certainly help me out on this, we are not  
15 anticipating -- you know, we are not forecasting 4  
16 and 5 percent growth. You know, we are trying to  
17 keep our forecast to a reasonable level. So it is  
18 not the spikes that we see, but we think we are  
19 going to at least maintain the 2-plus percent  
20 growth.

21 A MR. BOWMAN: I would just add that your  
22 comment was about continuation of trends seen in  
23 that Exhibit B-2, at page 24, that sets out the  
24 calculation of the growth rates that are used in  
25 the Plan. There are four different ways that it  
26 considers low to high scenarios. Both of the

YEC Panel  
Marx (Ex.)

1 higher-than-medium scenarios are based on recent  
2 experience. Both of the lower-than-medium  
3 scenarios are based on looking solely at general  
4 demographic trends, and the Plan takes something in  
5 the middle. So, if anything, the Plan is not  
6 reflecting continuation of what is seen at 1.85  
7 percent, it is below what has recently been seen,  
8 as we reviewed this morning, which has been more in  
9 the 2.2, 2.3 percentage range. So, from that  
10 perspective, it is not sort of hinging on  
11 continuation of what we have seen.

12 And I would just make the comment as well, in  
13 terms of the Plan, compared to resource plans that  
14 I have seen in other places, particularly in  
15 regards to the near-term scenarios, the types of  
16 projects that are talked about in the Plan hinge  
17 very little on the level of growth chosen. The low  
18 scenario to the high scenario do not change  
19 dramatically the type of number of megawatts of  
20 shortfalls that are needed. The shortfalls are  
21 really being driven by retirements and the change  
22 in the capacity criteria, and in the long-term  
23 scenarios, it is really being driven by large  
24 incremental changes due to mines.

25 So, in effect, although there isn't a need to  
26 look at the load forecast and the different

YEC Panel  
Marx (Ex.)

1 sensitivities to ensure -- on the one hand, to  
2 ensure that you are not over-building should the  
3 low scenario arise, and on the other hand, to make  
4 sure you are not caught offguard if the high  
5 scenario arises, it is rare to have a Plan that  
6 hinges this little on choosing the right percentage  
7 forecast.

8 Q All right. The other area I wanted to follow up on  
9 was with respect to the Acres Engineering Study,  
10 dealing with the winter capacity at the Whitehorse  
11 hydro plant, and Mr. Campbell, my question will be  
12 directed to you.

13 In the 1992 capital plan, the report, the  
14 Board's report on that, referred to a need for  
15 further study related to ice conditions, and I  
16 believe I -- what you said yesterday, and I have  
17 not had a chance to look at the transcript, but I  
18 believe you said that, at that time, YEC did not go  
19 ahead with those icing studies because they did not  
20 consider it to be a feasible option because there  
21 was excess hydro capacity at that time. Is that a  
22 fair assessment of what you said?

23 A MR. CAMPBELL: Perhaps I should  
24 clarify. There were some additional icing studies  
25 done, I think the Acres studies went on to about  
26 1995, but the results were not implemented because

1       there was little benefit and considerable risk.  
2       There was a need for some ongoing testing,  
3       modifying, the ability to prove that the modeling  
4       that Acres had been doing was accurate in terms of  
5       predicting how far you could go with changing flows  
6       and not affecting the ice.

7   Q   Okay.  So I guess that further study, beyond the  
8       Acres study, is what YEC chose not to undertake at  
9       that time?

10  A   Yes, basically the work on the icing stopped in  
11       around 1995.

12  A   MR. BOWMAN:                    If it is helpful, the report  
13       that Acres put out in 1995, which summarizes a  
14       number of reports through the previous years, is  
15       filed in response to YUB Round 2, Question 15, and  
16       it is a summary of the different work they had done  
17       leading up to 1995.

18  Q   Now, you indicated yesterday, Mr. Campbell, that  
19       YEC had just commissioned a study into the icing  
20       conditions, this further study.  When exactly was  
21       that commissioned?

22  A   MR. CAMPBELL:                   The work was scoped out  
23       and developed approximately three months ago, and  
24       the work was awarded approximately two weeks ago.  
25       We actually had a kick-off meeting with the  
26       successful proponent last week.

YEC Panel  
Marx (Ex.)

- 1 Q Now, given that your Resource Plan has been,  
2 I guess, in the works for some time, why would you  
3 not have looked at this -- or commenced this study  
4 sooner, as an option for providing additional  
5 capacity on the system?
- 6 A I think that is a good question. The response is  
7 that it is not a near-term option in terms of -- it  
8 does not have the ability to provide additional  
9 capacity next year. It is an option that does have  
10 the long-term capacity potential, and that's all it  
11 is at this point in time. But our guess is it will  
12 take several years to implement, if it is deemed to  
13 be feasible, because it will require some physical  
14 modifications to the gates at the Lewes dam control  
15 structure in the outlet of Marsh Lake, and it will  
16 take work with The City of Whitehorse, with the  
17 Water Resources group of the Yukon Government, and  
18 it may involve having to purchase some property in  
19 the Marwell area, or to providing some berming or  
20 some mitigation to some increased shoreline erosion  
21 due to icing and stuff in some of the low lying  
22 areas. So it is an option that we -- there is some  
23 potential, but I would not -- it is not a guarantee  
24 at all.
- 25 Q When did YEC first begin its work on the Resource  
26 Plan?

YEC Panel  
Marx (Ex.)

1 A The initial bit of the work was really started with  
2 the condition assessment work that B.C. Hydro, and  
3 that was really part of the first phase of the work  
4 which was -- the reports were filed in May of '04,  
5 I think the actual work was started in late 2003.

6 Q So what I am trying to understand is, I see that  
7 you are saying -- undertaking these studies, you  
8 know, you have got -- it is going to take some  
9 time, two or three years, potentially, before that  
10 could be implemented, but I am wondering why YEC  
11 would not have started looking at that back in 2004  
12 when it was starting to work on the Resource Plan?

13 A MR. MORRISON: Well, Ms. Marx, if  
14 I can help, or Madam Chair, we are not a very big  
15 organization, and we have a fair length of priority  
16 -- the job -- or the work that we have to do is  
17 pretty large in scope, and significant in scope,  
18 from my perspective. We set some priorities, they  
19 may not always be the ones that other people might  
20 set. We have a very small engineering group, tech  
21 services group, that is responsible for prepping  
22 work, for looking at the work to see which is  
23 needed, setting the priorities. I think, as  
24 Mr. Campbell mentioned earlier, you know, we just  
25 thought that this one could wait a little while.  
26 We have other priorities we thought we were putting

1 our efforts to, and that wasn't one of them at the  
2 time.

3 Q Would not it have made sense to look at this sooner  
4 if the potential is there to, perhaps, displace  
5 diesel generation, for example?

6 A Well, I think if the potential was, in fact, known,  
7 we -- you know, what the potential, or we could  
8 quantify what that potential is, and whether or not  
9 it is actually technically feasible, yes, that  
10 would have made some sense. But we don't know that  
11 yet.

12 Q Right. But if I take the Mirrlees Life Extension  
13 Project, for example, you would have had to -- you  
14 would not have known right away whether that was  
15 technically feasible either, you would have had to  
16 undertake all that study first to know whether it  
17 was technically feasible?

18 A That is correct.

19 Q So I don't know what the distinction is between  
20 that project and this project, for example.

21 A I will give you a couple of thoughts on that, and  
22 then Mr. Osler thinks that he wants to make a  
23 couple of points as well.

24 In very clear terms, the potential on the  
25 Mirrlees side is very substantial, compared to what  
26 the potential possibly could be on the icing

1 issue. So we are talking about 11 to 15 megawatts  
2 on the Mirrlees issue, and we are talking about a  
3 small number, that may be as high as two or three  
4 or four megawatts, on the icing issue.

5 Q I recognize that.

6 A Yes.

7 Q And I guess what I am getting at is, you made the  
8 comment that you didn't undertake -- that you did  
9 not look at this possibility sooner because you did  
10 not know if it was technically feasible. But  
11 I would assume that there are a number of other  
12 options that you did not know whether they were  
13 technically feasible, but you undertook sooner.

14 A I am just telling you that we set some rankings and  
15 we did not rank that one as high in terms of  
16 getting to it on a priority basis. So it has come  
17 up now, and we are going to look at it. But we  
18 don't have the luxury of taking a, you know, full  
19 shotgun approach to everything, and doing  
20 everything that we think might be feasible. I  
21 think there is also some question around energy and  
22 capacity, as well.

23 A MR. OSLER: Just to be helpful,  
24 Mr. Campbell has said that there was work done on  
25 condition assessments a certain period back. The  
26 Resource Plan, as you see it filed from B-1,

1 January, probably got started intensively in the  
2 summer of 2005. The surety that we were going to  
3 have a capacity shortfall flowed a great deal from  
4 the adoption of the capacity planning criteria  
5 change, which the Board of Directors examined and  
6 reviewed in a series of workshops, along with some  
7 of the preliminary thinking of this Resource Plan,  
8 over the fall of that year, in October and  
9 November, if I am not mistaken, and following into  
10 the final meeting in December.

11 So when we started off, there was not a  
12 capacity shortfall in front of us, and there wasn't  
13 an energy shortfall. There was a long-term issue  
14 of how to balance any possible industrial loads and  
15 some other things. And the Carmacks-Stewart  
16 project emerged that fall as a government-funded  
17 project option, which they were going to fund the  
18 first phase of. The world looks different today  
19 than it did then, is my first point.

20 Secondly, those that went through the '92  
21 experience, I would say, perhaps in a bias sense,  
22 what we learned about the issues that arose in  
23 looking carefully at the downstream flooding  
24 problems, and listening to the testimony that was  
25 given by some experts in that hearing, did not make  
26 it an option that came roaring to the top of

1 anybody's head to put your -- to put at the top of  
2 the pile.

3 Marsh Lake took a while to talk about, and we  
4 see how sustainable that idea was, given  
5 controversy around anything happening in Marsh  
6 Lake. There are serious risks, high likelihood  
7 without planning, that you would cause flooding.  
8 That is a certainty. The question is, can you  
9 build berms, can you study it more carefully, over  
10 a period of time, in order to take it on.

11 I suspect that the planning process we have  
12 gone through has led us to think more seriously  
13 about that, about one year later, about the middle  
14 of 2006 versus the middle of 2005. Ideally,  
15 I agree completely. In hindsight, if we knew all  
16 that we knew right now, I would say I would have  
17 loved to have thought of it more clearly back  
18 then. I give the process credit, the people we  
19 talk to, the people bringing up the ideas, and  
20 pursuing it. There is no great mystery about it.  
21 It is a very difficult option to pursue, it has not  
22 got a big pay-off. It has a lot of potential  
23 controversy and problems with it. But nonetheless,  
24 the Corporation has committed themselves to hiring  
25 very good people to look at it seriously and go  
26 about doing it seriously. Because if it is does

YEC Panel  
Marx (Ex.)

1 work, if it is cost-effective to spend some money  
2 on the mitigation measures, we do get -- as  
3 you just said, we get 2, 3, whatever it is,  
4 megawatts of extra winter capacity, not energy, but  
5 capacity, without using diesels.

6 Q It sounds like, from what you said, Mr. Osler, that  
7 perhaps the decision to not proceed with looking at  
8 this project sooner is due, at least either largely  
9 or in part, to the controversy -- potential  
10 controversy surrounding it.

11 A An engineer describes it as technical issues, and  
12 the technical studies needed. I am describing it  
13 as an non-engineer who took part in the '92  
14 hearing, so did Mr. Campbell. I remember it as  
15 technical issues that had some scary overtones for  
16 a corporation that is a Crown corporation, or any  
17 other type of utility, in Whitehorse. And in order  
18 to study and come forward with it as a proposal,  
19 you better have some answers to the questions that  
20 nobody had answers to back then.

21 When we went back and reviewed the 1995 study  
22 carefully, we saw some recommendations as to the  
23 type of courses of action that could be pursued,  
24 which were the studies that were carried out after  
25 the 1992 hearing.

26 Q So it had some scary possibilities to it, as you

YEC Panel  
Marx (Ex.)

1       stated, or overtones, but isn't that exactly the  
2       point of the study, to see whether you can address  
3       those factors?

4   A   I think, in the end, that is my point, is that the  
5       Corporation has come to do it. Ideally, I think  
6       there is not much sense arguing, if we had thought  
7       through it, would we have put it more front and  
8       centre in the thought process in the fall of 2005,  
9       even if we didn't get around to doing it. We  
10      probably would have, and I do not have any problem  
11      agreeing with that proposition. I know that I did  
12      not get -- if you want to be personal about it,  
13      even though I was there before, I did not get  
14      around to reviewing it and revisiting it until  
15      about the middle of 2006, in response to comments  
16      that people say, well, what about this, what about  
17      that.

18           I do not think a lot has been lost by the six  
19      to nine months difference between when we could  
20      have potentially first thought about it, and the  
21      time that we finally got on with it, in terms of  
22      reality. But I give you your point. If you think  
23      that we could have thought about it a bit sooner,  
24      and put it in the additional plan in January, I do  
25      not think it is a proposition that we can argue  
26      against you successfully on.

1 Q I think I have just have one more question on this  
2 area. Mr. Campbell, I believe the Acres  
3 Engineering study indicated that capacity, winter  
4 capacity, could potentially get to 29 megawatts  
5 under this. In your view, is there the potential  
6 for greater than 29 megawatts?

7 A MR. CAMPBELL: I think that would be  
8 extremely unlikely. Part of the issue is, there  
9 are two concerns with regard to ice management, and  
10 the first concern is when the ice is forming in the  
11 low lying areas, particularly in the Marwell area  
12 in Whitehorse. As the ice front builds in the  
13 early part of the winter -- well, I guess it is not  
14 that early in terms of the wintertime, because it  
15 occurs in December up here. As it builds past the  
16 Marwell area, it is a known area that floods every  
17 -- Wayne, maybe every second year? In fact, we  
18 have had -- we did install a water gauging station  
19 in the area in about 2000, in order to work with  
20 the City, to better understand what occurs when the  
21 ice formation is appearing in that low lying area,  
22 and that will always be somewhat of a constraint.  
23 And again, part of the purpose of the study is to  
24 identify, are there some ways to mitigate that  
25 during the ice formation period, and then the  
26 second part, of course, is to deal with how much

YEC Panel  
Marx (Ex.)

1 can we vary the flows on a daily basis once the ice  
2 has been set at that level. Past 29 megawatts ...  
3 actually no, I do not think we would be able to  
4 achieve more than that.

5 Part of the problem with daily flow variation,  
6 of course, you have to rebuild it. If you are  
7 going to draw it out at a higher rate, you have to  
8 build it back up at some part of the day or night,  
9 and there will always be a limit to how much you  
10 can scour the underside of the ice to increase the  
11 flow on a daily basis. So I think that would be --  
12 it is a pretty practical limit, in our minds.

13 Q Do you think there would be the potential for  
14 greater than 29 on a peaking basis, like just to  
15 meet -- I should say in an emergency situation, if  
16 you have -- let's say the Aishihik transmission  
17 line goes down?

18 A Yes.

19 Q Do you think there would be the potential for  
20 greater than 29 on a very short -- or over a short  
21 time period?

22 A No. In fact, it may well be the opposite, because  
23 a sudden release of water is more than likely to  
24 over-top the ice front, and you would have over-ice  
25 flooding which, in fact, we did see some of that  
26 during the upset that occurred on January the 29th,

YEC Panel  
Marx (Ex.)

1 where all of the units tripped off, so there was  
2 very low flow for a while. By the time the units  
3 had power back to open up the spillway gates, they  
4 had to open up a higher than normal amount of water  
5 in order to lower the water in Schwatka Lake. That  
6 higher flow of water, for a very short period of  
7 time, was enough to release shore ice, and caused  
8 part of the ice jam that occurred in the Robert  
9 Campbell Bridge area. So I would say no, it would  
10 be even more of a concern in a short term, because  
11 it is the short-term sudden slug of water that is  
12 most likely to cause the problem. A gradual  
13 increase is more likely.

14 Q Thank you.

15 Dr. Billinton, I will turn to you now. I do  
16 not think you need to turn up this reference,  
17 I will just mention it to you. In the YEC's  
18 overview, Section 3.3.1, they state that the LOLE  
19 function is an average, and that it doesn't  
20 indicate how long any particular outage will last,  
21 or the potential severity of the consequences for  
22 customers, and then they appear to suggest that  
23 this is the reason why the N-1 is used in parallel  
24 with the LOLE.

25 Now, the N-1 criteria, that doesn't give you  
26 any information about the duration of a potential

1 outage, correct?

2 A DR. BILLINTON: The N-1 criterion is  
3 relatively straightforward. Basically, the system  
4 should be able to withstand the loss of any single  
5 element. It is a little dangerous, then, to try  
6 and build any more into that than what is actually  
7 there. That is what it does.

8 Q Okay. With regard to the LOLE, that tells you the  
9 expected number of hours per year when the energy  
10 sources may not be adequate to supply the load. Is  
11 that fair?

12 A Yes. The loss of load expectation is the long-run  
13 average number of hours in a year when the load  
14 will exceed the available generating capacity. We  
15 should not mix the word "energy" sources in there,  
16 we should talk about "power" sources, because we  
17 are really looking at the instantaneous power that  
18 is available at that particular point in time.

19 You should also realize that, with an expected  
20 value, of course there is an underlying annual  
21 distribution of the loss of load, and there will be  
22 some years, hopefully, because the loss of load  
23 expectation is a relatively small number, there  
24 would be a large number of years in which there  
25 will be no situation such as that. The  
26 distribution is actually hyperexponential. There

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1 is also the possibility that there will be some  
2 years when the loss of load is much greater than  
3 the average value. But that's where it is; it is a  
4 duration index. You cannot ascribe properties to  
5 this indices or to the N-1 that they do not have.  
6 That is just wishful thinking. What it is, is  
7 simply a measure of the expected number of hours in  
8 the year when the load will exceed the available  
9 generating capacity.

10 Q So it doesn't really tell you how long you can  
11 expect any particular outage to last?

12 A No, it doesn't contain a frequency component, it  
13 doesn't contain an average duration component, it  
14 is the expected value of what could be a group of  
15 incidents.

16 Q Now, the loss of, what is it, expected energy, the  
17 LOEE, does that tell you more, in terms of the  
18 duration of a potential outage?

19 A No, it doesn't tell you anything about the  
20 duration. It tells you a blended composite of  
21 frequency duration and impact into an index that  
22 translates into the expected energy not supplied.  
23 And you cannot -- and again, you cannot give it  
24 properties it doesn't have either. That is  
25 basically what it does.

26 Q Okay. Now, on the first day, you indicated that,

1 in your view, the LOLE and LOEE are both good  
2 indices?

3 A They are certainly both good indices, right.

4 Q But you have recommended the LOLE because it is  
5 used more widely?

6 A It is certainly used more widely. If I could just  
7 take you to that table in the report, which is  
8 YUB-1-1, where our report is filed. If you look at  
9 page 7 of our report -- sorry, page 7 of 60 in that  
10 report, and I think it is worthwhile just taking a  
11 moment and looking at that report, because it  
12 alludes to, or it indicates, the jurisdictions that  
13 do use the LOLE. It also talks about their  
14 criterion, and it may provide us, I think, with the  
15 opportunity to dispel some myths with respect to  
16 what some of these indices really are. If you have  
17 that in front of you, if you look -- Madam Chair,  
18 is that okay?

19 THE CHAIR: The reference is  
20 YUB-1-1?

21 A Yes.

22 THE CHAIR: Thank you.

23 A If you look at that table, the first one you see is  
24 British Columbia Hydro and Power Authority use the  
25 loss of load expectation. And you note that they  
26 talk about one day in ten years. Now, that doesn't

1 seem to link to any of the indices that we have  
2 talked about. But they use a load model which  
3 represents the day by its peak value, so that is  
4 how they start out. Then they calculate the loss  
5 of load expectation in exactly the same way we have  
6 done, and they come out with an index of .1 days  
7 per year.

8 Now, for communication purposes, they decided  
9 that it is not so good, perhaps, talking about  
10 fractional days, so they take the reciprocal of  
11 that and they make it one day in ten years, and  
12 that is the index that you very often here tossed  
13 out in various jurisdictions, one day in ten  
14 years.

15 Now, that is an entire misnomer because that  
16 has a frequency connotation to it that says this is  
17 going to happen once in ten years, and that is not  
18 true. So that index is exactly the same kind of  
19 index that we are talking about, but expressed in a  
20 different way.

21 You look at the next index, Alberta  
22 Interconnected System ... now, prior to them doing  
23 a study, which I am sure your consultants on the  
24 Board know far more about than I do, but I did  
25 happen to participate in it, they used an index  
26 of .2 days per year, which says, when you compare

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1 it with the B.C. one, they were prepared to accept  
2 a lower reliability because they are prepared to  
3 accept a higher risk as their criterion, so .2 days  
4 per year. So right off the bat, you can see that  
5 those two utilities use the same methodology,  
6 essentially, that we are talking about, but do have  
7 slightly different indices because their management  
8 have perceived that those are acceptable indices  
9 for their particular system.

10 Now, we look at the next one, Saskatchewan  
11 Power Corporation, and, at first glance, you might  
12 have considerable difficulty relating to that.  
13 That is expected unserved energy, and that comes to  
14 the point, I think, that you are referring to, with  
15 respect to the expected energy not supplied. And  
16 here they use 200 upm. What is a upm? It is a  
17 unit per million.

18 See, the difficulty with the energy index is  
19 that, as your system grows, the amount of expected  
20 unserved energy will increase, only because your  
21 system is growing. So, therefore, you have to find  
22 some way of normalizing that so that you can have  
23 an index which can be used over time as your system  
24 changes size. So therefore, Saskatchewan Power  
25 Corporation decided to normalize the unserved  
26 energy by dividing it by the total amount of energy

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1 that the system requires in the year. So I note  
2 here, you divide megawatt hours by megawatt hours,  
3 and you have a dimensionless number.

4 Now, in their particular case, that number  
5 turned out to be .0002, and nobody wants to talk  
6 about that many zeros. You cannot have a  
7 discussion with anybody about what is the  
8 difference between three zeros 2, three zeros 199.  
9 So what they decided to do is multiply by a  
10 million, which then makes it into 200 units per  
11 million, only to get rid of all of those zeros. So  
12 you see, that was a normalizing effect that they  
13 have to do with the expected energy index in order  
14 to arrive with a number that is discussable.

15 Manitoba Hydro used .1 days per year. If we  
16 go to the next one, Ontario Hydro, you will see  
17 that they use expected unserved energy, but they  
18 decided that they are going to normalize it in a  
19 somewhat different way, so they divided the  
20 expected not supplied, whose units are megawatt  
21 hours per year, by the system peak. Now, loosely,  
22 now, you can divided megawatt hours by megawatts,  
23 and you will get hours. If I multiply it by 60, I  
24 will get minutes, so I will call that system  
25 minutes. So their criterion was 25 system  
26 minutes. Again, it is an attempt to normalize it

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1 so that they could use it on a continuous basis as  
2 their system changed size, and also, hopefully, you  
3 might compare it with somebody else, but  
4 unfortunately, nobody else does that so, therefore,  
5 it makes it very difficult to compare. And you  
6 will see that the remaining utilities in there use  
7 the loss of load expectation.

8 So the loss of load expectation is an index,  
9 which, when you see it, I think it is more  
10 understandable and observable than system minutes  
11 and upm. Those minutes, by the way, system  
12 minutes, are not real minutes, they are actually  
13 the minutes at the time of system peak which, if  
14 the system had an outage, would result in the same  
15 expected energy loss as the calculated value  
16 through a probabilistic analysis. I don't want to  
17 belabour this, but if you really want to explain  
18 that to somebody, you are going to probably have to  
19 do it several times to get your point across.

20 So it is an index which, from my point of  
21 view, is a good index, but which is not the kind of  
22 index that you might want to put before a Board, or  
23 before the public, or before the government, with  
24 respect to understanding. And the loss of load  
25 expectation index is a very useful and a very  
26 straightforward one.

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1           I just took the liberty, too, I would just  
2     like to quote to you what -- if I can find it -- I  
3     am not as organized as some people in our group  
4     here. I took the liberty of just copying down just  
5     what the index is, used by one of the largest power  
6     groups in North America, and that is the  
7     Pennsylvania-New Jersey-Maryland interconnection,  
8     which is part of the NERC grid, and I will just  
9     read you the first portion of their criteria:

10           "Sufficient megawatt generating capacity  
11           should be installed to ensure that, in  
12           each year, for the MAC system (and I will  
13           indicate that in a minute), the  
14           probability of occurrence of load  
15           exceeding the available generating  
16           capacity shall not be greater, on the  
17           average, than one day in ten years."

18     They are using the loss of load expectation  
19     approach, and that is pretty well prevalent right  
20     through the United States couple through the NERC  
21     grid system. BGM have about 75,000 megawatts of  
22     capacity.

23           I just wanted to show you the other end of the  
24     spectrum from the system that we are dealing with.  
25     We are talking about a very large system which uses  
26     the loss of load expectation technique.

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1           So I think, and I tried to make this point  
2           yesterday in response to Mr. Landry, I think the  
3           loss of load expectation technique is a sufficient  
4           technique. It does what is needed to be done with  
5           respect to providing a valid indication of  
6           generating capacity adequacy on an overall  
7           particular sense, and that really is, I think, my  
8           answer to your question.

9   Q   I think that might go down as the longest answer  
10       I have ever had to one of my questions, but it was  
11       helpful.

12           Just to follow up a couple of points ... so  
13       I can certainly see how the loss of load  
14       expectation is easier to explain and communicate to  
15       the general public, et cetera. From your strictly  
16       engineering point of view, setting aside the ease  
17       of understanding by the general public, which do  
18       you think is a better indice? Like, which tells  
19       you more, which is more helpful, the loss of load  
20       expectation, or the LOEE?

21   A   Well, I think, in a general sense, and we have done  
22       studies in the past to look at capacity expansion,  
23       and, striking a base value in each particular case,  
24       you would finish up pretty much with the same  
25       sequence of capacity additions. Because what  
26       happens when you do capacity planning,

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1 notwithstanding the range of things that have been  
2 looked at here, but just, let's say, more  
3 conventional capacity planning, the index would  
4 provide a trigger for the need to inject some  
5 capacity in there for some money into the system,  
6 and in either case, I think they would, starting  
7 from an equivalent point, they would inject the  
8 same signals into the system. So from that  
9 particular point of view, there is nothing to  
10 choose between them, in that particular case.

11 Now, if you want to do -- if you wanted to  
12 know the expected energy not supplied, if you are  
13 asking me, will I get that from the loss of load  
14 expectation, the answer is no. If I want to do  
15 something different, then obviously that is what  
16 I need to do.

17 Q So from that perspective, is there some benefit to  
18 having the LOEE criteria, over the LOLE, because it  
19 can tell you that information?

20 A If there is some direction that you wish to pursue,  
21 in which the expected energy not supplied, and the  
22 annual energy not supplied, and the distribution  
23 that is associated with it, serves some particular  
24 purpose.

25 Q And do you think there is some value to having that  
26 information?

1 A Well, studies have been done, right. I think  
2 I know where you are leading. Studies have been  
3 done to look at the -- to look at the cost of  
4 unserved energy, from a customer perspective, and  
5 to incorporate that in the evaluation. And if that  
6 is a direction that you wish to go in, then you  
7 obviously cannot get there with the loss of load  
8 expectation.

9 But if you wish to do basic and conventional  
10 generating capacity planning, by the way, as all  
11 those utilities have indicated they do, including  
12 the designation of load serving entities, and the  
13 allocation of capacity responsibilities to  
14 organizations within a big region, then the loss of  
15 load expectation is being used in those particular  
16 purposes.

17 So, again, it is like you asking me, if I want  
18 to take a screw out, is a hammer any good? No, it  
19 is all right for putting a screw in, it is not  
20 recommended, but it is not a very good way for  
21 taking one out. A screwdriver is a lot better. So  
22 you have got to decide what you want to do, and  
23 then proceed, if that is the case, use the right  
24 tool.

25 Q It seems that the sense I get is that, okay, all  
26 these other jurisdictions use the loss of load

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1 expectation, so why do we not do it, too?

2 A Well, you would have to tell me why not, if it is  
3 what I want to do. If I want to determine, is my  
4 generating capacity adequate, and this is a valid  
5 measure, and in my opinion it is a valid measure of  
6 adequacy of capacity, I think it is just a certain  
7 amount of reassurance that, by golly, all these  
8 other people use it, and are happy with it, and  
9 make decisions based upon it. So, again, it is a  
10 question of what you want to do. And my perception  
11 is, from the task that we were assigned in respect  
12 to looking at the probabilistic applications, this  
13 is what the Corporation wishes to do, and this will  
14 certainly, in my opinion, do just that.

15 Q So, if I understand it correctly, they are both  
16 good indices, they will both help you plan the  
17 system adequately; the benefit to choosing the LOLE  
18 is that it is simpler, it is used widely, it  
19 doesn't necessarily tell you as much information,  
20 but it is a simpler indice that does the job?

21 A It does the job, and it is also possible, I  
22 believe, to benchmark it against the index, the  
23 same index, methodologically, that other utilities  
24 use and, therefore, determine whether you are in  
25 the same ballpark.

26 There is also one other reason, which maybe

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1 you don't perceive to be a good reason, but it was  
2 accepted right next door in the neighbouring  
3 territory as the approach, and, therefore, it does  
4 provide some measure of comparison also, then, with  
5 the degree of generation adequacy that has been  
6 incorporated in planning in the Northwest  
7 Territories. I just put that in as the last  
8 comment because that should not be a driver in  
9 itself, but it is certainly a very important  
10 factor, and it is a fact. And it was discussed,  
11 and some of the discussion there was similar to  
12 what we are having now, before this Board, before  
13 that Board, because I participated in that  
14 discussion, too.

15 Q I was actually going to ask you about the Northwest  
16 Territories, and your involvement there. In that  
17 proceeding, did you look at both the LOLE and  
18 LOEE?

19 A In early studies, we did, we did talk about it.

20 Q And what was your -- was your recommendation for  
21 adoption of the LOLE?

22 A If I recollect, now, our first studies were done  
23 way back. I think we really, initially, only  
24 looked at LOLE in order to open the door for  
25 discussion of probabilistic methodologies, because  
26 they were wedded totally to the deterministic

1 approach. And then we did discuss it. I think  
2 there wasn't any tremendous interest in applying  
3 it, the LOEE technique, in that particular case.

4 Q Okay.

5 THE CHAIR: Ms. Marx, I note that  
6 we are coming up to the time we said we would  
7 break. Would this be an appropriate time in your  
8 line of questioning?

9 MS. MARX: Yes, I think that is  
10 fine.

11 THE CHAIR: Okay. We will take a  
12 15-minute break and reconvene about 25 after. Is  
13 that 15 minutes? Everybody tells me everybody's  
14 watch is a bit different here. 20 after?

15 (Proceedings adjourned at 2:10 p.m.)

16 (Proceedings resumed at 2:30 p.m.)

17 THE CHAIR: Ms. Marx, are you  
18 prepared to proceed?

19 MS. MARX: Yes, thank you.

20 Q MS. MARX: Dr. Billinton, I am  
21 going to do my best to still get us out of here at  
22 four o'clock, and finish all of my questions for  
23 you. It may require me to do a little jumping  
24 around in my questions, it may seem a little  
25 disjointed at times, but I would like to try to  
26 finish off all the questions I have for you. There

1 will be a few for YEC mixed in, in the mix here.

2 A DR. BILLINTON: Thank you.

3 Q We will see what we can do.

4 I would like to talk about the, just  
5 generally, I guess I could put it the benefits,  
6 perhaps, of the probabilistic versus deterministic  
7 criteria.

8 Now, with the LOLE looking at every hour of  
9 the year, so essentially all peak loads, that makes  
10 the criteria sensitive to the shape of the load.

11 Is that fair?

12 A That is fair.

13 Q And the deterministic criteria would be oblivious  
14 to that?

15 A Well, it would be oblivious to what you choose not  
16 to look at from a deterministic point of view. In  
17 general, then, it is -- the deterministic criterion  
18 is usually related to the peak load.

19 Q Right, and so it is just the annual peak that it is  
20 looking at?

21 A Annual peak. But it could be monthly peaks, but  
22 you are right, not being argumentative, it is  
23 basically applied to a particular load level.

24 Q Right. And I think it is fair to say that the move  
25 to a probabilistic criteria is a positive step  
26 forward for YEC. Would you --

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1 A Perhaps this might be a good time just to comment  
2 on the original deterministic criterion. That  
3 criterion incorporated a couple of factors, and  
4 that was the largest unit, and then it added a  
5 component of diesel capacity. And that criterion,  
6 I guess, was perceived to be acceptable and  
7 adequate at the time at which it was created. But  
8 it is not responsive to changes in the system, in  
9 the system parameters, it is inflexible, and  
10 therefore, it does not respond to the actual  
11 factors that influence their reliability, such as  
12 the hydro units in general happen to be more  
13 reliable than diesel units -- or, let's not pick on  
14 diesel ... on fossil units, or on nuclear units.  
15 That deterministic criterion does not respond to  
16 those kind of conditions. And going back to your  
17 earlier point, it doesn't respond to the shape of  
18 the load.

19 If you had an annual load factor of 90  
20 percent, or an annual load factor of 60 percent,  
21 which means, of course, the load is a lot peakier  
22 and drops off, then the deterministic criterion  
23 would not see that at all. So, therefore,  
24 deterministic criteria, in general, are not  
25 responsive to the actual factors that influence  
26 their reliability.

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1           So to go back to your question, yes, the  
2           probabilistic approach incorporates all of those,  
3           or can incorporate all of those and, therefore,  
4           gives you a more responsive index and, therefore, a  
5           better measure of opportunities that you are  
6           proposing in connection with expansion plans are  
7           properly evaluated.

8   Q   And I think you said this, but just to confirm in,  
9           sort of, my simple language, the LOLE is sensitive  
10          to each generator's failure rate, their unique  
11          failure rate?

12   A   The LOLE -- not the failure rate, the  
13          unavailability. The failure rate is the frequency  
14          of unit failure. The loss of load expectation  
15          utilizes the unavailability of the unit, which is  
16          the probability of finding that unit on outage at  
17          some particular time in the future. So it is not  
18          the failure rate, it is not the duration of outage  
19          of a generator, it is actually the two put  
20          together, which gives you the probability of that  
21          unit being unavailable. That is what it is  
22          responsive to, and the size of the unit. The size  
23          of the unit, and its unavailability, it responds to  
24          that.

25   Q   Sorry, can I get you to run over that again. The  
26          LOLE would give you the probability of outage of a

1 generator?

2 A No, this is input.

3 Q Okay.

4 A We are talking about input LOLE.

5 Q Okay, okay. So, essentially, the probabilistic  
6 criteria tells you more than the deterministic. It  
7 responds to a greater number of factors?

8 A The deterministic is a go/no-go.

9 Q Right.

10 A It says if I do not meet that, then -- it is not a  
11 measure of risk, it is not a measure of how often,  
12 or the likelihood. It is simply a bar that simply  
13 indicates above is acceptable, and below is  
14 unacceptable, or vice versa.

15 Q Okay. And if you have the probabilistic criteria  
16 in place, in your view, just briefly, what is the  
17 justification for having a deterministic criteria  
18 as well?

19 A Well, the justification for the deterministic  
20 criteria is with respect to particular incidents,  
21 and the severity of those incidents as recognized  
22 by the particular system you are dealing with, and  
23 the topology of that system. And I presume, of  
24 course, you are leading towards why would we want  
25 to have a probabilistic index and a deterministic  
26 index as a dual criteria in the case of the

1 Corporation. Is that the direction?

2 Q Sure.

3 A Yes. So when you look at the probabilistic  
4 approach, you get the overall assessment, you get  
5 the overall assessment of the adequacy of the  
6 system, in terms of its ability to meet the total  
7 system load, but generating capacity adequacy  
8 assessment deals with the ability of the total  
9 generating capacity to meet the load requirement,  
10 and it is not focused on any one particular portion  
11 of the system.

12 Now, when you look at most systems, the  
13 generating capacity adequacy does not, in itself,  
14 normally incorporate transmission facilities,  
15 because the transmission is usually redundant.  
16 I don't know of very many systems, perhaps other  
17 than next door, in which you finish up with a large  
18 amount of your capacity on the end of one  
19 transmission line, a single transmission line.  
20 Therefore, that system is particularly vulnerable  
21 to the outage of that particular facility. And it  
22 becomes obvious, when we started to do our  
23 probabilistic assessment, that the indices were  
24 very much affected by the transmission line between  
25 Aishihik and Whitehorse.

26 So when you look at that, and you see the

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1 vulnerability that is associated with it, and you  
2 think of the criteria that are very often used in  
3 conventional planning, even in those utilities  
4 which use adequacy assessment using probabilistic  
5 approaches, and that is the N-1 criterion, which is  
6 embedded within the NERC, the North American  
7 Electric Reliability Council, criteria with respect  
8 to system planning, then you see that the N-1  
9 criterion is an important criterion, and  
10 particularly important in this particular case,  
11 because the loss of that line has immediate and  
12 drastic consequences upon the continuity of supply  
13 at Whitehorse.

14 So, therefore, there is a need for, I think in  
15 that particular case, to recognize that  
16 vulnerability, and I think it was driven home, as  
17 I said yesterday, very dramatically on January 29th  
18 last year, and that was the loss of that line. So  
19 the N-1 criterion is immediate, it is a  
20 non-probabilistic index. It says the system should  
21 be able to withstand the loss of any single  
22 element, whether that element is a generator, a  
23 transmission line or a transformer. In fact, those  
24 are the conditions that are outlined in the NERC  
25 standard under Condition B, the three conditions  
26 that should be satisfied.

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- 1           So there is precedence again for that. And I  
2 think, in this particular case, because of the  
3 topology of the system, because of the topology of  
4 the system, then it has an immediate and a drastic  
5 effect with respect to the adequacy at the  
6 Whitehorse bus, which is the largest component, the  
7 largest load component, in this particular system.
- 8 Q And given what you have said about the Aishihik  
9 line being the most vulnerable component,  
10 essentially, of the system, would it not make  
11 sense, under the N-1 criteria, to focus on that, on  
12 finding a solution there, instead of -- what I am  
13 getting at is, instead of increasing capacity in  
14 other -- at other places on the system, would it  
15 not make sense to then focus on remedying that weak  
16 link in the system, for example, by twinning the  
17 Aishihik line?
- 18 A Now we are moving away from the justification, from  
19 an N-1, for a dual criterion, and decisions that  
20 might be made on the basis of having a dual  
21 criterion.
- 22 Q Yes.
- 23 A My task, by the way, was not to look at system  
24 planning for YEC. My task was to look at --  
25 initially, it was to do a probabilistic assessment,  
26 and provide the recognition of what are the

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1     pertinent factors, and then we held a workshop up  
2     here, at which time we discussed all of these  
3     things, compared it with what was happening in  
4     Northwest Territories, and then proceeded to  
5     determine the criterion.

6             Now, having gotten the criterion, now we come  
7     to -- you are asking me now, what would I do under  
8     those conditions, then, to plan the system. And  
9     you are right. If you were to put another line in,  
10    coming in from Aishihik into Takhini, now I apply  
11    the N-1 criterion, what would be my immediate  
12    effect? Now, you see the condition is different,  
13    right? I am not losing 30 megawatts, I am  
14    potentially losing 30 megawatts at Aishihik,  
15    I would be in a quite different situation. So you  
16    are right, it will have an effect. But once you  
17    have established the criteria, then, I believe, you  
18    are free to look at the alternatives, and the  
19    alternatives have been, not a host, but a group of  
20    alternatives have been put before the Board today  
21    as potential actions that are going to take place,  
22    could take place, in this particular system, and  
23    the criterion would then determine whether they  
24    meet certain requirements, and whether they are  
25    adequate in terms of moving forward.

26 Q Am I correct to say that you did not recommend, on

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1 your own, the N-1 criteria, but, to put it simply,  
2 perhaps you did not see a big problem with YEC  
3 adopting that, or you thought that was acceptable?  
4 A I do not think it was -- I would like to think it  
5 was nice and clear-cut as that. But what we had  
6 was a really good workshop here, in July I guess,  
7 of last year. We came with our report, we made our  
8 presentation with our report, with respect to  
9 benchmarking the loss of load expectation index.  
10 We then discussed the Northwest Territories  
11 situation, we discussed the similarity and impact  
12 of a line failure on Yellowknife and a line failure  
13 upon Whitehorse, and I guess, through discussion,  
14 we gravitated to the fact that the existing  
15 deterministic criteria could not be modified and  
16 extended to meet the requirements. A probabilistic  
17 requirement was required, but, because of the  
18 vulnerability of Whitehorse, that the N-1 criterion  
19 was a good criterion that should be added to form a  
20 dual situation.

21 I do not think -- I think you would be quite  
22 wrong to say that I suggested it, or I went along  
23 with it. We just had a really good discussion, and  
24 I think sort of arrived at that particular position  
25 on a collective basis.

26 Q And in the Northwest Territories, that we discussed

1 earlier, they have the LOLE and N-1, correct?

2 A That is right, correct.

3 Q And in that case, did you recommend the use of N-1

4 criteria?

5 A I think that came out of a series, as I said, we --

6 the situation there was somewhat peculiar in that

7 they decided, and I do not know the right

8 regulatory terms, perhaps our counsel can correct

9 me, but I think we had some conciliation meetings

10 between the intervenors, in an attempt to forestall

11 some difficulties that arose before we ever got to

12 the hearing. I am not sure just what the

13 appropriate term is for those, and -- but we

14 couldn't. We couldn't arrive at -- the intervenors

15 decided they did not like certain things, and they

16 were not about to back down on those particular

17 conditions. So then we finished up with many

18 discussions, which led us to a position that the

19 Corporation, that is the Northwest Territories

20 Power Corporation, accepted, and those are the ones

21 I put forward. And I think it is difficult to say

22 that, yes, this was a recommendation. It was,

23 again, a joint decision, and a joint discussion,

24 with the utility and with myself, over, I might

25 add, about an eight-year period. But we did arrive

26 at that conclusion at the end.

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1 Q Sorry, I am just trying to find a reference here.

2 In YEC's Resource Plan, on page 4-9, there is  
3 a chart there that is entitled "WAF Base Case  
4 Capacity Requirements". And I am not sure you need  
5 to turn it up, Dr. Billinton, but what it shows is,  
6 over the period of the 20-Year Resource Plan, and  
7 also beyond, but if I focus on the period over the  
8 20-Year Resource Plan, the N-1 requirement is  
9 consistently higher than the LOLE requirement.

10 Now, I assume that would be the case as long  
11 as we assume that, under the N-1 criteria, the  
12 worst-case scenario is the Aishihik transmission  
13 line going down. If we assume that, I think it is  
14 always going to -- it is going to stay that the N-1  
15 requirement is higher than the LOLE.

16 So my question to you is, given that, what  
17 would be the justification to -- if we went with  
18 the N-1 criteria, what would be the point of having  
19 the LOLE criteria, then?

20 A I just conferred with Mr. Bowman with respect to  
21 what YEC's intent was in that particular graph, and  
22 I think it is better that he explain the intent  
23 behind that graph.

24 But when you look at the two criteria, and  
25 let's just go back on a more philosophical  
26 approach, the location of the capacity would have a

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1 considerable impact with respect to what would be  
2 the drivers with respect to the largest  
3 contingency. And when you start looking at having  
4 capacity at the Whitehorse bus, then, of course,  
5 this is going to change the demographics quite  
6 considerably with respect to where the impact of an  
7 N-1 outage would be. And it would not be true, I  
8 do not think, when you start thinking of the  
9 location of the capacity injections, that the N-1  
10 would always be, would always be -- let's say,  
11 override the loss of load expectation.

12 So I think in this particular case, perhaps,  
13 with the plans and the things that have been put  
14 forward, perhaps it fits that particular mold, but  
15 I don't believe it is correct to say that that  
16 would always be the case, because the location of  
17 the capacity with respect to the existing topology  
18 of the network will have a big impact upon whether  
19 that particular event is the most serious.

20 Q But if that is the most serious event over the  
21 period covered by the Resource Plan, essentially,  
22 does it make the LOLE redundant over that period?

23 A No, no. Because the LOLE gives you a measure, a  
24 probabilistic measure, of the expected number of  
25 hours in a year that you are going to be in  
26 difficulty, keeping in mind that deterministic

1 criterion does not provide you with any -- as  
2 I said before, it is a harsh measure. There is no  
3 soft edge to the deterministic criterion, it either  
4 meets it, or it doesn't meet it. It doesn't give  
5 you any indication of the risk level, the  
6 probabilistic indicator with respect to the  
7 likelihood, or that particular portion of it, and,  
8 therefore, it provides just a go/no-go situation.

9 Q But essentially -- if I can just ask one more  
10 question of Dr. Billinton, and then you can provide  
11 your explanation, Mr. Bowman.

12 A MR. BOWMAN: Why, yes.

13 Q And I have lost my train of thought now.

14 A DR. BILLINTON: I thought that only  
15 happened to me, by the way.

16 Q Maybe it is contagious.

17 If you have the N-1, in this scenario, always  
18 having a higher requirement for capacity than the  
19 LOLE would, essentially, would you even need to  
20 undertake the LOLE calculations? Like, once you  
21 have adopted the N-1 under this scenario, and the  
22 Aishihik line being the worst case scenario --

23 A But you are saying you know the answer before you  
24 look at the problem.

25 Q I think once -- if you have this chart that shows  
26 that the N-1 is always going to be greater, I think

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1 you would not need to keep doing the calculations  
2 every year for the next 20 years.  
3 A Well, you have to think about system planning in a  
4 somewhat different way. Here, the Corporation has  
5 laid out a bunch of alternatives. Normally, you do  
6 system planning, and looking at a ten-year plan on  
7 an annual basis and, therefore, you look forward  
8 into the future, not necessarily with the objective  
9 of accomplishing everything that is in that  
10 particular plan, but with the objective of making  
11 the next decision, the correct next decision.

12 So, therefore, there is not that much  
13 certainty, with respect to looking way off into the  
14 future, that you are going to accomplish everything  
15 that you have put in your plan, because there is a  
16 considerable uncertainty associated with the  
17 future.

18 So as you march off, you make the next  
19 decision, and then you update your plan, and then  
20 you proceed to look at what you have already done,  
21 which has now become a fact, and then you proceed  
22 to look off in the future from that particular  
23 point. And there, the dual criteria, I think,  
24 would stand you in good stead because you could not  
25 say the N-1 will always prevail. You are drawing a  
26 conclusion, I think, from that particular diagram,

1 not necessarily from the idea of having two  
2 criteria, which would lead you to making the next  
3 correct decision.

4 Q Mr. Bowman, was there something you wanted to add  
5 with respect to that table?

6 A MR. BOWMAN: I just wanted to help,  
7 what may be -- and may not be -- but may be a  
8 misunderstanding in the premise for the question.  
9 The graph you have turned to is the simple WAF base  
10 case forecast, and that is at page 4-9. And it  
11 would show that in a base case forecast, where you  
12 have no industrial loads, the N-1 would, indeed, be  
13 the driving factor throughout the period of the  
14 Plan. There is one key difference, though, between  
15 the LOLE and the N-1 as proposed, as reviewed by  
16 Yukon Energy, and as ultimately adopted, which is  
17 the LOLE criteria reflects an overall balance on  
18 the system to ensure reliable power can be provided  
19 throughout the year.

20 The N-1 is an emergency or back-up criteria  
21 related to those loads that do not have their own  
22 back-up. The practical difference is that, when  
23 you are calculating the LOLE, you include the load  
24 of industrial customers. When you are calculating  
25 the N-1, you do not include the load of industrial  
26 customers.

1           So if you look at that same graph, the same  
2 model, but four pages further in the document at  
3 page 4-12, it will show the same graph but with  
4 those lines in the case where we have added Minto  
5 and Carmacks Copper mine, and you will see that, in  
6 that situation, within the 20-Year Resource  
7 Planning period (sorry, this is page 4-12), within  
8 the Resource Planning period, the LOLE becomes the  
9 dominant criteria driving the system during the  
10 life of that mine. So it is a relevant criteria  
11 for the period of the 20-Year Resource Plan.

12           And the other relevant consideration is that  
13 two criteria, together, are intended to be robust  
14 and not have to be redesigned should the system  
15 topology change. The concept of an N-1 criteria  
16 relating to those loads who do not have their own  
17 backup, and an LOLE relating to the entire system  
18 loads, is intended to be durable whether we build a  
19 second line or not, or whether other  
20 interconnections occur.

21           And to the extent that people would want to  
22 turn to it, the graphs start to get a little bit  
23 more complicated, but at page 4-36, the situation  
24 with an Aishihik second transmission line is  
25 shown. And in that case, you can still apply the  
26 same two criteria. You can still apply them during

1 the planning period, and they are relevant to the  
2 overall plan, and they would show the N-1 criteria  
3 dropping quite dramatically because you are no  
4 longer exposed to the 30 megawatt risk. The LOLE  
5 criteria drops somewhat for the same reason, but  
6 not nearly as much as the N-1. So, in fact, the  
7 LOLE is slightly above the N-1 criteria there, and  
8 that is before any mines are added. Were there to  
9 be a second line and mines, the LOLE would be quite  
10 a dominant driving characteristic. So the idea of  
11 proposing two during the 20-year period was that  
12 they would be robust and they would be able to deal  
13 with these different contingencies.

14 Q All right. I may come back to that later, or  
15 tomorrow, but for now I will continue with some  
16 questions for Dr. Billinton.

17 Could you turn to Figure 2.4 in your report,  
18 Dr. Billinton. I have it in the attachment to  
19 YUB-YEC-1-1, page 15 of 60.

20 A DR. BILLINTON: Right.

21 Q And this figure is entitled "Summer and Winter Load  
22 Models for the WAF System".

23 From what I understand, these are normalized  
24 load duration curves derived from actual historical  
25 load records; is that correct?

26 A That is correct.

1 Q And the 1.0 on the Y axis represents the peak in  
2 summer and winter; is that correct?

3 A That is per unit of the peak value, yes.

4 Q And as I move to the right on this table, which  
5 represents time, I see that both curves fall, quite  
6 quickly, to about less than .9, around .9 percent  
7 of the peak.

8 A Right.

9 Q Now, am I correct to assume from that, that the  
10 load is at or above .9 of the peak only for a very  
11 short period of time?

12 A That is true. In most systems, that is the case.

13 Q All right. Sorry, I am just trying to juggle my  
14 questions here.

15 Now, if I could get you to turn to Table 3.5  
16 of the Resource Plan, and this is at page 3-24.  
17 And if we look at the N-1 criteria, the columns on  
18 the right side of that table, in the column "Peak  
19 Excluding Haines Junction", if we look there, given  
20 that the load -- the load is only at or above .9 of  
21 the peak for a very short time -- sorry, just a  
22 moment.

23 So, under the N-1, would it be appropriate to  
24 be looking only at the peak, or at a broader  
25 section, like times other than the peak, given that  
26 the peak only occurs for that very short time?

1 A Now I think you are talking about kind of a  
2 modified N-1 criterion, in which you are going to  
3 mix the probabilistic likelihood of the load  
4 exceeding a particular situation. And the N-1  
5 criterion, as it is applied, is applied to the peak  
6 load level. So you can certainly do just what you  
7 have suggested, but what you are doing now is  
8 modifying the standard deterministic criterion.

9 The criterion, as is stated, by the way, as  
10 used in NERC, is that the interconnected  
11 transmission system is planned such that the  
12 network can be operated to supply projected  
13 customer demands and projected firm transmission  
14 services at all demand levels over the range of  
15 forecasted system demands. So it does not include  
16 a probabilistic interpretation of what the load  
17 would be and how long that load would exist. So  
18 you certainly can do what you are suggesting. You  
19 can certainly look at the number of hours at which  
20 that would result, but that would not be the N-1  
21 criterion.

22 Q So in my simplified terms, the N-1 is, I guess, a  
23 simple criteria, looks at the peak, looks at the  
24 worst-case outage that would happen on the system,  
25 it is quite simple from that perspective, but I  
26 think it is also probably quite pessimistic. The

1 likelihood of that happening is probably quite  
2 slim. Is that fair?

3 A Right. As I said earlier, the deterministic  
4 criterion is a hard criterion. It does not have  
5 any edge to it with respect to the likelihood of  
6 the event occurring. It simply says this condition  
7 -- can the system withstand this particular  
8 condition at the time of system peak?

9 Q So would you say that the LOLE criteria is more  
10 realistic?

11 A No, it is more responsive, and it gives you an  
12 entirely different perception of your system. And  
13 we believe, in this particular case, that accepting  
14 the two then provides protection with respect to  
15 the vulnerability of Whitehorse to that particular  
16 event, and also provides an overall assessment of  
17 the system, the second part of course coming from  
18 the LOLE.

19 Q Now, if I look at the middle column under the N-1  
20 criteria, which is N-1 criteria load carrying  
21 capability, and I look at the first figure for  
22 2005, of 55.7, this is -- am I correct that that is  
23 the sum of all available generating capacity in  
24 winter, excluding the generators that would be out  
25 if the Aishihik line was out?

26 A I think that comes from 87 minus 30 minus 1.3. Is

1 that right? The 30 comes from Aishihik. The 1.3  
2 comes from Haines Junction.

3 Q Okay. Now, Dr. Billinton, what was the probability  
4 of outage that you used for the Aishihik  
5 transmission line? Was that .66 percent?

6 A Right. And if you look in the appendix to the  
7 report -- which I will find the right page -- page  
8 58 of 60, in that YUB-YEC-1-1, the unavailability  
9 of that line was taken to be .006639 or .6639  
10 percent.

11 Q Okay, thank you. So under the N-1 then, the  
12 assumption is that it is at peak load, and it is an  
13 outage of the Aishihik transmission line, but the  
14 probability of that happening is only .66 percent?

15 A The probability of being in that particular state  
16 is .6 percent.

17 Q And if I look at the peak, again in that same  
18 column of Table 3.5, the peak of 55.4 for 2005,  
19 Mr. Bowman, that is the annual peak that you would  
20 expect likely during the November 2005 to March  
21 2006 winter period; is that correct?

22 A MR. BOWMAN: Actually, I believe  
23 Mr. Campbell dealt with this this morning, but that  
24 is based off of the numbers to the farther left of  
25 the table, of 56.4, which was an actual peak, and  
26 the date and time of that were given. I believe it

1 was in January 2005.

2 Q Right. But generally the peak is going to occur  
3 between November and March?

4 A It occurs in the winter months.

5 Q Okay. Now, according to this table, under the N-1  
6 criteria, YEC actually had a surplus, it shows a  
7 surplus of .3 for that period. Yet that is the  
8 period where there was the outage -- the failure of  
9 the Aishihik transmission line. So what I am  
10 trying to understand is how the N-1 would have  
11 helped you there, because that outage occurred even  
12 though you are showing a surplus for that period.

13 A And you are showing a much larger surplus under the  
14 LOLE criteria. But this was reviewed in some  
15 detail in a filing with the Board on April 11th,  
16 2006, about the outage response and what occurred  
17 with YEC's system. It goes to, I guess, your  
18 comment earlier, that the N-1 criteria may seem  
19 very pessimistic to some because it assumes the  
20 Aishihik line fails at peak. The N-1 seems very  
21 optimistic to others because it assumes everything  
22 else works at that particular point in time.  
23 Everything else on the system has to be working the  
24 way it is supposed to. And as this response goes  
25 through at that particular point in time, there  
26 were some other issues that had to be worked

1 through, which is what led to the outage. It would  
2 not lead to additional capacity on the system. It  
3 would not have led to additional capacity on the  
4 system as of January 29th, 2006.

5 Q Could I get you to turn to YUB-YEC-2-11, page 5 of  
6 7. And if I look at the first table, Table 1, LOLE  
7 Calculations, there is a column there entitled  
8 "Aishihik Third Turbine 2009", and it shows down  
9 that column, in 2009, that there would be, it says  
10 7.0. And that is the capacity of the third  
11 turbine, 7 megawatts. Is that correct?

12 A That is correct.

13 Q Now, it appears that, to get the shortfall, what  
14 you have done is taken the LOLE calculation and  
15 just added the 7 megawatts to that, in addition --  
16 I realize there are three numbers under the  
17 project's heading, so it looks like you took the  
18 LOLE shortfall and then took into account the 1.6  
19 for the Marsh Lake project, 8.0 for the Aishihik  
20 second transmission line, and the 7.0. Is that  
21 correct?

22 A I take it you are looking at the top left-hand part  
23 of this table, where there are sort of multiple  
24 tables on the page.

25 Q Yes, Table 1.

26 A And this question was asking for a particular

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1 scenario that said, assuming that you build Marsh  
2 fall/winter storage and the Aishihik second  
3 transmission line, and then put in place the third  
4 turbine, what would be the shortfalls? Just so  
5 everyone in the room is following, the top  
6 left-hand part of that page calculates the LOLE  
7 shortfalls, the bottom left-hand part of that page  
8 calculates the N-1 shortfalls, and the right-hand  
9 side of that page looks to which one would be the  
10 driver in the scenario. And so you can see that,  
11 depending on the -- after the line is built, LOLE  
12 becomes the driver. But what this is showing is  
13 that if you have the second line built, putting in  
14 place the third turbine benefits the system's  
15 capacity by 7 megawatts.

16 Q What I am getting at is how the calculation was  
17 done. I just want to confirm that you had the  
18 original LOLE calculation, and then you simply  
19 added that additional capacity to determine what  
20 the shortfall or surplus is?

21 A That is correct. You take the shortfall and then  
22 add the contribution from each of the projects, to  
23 get to the resulting WAF system balance.

24 Q Dr. Billinton, in your view, is that the correct  
25 way of determining what the shortage would be? I  
26 am wondering whether, in determining that, you

1 should not just be adding that additional capacity,  
2 but that should be factored into the LOLE  
3 calculation with outage rates, et cetera.

4 A DR. BILLINTON: Right. You could add  
5 the contribution associated from that particular  
6 resource addition. But you are correct in the  
7 sense that you would do a study in which you would  
8 add the second transmission line into the  
9 configuration, add the appropriate reliability  
10 levels, you would add the third unit on the  
11 Aishihik bus. You would then proceed to increase  
12 the winter capacity level in Whitehorse, by virtue  
13 of the reduced constraint associated with the March  
14 Lake, and then you would perform the analysis, and  
15 you would finish up then with a total picture.

16 Now, I think if you knew the individual  
17 contributions -- see, we have done studies right  
18 now, with respect to changing the restriction at  
19 Whitehorse, say, from 24 megawatts to 25  
20 megawatts. Well, there is a contribution there, of  
21 about 1.1 megawatts, for every change in load  
22 carrying capability, as a function of that 1  
23 megawatt change. So you could simply determine the  
24 contribution and then have that in that particular  
25 way. I am not sure, in this particular case, just  
26 exactly how that was done. But it would be the

1 contribution associated with that asset, to the  
2 load carrying capability of the system, and that  
3 would come about, or could come about, or it would  
4 be done in one simple study in which you put all of  
5 them in there and then proceed to do the analysis.

6 A MR. BOWMAN: Just to the extent it  
7 helps, there is an interrogatory that explains the  
8 estimation technique Yukon Energy was using with  
9 relation to LOLE, because, at the time these were  
10 prepared, it did not have a computer model to do  
11 that. Since then a draft computer model has been  
12 prepared by Dr. Billinton and his colleague that  
13 can now sort of start to try to run some of these,  
14 and it has basically confirmed these approaches;  
15 that the ratio of the megawatts you add, to the  
16 benefit and load carrying capability, is very close  
17 to one to one, within the range of projects we are  
18 talking about, including this size range.

19 Q Dr. Billinton, in your calculations, you used CEA  
20 industry averages for the outage rates for diesel  
21 plants and hydro plants, correct?

22 A DR. BILLINTON: That is correct.

23 Q And it is 10 percent for diesel plants and 3  
24 percent for hydro?

25 A Correct.

26 Q Now, ideally, wouldn't you use the actual forced

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1 outage rate for each individual unit in the  
2 calculations?

3 A Ideally, you would use the actual data, and I have  
4 said many, many times, the best data you can  
5 possibly have is your own data, but given a paucity  
6 of data, then you have to go elsewhere to get  
7 representative values that you would use in the  
8 calculation. And the lack of data could come about  
9 from not having collected it, or it could come  
10 about from having a relatively small data pool from  
11 which you might attempt to make some estimations.  
12 Your degree of confidence would increase as the  
13 population would increase, and therefore you just  
14 may not have sufficient data within your own system  
15 to arrive at a suitable estimate.

16 Q Would you expect that, in the not too distant  
17 future, that YEC would have sufficient data to make  
18 those calculations based on actual data, rather  
19 than using industry averages?

20 A I certainly would hope that they would have  
21 sufficient data. If they -- maybe I should not say  
22 this, but if they keep having outages with the same  
23 frequency, on Line 171, as they have had, pretty  
24 soon they will have lots of data to make a good  
25 estimate, but hopefully that will not come about.

26 I would just like to comment, Madam Chair, we

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1 filed our report on February of 2005. After that,  
2 you had three outages. I hope you are not going to  
3 blame me for the fact that those outages occurred  
4 because we drew attention to the vulnerability of  
5 Whitehorse because of that event.

6 But levity aside, going back to your original  
7 point, yes, I would. I would think it is important  
8 for YEC to collect data and to move towards --  
9 I made that statement in our report, I think you  
10 cited it in an IR, and that was responded to. I  
11 think they are making steps to report and to record  
12 that data in such a way that hopefully they will  
13 have sufficient data.

14 But I would just like to comment, the CEA  
15 data, that is representative data, and that is from  
16 a broad spectrum of utilities. It is collected in  
17 the consistent definitions.

18 In terms of the transmission line data, I may  
19 be wrong here, the CEA report, we produce an annual  
20 report, which we use five years rolling average.  
21 In connection with 138 kV wood pole H-frame lines,  
22 there's 93,000 kilometre years of data in that  
23 particular category. So there is a large  
24 population from which that statistic is drawn.

25 From the hydro unit case, there's 175 units in  
26 Canada between -- let's see, in the size category

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1 up to 25 megawatts, and therefore there's a large  
2 number units in that particular pool. When you  
3 look at the number of units and the number of lines  
4 that YEC has, you basically have one or two lines,  
5 we might call it, 170 and 171, you have a certain  
6 number of kilometres. The population size is not  
7 great, and therefore, having confidence in the  
8 statistic requires you either have an awful lot of  
9 outages, or to collect it for a long time. And,  
10 therefore, I think the CEA data is very useful for  
11 that particular purpose.

12 But going back to your original comment, you  
13 are correct. The best data you can have is your  
14 own data. And therefore I think you need to  
15 collect that data under consistent definitions.  
16 And I understand from the answer to that  
17 interrogatory, I think it is 2.3 or 2-3, that steps  
18 are being made to collect that data on a consistent  
19 basis.

20 Q With respect to the industry average for  
21 transmission lines, is there anything, in terms of  
22 the characteristics in the Yukon, that would make  
23 that outage rate, you know, maybe too high or too  
24 low? And what I am thinking of is, you know, in  
25 eastern Canada there is the possibility of ice  
26 storms, there's tornadoes in other areas of Canada,

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1 things that I do not think you would see here, but  
2 I don't know, maybe there are other things you  
3 would see here.

4 A Yes, you are right. Does that data completely  
5 represent the terrain over which the lines in the  
6 Yukon run? And I don't know the answer to that  
7 question. I chair the consultative committee on  
8 statistics for CEA. The CEA reports do not reveal  
9 the identity of the utilities that provide the data  
10 in those reports. Each utility receives its own  
11 data back, and it receives the compendium or the  
12 totality of data in various classifications, and no  
13 utility sees another utility's data, so therefore  
14 the utility is anonymous in that particular sense.  
15 But the definitions are on wood pole, there is data  
16 collected on cause of outages, there is data  
17 collected on the supporting structure, that is why  
18 wood pole would be a category of its own, as  
19 opposed to steel, or steel guide and so forth. So  
20 there's a considerable commonality with respect to  
21 that data. But there are differences in isochronic  
22 level, which would influence lightning, there is  
23 differences, as you mentioned, with respect to  
24 weather, but I think the data is representative of  
25 the performance of that particular type of line in  
26 Canada. So I don't know, I could not tell you

1 which utilities provided the bulk of that data.

2 I know my own utility, Sask Power, has data, which,  
3 when you drive around, you certainly see lots of  
4 wood pole lines, so it would be in similar  
5 circumstances.

6 Q Just bear with me for a moment. I think I am doing  
7 well. I think I have most of my questions asked of  
8 you, Dr. Billinton, good news for you, as you will  
9 get to get out of here at 4:00.

10 A I just hope I have managed to answer them for you.

11 Q So this means I have to try to figure out where I  
12 was before, and go back to that.

13 Perhaps I can ask a few more questions now  
14 about the failure of the Aishihik line in January  
15 of 2006.

16 Now, Mr. Bowman, you were mentioning that  
17 there were other problems as well, it wasn't just  
18 the line. There were some other additional  
19 problems. And I understand that the outage was  
20 triggered by the failure of one of the outgoing  
21 feeder cables. Is that correct?

22 A MR. BOWMAN: I would just comment  
23 that the -- I made that reference in reference to a  
24 report that was filed with the Utility Board here,  
25 which is not currently marked as an exhibit. It  
26 was filed on April 11th, 2006, and this is

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1 generally discussed, Mr. Campbell can go into more  
2 detail, but that is what I was turning to as a  
3 reference, if that is helpful.

4 Q I do not think we need to refer to that report  
5 specifically, just in terms of your general  
6 knowledge of what occurred. Perhaps you can tell  
7 me, confirm for me, what triggered that outage?

8 A MR. CAMPBELL: Sure. There was a  
9 failure of a short, effectively, in one of the  
10 cables from the underground powerhouse to the  
11 substation on the surface. The powerhouse is about  
12 500 feet underground.

13 Q Was this cable exposed or was it underground?

14 A It was an armoured cable, in the cable duct in a  
15 vertical cable tray, between the underground unit  
16 and the surface, adjacent to an elevator.

17 A MR. MORRISON: Ms. Marx, in a shaft.

18 A MR. CAMPBELL: Yes.

19 Q Okay. And what was the reason for the failure of  
20 this cable?

21 A We are not 100 percent sure. We assessed the  
22 failure as a premature failure of the cable, but it  
23 was evident -- the cable had some damage on the  
24 exterior, which eventually, because of the  
25 environment it was in, it is a very wet environment  
26 200 feet underground, it is damp, would have caused

1 the failure to occur.

2 Q Was this something you discovered after the fact,  
3 or was there some indication, through inspections,  
4 prior to that?

5 A No. This was based on the investigation that took  
6 place after the failure.

7 Q Right, okay. Is this something that could have  
8 been detected through an inspection?

9 A MR. MORRISON: I am not sure that --  
10 you know, I mean Hector can give you some  
11 additional -- it is in a cable bound in a shaft.  
12 We couldn't see it. It certainly wasn't anything  
13 that we detected prior to. Could you have detected  
14 it? I don't know that. But it certainly wasn't  
15 something you could visibly see and know that there  
16 was a cable in there shorting out.

17 Q So if it was a premature failure of this cable,  
18 then would it be fair to say that the chances of  
19 that happening again are pretty slim?

20 A Well, I am not sure, you know, in the sense ...  
21 yes, slim, but it hadn't happened before. The  
22 cable had been there for a number of years.

23 Q But, essentially, it sounds like it was a defective  
24 cable perhaps?

25 A It could well have been, yes.

26 A MR. CAMPBELL: I would say, for sure,

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1 a contributing factor was the environment that the  
2 cable was in. It is a very wet environment. And  
3 the area of failure was wetter than other parts of  
4 the shaft, so that would certainly have contributed  
5 to it.

6 Q Have any steps been taken to address that  
7 situation?

8 A Yes. Well, we have replaced those cables. And as  
9 part of the Aishihik Third Turbine, we have -- we  
10 currently plan to have a completely redundant run  
11 of cables, so that a single cable fault would no  
12 longer have the ability to take out both units.

13 Q Okay. And I believe Mr. Bowman said before that  
14 the severity of that outage was exacerbated by the  
15 fact that backup generators were not able to start?

16 A MR. MORRISON: I am not going to put  
17 words in Mr. Bowman's mouth, but let me be clear  
18 about something. The severity of that outage  
19 caused other problems. There were some backup  
20 generators on the system, not ours, not ours, that  
21 did not start. And when you look at the list in  
22 the Plan, on page 18 on the summary, there are some  
23 YECL units which did not immediately start. They  
24 eventually got them all started.

25 But just in terms of describing, in simple  
26 terms, we had 30 megawatts of load on that system.

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1 It went looking for a home. We did not have a  
2 spare 30 megawatts operating, and it knocked the  
3 entire system, the remainder of the system, out,  
4 and it took a little while, in terms of testing  
5 that system, before we were able to start turning  
6 things back on. And it did cause some  
7 difficulties, and some of the turn-on had to be  
8 done manually, but it got turned on.

9 As I said, there were some difficulties Yukon  
10 Electric had in getting some of their generators  
11 on, but they eventually did get them on.

12 Q And I am not trying to point fingers here.

13 A I appreciate that.

14 Q I am just trying to understand what caused the  
15 outage and what this means for your current  
16 planning criteria.

17 Do you know if steps have been taken to  
18 address that situation with these backup  
19 generators? Is there anything that was done, that  
20 could be done?

21 A Yes. Subsequent to this, we have sat down on a  
22 number of occasions with Yukon Electric, and one of  
23 the exchanges of information that we now do is,  
24 prior to that -- just as an example, if they had  
25 taken one of those generators out of service for  
26 maintenance, we would not have known that. We now

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1 know that. So we have agreed -- we have taken  
2 steps so that we can see their system, which means  
3 that we can shorten the turnaround time in terms of  
4 turning the system back on. We have been working  
5 very closely to make sure that we know where their  
6 capacity is on the system, when it is not  
7 available, who we can contact if we need to. And  
8 so we have worked, I think, very well together, to  
9 make sure that we can respond better the next time  
10 this happens.

11 Q So based on that, would it be fair to say,  
12 Mr. Morrison, that if another outage occurred, it  
13 would be less severe? Likely less severe?

14 A I am not the right person to ask that. If we lost  
15 the Aishihik line again, it would be as severe in  
16 the sense of, it would still knock the system out.  
17 We don't have a system that can take that kind of a  
18 hit.

19 Would we get it back up a little quicker?  
20 Yes, we would get it back up a little quicker.  
21 But, you know, if we say -- and I don't have the  
22 exact time in my head, but we were out for 12 or 13  
23 hours. Could we get the whole system back in one  
24 hour? No. Could we get it back in, say, 8 or 9  
25 hours, versus 12 or 13? It's probably more like  
26 that, but it would be out for a long time.

- 1 Q Mr. Campbell, did you have anything to add to that  
2 in terms of the technical aspect of those  
3 questions?
- 4 A MR. CAMPBELL: No. No. I think it  
5 has been said.
- 6 Q With respect to the N-1 criteria, I would like to  
7 go back to that. So it is assumed to be a peak, at  
8 the annual peak, and the worst outage, which is the  
9 Aishihik line. In your assumptions, are you  
10 assuming a drought year or a non-drought year?
- 11 A MR. MORRISON: Drought year for what,  
12 Ms. Marx, if you could help me here?
- 13 Q I guess, in terms of the capacity --
- 14 A Of Aishihik?
- 15 Q No, not of Aishihik. Just generally. I am just  
16 asking, generally, for the assumptions that are  
17 within the N-1 criteria, and I guess as it would  
18 relate to the Whitehorse Hydro Plant for example?
- 19 A I mean if somebody can --
- 20 A MR. BOWMAN: The answer is that it  
21 is based on the firm capability of the system,  
22 which is the winter output of Whitehorse Hydro that  
23 you can rely upon, the firm winter capability  
24 during a drought, correct.
- 25 Q During a drought?
- 26 A Yes.

- 1 Q That is the 24 megawatts?
- 2 A That is the 24 megawatts, correct.
- 3 Q And in a non-drought year, what is the firm winter  
4 capacity of the Whitehorse Hydro plant?
- 5 A Well, we answered an IR to this effect, and it  
6 would probably be helpful --
- 7 Q Sorry, I just do not recall.
- 8 A That is fine. It is not an easy number to comment  
9 upon.
- 10 Q Perhaps you can just tell me, is it much more?
- 11 A It is not much more. On a non-drought year, you  
12 will see that plant putting out more like 26,  
13 instead of 24, on a consistent basis.
- 14 Q And under the N-1, you are also, of course,  
15 assuming that the wind generation is not operating?
- 16 A That is correct.
- 17 Q The other assumption I think that is being made is  
18 that, assuming you have the Carmacks-Stewart line  
19 in place, that the Mayo-Dawson grid is also at its  
20 annual peak. Is that correct?
- 21 A No, not necessarily. In the case where we are  
22 modeling the two systems being interconnected, the  
23 peak load for the combined systems is effectively  
24 modeled off of the peak load for WAF, by adding in  
25 simply the number of annual kilowatt hours for the  
26 Mayo-Dawson system. We have not done detailed work

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1 on the peaks on each system and how coincident they  
2 are, and the relative load factors. So, in  
3 general, it just assumes that Mayo-Dawson is like  
4 an additional load growth on WAF that would  
5 otherwise occur at the same load duration curve and  
6 the same load factor.

7 A Okay.

8 A MR. CAMPBELL: We did attempt to go  
9 back over a few years and see what was the peak  
10 factor, that they were the same at the same time,  
11 and it was relatively close. When we looked at the  
12 last couple of years of WAF peaks, the peak loads,  
13 at the same time on the Mayo-Dawson grid, were  
14 within a hundred kilowatts of their all-time peak.  
15 And that is not unusual. In the Yukon in the  
16 wintertime, if it is cold in Whitehorse, it is  
17 colder in Dawson.

18 Q So you are assuming that the Mayo-Dawson grid would  
19 be able to contribute 6 megawatts?

20 A The assumption was based on basically the back-up  
21 diesel, that is currently available in Dawson and  
22 Mayo, would be available again as back-up for the  
23 WAF grid, but that the hydro would not be, that it  
24 would be fairly close to being fully utilized at  
25 the time?

26 A MR. BOWMAN: And just to make sure

1 the record is clear, it could be as much as 6  
2 megawatts at the time of interconnection, but the  
3 more the Mayo-Dawson grid grow, the less it has to  
4 contribute.

5 Q Yes.

6 A So by the time of 2012, when we tend to model the  
7 system, it is down to about 5.6.

8 Q Right.

9 A The other comment that might be helpful here, for  
10 those who follow the details, in terms of the peaks  
11 we are talking about in each case, we are talking  
12 about an hourly integrated peak, not an  
13 instantaneous peak for the system. All of the  
14 modeling works off an hourly integrated peak.  
15 Instantaneous peaks will be somewhat higher due to  
16 fluctuations during the hour, but we work off of  
17 that. So there are factors on the optimistic as  
18 well as the pessimistic side of the N-1, if you  
19 like.

20 Q I had asked you some questions earlier about -- I  
21 think I directed them to Dr. Billinton, but I want  
22 to confirm the way YEC did the calculations with  
23 respect to the assistance coming from the  
24 Mayo-Dawson grid under the LOLE criteria. And am  
25 I correct that it was done in the same way as that  
26 table I had referred you to, with respect to the

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1 Aishihik Third Turbine and the Aishihik  
2 transmission line, in that you started with the  
3 LOLE calculation, and then you just added in the 6  
4 megawatts of capacity to determine what the surplus  
5 or shortfall is?

6 A I don't have the table in front of me anymore, but  
7 the table you were looking at was simply additive  
8 across the rows, that's correct. The Mayo-Dawson  
9 column, though, is a little different than the  
10 others in that it is not citing a value of capacity  
11 on that system. It is actually taking the WAF  
12 system and the Mayo-Dawson system, plus the  
13 incremental losses that were expected to occur on  
14 the interconnection, the Carmacks-Stewart system,  
15 and taking all of the loads and modeling them as  
16 one system, not in a detailed modeling way the way  
17 the computer model that is now being prepared could  
18 do, but considering them all as one system, looking  
19 at a total peak, using the LOLE approach, and  
20 coming up with the 5.6 number by that route. And I  
21 was trying look for the IR quickly, but I am not  
22 going to find it, but to talk about how the losses  
23 on the Carmacks-Stewart were considered and how the  
24 two grids were integrated into one consistent load  
25 at the time of interconnection. It is answered in  
26 one place in the IRs, and I can look it up if you

1 like.

2 Q That is fine.

3 Has the probability of outage on the  
4 Carmacks-Stewart line been factored in to your  
5 calculations under the LOLE?

6 A No.

7 Q And is that something that you would look at doing?

8 A Based on the principles that Dr. Billinton was  
9 laying out earlier, it did not seem needed, to  
10 Yukon Energy, to try to model that into either of  
11 the criteria. Given that we are talking about a  
12 relatively small number of megawatts at the end of  
13 that line that are being contributed in the N-1  
14 type criteria, that would drive you to thinking  
15 about N-2, the .66 percent Aishihik failure  
16 happening at the same time as the Carmacks-Stewart  
17 failure, and we have not talked about trying to  
18 protect the system to that level. And even if  
19 someone were wanting to talk about that, the  
20 Carmacks-Stewart line would not be the next biggest  
21 unit you would want to think about. That is the  
22 same size as one of the big diesels at Whitehorse  
23 basically, and nowhere near the size of the hydro  
24 units in Whitehorse.

25 In terms of the LOLE criteria, YEC relied on  
26 the principles in Dr. Billinton's report, that it

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1 really was the unique characteristics of Aishihik,  
2 where you have that much generation compared to the  
3 size of the system at the end of a line, that you  
4 would want to pay attention to that transmission  
5 line. As an example, today there is generation at  
6 Faro, but we don't model the Faro line as its own  
7 probability. That generation at Faro is assumed.  
8 That line is assumed to be up in any of the cases  
9 where the Aishihik line is going to cause you  
10 problems, or the other unit considerations that go  
11 into the LOLE formula.

12 Q Dr. Billinton, can I just ask you one other  
13 question? As a follow-up to what we were  
14 discussing earlier about the use of the industry  
15 averages, are you confident that the industry  
16 average used, for the probability of failure of the  
17 transmission line, is a good proxy for what it  
18 actually is?

19 A DR. BILLINTON: When considering the  
20 data that is available, I think it is the best  
21 possible estimate that we could use at this point  
22 in time.

23 Q Okay, thank you.

24 Given what Dr. Billinton said earlier, when  
25 I was asking him about the fact that the worst-case  
26 scenario is a failure of the Aishihik transmission

1 line, and why not focus your efforts there ... so  
2 if I could pursue that a bit in terms of why YEC  
3 has decided not to pursue twinning of the Aishihik  
4 line.

5 A MR. OSLER: I will start, and we  
6 will see how much more detail you need.

7 In the opening comments, I summarized it, I  
8 think, as follows: We did take it seriously, given  
9 the new criteria, as an obvious option to examine,  
10 and a fair amount of time and energy was, in fact,  
11 devoted to it. At one point I thought it was the  
12 horse with the best chance of coming out in a short  
13 list, given some of the comments.

14 Two things affected its ultimate ranking at  
15 this moment in time. One was the fact that it  
16 takes time to licence a plan and build it, and  
17 there is a fair amount of uncertainty at the moment  
18 with respect to the time periods required. We were  
19 going into the Carmacks-Stewart project. We want  
20 to learn, from that one, what the new Yukon process  
21 takes. But it wasn't something that we could  
22 reliably say we can get this outcome within a  
23 certain date, and the senior people of management  
24 and Board of YEC, given some of the information  
25 about the capacity shortfall, wanted some  
26 assurances as to when things could be done in the

1 near-term.

2 The second problem is that it is lumpy. You  
3 get it all, and it costs 16 to 19 million dollars,  
4 according to the reports we filed, based on cost  
5 estimates that were back at the time we were  
6 estimating lower numbers, if you like, for  
7 Carmacks-Stewart. That means that, effectively,  
8 you were getting, at the moment, about 15  
9 megawatts, in round numbers, extra capability, for  
10 about a million dollars a megawatt. And looking at  
11 the Mirrlees units, you had the advantage as  
12 follows: You had the incrementality, you could go  
13 at them one by one, and half the cost or better.  
14 You could also get a certainty, relatively  
15 speaking, as to their price range, whereas the  
16 advice we received is you are not going to know the  
17 price of a transmission line until you get to the  
18 tendering stage. The markets are potentially  
19 volatile, and we have discussed that separately.

20 Q But that same factor would play into the building  
21 of the Carmacks-Stewart line?

22 A No question, but we are not building the  
23 Carmacks-Stewart line as a dominant lead project to  
24 solve the capacity problem. It is one that is  
25 being looked at for a variety of reasons, and if it  
26 gets built all the way to Stewart, it will

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1 contribute, potentially, a small part of the  
2 solution to the capacity issue. But it was viewed  
3 primarily as an opportunity project.

4         Whereas YEC, looking at Aishihik twinning,  
5 could only look at it as something to be done in  
6 response to the new capacity criteria, where the  
7 Aishihik line redundancy would remove the need to  
8 have protection for all of that capacity, and  
9 therefore it was being looked at very, very much as  
10 a trade-off between what are our other  
11 alternatives. Very low usage of Mirrlees units was  
12 viewed by YEC's management and Board as an obvious  
13 alternative, and what were its attributes. You  
14 could do them incrementally, you could get a better  
15 handle on prices that were not going to go way out  
16 of the picture, and it was ultimately cheaper.

17 Q If I look at the Carmacks-Stewart line and the  
18 Aishihik transmission line, and you take the time  
19 from when you first start the planning process, get  
20 things under way, to the in-service date, is there  
21 a difference, in that time period, for the two  
22 lines?

23 A I think the short answer is, I don't have a strong  
24 opinion that could be backed up by having looked at  
25 it in the same detail for both. We obviously have  
26 looked at Carmacks-Stewart in considerable detail.

1           The issues we would have to consider, to make  
2 a judgment whether they are basically the same or  
3 one is longer or shorter, would be, on the one hand  
4 which issues would surface in the YESAB process  
5 with the First Nations along that particular route;  
6 and, secondly, how much easier would it be, if at  
7 all, because we could perhaps look at the option of  
8 working within the existing right-of-way. And we  
9 would have to balance those two. We would have to  
10 make a decision as to exactly which option we are  
11 looking at. And we looked at a range of them at  
12 one time. We would have to make a quick decision  
13 on that, and make sure it was a sustainable  
14 decision.

15           And if, in certain moods, we thought the  
16 regulatory process could proceed at the same type  
17 of time period or less, there is no reason why the  
18 construction should take any longer. And so the  
19 issue would be whether the existing right-of-way  
20 gives you some inherent advantage in the Aishihik  
21 transmission line. We have to go through the same  
22 process, we concluded; 138 kV would require us to  
23 go up to the Executive Committee level and the  
24 YESAB process. At the moment, there is a fair  
25 amount -- it looks as though we may be the first  
26 project, the Carmacks-Stewart, to go through that

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1 process, which I am not sure is what we would  
2 ideally like. But if Yukon Energy is going to have  
3 to rely on getting things licensed in the future,  
4 we might as well get started and get some practical  
5 experience between the regulatory authorities and  
6 ourselves, as to how to do this, and we may take a  
7 bit longer the first time than, collectively, we  
8 will take the second time.

9 So when this was decided way back, we were  
10 well back in the thought process, the dollars were  
11 ultimately, I would say, the biggest single lump,  
12 plus trying to explain to people, who were just  
13 digesting all that you have been discussing with  
14 Dr. Billinton as a brand-new set of concepts, the  
15 idea of building another line side by side with  
16 existing line, and explaining that in Yukon as a  
17 cost-effective way to use \$20 million. I think,  
18 nowadays, we would say, with the Aishihik Third  
19 Turbine, if there is a big load growth in the  
20 system, and depending on how other things come,  
21 this is an option that YEC will continue to look at  
22 very seriously, and probably refine its estimates  
23 of cost and timing and how to do it most  
24 effectively, when it has a few minutes to think  
25 more about it.

26 Q So it is not something you have completely taken

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1 off the books as a possibility?

2 A I would -- Mr. Morrison can speak for the  
3 Corporation, but, as an advisor, I would say not to  
4 my knowledge at all.

5 I would just add, I think we have said it in  
6 one of the documents, but if, for some reason, the  
7 Mirrlees units had been concluded, after all the  
8 investigations had been going on, to not be a go  
9 for technical reasons, that is when the  
10 considerations about whether to spend money on new  
11 diesels, or look at this, became a pretty much  
12 closer horse race in terms of straight dollars,  
13 million dollars per unit for a new diesel, versus  
14 this line at about 16 or 17 million. And that is  
15 when the timing issue certainly was foremost in the  
16 minds of people looking at this.

17 So I do not want to confuse people about where  
18 one factor became more important than the other.  
19 When the Mirrlees were around, and they are now  
20 confirmed, they are just hands-down a more  
21 cost-effective way to get the capacity for that  
22 very small amount of time that you were talking  
23 about with Dr. Billinton, to make sure the system  
24 was secure and reliable.

25 Q So it is factors such as cost and timing that have  
26 played into that decision, rather than looking at

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1 issues like the fact that, with the Mirrlees units,  
2 you have the diesel emissions, the use of that --  
3 like, from an environmental perspective, versus  
4 twinning the Aishihik line where you are not  
5 necessarily having to use as much diesel. That  
6 wasn't really a primary factor in the decision?  
7 A You went through, with Dr. Billinton, the table of  
8 summer and winter load duration curves, and you  
9 pointed out the top 10 percent was a very low  
10 number of hours. That is another way of saying  
11 that these units are meant to be back-up, and they  
12 probably won't even be on that curve because they  
13 are there to cover contingency. So unit efficiency  
14 and emissions were not a factor in the assessment,  
15 for the reasons that have been discussed. But the  
16 desirability, if you can find the right  
17 circumstances, the right opportunity to do it, for  
18 twinning the Aishihik line, if you can find the  
19 right timing, the right costing is self-evident,  
20 because you bring on line at least 30 megawatts,  
21 and probably 37, and, with re-runnering of the  
22 Aishihik units, probably more. So if you can find  
23 the right timing and the right conditions to bring  
24 on that lump and do it, and you have not spent a  
25 lot of money on new diesels in the meantime, maybe  
26 in this planning period it will reemerge as a major

1 opportunity.

2 Q I just have a couple quick questions I think I can  
3 ask in the last few minutes of the day here.

4 In response to YUB-YEC-2-9, YEC indicated that  
5 the AH1 generator was rewound in 2003, and the AH2  
6 generator was being rewound in 2006, with an  
7 October scheduled completion date. Has that been  
8 completed?

9 A MR. MORRISON: Yes, it has.

10 Q And so the output from the two generators, is that  
11 now 30.8 megawatts from the two turbines?

12 A I just want to make sure we are using the right  
13 math here. I just want to look at this for a  
14 second if that is all right.

15 Q Sure.

16 A MR. CAMPBELL: With the completion of  
17 the second rewind, certainly the electrical  
18 capacity has been increased, but we have not yet  
19 recommissioned the units. We need to ascertain the  
20 mechanical capacity constraint, which is both  
21 two-fold; the ability of bearings and the  
22 mechanical parts of the system, or of the turbine,  
23 to handle increased output from a torque standpoint  
24 and so on, as well as the ability to put more water  
25 through the penstock and through the wicket gates  
26 of each unit. So we cannot say for sure -- we

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1 know, electrically, the capacity has been  
2 increased, and we will be doing some testing next  
3 year, once we are past the winter season, to  
4 ascertain, overall, can we increase the capacity of  
5 both units.

6 A MR. MORRISON: Ms. Marx, I just want  
7 to ask Mr. Campbell a question.

8 A MR. CAMPBELL: I should be clear that  
9 the electrical capacity of AH2 is the one that has  
10 been increased. The second rewind, we were able to  
11 obtain some better class insulation, increase the  
12 rating, reduce the temperatures, that will allow us  
13 to increase the electrical rating of the unit.  
14 With the first unit, there was really no  
15 significant increase, electrically, in the output  
16 of the unit.

17 Q Would you not have known that ahead of time? I am  
18 wondering if you did the rewind of the first unit,  
19 and it did not really increase the rating of it, is  
20 that something you could have known ahead of time?

21 A MR. MORRISON: Ms. Marx, let me help  
22 Mr. Campbell out here because the short answer to  
23 your question is, yes, we could have. We did not.  
24 We did not address that when we looked at the  
25 project, and you cannot go back and do it now. So,  
26 yes, we should have looked at it. When we did the

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1 first unit, we were not in a system planning  
2 mindset, if you will. And it was a maintenance  
3 type of approach to the unit. It had reached a  
4 certain point in its life. It needed to be  
5 rewound, from a maintenance upkeep technical point  
6 of view. We could have looked at it. We did not.  
7 We hadn't adopted the philosophy at that point in  
8 time, which I think we now have, which is that we  
9 need to -- in terms of trying to build the  
10 necessary capacity, that we have got to look at all  
11 of the efficiencies within the existing assets and  
12 see, can we wring another 500 kilowatts or a  
13 megawatt out of these units as best we can.

14 So when we looked at AH2 and did the past  
15 rewind, we were in the mindset of looking at  
16 additional capacity requirements on the system. We  
17 made sure that we contracted for and got additional  
18 capacity. It was a little bit more money than not  
19 doing it that way. And, yes, there is still some  
20 risk, because as Mr. Campbell said, we still have  
21 to confirm the mechanical capability to, in fact,  
22 drive that, and we still have to confirm some  
23 additional water information, to make sure that we  
24 can actually get that additional capacity from the  
25 electrical side. But it was worth the investment  
26 at the time, to make sure that, if the other pieces

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1 fell into place, that we could do it, because it  
2 was such a small amount of money in addition to the  
3 dollars being spent. But, yes, we should have,  
4 and, no, we didn't.

5 Q So if I can just summarize, with the first AH1, the  
6 rewind was done more for a maintenance perspective  
7 rather than additional capacity. When it came to  
8 AH2, I assume it was also done for maintenance  
9 reasons, but in addition you were looking at it for  
10 increased capacity, and therefore, you had it done  
11 differently, spent a little more money?

12 A I think that is fair. We also had -- in the  
13 schedule, we were going to do AH2 as -- you and  
14 I can talk about it as maintenance, the engineers  
15 might call it some other technical term, but it  
16 needed to be done. It was in the schedule. When  
17 it came up in the schedule, we were in this  
18 Resource Plan process, we said, you know, in  
19 addition to just doing the maintenance work, we  
20 need to see if we can successfully rewind it at a  
21 higher level, which we were able to do. So you are  
22 correct.

23 MS. MARX: Thank you.

24 Madam Chair, I think now is a good time to  
25 break.

26 THE CHAIR: Thank you, Ms. Marx.

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1 I note that the Board will have a public input  
2 session tonight at 6 p.m., and we will adjourn  
3 until tomorrow morning at 9:00 a.m.

4 I do not know if I made that clear; the public  
5 input session is tonight at 6:00, and tomorrow  
6 morning we will meet again at 9:00 a.m.

7 (Proceedings adjourned at 4:00 p.m.)

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