MANITOBA CLEAN ENVIRONMENT COMMISSION

BIPOLE III TRANSMISSION PROJECT

PUBLIC HEARING

VOLUME 28

* *

Transcript of Proceedings
Held at Winnipeg Convention Centre
Winnipeg, Manitoba

TUESDAY, MARCH 5, 2013

* *

APPEARANCES

CLEAN ENVIRONMENT COMMISSION
Terry Sargeant - Chairman
Pat MacKay - Member
Brian Kaplan - Member
Ken Gibbons - Member
Michael Green - Counsel to the Board
Cathy Johnson - Commission Secretary

MANITOBA CONSERVATION AND WATER STEWARDSHIP
Bruce Webb
Elise Dagdick

MANITOBA HYDRO
Douglas Bedford - Counsel
Janet Mayor - Counsel
Shannon Johnson

BIPOLE III COALITION
Brian Meronek - Counsel
Karen Friesen
Garland Laliberte

CONSUMERS ASSOCIATION OF CANADA
Byron Williams - Counsel
Gloria Desorcey
Aimee Craft - Counsel

MANITOBA METIS FEDERATION
Jason Madden - Counsel

MANITOBA WILDLANDS and SAPOTAWEYAK CREE NATION
Gaile Whelan Enns

GREEN PARTY OF MANITOBA
James Beddome

PEGUIS FIRST NATION
Robert Dawson - Counsel

TATASKWEYAK CREE NATION
Ian Cluny
Shaun Keating

APPEARANCES CONTINUED:

PINE CREEK FIRST NATION
Charlie Boucher
Warren Mills
John Stockwell

INDEX OF EXHIBITS

INDEX OF EXHIBITS

INDEX OF EXHIBITS

INDEX OF PROCEEDINGS

Tuesday, March 5, 2013

Upon commencing at 9:00 a.m.

THE CHAIRMAN: Okay. Could we come to order? We have a Bipole day ahead of us today, with witnesses presenting on a couple of different themes around the location, or the southern end of the Bipole line.

Before we turn to the Coalition, the secretary has a number of documents to place on the record.

MS. JOHNSON: These are all the documents that have been received since we went into the adjournment. Many of them were referred to yesterday.

So CEC 06 is the letter to Mr. Bedford regarding the topics we're talking about today, the rerouting of the line to Dorsey.

CEC 07 is the response to Mr. Meronek regarding the motion.

MCWS number 2 is the letter to Mr. Sargeant regarding the line rerouting.

MH 103 is the list of undertakings from December 14th.

MH 104 is the response to the letter from Mr. Sargeant regarding the Dorsey converter.

MH 105 is the letter to the department with additional TAC comments.

MH 106 is the response to undertaking regarding forest fragmentation.

MH 107 is the enhanced assessment of the adjusted final preferred route for moose.

MH 108 is the letter to the department regarding the mitigation measures.

MH 110 is the supplemental environmental assessment on route adjustments presentation from yesterday.

MH 111 is the EACP presentation.

MH 112 is the culture and heritage presentation.

MH 113 is the moose and caribou presentation.

MH 114 is the chart comparing the VECs.

And MH 109 is the actual supplemental report.

That's it for now.

(EXHIBIT CEC 06: Letter to Mr. Bedford re rerouting of line to Dorsey)

(EXHIBIT CEC 07: Response to Mr. Meronek re motion)

(EXHIBIT MCWS 2: Letter to Mr. Sargeant re line rerouting)

(EXHIBIT MH 103: List of undertakings from December 14th)

(EXHIBIT MH 104: Response to letter from Mr. Sargeant re Dorsey converter)

(EXHIBIT MH 105: Letter to department with additional TAC comments)

(EXHIBIT MH 106: Response to undertaking re forest fragmentation)

(EXHIBIT MH 107: Enhanced assessment of adjusted final preferred route for moose)

(EXHIBIT MH 108: Letter to department re mitigation measures)

(EXHIBIT MH 109: Supplemental report)

(EXHIBIT MH 110: Supplemental environmental assessment on route adjustments presentation)

(EXHIBIT MH 111: EACP presentation)

(EXHIBIT MH 112: Culture and heritage presentation)

(EXHIBIT MH 113: Moose and caribou presentation)

(EXHIBIT MH 114: Chart comparing the VECs)

THE CHAIRMAN: Thank you. There is no other preliminary business to take care of, so Mr. Meronek, over to you.

MR. MERONEK: Thank you, Mr. Chairman. I'd like to introduce the panel that's going to be presenting evidence and be available for questioning afterwards.

On my immediate left is Dr. Graham

Lawson from Albany, New York. To his left is Mr. Art Derry. You all know Karen Friesen, who is our tech person. And on her left is Mr. Dennis Woodford. And they are ready to be sworn in.

THE CHAIRMAN: Thank you.

MR. DERRY: Art Derry.

Art Derry: Sworn.

MR. LAWSON: Graham Lawson.

Graham Lawson: Sworn.

MR. WOODFORD: Dennis Woodford.

Dennis Woodford: Sworn.

THE CHAIRMAN: Go ahead.

MR. MERONEK: Mr. Chairman, I have a couple of preliminary matters before we get into the evidence.

First of all, yesterday I submitted some slides that are going to be used today. And I also incorporated in my letter some minor changes to the reports. And perhaps that letter should be marked as an exhibit, my letter of March 4 of yesterday.

Secondly, if I am a little cranky this morning it's because at approximately 6:29 last night, an e-mail from Shannon Johnson was sent which attached two reports in the form of rebuttal

evidence. She says:

"Hi, Please see attached Manitoba Hydro's rebuttal to recent evidence filed by the Bipole III Coalition. Regards, Shannon."

The "Hi" and the "Regards" clearly did not assuage my upset. It wasn't until about 8:00 o'clock last night that I was able to sit down with my experts and go over this. We went into the wee hours of the morning.

I had on several occasions asked Hydro, through the Commission, to make sure that if they were going to submit rebuttal evidence, that it was done in a timely fashion, so that what I call kitty by the door, gun and run conduct, would be avoided. And this is what I call it. It's inscrutable in my mind that we would get this evidence at such a late hour, without any opportunity to assess it and to prepare. I can't fathom why it wasn't provided earlier. This is too important a hearing, the subject matter is too important to have conduct be embraced of this nature.

To me, the most appropriate remedy would be to have an adjournment, but I'm not going

to ask for that. We too, like the Commission, want this to be over in the scheduled time. We want to be responsible about this. So what we're going to do today is present our evidence. I'm going to ask questions of the panel, to the best of our ability, on what has been presented last night. But I am going to ask the indulgence of the Commission, that if at the end of the presentation on Thursday I need some time to confer with my experts and to be able to properly cross-examine, and perhaps even have clarification from two of the witnesses -- Mr. Lawson will be gone -- then I'm going to seek that ability to do so either this week or early next week. But I will hedge my bets, as it were, but I just want to put the Commission on notice that we feel very hard done by with respect to this late, substantial evidence that's come in. But we are prepared to proceed. Thank you.

THE CHAIRMAN: I'd like to take a couple of minutes to address that.

Mr. Bedford, do you have any comments on behalf of the proponent in this regard?

MR. BEDFORD: I can remind everyone in the room that the date to which we committed to

file the rebuttal was today, March 5th. I did that a month ago. So Mr. Meronek presumably knew that. We have had two weeks since receipt of his clients' reports to prepare the rebuttals, and I'm pleased to say that we actually improved upon the deadline to which I personally committed, which was today. They were distributed last night.

Now, I'm sympathetic to the challenge that any advocate, including Mr. Meronek, has under circumstances like this to get documents, to go through them, to sit down with his own client and his own expert witnesses to go through them. Which is why I was anxious, notwithstanding that it was very short time for him, that he have them before today so that he would have some opportunity to go through them with his client.

To repeat, we had two weeks from receipt of his. I could go through a litany of challenges that we have had on our side to deal with his expert reports, which included my primary expert being unavailable to us until this last weekend. And that would be Mr. Mazur.

I'm also sympathetic to anyone that had to be up working on this material after midnight last night, because I was up for several

hours after midnight last night working on this material. So I am also quite sympathetic to Mr. Meronek if he too was having to do that. But Mr. Meronek is more experienced in the profession than I am. He's been practising longer than I have. He's a litigator. I have spent many years as a litigator, and I simply say to younger lawyers, it just goes with the territory. When you're in a hearing wherein you're in a trial, the reality is that you just have to work long hours. And inevitably, human nature and condition being what it is, you end up getting significant material at a late time.

Now, I have no objections whatsoever. In fact, I rather anticipated that the writers of the rebuttal would be produced a week from today, Tuesday, March 12th, and Mr. Meronek would be cross-examining them on that material. So practically speaking, he has a whole week to prepare his cross-examination on that material if he chooses. No objections if he wants to put forward questions this Thursday on the rebuttal material as well. So all arguably that we're missing is he would have preferred, I do understand that, several more days to have

Dr. Lawson, Mr. Derry, Mr. Woodford, Ms. Friesen, go through the material.

That's what we're short here, is their opportunity to thoroughly work and weave in their reaction to that material in their presentations today.

THE CHAIRMAN: Thank you.

Mr. Williams?

MR. WILLIAMS: Yes, just a couple of brief comments. In terms of the prejudice to the interests of the Bipole III Coalition, Mr. Meronek can take care of that himself. From our client's perspective, we're concerned about the prejudice to the process. And we have got an important piece of evidence today, new evidence put on the record last night. And with respect, new evidence that's not very well cited in certain circumstances. It's difficult to tell which load forecasts Manitoba Hydro is relying upon. It's difficult to tell where their numbers are coming from.

And so certainly our client is of the view that Mr. Meronek would be well within his rights to seek an adjournment. His proposal, as I understand it, is to leave open the opportunity of

calling back his witnesses when they have had an opportunity to review and to assimilate Manitoba Hydro's information, and also to understand through cross-examination where they are coming up with these estimates.

And from our client's perspective, that's an eminently reasonable position, and also one that is best designed to assist the process. If this evidence is important, and our client certainly believes it is, then from our client's perspective, if Mr. Meronek feels that he can't adequately address these issues through cross-examination, that that opportunity of bringing back these witnesses should be offered to him.

THE CHAIRMAN: Thank you. Any other comments? We're going to recess for about five minutes so the panel can discuss this.

(Hearing recessed at 9:12 a.m. and reconvened at 9:16 a.m.)

THE CHAIRMAN: Mr. Meronek, I'm aware that you had requested that Hydro submit its rebuttal at an earlier time, but I am also aware that we had said no, that we felt that the two-week period was reasonable. If that

prejudices your evidence at all, we will certainly entertain allowing you some time later this week or early next week, or one evening this week or next week to bring back your witnesses, if you need to.

MR. MERONEK: We appreciate that.

THE CHAIRMAN: So proceed, please.

MR. MERONEK: Mr. Derry, I'd like to start with you. I know that I had submitted a CV of your background and experience way back when, but if you could just indicate in your own words to the Commission what your background experience is and how it relates to this particular hearing?

MR. DERRY: Good morning, Mr. Chairman, Commissioners, staff, participants, Manitoba Hydro staff, and those in attendance. I will go over my name again. My name is Art Derry, a retired employee of Manitoba Hydro. I have been a professional engineer since 1960, two years after graduating from the University of Manitoba in 1958. And no need to worry, I'm not going to take up the whole morning covering my career, which it appears that it hasn't come to an end yet.

I will go over what I call my short

form CV. So in 1958, I had a Bachelor of Science in Electrical Engineering from the University of Manitoba. In 1960/61, I attended the General Electric Power Systems engineering course, it was an eight month course starting in September of 1960, ending in end of April '61. I was sent there by my employer at that time, Saskatchewan Power Corporation.

So from 1958 to 1967, I was employed by Saskatchewan Power Corporation. I started out as an engineer in charge of transmission planning, and I spent about three or four years at that, and then I became the engineer in charge of generation planning. So I have the whole part of planning process.

In fact, in 1960, I took part in studies with Manitoba Hydro on the first interconnection between Manitoba and Saskatchewan. Those studies took place in Pittsburgh, Pennsylvania at the Westinghouse Electric Corporation.

In 1967, I left Saskatchewan Power Corporation to come to Winnipeg, back to my home -- I come from Pine Falls. And I was employed by Atomic Energy of Canada from '67 to

1972 as an HVDC engineer on the Nelson River Bipoles I and II transmission project.

For those who may wonder about the involvement of Atomic Energy of Canada on the Nelson River project, the Federal Government provided funding for the first phase of Bipole I and the two lines that were built from the north to the south. So they had to have control of the project. And at that time, Teshmont Consultants were formed, which involved the Templeton Engineering, Shawinigan Engineering, and Montreal Engineering. And Teshmont is still here at this time. In fact, I guess they are a subsidiary of Manitoba Hydro, I take it.

During that time with Atomic Energy, I attended studies in England on the Bipole I project to do with the synchronous condenser sizing and filters, et cetera. The project was coming towards an end around 1970, the lines were built. And at that time Hydro offered, just a small group we had in Winnipeg here to look after the project, there were engineers and other people, Hydro offered jobs to those people so they'd still be with the project. So we were seconded for a couple of years while they sorted

out our pensions, et cetera. And I went over to Hydro in 1970 as an HVDC planning engineer.

And my first project with Hydro was to prepare a recommendation for the northern Bipole II HVDC terminal location in the north. That study resulted the recommendation that we go through Henday rather than build the station like they did at Dorsey where they put Bipoles I and II together. I did the north part, I had nothing to do with the south. My recommendation was to go to Henday, and it wasn't taken too well by the operating staff. I can tell you they wanted to have it so they can have one operating place. But we did win out. And it was a good choice to this day. And Bipole III location is also going to be located at another location, not at Henday, it's going to be up by Conawapa.

After that, I became manager of generation planning because I did have experience in Saskatchewan. And my responsibilities included the recommendation of inservice dates, first for Long Spruce and secondly for Limestone.

Now, Limestone was started but the load growth dropped off. At that time, we had load growth at 6, 7 percent. Load growth dropped

off, a decision was made that we would stop Limestone. We had just done the coffer-dam, so we flooded it. So come 1984, we went out -- I should say before that we had a 500, I worked 500 kVAC interconnection with Northern States Power. And I was involved in the contract negotiations on the diversity exchange. That was the -- I guess it's the contract that really made the line pay for itself, to start it for both the utilities. And I don't know if you know what diversity exchange is, winter time when we have our peak days, they would supply us capacity. In the summer time when they had their peak, we would return their favour.

MR. MERONEK: Mr. Derry, if I could ask you to just bring the mic a little closer to you?

MR. DERRY: Okay. So under my generation planning, we negotiated the power sales as well. And with the sale to Northern States Power of 500 megawatts that was negotiated in 1984, we were able to restart Limestone. And that was a 500 megawatt sale. I worked on that contract for that and I also participated. At that time, we had to have hearings with the National Energy Board and I participated as an

expert witness on that project.

So during the period of the '70s and '80s, many significant decisions of new generation and the 500 kV interconnection to the Northern States Power were made. I must say I was proud to play a role when I was with Hydro on decisions that are still providing benefits to consumers of Manitoba.

That's my CV. Before I start my presentation, I want to make the following point. Planning is not a rocket science, it's just common sense, and let us all remember this as we proceed with reviewing the various locations, options, route selections, to minimize the effects of Bipole III on the agricultural community in Southern Manitoba, as well as keeping in the forefront the need for improved reliability of the Manitoba Hydro system to a catastrophic failure of Dorsey Converter Station and northern transmission line corridor.

Okay. The report subject is up on the screen right now. I will read it out. It's location options for Bipole converter stations near Winnipeg, part one, Art Derry P Eng.

I'm going to go over the outline of

the presentation. The presentation will provide options of converter station locations at nine routes to achieve the same results or better to the agricultural community, as well as offering a more reliable system at a much lower overall cost than that of either the CEC or Manitoba Hydro. It will include discussion on the options, including configuration of the lines to various station locations, the timing, the cost, and the reliability issues. They will discuss all proposed routes with the prime function of minimizing the effect on the Southern Manitoba agriculture community, plus the reliability.

The main concern from a reliability perspective is that both HVDC lines come into the Dorsey station. And if Dorsey goes out for a catastrophic event, then the heavily populated and industrial areas of Winnipeg and Southern Manitoba will suffer severe power outages.

The first consideration will be a comparison of the CEC Inquiry Manitoba Hydro Coalition route proposals. It will be followed by the proposed converter locations of Bipole II and Bipole III offered by the CEC, Manitoba Hydro. And this report includes a discussion of the

reliability effect of such locations.

Now, the slide is up there. There will be five options. The first one is the status quo. Next, relocate Bipole II at Riel and build Bipole III at Dorsey, CEC inquiry; locate the converter station for Bipole III at Riel, a Manitoba Hydro proposal; relocate a new converter station for Bipole II at Riel, the recommended proposal of this report; and build a converter station of Bipole III in the vicinity of LaVerendrye, recommended proposal.

The effect of corridor outages on the existing Bipole I and II transmission lines will be examined during the shoulder months, which are the months of March, April and November, and the off peak months of May through to October. The capital cost of all the options will be provided, as well as the capital costs for underground cable proposals, the carrying charges for the Manitoba Hydro option C, the CEC option B, part of it which is the relocation of Bipole II to Riel, and the recommended option, which is the relocation of Bipole II; and finally the conclusions will be provided.

So, first we'll look at whether the

line routes could be terminated that would provide the least effect of the overhead lines from the perspective of the landowners.

This figure 1.1 indicates the various routes that we're going to be talking about. The green line you should know, you've seen it enough, I'm sure, over the last two months. That's the Hydro proposal. It is some -- I'll go over -- the red line is the CEC Inquiry, which would go straight across Westburne to Dorsey. The red line and then the purple line goes down to LaVerendrye Bipole III location that we're suggesting is a report recommendation. And there's another line that was brought up to you by Mr. Ennis at some of the hearings, and that goes from the Long Plains First Nations reserve, follows the 230 kV line that goes through Brandon. And then goes down a route, that light green route that was put up by Hydro, was never used. And then picks up on another 230 kV line that goes into LaVerendrye. So we're following routes that are already there. It would mean you just have to extend that at the right-of-way.

Okay. Now if we look at the CEC proposed route, it's about 95 kilometres to the

Dorsey station, the red line. The Hydro preferred route that goes in the green is 250 kilometres, or 230, I'm not sure. The Coalition proposed route would come within 40 kilometres of the Bipoles I and II lines, and then head in a northeast direction to LaVerendrye, and the total of that would be about 105 kilometres. And then Mr. Ennis's route would be about 110.

So preparing the routes, of course, the shortest, from a reliability perspective, the shortest is the CEC, and from a reliability perspective, no effect of reducing the deficit for Dorsey outage, such as equivalent to the Hydro proposal where they would refurbish Bipole II at Dorsey. In other words, if you had a dozen eggs at Dorsey, and you took six out and moved them over to Riel, and you came back and put another six in at Dorsey, so you end up with the same problem with having all your eggs in one basket.

The Coalition alternative, on the other hand, from Westburne is equivalent to the Hydro Riel option from a reliability viewpoint. However, from the perspective of landowners, it would reduce the line length for 125 kilometres resulting in less line being affected. It will

also have the advantage of utilizing underground cable. From the point where it leaves Westburne route to go southeast to LaVerendrye, resulting in over 40 kilometres of overhead lines, reducing the total to LaVerendrye to 190 kilometres of overhead lines.

Mr. Woodford and Dr. Lawson will discuss this alternative further in their presentations, the cable route. Mr. Ennis's alternative would reduce the line length by about 120 kilometres. It could be overhead lines following the extended right-of-ways that I discussed earlier.

I'm going to use this just to get our bearings, so everybody knows when we talk about Dorsey, Riel and the possible station near LaVerendrye. So on the top, on the top left-hand side you will see the Dorsey station. Of course there is 3,800 megawatts right now of conversion capacity there.

The Riel site, we are suggesting that the Bipole II be -- a new Bipole II be built at Riel, and it would be located at Riel.

And the third option is to put a converter station over near the LaVerendrye

station.

On this map there, or whatever it is, a drawing, you'll see at the bottom a brown line that is a south corridor, which is an existing undeveloped right-of-way. There is no lines on there. It's been there for years.

November 22nd, 2012, a Hydro witness commented in reference to a question to the Chairman -- the question was, what about LaVerendrye -- that it wasn't feasible to build Bipole III at this location because they would have to build five or six Hydro 230 kV lines to go back from LaVerendrye over to Riel. I disagree with that conclusion. It would take one 500 kV line. And the right-of-way is there for it right now, because that right-of-way was put in for a 500 kV line that was going to interconnect back into Dorsey in the earlier years. And it never got put in because Bipole III was never built on the east side of Lake Winnipeg and terminated at Riel.

And there is further evidence that there is plans to put a 500 kV line on that right-of-way in that Hydro capital venture forecast. And Mr. Woodford will talk further

about this in his report as well. In fact, there's plans to go all the way back to Dorsey station with 500 kV. You don't see a right-of-way for it there now, but they would have to get a right-of-way.

Now, just to cover off, should Bipole III, in the recommended plan, Bipole II would come first and then Bipole III. In other words, Bipole III will be delayed if we build a new converter station at Riel for Bipole II. But should that not happen, should Bipole III precede the relocation at Bipole II at Riel, then that 500 kV line would be required to go back to Riel.

This is an interesting figure, it comes from a Hydro report, page 34. The report is titled "Ultimate HVDC Development in Manitoba," authored by Mr. P. Lang and Mr. R. W. Mazur, signed by Mr. G. Neufeld, and distributed to many divisions, as well as to Mr. Tymofichuk, being one of the executives.

Now, let's see what this figure tells us. Let's start at the bottom. It shows from zero to minus 2000. The existing system, it shows how much deficits are starting in 2010. You will note that they missed the five on 2050, but we

know what that is. We go up to 2020. So with the existing system, we have a deficit, and we know we have had that, and I'll show another figure shortly, it's a Hydro figure. Again, you have seen it before. But if we -- if they do, or they are doing the Riel sectionalization, and I don't know whether it's finished or not, then they reduce the deficit from about 300 megawatts. Because they can import more power from the U.S. by having that sectionalization.

They show on there a Bipole III of a thousand megawatts. I think at one time they were thinking of only putting half a Bipole in. So I guess when they wrote the report, they had put that on there. But you can see now, if we relocate Bipole II from Dorsey to Riel, we go into the surplus position, just as well as if we built Bipole II, 2000 megawatts. And I think the dotted line is very accurate there, because Bipole I is it 1800 megawatts, of course, and Bipole II is 2000. So depending on which one you lost.

So then on top of that, if you read at the top, it shows what would happen if you had three Bipoles, in other words Bipole I at Dorsey, Bipole II relocated -- they don't say where and

they don't say when on this table, I'm going to cover that -- and Bipole III, of course. And now we have quite a big surplus. And I'll be showing you later that that surplus could last at Hydro's forecast rate of growth of 83 megawatts per year to about 2050. It will add 25 years to that 2020 -- 2025 I should say.

I guess I think I have made the point, that top line is three Bipoles, three different locations.

Okay. I have just come back to the options again, I can go through them quickly again. Status quo; relocate Bipole II at Riel; build Bipole III at Dorsey, CEC Inquiry; locate the converter station for Bipole III at Riel, Manitoba Hydro proposal. And remember, these A's, B's and C's, because I am going to put the figures to that later. D is relocate a new converter station for Bipole at Riel; and E, build a converter station for Bipole III in the vicinity of LaVerendrye.

You've seen this one before. And now I'm going to start off by looking at the status quo sort of thing. You can see by 2017, Hydro had projected a 1500-megawatt. By the way, this is

for the loss of Dorsey, in the peak period, in winter period. And I define the peak as happening somewhere between the month of December, January or February. You can have a peak in either one of those months, usually it's January more than often. So I guess we can go to the next slide.

The next slide is the one that we have prepared using the 2012 load forecast. I don't know what forecast they used on that last figure, but using the 2012 forecast, we don't come out with very much different answers. You can see the deficit starting in 2013/14, it goes from about 1050, 1100, up to 2000 megawatts come 2025, much the same as the other. If we look at 17/18, 2017/18, I think is 1400 megawatts instead of 1500. We're not going to argue about that.

MR. MERONEK: Mr. Derry, just go back to the last slide. Could you explain --

MR. DERRY: I'm sorry, I didn't cover off the blue. There's two colours there. The red forecast is the expected forecast of Manitoba Hydro, and the blue one is -- says 10 percent probability forecast. It's really the load forecast -- the load forecast that they have come up with. And I was interested in this. I wanted

to see what the difference would be. Because I don't really think they are going to beat that expected forecast, and I'll tell you why. From 1992 to 2012, the average load growth was 44 megawatts per year. And this forecast that they are putting out now from 2012 to 2032 is 83 megawatts per year, twice the amount.

Okay. Now I'm going to talk about the -- so, if we didn't do anything, just stay at the status quo, those are the outage deficits that we would suffer for a catastrophic outage at Dorsey. And in the Teshmont reports, it has a one in 200 year return period. It happened once every 200 years is the way I like to say it. So to have such a failure, we agree something should be done to cure the Dorsey problem.

Okay. Now we'll go to the -- this first figure is figure 1.3(b), and that refers to the CEC Inquiry. So what I've done here is I said, okay, we had the figure 1.3 but it didn't have any locations on it. It just talked about Bipole II relocation, it talked about Bipole III, and it didn't have any timing to it. So I put some times on these things. So if we look at the CEC Inquiry, we have a good idea of moving Bipole

II from Dorsey to Riel. Because you see, you get there, you relocate Bipole II to Riel. And that that is good, and this has been documented by Hydro that any of these, Bipole III or Bipole II relocated are only good until 2025. I extended that line to show where you'd start going into deficit again.

Now, the problem becomes one that you have Bipoles I and III at Dorsey, so what are you going to do in 2025, because you've got a deficit? And looking at the report, the 2010 report, the key findings, and you'll find them quoted in my report, but I'm just going to make a short comment on them. You will see they have suggested a high voltage. They don't say 500, but they say a high voltage AC transmission line north/south for additional -- will be required for additional north/south transmission beyond 2025.

And the second point was that splitting Dorsey Bipoles I and II shall be considered to reduce the power costs of 3800 megawatts.

So I have assumed to be able to have something comparable to what you're going to see in the recommended alternative, something has to

be done, you have to add 2000 megawatts to get back up to that top line. And if you remember Mr. Mazur's presentation, he compared the 2000-megawatt AC line to the DC line, for the line lengths of 1300 megawatts, and it came out to be $4.18 billion, much more than the DC.

So this is what I have suggested they would have to do. Now, if they didn't do that, what else are they going to do? Are they going to add 2000 megawatts of gas turbines? They have to do something to be comparable, to get to that top line that we have in figure 1.3 before, which we are going to recommend as the report's recommendation.

This ends up much -- identical, except what we have now is we have Bipole III at Riel, Bipoles I and II are still at Dorsey, so we end up with the same problem. So I said again, well, we've got to do something to get that same level of reliability.

Now, this is a recommended alternative. It ends up with, like I said in the first case on figure 3, 1-3, there are three distinct locations for the Bipoles. You would relocate Bipole II to Riel first. That's 2017, we

never put the date on there, but that's where that starts. But come 2025, then we're there if you want, they build Bipole III at LaVerendrye. And we have a system now that has three distinct Bipole locations. So you could lose one and you'd still have two. It's not just like losing Dorsey, then you'd lose two of them.

Now, if -- I think I mentioned later too -- if we don't pick up on the idea of relocating Riel, Bipole II to Riel, and just refurbish Bipole II at Dorsey, like Hydro is recommending, it's going to be another 40 years before you get a chance to redo it. There's a window of opportunity there now. If you don't take that window of opportunity, you're going to just keep refurbishing. And it's not just replacing the thyristor valves which Hydro has used in costing, there are other components that have to be replaced. And Mr. Woodford will talk about the condition of, is it better to build a new converter station or to refurbish?

And this one, this slide that's up here now, this recommendation will be shown to be the lowest cost and provide less effect on the agricultural communities in Southern Manitoba.

So what does all this mean? Next slide? What the analysis means, okay, we're not saying stop the route selection for Bipole III, it should not be stopped, it should be finalized. And the location to where it goes should be finalized. We're only talking about an eight year span between 2017 and 2025, where we could have some corridor problems. But I will cover these off, and the ones that we have had to date and the cost of those also.

So the location of Bipole II should be at Riel we are saying for 2017. If you look at the capital costs that I have in my report, you'll see that Bipole II is 27 to 31 percent of Bipole III in service costs. The reason there's two numbers there, we don't know whether they are going LCC or VSC, voltage source converters or line commutated converters. They haven't made their mind up yet.

One of the costs that you hear all the time is 3.28, which is the voltage source converters. And if they did go line commutated converters, it's more like 3.98 billion, both of those are billions. So then we say the location for Bipole III should be at or near LaVerendrye by

2025. All the above minimizes the effect on the Southern Manitoba agricultural community.

And I thought it would be nice to know how much they have spent on Bipole III up to now. I got this out of the financial forecast that Hydro provides to the Public Utilities Board. And up to the end of 2011 was actual, 2012 was estimated, and I found it to be 194 million, about 6 percent of the Bipole II total cost of 3.28 billion.

Now, moving Bipole II to Riel doesn't do anything for the transmission. We've still just got two transmission lines. For Bipole III we provide another transmission line. And in all the reports that I've seen from Hydro, they never did an analysis of what I call the shoulder months, or the off-peak months, of how much the deficit would be for the outages. Now, that's what I'm going to present here now that I've done.

So if you look at the figure here, that is the per unit for each month of peak of January, that's how much the load drops off. So if you looked at what I call the shoulder months, starting in March, April and November, those three months I call the shoulder months, they are about

80 percent of the peak, or 8.8 per unit if you want to use per unit. If you look at the off-peak period, which is May through to October, I estimated that it would be about 65 percent of the peak load. So using those peak numbers I went through deficit calculations. Next slide.

So this is for the transmission corridor outage and the shoulder months with the peak of 80 percent. And those are the deficits we have calculated for the two different forecasts, the expected and the low forecast.

Now, you can see we're not talking 2000 megawatts anymore, we're talking from 2017, something close to 400, going up to a thousand, almost a thousand in 2025. And with an outage like that, this can be handled by an increase in the -- increase in the -- I'll get it yet -- in the import capability from 900 to 1200 megawatts, which is 300 megawatts. And there is in place on the system right now 800 megawatts of load shedding. Now, this load shedding is automatic load shedding. So if you did have a loss, the frequency drops, and those loads would be shed. And so it is something that can be covered, it's not an outage like Dorsey of say months or -- yes?

THE CHAIRMAN: Could you just define what shedding is, please?

MR. DERRY: Load shedding, it's sending a signal to a breaker that will open up the line, that they will take the load that's on that line off. Okay.

THE CHAIRMAN: Thanks.

MR. MERONEK: Sorry, Mr. Derry, is another word for that interruptible?

MR. DERRY: Interruptible, it could be, but that's not done the same way, this is done by a frequency relay.

Now, what I was going to say is, in the case of Dorsey we were looking at things that had a one in 200 probability with a duration of months, and Hydro's moved that up to three years. Anyway, so we're in agreement we have to do something there. This one is more like weeks, this type of outage. Because all you have is a transmission line. And if you have enough equipment on spare parts and everything else, in fact, the 1996 outage of the corridor, within one week they had that full amount of power again going, because they could parallel the lines. So we're talking weeks here, we're not talking

months. And the load is down, it's not at the peak. So we'll go to the next one.

This one I just included so you have a good idea when you might have the tornado days and the thunder storm days. This is out of the Teshmont report. This is not mine, this is out of the Teshmont report.

So it shows the months of June, July, August are the ones that are worse. But we did have one in September actually. We had a wind event in September in 1996. Okay. The next one.

This is the same, this is 65 percent. And you'll have to watch this, because the bottom part is excess and the top part is deficit. I wanted to stay the same as I did with the other ones. So in other words, we are in an excess position during the summer months until we get out to about 2019, and then it goes into deficit. And to be fair, I have not put in any maintenance. Maintenance is performed on the system, on the units during the summer months. And with the 300 megawatts extra of import capability, there's 1200 megawatts and 800 megawatts of load shedding, or extra 300, 1200 megawatts of load shedding, I don't see a problem here. Again, it's weeks, not

months.

I'm going to quantify some of the events that have happened, only one in Hydro, I'm going to tell what you it cost us later.

I guess that's here.

Cost of outages, this was the request at the Public Utilities Board in this last hearing by the PUB for Manitoba Hydro to quantify what the loss was during that 1996 wind storm. That loss is made up of lost revenues for export sales and capital equipment that had to be replaced. Their estimate came out to $11.1 million. There was another storm, I guess a winter, Dorsey storm in 2011, and that estimate is $6.6 million.

Now, if you take the $3.28 billion, and take the annual carrying charges on it, which was interest depreciation of about 9.1 percent used by the PUB, you would come out to a carrying charge of $322 million per year. So are you going to spend $322 million to cover something that costs 11 or 6?

Next slide. These are the capital costs that we used in the report. The 1.2 billion is a figure that came out of the IRs from Manitoba Hydro. If you read the report, you'll see the

reference to it. So with Bipole II at Riel -- we'll go through each one separately -- CEC alternative suggests -- you said moving Bipole II, but the thing you would do is build a new Bipole II at Riel, 1.2 billion. Replacing the Dorsey Bipole II with Bipole III at Dorsey would be 3.14 for a total of 4 -- I'm sorry, the north/south for compatibility, or comparison to what we have with alternative D and E is 4.18 billion, which came from Hydro. So we had 8.52 billion for that alternative.

Now with the Manitoba Hydro alterative we have the 3.28 billion in costs. And in the report in appendix 1, you'll find the cost of .54 billion, which includes the valves, new transformers, replacement of transformers, moving reactors and so forth. It's greater than Hydro's estimate of -- I think their estimate was 1.1 -- 186 billion for each location, the north and south location or something like that.

Now, if you go to the Coalition alternative we used the 1.2 again, and locating Bipole III near LaVerendrye, we have a cost of 3.17 or 4.37.

Now, we made a comparison of the

capital costs, underground cable versus overhead lines, and all these costs are in millions of dollars. With Bipole III cable to LaVerendrye, which is 65 kilometres, we came up with $292.5 million. Bipole III overhead to Riel, credit 190 million of the overhead to conductor...
(POWER OUTAGE)

MR. DERRY: Going over this again starting with A, which is the LaVerendrye site it's Bipole III cable costs 292.5, all millions of dollars, and then a credit, because you are now doing away with 190 kilometres of overhead line, which is at a million dollars per kilometre, 190. So the difference is about $102.5 million, which is about 3.1 percent of the Bipole III cost.

And with Riel situation, you have to put a line from Dorsey over to Riel. And if you assume it was cable, 50 kilometres, we have a cost of 225 million, and a credit there of 170 kilometres of line, because in the Hydro alternative that they submitted in the January 28th letter, it had a hundred kilometres in the north part that came off around St. Ambroise or somewhere, goes across and came back down to Riel. And they had 70 kilometres on the

southern route, that brown route I showed you before, so that's a credit of 170. So it's about $55 million more, or 4.6 per cent of Bipole II costs, which is 1.2 billion.

Okay. Now this is an interesting one here too. I have talked about the carrying charges before. So the 322 you have seen, which is the voltage source converters, and the LCC alternative would come to 385. In that 322, I have given a credit because Bipole III will reduce the losses on the system by $26 million, so that's in the 3.22.

Now if you put Bipole II at Riel at a cost of 1.2 billion, you're looking at carrying charges of 109 million a year in that same period, between 2017 to 2025. I guess if we have any economists in the crowd, if you take the difference of the 322 minus the 109, which I think is 213 billion a year, and you take that present value of those eight years at 6.1 percent, which is Hydro's interest rate or discount rate, that comes out to $1.3 billion in savings, more than the cost of relocation of Bipole II.

Okay, next slide. Okay, just go back again to go over, before we give you the

conclusions. The recommendation, of course, is to move Bipole II and build a new one at Riel, put Bipole III in the southwest corner of Winnipeg. Just because we show it there doesn't mean it has to go at that location. It's up to Hydro to pick that spot, but it's at that corner somewhere. So that is the recommended location of this report, recommendation to this report for the location.

So the conclusions, again, are that it's the least cost alternative to relocate a new Bipole II at Riel for 2017, locate Bipole III at LaVerendrye by 2025.

And the last slide, just go back so you can see the routes that were suggested.

And that concludes my part one.

MR. MERONEK: Thank you. With the indulgence of the Commission, I would now ask Mr. Derry some questions with respect to the rebuttal.

Mr. Derry, do you have the rebuttal evidence of Manitoba Hydro that was filed last night?

THE CHAIRMAN: Mr. Meronek, ironically the panel has not received copies of this rebuttal. We are anticipating getting them by

noon. I'm not quite sure why.

MR. MERONEK: Then why don't I go through with all the presentations, and then we can pick up after that, when you have had the copies that you can follow along with.

THE CHAIRMAN: Yes, that might be helpful.

MR. DERRY: We're going to do it later?

THE CHAIRMAN: Yes.

MR. MERONEK: We'll move over to you, Mr. Woodford. And I would ask that you bring the mic close to you so that we can all hear what you have to say.

MR. WOODFORD: Mr. Chairman, Commissioners, ladies and gentlemen, my name is Dennis Woodford, as I said earlier. On my CV, I graduated in 1966 and joined a company called then English Electric, which was the manufacturer and supplier of Nelson River Bipole I. And then during that period of time until 1970, when I worked with -- I worked on that project, from the supplier's point of view, and did some work on Bipole I in the United Kingdom.

1970, I moved to Canada, went to the

University of Manitoba, got a masters degree. 1972, I joined Manitoba Hydro in system planning and continued working on Bipole I, but this time from the owner's perspective.

I also worked on AC transmission interconnections. And over through the 1970s worked with Mr. Derry in establishing the 500 kV AC transmission line to Minneapolis from Dorsey. My side of it was the technical side. Mr. Derry's was the important side where the money and contracts was involved. I also worked on the studies for Bipole II.

In 1986, I was appointed executive director of the Manitoba High Voltage DC Research Centre. And that had been established because it was felt back in about 1980, that since there was such a heavy reliance on the DC transmission to bring power into Manitoba with Bipole I and Bipole II now in operation, we needed a research centre to help improve any reliability issues.

And so during the 15 years I served as executive director of this independent research centre, from which we received quite a few contracts from Manitoba Hydro, we did look at quite a few issues that related to reliability of

the Nelson River. To recount two, one was wall bushing flashovers, that was studied to a great extent and resolved with Manitoba Hydro. Another one, which never was properly resolved, and that was what we called anomalous flashovers. I won't go into detail on that but we spent over 12 years trying to study that and find out what occurred.

In about 2000, Manitoba Hydro assumed responsibility for the Manitoba HVDC Research Centre. It was taken over and eventually incorporated into what is now Manitoba Hydro International. I, having served 15 years as executive director, it was time for younger and smarter people to take over. So with Hydro's blessing, I worked with them until the new director was in place, and started my own consulting company in electric power transmission, particularly difficult situations of transmission. And that was started in 2001.

And in that 12-year period that has existed, we have undertaken over 300 projects around the world involving AC and DC transmission, from a large network grid we are working at the moment with Teshmont Consultants, which is the Atlantic wind connection, 7000 megawatts DC grid,

with cables undersea and underground cables on the West Coast and the East Coast of United States -- that project is in progress, or at least it is developing, it's not built yet -- down to small projects, say down in Arizona, where someone is putting up a 20-megawatt solar generator.

We have worked all over the world with those 300 projects. So we have had quite a bit of experience. We do the very difficult work which many people need done in transmission, AC and DC studies.

That is a basic summary of my experience. Carry on?

MR. MERONEK: Yes, sir.

MR. WOODFORD: Thank you. Here we have a graph that was published in August 2010, in a CIGRE paper prepared by Manitoba Hydro high voltage DC transmission engineers. CIGRE is an international learned society based in Paris, that's probably the most exotic or most important learned society in this area in the world. Manitoba Hydro contributes significantly to this organization.

And in this paper entitled -- I forget what it's entitled, but discussed -- that's paper

B4-101 -- it was about the replacing, or refurbishing and developing the Nelson River transmission, DC transmission systems. And this particular graph published out of, reproduced out of that paper, shows that as time progresses, with a DC converter station, that you have to spend money refurbishing it. It would be nice to build a DC converter station and have it last 40 years and do nothing, just like you would buy a wonderful car like a Rolls Royce and expect to have no maintenance for 40 years. However, as you can see, you are maintaining it all the way along. And after about, as you get to 30 years, you've got to start to put big money in and replace a lot of equipment.

And this is the window of opportunity that Mr. Derry pointed out. And this is an opportunity now, instead of spending that money, putting some of it into building a completely new converter station which we are suggesting be located at Riel.

Now, here is a bird's eye view from Google Earth of Dorsey converter station as it is today. It's very interesting in that Bipole I, 1800 megawatts, look how big it is. That was the

one I worked on in the 1960s with the supplier of the equipment. Now, look at Bipole II, 2000 megawatts, and it is much smaller. If they went to voltage source converters for a 2000-megawatt converter station, it would be half or a third the size of Bipole II. So things are shrinking.

If we completely took Bipole II out of commission, or decommissioned it, there would be a big empty hole there. But I wouldn't suggest doing that. I would say leave the buildings there, and perhaps even leave the converters there. But I'll explain that later.

So, in moving a Bipole such as Bipole II to another location, there's a great example in the City of Los Angeles where there's a 3100-megawatt DC link coming into Los Angeles from the north, from the Columbia River. And at the Sylmar converter station, during its development -- it was originally developed about the same time as Bipole I -- they have done some refurbishment and they have expanded its capacity, and they ended up in the late 1990s with aging two converters that they had put in, and operating in parallel. You can see the original one, Sylmar

West, 2000 megawatts, big station, all the technology. Then they expanded it by 1100 megawatts and put in Sylmar East. And by early 2000s, they figured that these converter stations were aging and were going to cost a lot of money to replace the bits and pieces. And so it was decided to completely replace them.

And the way they did that was -- if we go to the next slide -- they reduced the operation down to 2000 megawatts by just having the Sylmar West station in operation. And that was the 2000 megawatts. So they suffered a loss of transmission capacity because they opened up the line to the 1100 megawatts Sylmar East station. And that's the one they refinished. And you'll see how much smaller it is. And what they were able to do is they tore out the insides, all the valves, the converter transformers, the controls and all the bits and pieces, out of that small converter station and put in it -- go to the next slide -- a 3100-megawatt converter station, with all the new equipment in it. All that was old was the building itself.

They then decommissioned the operation of the Sylmar West station. You can see there's

no line anymore between the two, and it's now operating functionally well at 3100 megawatts.

And the reason I bring this up is that this was an example of being able to put in new converters in a different location or a different situation, similar but not the same, of course, as what we're talking about with Bipole II being taken over to Riel. But it did not require much down time at all to the City of Los Angeles.

And in fact, it would be a good idea to go down and talk to the folks at Los Angeles Department of Water and Power and find out exactly how much down time they had, if any, in this complete reconstruction with a new converter at Sylmar station. Because Manitoba Hydro has emphasized several times in their representations to you that to do this relocation of Bipole II at Riel is going to require extensive down time, and all sorts of problems and difficulties and challenges. And I know there are challenges. I don't disagree with that. But with good engineering, as was able to be accomplished in the City of Los Angeles, that this can be really minimized. And if they wish to find more information on this situation, they can go to the

Bonneville Power Administration up in the Vancouver, Washington, where they are doing a similar type of operation now. And Bonneville Power Administration is a part of the U.S. Department of Energy, and gain some -- see what experience and what problems they are having in their re-establishment of a new converter system.

So I bring these points forward to present to you that this relocation or rebuilding, or putting a new converter at Riel or Bipole II may not be such a big, terrible situation as we have been lead to believe.

Next slide. This is a diagram pulled out of another paper presented by Manitoba Hydro HVDC transmission planning engineers, it is figure 8 again, 103.1 -- 103. This is public domain information, and it shows how they anticipate the development of, as has been proposed by Manitoba Hydro, of Bipole III at Riel, and Bipole I and II remaining at Dorsey.

The interesting point I wanted to make out, that with this we have two 500 kV interconnections between Riel and Dorsey. There's two black lines -- there it is. Anyway, you can see that. Of course, they anticipate in the

future that there will be hopefully a second 500 kV line coming out of Dorsey.

So 500 kV double circuit with Bipole III between Riel and Dorsey seems to have been an issue that they are considering. And we know from the representations made by Manitoba Hydro that this is under consideration. And as Mr. Derry pointed out, there is the right-of-way that could go all the way from Riel, south of Winnipeg, up past -- near LaVerendrye and presumably on up to Dorsey, as they had shown there. And that would be with Bipole III, it seems, for this representation. It's only a representation, but it's something that has been considered by Manitoba Hydro, and it could be done, of course, as a consequence.

Again, this is just a picture to show how we would put Bipole II over at Riel, but we would leave Bipole III there. You know, Bipole II at Dorsey, don't decommission it for a while anyway. And this is quite important because, as is rightly being considered, there could be some issues associated with building a new converter like that. If you've got Bipole II that is still functionable, heavens, just switch out the one,

the new one you are putting in and get it fixed, and get it back to the old one and let it work. That way you can minimize any down time.

This is another diagram of the same thing. And one of the points that I wish to make here is that we need to get, if we put Bipole II down at Riel, we have got to build a DC line to Riel. And there are a number of options. Manitoba Hydro, as I'll show you shortly, have proposed that that line will be over a hundred kilometres long and go away north and come way down to Bipole -- to Riel, if this was done.

The issue here I want to point out is that by keeping the connection to the existing Bipole I and II transmission lines, and not disrupting them at all, except perhaps to have an interconnection station, that we can still parallel, at least from Dorsey up to in the Radisson, in case we lose one line.

This now raises the issue, well, what happens if we lose the section between Riel and where it connects under the DC line? And of course, we can't parallel that. And so my preferred recommendation, and I don't think anyone else will immediately agree with me, but I would

recommend that we put Bipole, the line from Dorsey to Riel as an underground cable down the 500 kV AC right-of-way, which is only less than 50 kilometres. And then if we did, we wouldn't lose any towers due to environmental issues, we might get some cable faults. And although I have got Bipole II at Dorsey decommissioned there, why not leave it in for a while, operational, just keep it there? Don't use it unless you have to. And then if you do lose that line or lose the other Bipole, until you bring in Bipole III anyway, you can bring in, start up, fire up the old Bipole II at Dorsey and off you go. These are issues that I'm presenting to you that haven't been really studied. They haven't really been presented, and they need to be.

Now, if we do convert or transfer Bipole II away from Dorsey as we have proposed, we do solve the problem of Bipole II going out and Bipole I going out simultaneously. I know when we were building Nelson River Bipole I and II at Dorsey, some of the technicians that were working out at Dorsey station were saying, you know, this is pretty close to a runway, one of the runways from the airport. And if a Boeing 747 came

roaring in and crashing down, it will take out the whole station. So we recognized way back in the '70s that this could happen. But by moving it, as has been widely proposed to move Bipole II and separate it away from Dorsey, and if the Boeing 747 crashed into Dorsey, then it would only take out Bipole I. I'm just bringing that up as a fact that we discussed that way back 30, 40 years ago.

Now, that leaves the transmission lines, which Mr. Derry has discussed before. When they go down -- here is the 1996 towers that went down. And for some reason or other -- this is out of the chapter II of the EIS, these pictures -- they've got 1991 written on them, but I guess that's a mistake.

And as a consequence of this, we're suggesting that, as Mr. Derry said, if we had good inventory and we had good restoration practice in place, this outage will not be very long.

Now, we have heard six to eight weeks. This of course is a worst case scenario. Why do we always have to have worse case scenarios presented to us? When we have had an actual situation that took I think five years, you said a week, but I think it was five days when Bipole I

and II were back up and running. So there is a worst case, which may be six to eight weeks, but there is also a reasonable case. Where is this reasonable case presented? We don't see that in the submissions from Manitoba Hydro. And I'd like to see some reasonable cases. I'm proposing to you that with good inventory and a good restoration practice, we can minimize the possibility of this worst case scenario happening, not the six to eight weeks.

And one of the things I would like to also raise is, will severe wind occur when the Bipole lines are going through the forest? There have been some weather studies done, and I have read, I think I have read all of them. But I ask the question, in the forest, there is turbulence created near, you know, within the first 30, 40 metres above the ground because of the trees. How does this turbulence, as it comes across to the lines, how does it impact the wind on the conductors, which is what caused problems to pull the towers over. On the prairies, there's nothing to turbulate the air. And so, of course, we see this thing happening. I would like to know the answer to this. I don't know it. It's not in the

weather studies that I have seen. Does the forest, lines going through the forest, do the trees turbulate the air enough to cause -- or to limit the lines coming down? The forces on the transmission lines, maybe Manitoba Hydro can present this at some stage, or someone can.

Next slide. Icing, big problem. Here's a picture of an insulator. Studies done on insulators show that as long as we're not near the sea, the ice tends to be reasonably good insulator, and it may hold full voltage. But on the DC lines we can easily remedy that if we don't trust full voltage on the insulators, and lower the voltages, as we do when we have the fire under the line, we have to lower the voltage of the DC conductors so that the ionized air from the fires doesn't cause a flashover to ground at the high voltage. And so we could probably minimize any flashovers occurring, at least on the DC line from the insulators icing up.

Let's go to the next slide. Looking at some recent icing conditions, and I can only bring these two up because that's all I could find on the weather station on the internet. For the October 5th terrible ice storm in Southeast

Manitoba, the temperatures on October 5th, as is shown there, maximum was 1.9 degrees Celsius, minimum was minus 0.1 degrees Celsius in Steinbach.

There was a severe ice storm in 2009, February 2009, that went from Saskatchewan right across into Manitoba and took out transmission, probably more in Saskatchewan than Manitoba. But in Brandon, the temperatures there as shown for that day, maximum .8 degrees Celsius, minimum minus 5.6-degrees Celsius.

The reason why I'm putting this up -- let's move to the next slide -- as a consequence of the tremendous disaster in 1998 in Quebec and the United States, well at least the United States, with a terrible ice storm. In fact, this is considered to be the most devastating natural disaster in Canadian history, an institute was formed in Boston known as the Institute for Catastrophic Loss Reduction. And the first study was the Hydro Quebec and Northern U.S. ice storm. And this is a chart from that first study. And it shows that icing, freezing rain which causes icing is very much a function of altitude. And this is a problem, of course, for airplanes which can be

quite high up, and they can ice at very low temperatures, minus 20, minus 30 degrees, if they are high enough. But in Manitoba, where we're less than 3,000 metres above sea level, freezing rain will happen around 0-degrees Celsius, which is indicated by the two studies I have just showed you, the two reports I have just showed you about the two ice storms, which is around 0 degrees Celsius. Now, why is this important? Let's go to the next slide. Contrary to what is written in one of the Manitoba Hydro presentations, when you're in these ice storm conditions, the conductors still get warm if they have current going through them. You can't put current through a conductor, no matter what the ambient temperature is, without it getting a little warmer than the ambient. And this is based on calculations presented in IEEE standard 738, where conductor temperatures above ambient are presented. And using these calculations from the standard, taking into account Bipole I and Bipole II, assuming we can load the phases of the poles up to 2000 amps, and there's two conductors in each pole, each conductor should heat up at an ambient temperature of 0-degrees Celsius. And in

this case, we had an 80 kilometre an hour wind. That was the temperature -- and no sun shining, of course -- that was the temperature rise above ambient that would happen in the conductors. So if we had 2000 amps, we've got 9 degrees of heat above ambient. If the atmospheric temperature, if the ambient temperature is around 0-degrees, then any freezing rain hitting those slightly warm conductors is not going to stick. Okay. It's going to just drip off.

The problem is with freezing rain, if it hits a cold surface like a road or a tree that's been in the winter for a long time and is cold, that freezing rain turns to ice, and sticks. And accumulates. It's heavy, and it pulls down trees, pulls down conductors, and does devastation as we know.

And the secret is to prevent the ice from happening in the first place. And this is possible with Bipole I and Bipole II, from preventing the icing from happening on the main conductors.

Now, you'll still get icing on the shield while it goes overhead, a little steel wire about three-eighths of an inch or half an inch in

diameter, and you'll still get icing on the insulators, and you will still get icing on the towers. But they should be designed to handle that. In fact, in the Hydro Quebec storm of 1998, what they did after that was that Hydro Quebec developed a device, or a power, which had two functions. One function was to generate DC current that they could push down this 735 kV AC lines, which they have over there, and melt the ice. It's harder melting the ice than it is to keep it off in the first place. And then we're going to use a DC converter to do that. That DC converter, when there was no ice storms, can be switched and operated in a different mode and provide AC voltage control. And that is in operation in Quebec today as a means of, if they ever get another ice storm like they had in '98, at least be able to keep the ice off some of the critical 735 kV AC transmission lines. And they wouldn't keep the ice off the shield wires, and they wouldn't keep off the insulators, and they wouldn't keep the ice off the towers, they would stand up, or they should stand up -- otherwise they are being designed inadequately. So it's getting the ice off the conductors that's the key

factor for icing on these high voltage lines.

Converter controls, there has been concern about all these controls if we change Bipole II over to Riel. That's going to be a bit of a headache, and that will be. But the Bipole I and Bipole II controls are analogue controls, and these are 30 years old. When I was at the university in the early '60s, we used analogue electronics in our laboratory work, didn't do any digital stuff. But today everything is done digitally and there are many projects of DC transmission systems that have these old analogue controls, and they are replacing them with digital controls. And when they do that, they'll have more flexibility and be able to do things that they can't normally dream of with the analogue controls. As long as we have a good communication system in place, which we would do with fibre optic cables underground -- well, they can do it any way they want.

Resonance is raised as an issue. Resonance is a sustained oscillation of DC line voltage and current on the DC side of the system, due to various reasons.

And this is raised as a big concern,

and particularly with this real long line all the way down south of Winnipeg and over to Ste. Annes and back into Riel. They have a problem with the long distance. If we shorten the line significantly, like we're trying to do, and putting in a bit of cable as well, it will change that resonance situation. And this need to be studied. And I think this problem can be remedied and studied and fixed without too much expense, notwithstanding the fact that Manitoba Hydro is concerned about the expense that might occur in the remedy of the resonance situation.

Again, that has to be studied, and I'd like to see the studies to show that this is what the remedy would be.

And here is the case that Manitoba Hydro has presented if we -- Bipole II located at Riel. You see that -- let's see if I can get this working again.

Okay. So they have this great big line way up north, coming all the way down here. I think it's greater than a hundred kilometres, but nonetheless -- my recommendation, again, it's just my opinion, put a cable in. Because if we can delay Bipole III, as Mr. Derry has pointed

out, we have got $322 million carrying charges a year we are saving. And delaying even a year, that $322 million could be used in -- we could pay for that cable, and other things as well.

Now, whether this line is DC, I don't think it should be DC. That should be 500 kV AC all the way from here to here, when it comes time to build it. This is an arguable point, but that's my position. And that 30 kilometre, the 50 kilometre line along the 500 kV right-of-way, which would be cable, would be my preferred opinion, but maybe I'm a voice crying in the wilderness on that one.

And here again is just a reproduction of that, the future. Putting in Bipole III, we would come in the short route, so we don't go all the way around the province to get to Riel. And the 500 -- the issue here I think is the 500 kV line to here. Is that a single line? My feeling is that that -- and I'm pretty sure Manitoba Hydro would view that a single line 500 kV from here to here would be completely inadequate and that we'd need to extend the 500 kV line up to Dorsey.

If perchance that Bipole III could be delayed, we have Bipole II feeding into Riel, here

we've got an advantage and a benefit to Manitoba Hydro, because we learned in the rebuttal that we got late last night that they are really concerned about the area, Winnipeg area transmission with a heavy load west to east, and any power injected in at LaVerendrye would exacerbate that. But if we go ahead and put in Bipole II in the east at Riel, then we are counteracting that flow, and it would help resolve that issue until Bipole III comes in.

And then I would like to see the studies of what would happen if we put these three converter stations in the three different locations, with a 500 kV ring right around Winnipeg, and what would that impact have on the Winnipeg area transmission loading west to east? That would be a study I would like to see.

So conclusions, Bipole II inverter could be located at Riel with little disruption of power. And if you folks don't believe me, I suggest you go and talk to the City of Los Angeles and find out what they did. Three inverters at three different locations around Winnipeg, that will increase reliability. That's just plain common sense, as Mr. Derry suggested, was important in this matter.

Ice storms can be managed effectively as it impacts the Bipole I and II DC transmission lines. And really, if you have a severe ice storm where you are going to endanger those lines, you have got real troubles in this province. Because you begin to lose your AC system. And that outage that we saw before will last a long time, as we saw down in Southeast Manitoba in October.

(POWER OUTAGE)

(Proceedings recessed at 10:50 a.m. and reconvened at 11:05 a.m.)

THE CHAIRMAN: Okay. Can we come back to order? We have a third presentation by the Bipole Coalition. Mr. Meronek?

MR. MERONEK: Thank you, Mr. Chairman. Dr. Lawson, could you please indicate to the Commission what your professional background is?

MR. LAWSON: Yes. Mr. Chairman, Commissioners, ladies and gentlemen, as far as professional qualifications are concerned, I have a BSs in Physics from the University of Edinburgh in Scotland, and a Ph.D. in electrical engineering, actually it was a study on high voltage DC cables that I did for my Ph.D. at the university of South Hampton. And I'm a chartered

engineer, U.K. chartered engineer, and I'm a fellow of the Institute of Engineering Technology. This used to be the Institute of Electrical Engineers, but all of the institutions have merged in the U.K. and now we call them the FIET, engineering technology.

I am pleased to be in Winnipeg, it is my first time. I do have distant relations here. The Sinclairs came from Scotland many, many years ago. My sister has met them, but I haven't, so this is an opportunity to make contact.

Actually, I'm lucky to be here. Because at Immigration when I mentioned Bipole III, they almost turned me around, sent me back home. Just a joke.

As far as my professional experience is concerned, my 40 years engineering experience is divided approximately in two, two periods of about 20 years. First 20 years I worked with Prysmian, it was Pirelli in my time, now it's Prysmian. I joined Prysmian in 1970, and spent 20 years with them. I joined as an international engineer, a person who was willing to travel. And so during that period I worked in Brazil for three years, in Italy for three years, and I was

actually the vice-president in charge of research development and engineering, which is a planned technology in North America. In these days the company was called Pirelli Cables North America. So I was responsible for plants in Canada, in Montreal, in Prescot, Ontario and a plant in Surrey British Columbia was subsequently moved down to South Carolina, and also several plants in the U.S.

As far as my experience is concerned, I have worked with local engineers. I worked with three different groups of Winnipeg engineers. I have worked with Teshmont on a DC project in the Philippines. I worked with Dennis's company, Electranix, a project in Malaysia in 2007, and also with Dennis on the MAPP project, that is the Mid Atlantic Power Pathway, which was going to have a DC connection across the Chesapeake. That didn't happen yet so we're still waiting for that one.

Other than that, I have spent almost a solid year in Malaysia at three different cycles of the same project. The first cycle was probably the most exciting. We went through the complete gamut of studies and surveys of specifications, of

the bid process, of selection of the contractor, which was ABB. ABB actually started to make cable for the project. This was in 1997, when there was the currency crash in Southeast Asia, where the Malaysian ringgit went from 2.5 to the dollar to 4 to the dollar, that killed the project. So that was ABB with 30 kilometres of cable, not knowing what to do with it.

I spent a lot of time at the plant, at ABB's plant, several months, following the development work, following the type testing, the qualification testing, and also the manufacturing of that 30 kilometre length.

And I did something similar for the Neptune project. I actually think of this as my project. I was in it from the start in 2002, and worked in the Halden plant of Norway, again during the development of a 500 kV DC cable. And that didn't work out, so we changed suppliers. We changed from Nexans in Halden, Norway to Prysmian in Naples, Italy. And they were very successful. And the project was brought in under budget and on time in 2007.

Neptune is interesting because it does have probably the largest land cable at that time.

It was about 23 kilometres in length. So that was good.

Again, I witnessed all of the testing in Naples, but I also witnessed the testing of the land AC cables in Prysmian's plant in France, and also in Delft, Prysmian's plant in Holland. So that was quite an interesting experience for me.

In total I worked on 32 submarine cable projects, and a large number also of land cable projects since becoming a consultant.

So that basically is my qualifications and background.

MR. MERONEK: Perhaps, now you can go through your presentation, sir.

MR. LAWSON: All right. So I thought we'd like some nice pictures to have a look at, starting, on the right you have a 500 kV DC termination. And if you look at the little guys at the bottom, you can see just how high that is. It's about seven metres long. And the length really depends on the conditions. So it can vary quite significantly according to the weather conditions. And it depends on how many millimeters of kV they require, and that determines the total length.

And middle top is the transition station of the Basslink project. And this is in Australia, this is between Tasmania and Victoria on the mainland. And I actually worked in the project with Tasmania Hydro, but never managed to get to Australia. I got to New Zealand three times, but Australia never. And I worked on the middle bottom picture is the Middletown, Norwalk project, 345 kV project in Connecticut. This is probably one of the longest cable projects of its type in the world, about 20 kilometres, double circuit. And this is a trench being infilled.

And the picture on the left is a picture of the Norway to the Netherlands 450 kV project. The double cable arrangement there was relatively unsuccessful. It could only be laid in very shallow water. And the deep water was two separate cables. And you don't blame me for this, because I think it was the utility's idea to do it this way.

So next slide. This is a nice drawing of mass impregnated cable, 500 kV. So you can see the various layers. What I want to bring your attention to is that the land cable will be very similar up until the polyethylene sheath, number

seven if you can see that. And we have to bear in mind when we're talking, particularly about splices, and I think that we have a question here. Splices for submarine cables needed to be flexible in order to lay the cables, particularly if you're laying the cables in deep water. And since there's relatively little experience on land compared with the experience that there is submarine cables, DC submarine cables, something like 4500 kilometres already installed. And about half of that is in the voltage range 400 to 500 kV. So we need flexible splices. And these flexible splices are really just a reconstitution of the cable itself. And they are something like 5 metres in length. And since we had been dealing mainly with submarine cables, when there is a relatively big land cable project, you tend to have the same splices. The industry hasn't yet got to the point where it's developing rapidly fitting splices, which are larger than the diameter of the cable. And this could be a good idea from the point of view of land cable splices, they are not available as yet. I mean, even in the Skagerrak four cable, which is the 90 kilometre cable that you mentioned which is going

in, in Denmark, the splices will continue to be five metres long. And this is also the case in the project in Neptune project in Long Island.

So that's why we have problems with times of splicing times.

Now, I have said for the splicing time, I said four days, and Manitoba Hydro had said five. Well, you probably will get the answer five if you ask the suppliers. And that is because they are thinking in terms of splicing submarine cables. If you see the armour wire and everything else outside item 7, all these have to be dealt with as well. So for a submarine cable it is fairly typical to say five days. This isn't the case for a land cable without the armour. And that's why I dropped from five to four. And not only so in the case of the underground cable that we're talking about here, we're talking about two cables. And two cables are fairly close together. And so when you're doing the splicing, you can actually work on the two cables more or less at the same time. So your 10 days for two cables, if they are in close proximity, will come to something like eight. So that was the reason why there's this discrepancy. Your five is good, but

I think my four is better.

Next slide. Just some of the main cable links, in service or being installed at present. Just to give you a flavour of the extent to which these cables are being utilized.

The Fennoskan 2, unfortunately I haven't put Fennoskan 1 in there, but I did want to say something about Fennoskan 1 between Sweden and Finland is quite important. Because at that time, 1994 I think, the production capacity of the manufacturers was about 120 kilometres a year, quite small. So in order to have the Fennoskan installed, it would have taken two years for one supplier. But APP and Nexans got together and they supplied half of the cable each, so they were able to do it in much shorter a time.

This is relevant also to our situation. I think we can consider the possibility to have more than one manufacturer doing this work.

Western Link U.K., third from the bottom is very interesting. You'll see the voltage, this is the first ever voltage at 600 kV. Now, the interesting thing is that it's a similar cable design but the material is slightly

different. Instead of paper tapes impregnated with a viscous fluid, they have paper polypropylene laminate tapes. In fact, the laminate is good because it prevents the mass impregnated liquid, fluid draining much more so than standard paper cable. So you can operate at a much higher temperature, much higher loads of stress. So you have got 600 and you've got two cables with 2000 megawatts.

This is going between Wales and Scotland. It is a project which has been undertaken by Prysmian. The Strait of Belle Isle is a project which has just been announced recently, fairly recently. It has gone to Nexans.

And this is interesting too because it's a Bipole, and you see three cables in it, and you see a spare. And Manitoba Hydro has expressed interest to have a spare for the land cable. This is a very difficult situation. And you have icebergs and things to worry about. That's why they have this spare. It's a very difficult route as well. That's why they have the spare. And in practice, very, very few of these projects -- and, in fact, if you look at all of the projects that are in service today, very, very few have spare

cables. And some do, I admit, but very few.

This is the same with land cables. You find very few installations on land with spare cables. Because -- well, from the point of view of the spare cable for a submarine installation, particularly in Belle Isle Strait, it doesn't make sense. Because if there's damage, it will take a long time to have the ship available and so on to do the repair. But it's not true with the land cable. If you have damage on the land cable, you generally have spare cable available, so you can make a repair and use the spare cable to do that.

So I really don't think that a third cable in our case is necessary. The reliability of these cables is such, and it's proven by the amount of activity that's going on, the reliability of the mass impregnated DC cable is very, very good.

The other thing I should say here concerns the nominal life. We have been saying for generations that nominal life of these cables is 40 years. But at least in two instances when the cable was removed and tested, both chemically and electrically, there was zero deterioration after 30 years in service. The reason that these

cables were removed, they were no longer capable of supplying the power required. They were too small in other words. So they were replaced by bigger cables. But deterioration doesn't happen. So when we say nominal life of 40 years, that really is nominal. And I don't think the cable industry will say more at the moment than it's nominal, but we expect it to be much longer than that. But if you ask them how much longer, they won't say. Presumably they don't know. There's no indication of deterioration, so it could go on for quite a long time.

Next slide. These are the standard cable design parameters. The maximum conductor temperature is very low at 55. This is because if you have it higher than 55, there's a danger that the compound will drain, the voids will be formed and you will get deterioration. That's never happened in practice if you keep the temperature at 55. The interesting thing with the western link, with the new laminate tapes, you can go up higher, probably to 60, 65, rather than to 55, so you get much more power.

I think we know the rest of the data, probably not worth saying very much about it.

The ground temperature is favourable at 14, maximum ground temperature burial depth. If you go to tropical countries, you're dealing with 30, 32 degrees. And of course that cuts in significantly to your power transmission. But here 55 is good, especially with a 14-degree ambient.

Next slide. So we have two possibilities. Either two cables per pole in separate trenches, or one cable per pole in single trench. Obviously we opted for B because of the difficulties of splicing, the time needed to splice basically.

Next slide. And these are the trenches that we may have to consider, at least at some stage. The one on the left is Long Island, and they are putting in the first cable. Because there are two cables go in there, they have a return cable as well, low voltage return cable, as well as the high voltage DC cable.

The trench at the right is quite interesting. Because in this case, the Baltic cable which goes between Sweden and Germany, at that stage ABB did not want to have the risk of a splice between the submarine cable and the land

cable. So what they did was they pulled the submarine cable five and a half kilometres in this trench that you see a section of here. So talking about pulling cable into trenches, everything is possible. That's five and a half kilometres. So if you can get five and a half kilometres of cable to your trench, you can pull it in.

Next slide. This is Europacabel, which was published just recently. The emphasis now at the lower voltages is in cross linked polymer, DC polymer dimetrics. So at the present stage of development, you can have 320 kV, but not 500 kV. It may take between three and five years for the industry to fully qualify this kind of cable for 500 kV operation. But in this booklet, the interesting thing for me was that they also comment on cost. And with this type of design, they are costing the ratio between the equivalent overhead line. And this cable is three to one according to Europacabel, all of the cable industries in Europe. And a lot of this kind of cable is actually going in at the moment in -- well, submarine and land, but the land sections are quite significant, between 45 kilometres and 75 kilometres, and this is a Bipole touching in

that case.

This is your neighbour, I think, Alberta Energy. They did studies some years back and their report is on line. Among other things, they did a study of underground transmission cables AC/DC. And for the DC, the 500 kV 2000-megawatt design that they produced and costed is shown in this slide. And the cost for that is, I think it's in the next slide. Next slide, please? This is back to the Neptune with the land cables, the big reels being delivered by barge to the shore on Long Island.

Next slide. This is the question of a spare cable. Neptune does not have a spare cable installed, Neptune has a spare cable on reel. This is a thousand metres of cable on this reel in two layers, and they have limited to a thousand because it's for long-term storage, just in case there's any change of geometry of the cables. There won't be, but they are keeping it to a thousand for that reason. You could actually have much more on the reel. And of course it was transported on land. Looking at the background, this is in Italy, it is not in Long Island. It was transported in Long Island, though, because

the installation was fairly near to the Wantagh Parkway on Long Island. The only problem they had was they had to transport it during the night, when the road was closed for that purpose.

Next slide. These are the costs. The first one was actually based on budgetary pricing, which I had for the Neptune project land section. I'm not saying that that is the actual price that we ended up with, that was a budgetary price before contract was lead. So I did some escalation there and obviously took the price of the cable and doubled and so on, did the best I could. Came out with 4.35 for route kilometre. Estimate two was supplied by a supplier informally, because it's very difficult for myself to go to a supplier, who are very busy, and say, I want you to tell me how much this cable is. They want to know site conditions and all sorts of things. But they were very good and they said, on the basis of the length that you've told me and so on, 5 million would be good. And these are current pricing.

And then Alberta Energy report, you can use the data which are also in the report, and do a calculation there. That turns out to be

4.5 million per route kilometre.

So I was feeling quite happy with these figures. What makes things difficult is your spare cable that you insist upon, and as I have said, I don't think it's necessary.

Next slide. This is how you can get in real difficulties with costing. Because if you take this Inelfe, that's the link which is going in between France and Spain, it is also a 2000 megawatt link, four cables each Bipole into separate trenches. But if you take the figures and you just lump in the tunnel cost with the civil works, you come out with 6 million USD. So without knowing what's going on there, you can say, well, that should be 6 million for the link. Next slide. This is the transition station in Victoria. That's the Basslink project, 400 kV. That's the picture on the front page, front slide.

Next slide, please? Nothing against overhead lines, that's a beautiful picture. In fact, historically, cables were only used when there was some problem. Either the land was of extreme beauty, scenic beauty that they didn't want overhead lines, so use cable, or in cities or in offshore islands where you couldn't use

overhead lines, you used cables. So cables have always been used where overhead lines had some problems. As in this case, it seems quite appropriate that cables should be used for at least a section of the Bipole III.

The two pictures on the right actually come from France. The left picture, 2004, is the land, natural grassland they call it. This is the land before the underground cable was laid. And this is a 400 kV XLPE. I don't know the rating, but it's three cables. That was installed in, I guess it must have been just after he took the picture, in 2004. And then we looked again in 2005, it almost recovered; 2006, he looked again and the picture tells you that the land has recovered. You do see a couple of trees missing, but that's obviously necessary to take these out for the trench. And this is a study which was done for that purpose as well, to satisfy the environmentalists that the land can recover. So thank you.

THE CHAIRMAN: Thank you, Dr. Lawson.

Mr. Meronek, you had indicated earlier that you'd like to sort of look at Manitoba Hydro's rebuttal and ask your presenters some

questions based on that. Now, we have copies of it, we received them during the break. But we haven't had a chance to read them. If you want to take us through it. I mean, not take us through the whole thing, but as you go question to question, if you can highlight it? If that works for you, that would work for us I think.

MR. MERONEK: That's what I intend to do, sir.

THE CHAIRMAN: Okay. Let's try that. If we get thoroughly confused, it won't be new.

MR. MERONEK: You mean more thoroughly confused.

THE CHAIRMAN: Better way of putting it.

MR. MERONEK: Back to you, Mr. Derry. Have you got the rebuttal evidence in front of you?

MR. DERRY: I have it in front of me.

MR. MERONEK: I wish I could say the same. Here we go.

Now, in the brief time that you have been able to analyze the rebuttal, I want to direct you to certain statements made in the rebuttal and get your comments.

Firstly, on page one, under the heading report part one recommends, the last sentence of that paragraph states:

"Manitoba Hydro disagrees with these assumptions..."

And it relates to your risk assessment for the loss of the Bipole transmission lines based on your analysis of alternate supply of load. It says:

"Manitoba Hydro disagrees with these assumptions as the assumptions could result in extensive periods where significant load would be exposed to rotating blackouts during the extremely cold Manitoba winter months."

Can you comment on that observation or statement by Manitoba Hydro?

MR. DERRY: First I want to talk about the 1200-megawatt increase and the import capability. This has been documented in my report.

If you look at page 1-5, and you'll find out where I picked that figure up.

Secondly, I have looked at the shoulder months, I have not looked at the peak months, and neither has Manitoba Hydro. They

haven't given you -- like I guess we have in a way, we have looked at the peak months. But normally in the peak months you don't have conditions that would take out the Bipole corridor. When you have a peak, you usually have a high pressure area with minus 40-degree temperatures, and you may have some winds in some cases. But I have assumed that normally there wouldn't be a problem. And I would like Hydro to tell me if they have ever had a problem in the last 40 years during the winter period with the corridor?

I have looked at the shoulder months, and I can go back to the slides if you want. And I have concluded that because of the short time period, and with the 1200 megawatts of import capability and the load shedding, that we could live through that period, which may be two weeks, or a few weeks longer. I don't know about the six to eight weeks that Hydro has come up with. So I don't think there's a problem. That's my opinion.

MR. MERONEK: Secondly, just going further down in the next paragraph, it states that -- it's the whole issue of you having inputted $4.18 billion for a north/south 500 kV AC

line by 2025. And that's the assumption you made as to what Manitoba Hydro intends to do. Manitoba Hydro indicates that its development plans do not indicate such a proposal.

MR. DERRY: In this overhead I have assumed the 500 kV AC, and this is the line that they are questioning. They said that it's not been put in the plan. Of course, it hasn't been put in the plan, but it does appear in that 2010, the 2010 report that they have put out.

So something has to be done in 2025 to make it comparable or compatible to the case in the report where we have three separate locations, where we have Bipole I, Dorsey, Bipole II at Riel, and Bipole III at LaVerendrye. And that takes us out to 2050 before we go into a deficit. In this case they are stopping at 2025 and aren't telling us what they are going to do. They say that will be looked at later. But why would you go do that when you can solve the problem now by relocating Bipole II to Riel and building Bipole III at LaVerendrye?

So some way there's got to be a cost put in, or something. I'm not actually using the cost in my -- in my analysis you will see later, I

have only looked at the analysis of Bipole III coming into 17, compared to the relocation of Bipole II, and that's where you'll get the saving of $1.3 billion, which we paid for relocating Bipole II. So we don't have this problem where we have to look at some solution later, we've done it.

MR. MERONEK: Just for the record, you are referencing figure 1-3(b).

Just over on page 2, in the second paragraph, third bullet, there's an indication, just repeating the testimony of November 22 of 2012, that LaVerendrye for a variety of reasons is unacceptable as a termination point for Bipole III. Can you comment on that, sir?

MR. DERRY: I think I did talk to this. The witness suggested that he would need five or six 230 kV lines to interconnect LaVerendrye to Riel. And Mr. Woodford also covered it. We know that there are plans to put a 500 kV AC line in there one way or the other, and it will go from Riel to LaVerendrye, back up to Dorsey. So I don't accept the 230 kV, he said five or six 230 kV lines. If anything is going to be done, it will be the 500 kV AC line.

MR. MERONEK: Over on page 3, Manitoba Hydro has replicated your appendix 3 with visions in green. Have you had an opportunity to digest that particular revised appendix 3 and make sense of it from your perspective?

MR. DERRY: Yes, I have. If you look at the table and look at the green additions that Hydro put in, I knew when I used the cost for Laverendrye that there would be some other costs and I didn't have them. I'm not experienced in doing switching station design and stuff. So fine, Hydro has added in 117 million for AC station, 6 million for termination, and the line of 84 million. I can't argue with the cost or their costs, so that's fine. So it does increase the cost of a Bipole III. And I'll talk more to it on the next page, on 4 I think. And let me look at the -- well, what they have done in the case of Riel, they have come up with a cost of 370 million for their cable recommended by Mr. Woodford, from Dorsey to Riel. I think we had a cost of 225 million in our overhead. So some way they have got a higher cost, and I don't know why.

MR. MERONEK: Do you know where the

$1.631 billion comes from in terms of the subtotal in 2017?

MR. DERRY: Yeah, if you add up those costs for Riel with the 370, and you come very close, I think I got 16.1 or something. I don't know. I had problems with it.

MR. MERONEK: All right. Over on page 4, Manitoba Hydro is pointing out that there have been a couple of instances where a north/south 500 kV line has been referenced. One is in your report, and then one is in the -- I'm looking at paragraph 4, and that's the Manitoba Hydro report that you have entitled "Ultimate HVDC Development Manitoba." And the report, this response says that the report doesn't specify the nature of the line, the cost or the time frame. Can you comment on that?

MR. DERRY: Can you give it to me again? I didn't get the start, where you are starting?

MR. MERONEK: It's in the fourth paragraph starting with in the second instance.

MR. DERRY: Yes, I have got that, thanks.

MR. MERONEK: Do you have any

comments?

MR. DERRY: The only comment I have is that we're looking at reliability here. We're not looking at bringing power from new stations in the north. And if you did put in a double circuit 500 kV line to make it comparable to the alternative D and E that the report recommends, then you would use that cost of 4.18 billion that comes out of the presentation by Mr. Mazur. You have to use something because you've got to make them comparable. In the case where they put the costs in on the other side, they have not put any costs in for -- like I had in the table where I put 4.18 billion in the alternative of the CEC and the alternative Manitoba Hydro.

MR. MERONEK: Manitoba Hydro goes on in its rebuttal to, the next paragraph, to talk about the possibility of a 500 kV export tie line which would increase the import capability as a possible solution. Do you have any comment on that?

MR. DERRY: Yeah. With an additional 500 kV AC line to the United States, you will be able to import more than the 900 megawatts, or whatever they use in the calculations for the

deficits. But there's a cost to this as well. They don't get that for nothing. And whether or not they would turn around and say, oh, but we get a reliability benefit out of this of 1100 megawatts, and that's worth X dollars per kilowatt, they may try to do that later. So that's a cost and it's not showing up in this. And we're not talking, like I said before, we're not talking about any new generations. In fact, Hydro said that themselves. They say this is a reliability project, just reliability. And to have the same reliability as you'd have in D and E, you'd have to do something in the C and B cases that I have shown before. There's got to be something done, there's got to be a cost in there.

MR. MERONEK: Do you have any comments on your table 1 that's been revised by Manitoba Hydro on page 4?

MR. DERRY: Yeah. The one comment is a typing error, the 3.37 should have been referring to Bipole II -- Bipole III near LaVerendrye should be down under the Coalition D and E case. And the other comment I have, in the table I had, I had 1.2 billion for the CEC alternative, and 1.2 billion for the Coalition

alternative. All of a sudden they've got 1.43 for the CEC alternative and 1.63 for the D and E alternative. And I know the difference. It's they are using cable instead of overhead, in the case of CEC, some cable, and in the case of the D and E it's underground. So let's be consistent.

I have a further comment here that I don't think has been brought up by any of their rebuttals or whatever they are. They have not looked again at the annual carrying charges of the alternatives. And even increasing the cost of the D and E alternative to $1.63 billion, if you take the annual carrying charges on that and take the difference between that and Bipole III alternative, which I had done in the other case and come out with $1.3 billion savings, this will give you a billion. Now it reduces to a billion if you make that calculation. So you've still got a billion dollars laying on the table.

MR. MERONEK: Over on page 5, the second paragraph, in the middle of the paragraph, it says that this recommendation, your recommendation does not address the significant risk associated with carrying out the Bipole I and II separation project without having adequate

spare transmission to cover the planned and unplanned outages that will be experienced during the project. Can you comment on that statement?

MR. WOODFORD: Can you repeat the question, in case I can answer that?

MR. MERONEK: If you look at paragraph 2 --

MR. DERRY: I can handle that one, I think.

I guess what they are saying here is that for the Dorsey station outage probabilities, there was one in 200 years with a return period of eight months to years. And this one they are saying that the outage probability of the corridor is, I think it's one in 17 that they were using for tornadoes, and one in 50 for icing. And in fact, I think in a later report by Teshmont, they dropped that to one in 20 for icing.

Now, I have shown the cost of the one outage that they had, or two outages. One was 11.1 and one was 6 point something. And I still say that we have had one outage in 40 years. So I guess we're due for another one pretty soon if you want to get down to one in 17. But we only have a span from 2017 to 2025, of eight years that we

have to worry about. Because after 2025, if you follow our recommended plan, we have Bipole III and there will be no problem. So do you want to take the chance over eight years? You have taken the chance over 40 and had one.

MR. MERONEK: Over on page 6 there are a couple of issues flagged here by Manitoba Hydro. One is the issue of your assertion as to shedding, the shedding of load, and one is with respect to what Manitoba Hydro says is an incorrect import assumption in terms of import capabilities.

MR. DERRY: That goes back to that same item that I referenced at the beginning, that there is a report that shows that in the off peak and the shoulder months, you could import an additional 300 megawatts to take you from 900 up to 1200.

MR. MERONEK: What about the issue of shedding, as mentioned in the first full paragraph on page 6?

MR. DERRY: Is that the part that says low shedding is considered a do nothing scenario? Manitoba is very evident, Manitoba is planning to avoid to the extent possible... well, that's an awful lot of money to spend for a case when it

might happen once in 17 years.

MR. MERONEK: Over on page 10, second paragraph, Manitoba Hydro disagrees with deferring Bipole III to 2025. It also disagrees with locating the southern termination of LaVerendrye. And it says in part:

"LaVerendrye is the wrong location due to its proximity, electrical and geographic, to Dorsey."

Can you comment on that assertion?

MR. WOODFORD: Could I comment on that, sir?

MR. MERONEK: Sure.

MR. WOODFORD: Yes, that may be true in terms of proximity effects. If Bipole III was brought into operation, as I had mentioned in my report, at LaVerendrye, it would have to go in with a 500 kV ring, southern ring from Riel to near LaVerendrye to Dorsey. And a single line from LaVerendrye to Riel, 500 kV AC, is very inadequate. But under these circumstances you get enough strength and support to hold Bipole III at LaVerendrye, with a 500 kV circuit running from Riel to LaVerendrye up to Dorsey.

MR. DERRY: What about on page 10, the

bottom paragraph?

MR. MERONEK: Sure, you could take a crack at that.

MR. DERRY: There's some talk that LaVerendrye would be too close to Dorsey. Dorsey had an outage probability of this one in 200. They say that in this case, 25 downburst clusters inside the damage path of 27 kilometres. Has Hydro calculated what the outage probability would be of both those stations going out if they are separated? Is it one in 4,000 compared to one in two? I'd like to know.

MR. MERONEK: All right. Then over on the last page -- this completes my direct of you, Mr. Derry. Do you have any comments with respect to the conclusions that are reached by Manitoba Hydro on that page that you haven't already expressed?

MR. DERRY: No, I think I have expressed all my concerns that the witness came up with.

MR. MERONEK: Mr. Chairman, noting the hour, I wonder if we should not take a break now and then I'll pursue this afternoon the rebuttal with Mr. Woodford, and then with Dr. Lawson.

THE CHAIRMAN: That's very good idea, Mr. Meronek. Thank you. Thank you, Mr. Derry. So we'll take a break now. We'll reconvene at 1:00 p.m.

(Hearing recessed at 12:00 p.m. and reconvened at 1:00 p.m.)

THE CHAIRMAN: We might as well resume.

MR. MERONEK: Thank you, sir.

Mr. Woodford, we left off with you, and I would just like to ask you some questions, a bit of a dog and pony show here with respect to the rebuttal as it may relate to your evidence.

Firstly, on page 7 in the first paragraph, Manitoba Hydro indicates that the repairs on the northern DC transmission lines will have a greater impact to restoration time than you indicate. Do you agree with that assertion?

MR. WOODFORD: It appears that Manitoba Hydro, Hydro's case for line restoration, or line -- is fixed on a worst case scenario. That includes the failure of both the DC transmission lines, in the worst northern location available, with the worst weather conditions. It

would be nice to see a reasonable scenario, and the probability of each occurring.

We have presented, from our point of view, a reasonable fair scenario, which for some reason or other Manitoba Hydro is relentless in considering only this worst case scenario of the failure of these lines, six to eight weeks to repair, it is all they will consider, for a very low probability event.

MR. MERONEK: All right. Then the question, I guess in the next paragraph, Manitoba Hydro is asserting that your suggestion of ameliorating equipment in such event, including a sky crane, would consume too much fuel, cost too much to be practical, and in addition to which tar foundations may be damaged and very difficult to repair. Can you comment on that assertion?

MR. WOODFORD: Yes. This may well be, but it is again a worst case scenario. When the one and only multiple tower failure occurred in 1996, wood poles were temporarily used. Is it possible is the question I ask, is it possible to use wood poles on a temporary basis to get one line up while the tower foundations are being repaired? I don't know the answer to that, I'm

not that sort of an engineer. Is it possible? And if so, could we reduce the time from a worst case scenario to something more reasonable, as was the case in 1996.

MR. MERONEK: Looking over on page 8, down at the bottom and I quote:

"The concern Manitoba Hydro has is that in the absence of a DC connection from Dorsey to Riel there is no paralleling to deal with failure..."

Sorry, lost my place here. Okay, sorry, my mistake.

On page 8, Manitoba Hydro, in the middle of the page indicates:

"Manitoba Hydro notes that the foregoing consultants and others in Winnipeg with technical skills caution Manitoba Hydro about the gravity of the risks in separating Bipole I and II without adequate spare transmission."

Can you comment on that?

MR. WOODFORD: If part two was read closely, it would be seen that we proposed leaving the existing Bipole II converter in place, as I

mentioned earlier, and leave it functional to avoid such a need for Bipole III to be in place. This common sense approach has not been addressed by Manitoba Hydro and their experts. When they do, we would welcome a well-informed discussion on the subject to see how these undefined risks quoted in the question -- sorry -- these undefined risks quoted in the question can be eliminated without Bipole III being in place, as spare transmission. Do we need Bipole III as spare transmission? That's the key. The whole thrust of building a new Bipole II converter at Riel, while leaving the old Bipole II converter functioning at Dorsey is to reduce such risk until operation of the Bipole II converter at Riel is working at an acceptable level of availability.

MR. MERONEK: Carrying on at the end of 2.2 on page 8, Manitoba Hydro makes the observation that the Commission didn't ask Manitoba Hydro to identify a third site for a southern converter station. Accordingly, Manitoba Hydro is not ignoring a key finding regarding the Dorsey converter station, but simply responded to the question that was asked. Can you comment on that statement?

MR. WOODFORD: Okay. The CEC inquiry was not the total solution. We did not want to -- we did not want the issue to be left hanging that the CEC raised, and that's why we have our proposal.

MR. MERONEK: Paragraph, or section 2.3 at the bottom of the page 8, and I quote:

"The concern Manitoba Hydro has is that in the absence of a DC connection from Dorsey to Riel there is no paralleling to deal with the failure of the proposed 100 kilometre portion of the Bipole II line from the tap off point to Riel."

Can you comment on that statement?

MR. WOODFORD: Yes. I mentioned this in my presentation. The 100 kilometre overhead line route from Bipole I and II DC transmission lines north of Dorsey to Riel, as they had presented, would be again a worst case scenario. Personally, I would prefer to run 500 kV cables, as I said, from Dorsey to Riel on the existing 500 kV AC transmission right-of-way, less than 50 kilometres. This would be easily permitted, not subject to environmental disturbances, and once

the splicings were stabilized, should be quite reliable. The extra cost for the cable could easily be justified on the savings of annual carrying charges if we can delay Bipole III.

MR. MERONEK: Over on page 9 they talk about, Manitoba Hydro talks about resident frequencies, and you have commented on that in your evidence already, correct?

MR. WOODFORD: Right.

MR. MERONEK: On page 11 there is an issue of multi in-feed -- sorry, section 3.1.3 is headed multi in-feed issues. And in that discussion in the first paragraph, Manitoba Hydro says and I quote:

"While LCC technology would present greater challenges in maintaining the required system performances, even VSC technology would present a significant challenge due to the electrical proximity."

And then it goes on at the end of the page to state:

"The Coalition proposal to locate the converter for Bipole III at LaVerendrye creates a different multi

in-feed configuration that can lead to HVdc system recovery performance issues which may result in higher costs such as requirement for additional synchronous condensers."

Can you respond to those statements?

MR. WOODFORD: Yes. This may be so, but our experience, based on our simulations and studies of the many years with voltage source converter technology, and with Bipole III, add on LaVerendrye in this case, we would assume, in close proximity to the LCC converter Bipole I at Dorsey, this would have a much reduced in-feed, multi in-feed problem. By multi in-feed, what we are saying here, or what I think is being said is if we have a commutation failure, which is an occurrence that would occur on Bipole I, that does occur. We sometimes see it manifested with the lights flickering. That may transfer over to another Bipole nearby, and that would go into flicker, exacerbating the total flicker. And that's what the multi in-feed problem is.

Fortunately voltage source converters do not fail commutation and tend to be fairly robust and impervious to these sort of the things

happening. So if Bipole I goes into a commutation failure, Bipole III, if located at LaVerendrye, and if it was a voltage source converter, it is open to question as to how much the impact of the multiple -- the impact of Bipole I and Bipole II will have -- Bipole III will have. And I would propose that a detailed study using the latest simulations technologies should be done so that we can find out what really happens.

Now, in addition CIGRE, this international electric power learned society, is studying this issue at the moment. And when their results are made available, these conclusions should be brought forward, if available.

MR. MERONEK: Now, carrying on to page 12, firstly, at the bottom there is a reference to NERC, North American Electrical Reliability Corporation, and some issues that Manitoba Hydro is throwing out in relationship to satisfying that particular regulatory body. Can you comment on that particular issue?

MR. WOODFORD: Yes. The delay in Bipole III has been proposed, then the 500 kV AC ring around Winnipeg may not be needed until then. It is sensible to consider that with Bipole III

eventually coming into service with the delayed requirement we proposed based on reliability issues, and it being located near LaVerendrye, that it can only be connected into the southern Manitoba system on to the 500 kV ring for its support and strength of operation. So if the 500 kV AC line section from the Bipole III point of interconnection over to Riel has failed and tripped from service, that 500 kV AC line section to Dorsey would still be, and could handle the Bipole III in-feed, perhaps with some controls adjustment, if necessary. And one assumes that when Bipole III is finally brought into service, it would be -- it would be to deliver power to the Manitoba load, and presumably the second 500 kV interconnection to the U.S. would also be brought into service at about the same time. For potential sales south from this new northern generation, the power is to be brought down Bipole III. This would be a third section of 500 kV AC transmission interconnected at the Bipole III near LaVerendrye. So the NERC reliability standards could easily be accommodated.

In any case, it is Manitoba Hydro's responsibility to design the southern power system

with the 500 kV ring completed by Riel to Bipole III near LaVerendrye to Dorsey, and the second interconnection to the U.S. along with Bipole III when it is ready to deliver real power from the north. So that's my response to that.

MR. DERRY: Mr. Meronek, Art Derry, I would like to add something to this discussion about whether or not LaVerendrye is the right position for Bipole III.

In the 2010 report on page 9 of that report, they have what is called an option 3, and that's Manitoba Hydro have an option 3, Bipole I at Dorsey, Bipole III at Riel, Bipole II at a new location. Then it goes on to say, not unlike option 2, but with further splitting the Dorsey station, this variation provides the greatest three pole reliability benefit. A possible Bipole II converter location could be at or near LaVerendrye station or along the future south Winnipeg transmission corridor.

So what they are saying is you can locate a Bipole there, it could also be three, in our case it is three. So it contradicts the statement about LaVerendrye as another possible location, they have assumed it could be.

MR. MERONEK: Thank you, Mr. Derry. Moving over to -- or back up the page.

THE CHAIRMAN: Mr. Meronek -- Mr. Derry, you said 2010 report, is that the Teshmont report?

MR. DERRY: No, it is the Manitoba Hydro report called "Ultimate HVDC Development in Manitoba."

THE CHAIRMAN: I think it is referenced in here. Thank you.

MR. DERRY: Yes.

MR. MERONEK: Moving back up the page, it is a bit out of order. In section 3.2 on page 12, it is stated at the end of the first paragraph, should this 500 kV AC line be proposed for the outlet transmission from LaVerendrye, the cost needs to be included as part of the LaVerendrye converter site. The line would also require an environmental assessment and licensing.

And how does this impact your presentation before the Commission?

MR. WOODFORD: Well, I agree with this. With Bipole III delayed to when it is really needed, as put forward in part one of our report, then there will be plenty of time for the

permitting, and any extra costs are easily accommodated by the huge saving in annual carrying charges that comes with such a delay.

MR. MERONEK: And on page, or again going further up the page in the second paragraph of the rebuttal, Manitoba Hydro raises an issue with power flows around Winnipeg predominantly being from west to east, resulting in an unacceptable loading of the existing transmission in the Winnipeg area.

What is your response to that statement?

MR. WOODFORD: I did touch on this in my presentation. I will add to it.

With Bipole III delayed, as we recommend, and Bipole II in-feed at Riel instead of at Dorsey, then this problem is remedied or postponed presumably, until Bipole III has to come on line. In other words, the feed-in at the east side at Riel from Bipole II will push back against this natural flow west to east, and accommodate that distress of the Winnipeg area transmission system. If the 500 kV AC ring is completed around Winnipeg, particularly when Bipole III is brought on line, a response from Manitoba Hydro should be

provided after they have conducted an adequate study to see what effect of Bipole III at LaVerendrye, only LaVerendrye, has on -- as well as the completion of the 500 -- sorry, as well as the completion or implementation of the second 500 kV AC line to the U.S., what all that will have on the loading of the existing transmission system in the Winnipeg area. In addition, they should seriously study the benefit that might be possible by increasing the rating of Bipole II into Riel and from Henday to perhaps 2,500 megawatts, or even higher to 3,000 megawatts. Then there would be the potential for delivering lots of power into the eastern side of Winnipeg to combat this issue of west to east loading on existing Winnipeg area transmission.

So, in summary, Manitoba Hydro needs to spend more time looking at the many options that are possible beyond this fixed in stone scenario that they are bringing before this Commission.

MR. MERONEK: Going over on the last page, page 13 at the top of the page, the rebuttal evidence states in part, in the event of a loss of 500 kV AC line, the power will naturally flow out

to the other 230 kV and 115 kV lines of the LaVerendrye and potentially result in overload and potential cascade tripping. Is this a severe problem that seems to be indicated?

MR. WOODFORD: Well, reading this, as written by Manitoba Hydro in their rebuttal, implies that they are considering, as I read it, only one 500 kV line from this proposed point of inter-connection of Bipole III near LaVerendrye, and then that 500 kV line, single 500 kV line would go on to Riel. That's how I interpret it. This is plainly inadequate, as they state. Hence when Bipole III is eventually brought into service, the 500 kV AC ring around Winnipeg with its point of inter-connection near LaVerendrye should be part of the project.

The delay of Bipole III, perhaps as much as 8 years, at $322 million per year in saved carrying charges, there is a lot of money to apply to improving the transmission reliability of the Winnipeg area, still leaving significant savings to Manitoba Hydro and its customers who are required to foot the bill.

It is Manitoba Hydro's responsibility to investigate these options the Coalition has

brought forward, as well as other options that may open up as a true planning study is undertaken.

MR. MERONEK: And lastly, Mr. Woodford, on page 13 with respect to line routing and impact on project schedule, Manitoba Hydro expresses concern about the licensing delays to get the transmission lines in place to accommodate a 2017 in service date. Can you comment on that concern?

MR. WOODFORD: Yes. With Bipole III delayed, then indeed we have to get the transmission in place with the new Bipole II converter located at Riel. My personal preferred way, as stated earlier, is to do this with underground cable along the 500 kV AC transmission line right-of-way that's in existence. And this would require little permitting, little time in permitting. One of the advantages of underground cables is much reduced permitting time compared to permitting overhead lines, as is apparent from this hearing.

And now this was the case of the project in Australia called Murray link, where 180 kilometres of underground HVDC transmission cable was constructed in 2002, near where I grew up.

The cable option was applied because the line was generating revenue for the many years it would have taken to permit and build an overhead transmission line -- might I add, across good farmland. It is interesting to note that this DC cable project was built by Transengerie, a Hydro Quebec subsidiary, and has since been sold to a company called Australian Pipeline Trust, and that was transferred over from Hydro Quebec in 2006. So let's not throw out underground cables as a means of reducing permitting time.

MR. MERONEK: Thank you, Mr. Woodford.

Over to you, Dr. Lawson, I just have a couple of questions relating to the rebuttal in relationship to your report. Most of the questions I believe you covered off in your initial presentation, but I want to take you to page 2 of Manitoba Hydro's rebuttal in relationship to your report, and under the heading scheduled risk due to field splices.

And as I understand, the concern by Manitoba Hydro is that there will be a lengthy period of time in terms of splicing of the cables, presumably if there was only one crew working, and which extrapolates over to a long period of time

as set out in the report, 35 months I believe.

Anyway, have you got any comments on your experience in that regard?

MR. LAWSON: There isn't a whole lot of experience with underground really. There are short lengths at the ends of submarine cables. But I think I did touch on the splicing time, and I believe it is better to have a four day than a five day, for reasons that I explained during my presentation. But also I did touch on this too, I mentioned the fact that when they had problems with capacity, ABB and Nexans worked together on the Fennoskan project. So it is possible to have more than one supplier. So if you are able to have two suppliers, that's a great help. And multiple teams must certainly be available, because the business is buoyant at the moment and the supplier can't manage with just one splicing team. Two splicing teams would probably be available for the single job anyway, so I think you can rely on two. And there is the other factor that when you have two splices to make off in close proximity, then also the splicing time comes down because the fitting out and so on you do for two instead of just one.

MR. MERONEK: Manitoba Hydro would respond and has responded in the rebuttal to the effect that there are few suppliers, a few factories, and they all seem to be booked up until 2017. Can you comment on that concern?

MR. LAWSON: Well, I think they said there were four factories, four plants, three suppliers. That would be ABB, would be Nexans, would be Prysmian. Now, ABB -- sorry, Nexans more or less own the viscous plant in Tokyo Bay, so that would be the fourth. But we are forgetting about the J-Power Systems Plant, and also there is the new plant in Korea. They had just done a project to an island in Korea with HVDC mass impregnated cable. So there is another couple of plants. The Japanese, the J-Power Plant, they have qualified for the western link, so they have a 600 kV HVDC mass impregnated cable qualification already. They have not had any contracts, but they are competent and I assume at the moment they are available.

MR. MERONEK: What is your -- what are your comments on it with respect to what is happening in the industry in terms of increase in capacity?

MR. LAWSON: Well, I did mention that in the Fennoskan cable capacity was in the order of 120 kilometres per year, per plant. And this is because the process, the bottleneck in the process is the impregnation, and particularly the cooling of the impregnant under pressure is very slow, but it is not high tech. So in order to increase your capacity, you put in another tank. In fact, ABB now have four tanks. Nexans probably have four as well, I can't confirm that. And Prysmian have four. So we are talking in terms of capacity, something like 250 to 300 kilometres per plant per year. And yes, they are very busy, and Prysmian in particular with the western link, which is 400 kilometres long, and then we have just had the announcement that Prysmian also have one part of Montenegro cable, which is 415. So they have orders at least for 815 kilometres of cable, 500 kV. So it is a busy period for them, yeah. But I don't think -- I never heard of a supplier refusing to take an order, or to make a bid. Sometimes they make bids with very high prices because they can't handle the work, but to say they can't do is not the usual situation.

MR. MERONEK: In terms of the issue

of -- over on page 3 there is a concern about regulatory requirements for cables. And there is a comment there at the end of the paragraph that says that, in reference to the picture at least, that it is worth noting the proposed cable runs through agricultural farmlands. I guess the implication being that we are not really avoiding agricultural lands by going underground cable, as we intended to avoid by going with overhead lines. So can you comment on that concern?

MR. LAWSON: Well, I did sort of touch on that in the report I think. What I had in mind was the alternative of using route 26 as a way for ease of transportation and access. So that would be slightly better. But there is no reason why you can't have projects like the one in the photograph on page 3. There is actually cable in the trench, I think if you look closely, they certainly have the cable reels installed ready to do the pooling.

MR. MERONEK: There is, over on page 4, there is a comment under heading four, cable supplier factory capacity and commitments for MI cables. And at the end there is an estimation that for the manufacturing and delivery of cable,

it could take at least two years. Can you comment on that suggestion in terms of timing?

MR. LAWSON: Well, more or less standard for a project of this nature is three years. And that largely depends on whether the client wants to have a type test done. You can have a special type test for the particular project, your project. Most owners do want that special electrical test done before the cable is supplied. It is not strictly necessary, because if the supplier has already supplied similar cable, it is not necessary and, therefore, you can cut down the time. But as I say, usually three years is the duration of this sort of project.

MR. MERONEK: And lastly, on the bottom of page 4 there is a reference under the heading "Logistics for Cable Transportation and Accessibility at Site," the statement at the end says:

"This is a significant challenge in terms of logistics..."

And it is referencing the transportation and risks of cable damage during transportation, handling, and impacts on farmland. Can you comment on whether there are significant challenges, whether

they are overstated?

MR. LAWSON: Only to say that every project has its challenges. That hasn't stopped the Neptune land cable going in, and doesn't seem to have stopped the 90 kilometre Skagerrak 4 cable going in, in Denmark. These things have to be looked at. We know that the cable can be transported on reels. At the moment I have limited it, because of some uncertainty of how much cable -- the reel will hold a lot more cable, but you are not sure because it is mass impregnated, how to fully load these reels. And it is a question of also logistics, and these things have to be looked at. But I think this is, my opinion anyways, relatively high level feasibility study. So we have done what we can.

The next step would be to have surveys done of the opinions of the industry concerning the results of the survey and so on.

MR. MERONEK: Thank you, Dr. Lawson. Those are my questions, Mr. Chairman.

THE CHAIRMAN: Thank you, Mr. Meronek. Manitoba Hydro?

MR. BEDFORD: Mr. Derry and Mr. Woodford, good afternoon. My name is Doug

Bedford and I work at Manitoba Hydro, but of course, my career at Manitoba Hydro has not overlapped your respective careers at Manitoba Hydro.

The first question that the Clean Environment Commission posed in a letter that it wrote to me on December 3rd, 2012, was whether or not one could build Bipole III, and at the southern terminal point connect the conductors of Bipole III to the existing converter equipment at Dorsey.

Now, having read your two reports, having listened to your presentations, and having listened to the answers to the questions that Mr. Meronek posed to you, conclude that with respect to that first question that the Clean Environment Commission posed to me, you agree that it is not recommended to place the southern converter station for Bipole III at Dorsey and simply use the existing converter equipment in Dorsey to handle that?

MR. DERRY: Yes, I agree with you.

MR. BEDFORD: Now, with respect to the next question that the Clean Environment Commission posed in its letter to me, whether or

not it would be feasible to separate Bipoles I and II and move one of them to the Riel site, I understand, Mr. Derry, that you believe that can and should be done?

MR. DERRY: I believe that you can build a new station at Riel, not move the existing Bipole II.

MR. BEDFORD: And you agree that if one is to do that, it should be the southern terminal point for Bipole II that is moved?

MR. DERRY: Can you repeat that again, please?

MR. BEDFORD: If one were to separate Bipoles I and II, and to move one of them to the Riel site, you believe, as does my client, that it would be Bipole II that you would move?

MR. DERRY: Yes.

MR. BEDFORD: And I've read, Mr. Derry, your report, you think that should be done now and can be done by 2017. And on page 20 of your report, I saw that you estimated the cost of doing that to be about $1.2 billion?

MR. DERRY: That's correct. That's the number that I used that Mr. Mazur had been using in his IRs.

MR. BEDFORD: And then as I have read and listened to your recommendation, I understand that you recommend that some 8 years from now, for a 2025 in-service date, one would also then build Bipole III; is that correct?

MR. DERRY: That's correct. And that's the date that Hydro has indicated that it would have to do something, from their figures, 1.3.

MR. BEDFORD: And your general thinking, the price that you are using for building Bipole III, but for in-service some eight years later than what my client is proposing, would be about $3.14 billion, as I read your estimates. Have I got that correct?

MR. DERRY: Now, can you tell me where you found that in my report?

MR. BEDFORD: Page 20.

MR. DERRY: Correct.

MR. BEDFORD: And of course, your estimate of 3.1 billion is very, very close to the $3.28 billion that my client has advised this Commission is its estimate of the cost to build Bipole III, correct?

MR. DERRY: The difference is the

shorter line.

MR. BEDFORD: And so if I try and summarize your recommendation to the Commission, between today and 2025, if your recommendations were followed, you would have us spend 3.14 billion, plus about 1.2 billion, for a total of about 4.2 to 4.3 billion to improve the reliability of the Manitoba Hydro system?

MR. DERRY: And that's in 2017 dollars.

MR. BEDFORD: Now, as I understand it, on the subject of separating Bipoles I and II and moving the southern converter for Bipole II to Riel, the primary difference between your views, your recommendation and what my client is proposing to do is that you would do the separation, do the movement before Bipole III is constructed, whereas in my letter of January 28th, replying to the Commission, I said that the separation should prudently take place only after Bipole III is in service.

So that's a significant, the significant difference between your recommendations for separation and what my client has proposed?

MR. DERRY: That's correct. We are saying Bipole II should precede Bipole III.

MR. BEDFORD: Now, I do understand that long before I joined the company, you did work for a number of years in senior positions at Manitoba Hydro?

MR. DERRY: What was that again, please? I have a hearing problem.

MR. BEDFORD: You worked, long before I arrived there, for a number of years in senior positions at Manitoba Hydro?

THE WITNESS: Yes, I did. I never mentioned this morning that I was vice president of business development when I quit, when I retired.

MR. BEDFORD: And of course, to your knowledge, it is certainly true that Manitoba Hydro has never attempted to separate Bipoles I and II?

MR. DERRY: No, not while I was there.

MR. BEDFORD: And I'm assuming that you've had an opportunity to read the letter that I wrote on January 28, 2013, to the Clean Environment Commission, providing answers to the questions that it posed to me on December 3rd?

MR. DERRY: December 3rd letter, is that the one in --

MR. BEDFORD: January 28.

MR. DERRY: Oh, January 28th, I'm sorry. Yes, I have it here.

MR. BEDFORD: I told the Commission in my letter that if one were to tackle the job of separating Bipoles I and II, that amongst the many significant challenges, there would be a major one regarding the controls that exist today at Dorsey, the controls that allow for an instant reduction of power flow in that system in the event of tripping.

Do you recall me advising the Commission of that concern?

MR. DERRY: I put that in your letter, but Mr. Woodford will handle that question.

MR. WOODFORD: What was the question?

MR. BEDFORD: I would suggest to you that in light of the challenges and the inexperience Hydro has in separating Bipoles I and II, it would be foolish for any of us to assume that in the process of going forward and doing that there would be no power outages?

MR. WOODFORD: There would be possibly

minimal power outages, and that is why I suggested you see what happened in Los Angeles, to see in a similar, but not the same circumstances, what outages occurred in that situation. By retaining the existing old Bipole II in functional condition, it could be brought up pretty quickly if needed because -- if there was a major failure in the cable to or the line to Riel, or the DC converter station. But your question was about controls. Tell me what your issue is there?

MR. BEDFORD: Well, the issue is I'm informed, Mr. Woodford, that the controls are a critical aspect of the operation of the transmission system because they are our protection or defence from cascading outages if the lines are tripped. And accept that that's a lawyer, not an electrical engineer, explaining to an electrical engineer his imperfect understanding of his client's system. That's what I'm told is a critical challenge, is to in effect dismantle those controls, with the view logically I suppose of setting them up somewhere else. You have reminded me of the example that you provided us from California. I understand that the, I will call it the old Sylmar converter station, was

damaged in an earthquake in the 1990s, and that's what motivated the Californians to revisit what they were going to do about refurbishing or replacing that particular converter station. Am I on the right track with that?

MR. WOODFORD: Yes, but it was also damaged back in the '70s by an earthquake. So that was the second damage. They had tried to build the old station to be more resilient against earthquakes. They succeeded to some success, but not completely. And as a consequence they had to build, as part of the consequence they had to build a new, completely new 3100-megawatt converter station at the east site, which they were able to do, with new controls, completely new controls, completely digital controls. And I should raise the issue here that Bipole I and Bipole II today, to my understanding, and I stand corrected, are running on analogue controls, as was the Sylmar station. Once you go digital and once you use high speed telecommunications, as we are proposing and as would be applied, and engineered accordingly, then you can do a lot more and have a lot more flexibility than if you still stick with these old controls. And this is a

factor that's a real technical issue, I understand, and I remember getting chastised by a lawyer for saying that you are an engineer, don't do legal stuff, and I appreciate your position. And the controls are very important. But the day has come where there is a lot more development going on, and running continually now with analogue controls of 30 plus years is not a good idea. Now, you tell me otherwise.

MR. BEDFORD: Well, I will confess to you that I've been known to chastise other lawyers, but not engineers.

I understand that one of the advantages they had outside the City of Los Angeles, when they approached a somewhat similar challenge with converter stations, was that they had alternative sources in Los Angeles of supply of power while they took one converter station out of service and they put another one new into service. Would I be correct?

MR. WOODFORD: No, not quite. Because as I presented to you, they were at least able to keep 2000 megawatts functioning while they rebuilt the east Sylmar station. And then when it was functioning and operated and commissioned, they

were able to connect it back in and take out the old west side station. So the outage time was minimal, if at all. Now, I don't know what the outage time is.

I have worked with the Los Angeles Department of Water and Power, and know them very well. And if you folks contacted them and talked to them about it, I'm sure they would be very pleased to inform you what the true situation was in that issue.

MR. BEDFORD: Well, either Mr. Derry or Mr. Woodford, on the subject of outages. I gather if we were to proceed with your recommendation, separate Bipoles I and II, build Bipole III eight years later, and in doing that we did have an outage or outages, plural, the back-up plan that you have in mind for my client is that we could, as you put it, shed up to 800 megawatts of load and import, I heard you say, Mr. Derry, 1200 megawatts of energy, primarily obviously from our neighbours, the Americans. Have I got that correct?

MR. DERRY: That's correct.

MR. BEDFORD: Now, when an engineer says to a lawyer, we could shed up to

800 megawatts, the lawyer says in his mind, what that really means is there will be no electricity flowing in to whatever number of businesses and homes we require 800 megawatts to power up. Have I got that right?

MR. DERRY: That's right. But it will only be for the time until the load drops off. You are not at peak load all of the time. The numbers you see are peak load. So there is the situation where you have to shed and then you can get them back on.

MR. BEDFORD: I did read, as I said, your report, Mr. Derry. And I saw you appropriately acknowledge that shedding load is disruptive in the life of a province. But your conclusion is that shedding is not a sufficient concern to, in effect, motivate my client to want to build Bipole III first for a 2017 in-service date. Have I summarized that fairly?

MR. DERRY: That's correct. But I did specify and gave you some examples of how many dollars are involved in an outage, as compared to the amount of money that you want to spend to cover off that one in 17 year condition over that eight years. And I don't think it is worthwhile.

MR. BEDFORD: And only fair of us, I suppose, to recall, because my client is quite mindful of this, as is apparent in its rebuttal document, that when it comes to shedding, if it is you or I that's operating one of those businesses or living in one of those homes with no power now coming in, we would likely have a very different opinion than Mr. Derry's about whether or not shedding is an acceptable solution to deal with an outage caused by a decision to separate Bipoles I and II, would we not?

MR. DERRY: Maybe those customers will think about the fact that by adding $322 million to your rate base they are going to be paying a heck a lot more money over that eight years.

MR. BEDFORD: And I think you are right, we are always concerned about paying more money. We seem to have a long history in this province of bragging about the fact that we have the lowest electricity rates in North America.

MR. DERRY: And I even brag about that because I was involved in those decisions.

MR. WOODFORD: Can I add a comment about load shedding?

MR. BEDFORD: Generally in

cross-examination the lawyer tells you, no, you can't, but this lawyer is prepared to be accommodating this afternoon, Mr. Woodford. We are here to try and do the best we can to educate five Commissioners, there is only four of them present today, because I would like them to make the best possible recommendations about my client's project. So I'm sure they might be interested if you have an additional comment about load shedding.

MR. WOODFORD: Well, prior to 1980, before they put in the 500 kV AC transmission line down towards the Twin Cities, Bipole I was in service and it had troubles staying in operation from time to time and there was frequent load sheds in the City of Winnipeg. It was so bad that at those times the electrical clocks worked off the frequency of the AC system, or batteries. And I could never trust my clocks, so I had to buy a wind-up clock, because I was ending up going to work late. Because I still looked at the clock that had been load shed, and my clock was running very slow, sometimes I was an hour or two late. So that's the consequence of, in our homes, of load shedding. It is probably an irrelevant

statement, but I remember it very well because of the late times I went to work because of load shedding.

MR. BEDFORD: Well, it is not relevant to anyone else in the room today, but I'm happy to reveal to you that I brought one of my late grandfather's wind-up clocks.

Now, Mr. Derry, you concluded that, in the event of an outage, part of the back-up plan work to import, and your number is 1200 megawatts of power, primarily as I indicated from the Americans, given how our international and inter-provincial transmission connections are set up.

My client assures me that the maximum today is 900 megawatts, 700 of which they describe as firm and 200 of which would be non-firm.

Can we at least agree that the firm and non-firm are numbers that you understand and recognize?

MR. DERRY: Yes, I understand.

MR. BEDFORD: Now, one of the things that occurred to me, which I think ought to occur even to engineers, is that it is one thing in planning and studying to say you have the ability

through your system to import, be it 900 or 1200 megawatts. But be it 1200 or 900 firm or non-firm, you must assume that you have someone on the outside able and willing to sell you the power to actually import. Am I correct?

MR. DERRY: I guess partially. What I'm talking about, when you have an outage, what will happen instantaneously is that those lines will assist you as much as they can. If they don't trip, then it is fine.

Now, in the longer term if you are talking hours, yes, I've made the assumption that you can import 1200 megawatts, be it from the U.S., Saskatchewan or Ontario. And the 1200 megawatts is not my number, it comes from a report that I've documented in my report, referenced, and it was a 2001 study done by Hydro where in the off-peak periods, which I call the shoulder, the off-peak period, you could import up to 1200 megawatts. That's where I got the number.

MR. BEDFORD: Well, some of the engineers who succeeded you and Mr. Woodford at Manitoba Hydro are being questioned on Thursday. They are still scratching their heads, because they can't determine how you found another

300 megawatts not having -- notwithstanding that they have had the benefit of reading your report and listening to you. So I'm not going to succeed in resolving the mystery of how we moved from 900 to 1200, but my point was that we all need to appreciate that the capacity to import depends ultimately on the existence of a willing seller who is able to meet your firm or non-firm demand on an urgent basis for energy.

MR. DERRY: That's the whole idea of having a power pool, everybody helps each other when they are in trouble, and they are supposed to help you.

MR. BEDFORD: In the event that we proceed with your recommendation, we are in the midst of separating Bipoles I and II and there is an outage, or outages, would I be correct in saying that situation of outages would be further complicated if at the time they occurred my client and the people in this province were experiencing for example, low production in generation due to a drought, or trying to cope with another catastrophe that has affected one or other of its generating stations? For example, we have had a fire recently at our Jenpeg station which has

largely put it out of service?

MR. DERRY: You are telling me that you have units out of service that aren't in the calculations that I made, I guess you are saying?

MR. BEDFORD: My concern is your calculations and your assumptions don't address that there could be further complications caused because of outage.

MR. DERRY: You are adding on top of another here, you are adding many things on to it. Again, as Mr. Woodford says, you are taking the worst scenario that you can think of.

MR. BEDFORD: I know that Mr. Woodford finds me depressingly pessimistic with the worst case scenarios that I keep putting forward on behalf of my client.

MR. DERRY: You didn't mention maintenance in the summer period. I did mention it in my report that my graphs that I put in there don't include maintenance, and there would be maintenance there. But the amount that is lost is very minimum, and you could do up to another four or 500 megawatts of maintenance within the months of those summer months and still get it through.

MR. BEDFORD: Well, to bring this line

of questioning to an end, I want you, Mr. Derry, or it could be Mr. Woodford, to assume that you are in charge at Manitoba Hydro, and you are on the cusp now of implementing the recommendation that you described to us. Your dream is coming true. And then one of your staff at Manitoba Hydro points out to you that your first priority always in the business of Manitoba Hydro is to meet load, domestic load. And you are not allowed, in carrying out your daily functions and your jobs, you are not allowed to initiate or do anything that risks you failing to meet load. Now, if that conversation with your staff takes place, and if the reality is that your first priority is always to meet load and not to initiate changes in your system that could lead to outages, is it not true that you should not be separating Bipoles I and II until Bipole III has been built?

MR. DERRY: Well, I would say at what cost? There is going to be a cost to this. You can't design a system to be 100 per cent reliable. So I would ask that person, whoever it was, what is this going to cost us as, compared to doing the alternate?

MR. BEDFORD: Well, the reference to first priority, a lawyer can tell you comes from the legislative mandate that Manitoba Hydro is required and obliged to respect. But part of the purpose in my question to you, and my illustration of putting you back into the most senior job at Manitoba Hydro, was to address something Mr. Woodford quoted in his paper.

Mr. Woodford, that's at page 3, but it will -- I'm sure you will recollect it quickly. You chose to quote a report written by two people I do know well, Mr. Mazur and Mr. Wang. Mr. Wang has actually been here throughout the day. And you were puzzled why, having recognized the wisdom of separating Bipoles I and II at Dorsey, those two gentlemen wrote:

"...but should not be pursued at this time unless there is no other option."

And I would suggest to you that answers the mystery that was in your mind; why, having recognized the desirability of separating I and II for reliability purposes would they then go on to opine that this should not be done now unless there is no other option.

Well, I suggest to you that's why they

wrote this should not be done now unless there is no other option, because working at Manitoba Hydro they are thoroughly cognizant of the company's mandate not to initiate actions which could lead to outages and thus violate the primary mandate to meet load.

MR. WOODFORD: Thank you for your question there. There is a lot in it.

First of all, Manitoba Hydro does suffer outages, notwithstanding that mandate. And so what? There is the potential -- or the possibility of 100 per cent reliability to all the customers of Manitoba Hydro is not possible, no matter what you are doing, it is not achievable.

Now, I don't know whether the lights went out today because of Manitoba Hydro, I suspect it is because of the building. But lights do go out. All right. So you can't maintain that mandate, as you've put it, as you have worded it. It is not possible. And we know that. We saw that on October 5th, last year, when we had the ice storm in Southeast Manitoba. You weren't able to maintain your power supply to those customers of Manitoba in that area. So these outages do occur. And we are talking about extreme outages

where we are losing two Bipoles simultaneously, which is not unlike an ice storm in Southeast Manitoba. So we are not in a situation of being able to provide that mandate at 100 per cent, 100 per cent of the time. You understand that, I'm sure. And so we have to provide the best reliability we can.

Now, in December I was in the United Kingdom and I attended a lecture or talk given by an executive of -- what is the U.K. power authority -- National Grid. And they have got some tremendous developments to do in the United Kingdom. And the question he raised before us was, where do we call the level of reliability? And it was an unanswered question, but it is a question that he had as a senior executive of National Grid, where do we call the level of reliability? Because to try and get close to that 100 per cent costs billions of pounds, but perhaps to get to 99.9 per cent, it wouldn't cost so many billions of pounds.

So as engineers this has to be -- and folks administering the rates, this issue of probability is a key issue of reliability, and this is what we are here for. This is the whole

point of this presentation is reliability.

And again, when we have extreme disturbances such as the October 5th wind storm or something that takes out Bipole I and Bipole II, these are extreme. And to say that we are not fulfilling -- you are not fulfilling your mandate 100 per cent is not good engineering. It may be good legal stuff, but it is not good engineering.

I have said more than I should. And I want to make that point very clear to the Commission, that's an extreme and important point that reliability is a key issue, but the lights do go out.

MR. BEDFORD: Of course. And there is a difference, Mr. Woodford, between an outage caused by a natural event like an ice storm, that no human can claim credit for having caused, and an outage that results from a decision consciously made by a group of men and women, engineers, to separate Bipoles I and II.

MR. WOODFORD: Such as?

MR. BEDFORD: Such as a decision made by engineers to separate Bipoles I and II, knowing that there is a risk of outages?

MR. WOODFORD: That is what Manitoba

Hydro has said. And I have presented to you today that others have done this with minimum outage, and the outages would be planned at a time when the load could handle it, perhaps 3:00 o'clock in the morning, I don't know. So that whatever switching is planned happens. We are not talking about equipment suddenly going up in smoke, are we? We are talking about taking stuff out, taking equipment or facilities out of service while we put new service or new plant in. And that should be planned so that when we do that it is at a time when, hopefully, I'm asleep and don't know what is happening.

MR. BEDFORD: Mr. Derry, I'm sure you appreciate that one of the tasks that Mr. Mazur and his staff had to undertake in the early stages of considering Bipole III was whether or not there were any alternatives to building another high voltage DC line from Northern Manitoba to Southern Manitoba. And you may have read about that analysis that they did in chapter 2 of our Environmental Impact Statement.

Were you able to do that?

MR. DERRY: Quite a while ago that I looked at it but --

MR. BEDFORD: And logically, one of the obvious alternatives to building another high voltage direct current line from Northern Manitoba to Southern Manitoba is to build a high voltage alternating current line from Northern Manitoba to Southern Manitoba. Correct?

MR. DERRY: That's correct, that's where I got my figure of $4.18 billion.

MR. BEDFORD: That's exactly what I thought, because that is the number that they came up with and I saw your references to that number in your report. But that concept as an alternative to Bipole III was clearly discarded, because we are here today to consider a project that is a high voltage DC line.

MR. DERRY: But I didn't discard it. I said that you have to do something to make it comparable to having three Bipoles. You can serve the load out to 2050, with those two different Bipoles. You have to do something in 2025, with the Hydro alternative, because you are going to start to go into a deficit again. So my proposal would be build the north/south transmission line to give you compatibility or comparability to what we are recommending. Something has to be done to

get to the same level that we are at.

MR. BEDFORD: I understand that. And what you are recommending is build Bipole III, not a $4 billion high voltage alternating current line for Northern Manitoba to Southern Manitoba.

MR. DERRY: Or the alternative that we have where we move Bipole II to Riel, and then build Bipole III in 2025. But in Hydro's alternative where they have 3800 megawatts at Dorsey, and only another 2000 at Riel, that will only take you out to 2025. You have to do something in 2025.

Now, if you don't want to build a north/south line, then put in 2000 megawatts of gas turbine, which they did study in their study, or build two lines to the United States, which they did study, and came out and said, no, the best alternative is Bipole III for that.

MR. BEDFORD: The sense of urgency that you associate with the year 2025, I have concluded from going through your paper more than once, I will admit, is your concern that the projections that the company has to meet its load requirements will require additional supply of energy from some source in 2025, be it new hydro

generation, as you say, could be gas turbines, could be imports from another country, but that's what drives your attachment to the year 2025. Am I correct?

MR. DERRY: That comes from the 2010 report. I showed you the figure 1.3. If you extend those lines down, which I did, and the 1.3, B, C, D and E, you will see that you have run out of capacity and you have to do something. I can put it back up if you want to look at them on the screen?

MR. BEDFORD: So whether one agrees with Manitoba Hydro that Bipole III should carry forward and be done now, so that it can be brought in service in about 2017, or whether one finds persuasive your recommendations for a very different approach to the topic -- one aspect of which you are recommending that I have clearly read is that when it comes time in your recommendation to put a second new converter in Southern Manitoba, because you want to do one for Riel more or less right away to accept separation of Bipole II, so we will do another one for 2025, for a terminal point for Bipole III, which we are now building, in your recommendation, and you

would like to see that sited at the LaVerendrye site?

MR. DERRY: That's correct. And I just gave a statement a little while ago on that same 2010 report, that is option three on page 9 of that report.

MR. BEDFORD: And LaVerendrye, you know and I know, and some of us here will remember, is presently the site of an alternating current switch yard that forms part of Manitoba Hydro's southern distribution system, no doubt about that.

MR. DERRY: What was the question again, please?

MR. BEDFORD: LaVerendrye today, presently is the site of an alternating current substation?

MR. DERRY: It is a 230 kV substation.

MR. BEDFORD: Sorry, I think I said switch yard, and you are right, it is a substation.

MR. DERRY: I'm not suggesting any location. I'm saying that Hydro should look at a location. We have shown it on the map at the corner of where that existing corridor, which

doesn't have any lines on it, terminates. It could be moved along that line. I don't know where it is going to go, I leave that to Hydro, that's an engineering decision.

MR. BEDFORD: In effect, if one has the money to build a second new converter station in Southern Manitoba, you would accept that building it only 21 kilometres from Dorsey is probably not the wisest choice of site. You might be wiser to look at a different geographic location, south, southwest of Winnipeg, correct?

MR. DERRY: You could. But has Hydro done any reliability studies of what the outage probability will be? You have a 1 in 200 probability for the loss of Dorsey. Now, if you move one of those, if you take converters, one of them out and put it at Riel and you want to build another one at LaVerendrye, what is the probability of both LaVerendrye and Dorsey being hit by that same wind storm? Is it 1 in 200? No it isn't, I am sure it is more like 1 in 4,000 or something. You haven't done that study. Do that study.

MR. BEDFORD: Before too many minutes go by, I'm going to say something about

probability, and people who listen carefully will begin to learn what grade I got when I studied statistics at the University of Manitoba.

I think I understood, through Mr. Meronek's walking you through the rebuttal document, which for better or for worse we were -- we had to file yesterday evening. But I did hear you acknowledge, so I won't belabour the point, but you can confirm for me that to carry forward with your recommendations there are somewhat expensive items that you knew there would be costs associated with, but you didn't have the materials to estimate the costs, so you left them out, but there is not really an issue that there are some expensive items that would add to the costs of your recommendation.

MR. DERRY: Yes, I did say that I think when I replied --

MR. BEDFORD: For the sake of those in the room who don't pay very close attention to the evidence that's given, I have four items down, and they would include a new alternating current switchyard in association with wherever you sited this second converter station, correct?

MR. DERRY: Correct.

MR. BEDFORD: And at least one now high voltage alternating current line to carry the power brought to the new terminal point for Bipole III over to the east of Winnipeg to the Riel site?

MR. DERRY: That's correct.

MR. BEDFORD: And I'm told there would be some termination equipment required at Riel to accommodate the end point for that new high voltage alternating current line.

MR. DERRY: That's correct.

MR. BEDFORD: And finally, I did hear Mr. Woodford's preference for a new underground high voltage direct current line running from Dorsey to Riel, and that comes with a price tag as well, easily in excess of 200 million, perhaps more, depending on what Dr. Lawson may tell me in a few minutes about pricing and splicing of underground cables.

MR. DERRY: If I remember the number, it was 370 million that you assumed, and we assumed 275.

MR. BEDFORD: You are relying more closely on Dr. Lawson's opinion --

MR. DERRY: That's correct, his cost was four and a half times the cost of overhead,

and yours is something like seven.

MR. BEDFORD: Now, I also wish to confirm that I detect there really isn't a difference of opinion between the engineers that still work at Manitoba Hydro and you, Mr. Derry, and you Mr. Woodford, when it comes to the prudence and wisdom of having alternative paths for alternating high voltage current to flow in the event that a single 500 AC line is tripped, there should be other paths for the energy to go. So whether or not they are an additional series of 230 kilovolt alternating current lines to accommodate that, whereas I think I heard Mr. Woodford say additional 500 kV lines that your client, Mr. Bedford, may build some day, the logic of having those alternate pathways to defend one's self and to cope with the disaster of cascading tripping is accepted by all electrical engineers. Am I right?

MR. WOODFORD: Possibly you are right there, but my recommendation -- this is my personal recommendation as an engineer, that when we build Bipole III, and if we build near LaVerendrye station, that we will need to complete a 500 kV AC ring around Winnipeg and make sure

that this converter station is interconnected on to that 500 kV ring. So that if we lose one section of that ring, it is not going to cause any cascading outage. And it may require some intelligent controls manipulation to help in that situation. We do that today. We lose transmission lines, major transmission lines, and the power is quickly reduced on the DC lines so that we don't cause the cascades that you were talking about. So it would be an implementation of a completed 500 kV ring, as well as intelligent application of controls, high speed controls, to ensure that no cascading occurs.

I would like to see such a study, it will take time to do such a study, I don't expect it here, but my understanding is that such a design could be accommodated without cascading, with Bipole III located at or near LaVerendrye and connected into the 500 kV ring. And so that's the clarification I would like to make to your question.

MR. BEDFORD: Mr. Woodford, one of the areas of law that I have had to learn something about since I came to work at Manitoba Hydro is generally called environmental law, and it wraps

into its umbrella things like hearings before the Clean Environment Commission of the Province of Manitoba. I have had to learn a little bit about the challenges of all of the biological and socioeconomic analysis that has to be done with routing. So I listened with some quick interest when Mr. Meronek asked you about my client's concern about meeting a 2017 in-service date if we were to go with Mr. Woodford's dream of an underground route from Dorsey to Riel. And I believe the words you used were an acknowledgment that, yes, of course there would be permitting necessary, but surely it would be easier, less involved than these assessments for overhead conductors and towers and so forth. And it immediately crossed my mind that one of the huge enormous challenges in this province, in the neighborhood of this City, of putting these conductors underground would lie with the concern we have about aquifers. And they can be incredibly controversial and of concern to people that live in the city, and I suspect that that one topic alone would require a lot of detailed assessment, and a lot of science to be brought forward, were we to seriously want to engage in

building an underground cable.

MR. WOODFORD: Could you tell me what you mean by an aquifer?

MR. BEDFORD: Well, what I understand by aquifers is that, in simple terms, there is bodies of water that lie beneath the earth that I walk on in this area. We draw on those aquifers for water, and we have to be very careful about tampering with that resource.

MR. WOODFORD: Right. Now, I think, based on Dr. Lawson's presentation on burying cables, you were only going down less than one metre. That's less than the foundation of an overhead AC line, or DC line. So how are we going to impact the aquifer?

MR. BEDFORD: Not so quick. Dr. Lawson may find himself agreeing with me in about ten minutes. A metre may not be quite adequate.

MR. WOODFORD: But the question I have is, how can a metre deep channel impact those critical aquifers?

MR. BEDFORD: Well, in the event we go with underground, we may hire you to convince those citizens of this province that there is

nothing to worry about with underground.

Mr. Woodford, I heard the reference to Teshmont from you. And I also heard Dr. Lawson mention that he has worked on international projects with Teshmont. And I felt rather warmed by the thought that Teshmont is a local company in Manitoba. So I conclude that if you work with them regularly, you do have confidence in their skills and their level of expertise in doing analysis and consulting for various companies?

MR. WOODFORD: Yes, but being an engineering arrangement, some of our meetings are very interesting as we have a difference of opinion, and it is natural and normal, and sometimes I'm right and sometimes they are right. So, dealing with engineering situations, we have to get to the best engineering solution possible, and I would be the last to say in my profession, me and my company, that we do change our mind from one engineering solution to another, and better engineering solution, if someone such as Teshmont or Manitoba Hydro can convince me to do so. And so, yes, I respect Teshmont, I work with them, I'm working with them now on a very big project. And we do have differences of opinion. We resolve

them and we try to come to the best engineering position. They will have one position, we will have another, and we come to an agreement in due course and proceed forward.

MR. BEDFORD: Mr. Woodford, one of the things that Teshmont has done in its career as a consultant is provide assessments to my client regarding Bipole III, which, as I understand it, say that compared to a catastrophic event which would destroy the Dorsey converter station, there is a far greater probability with respect to Bipoles I and II that a natural event will damage or destroy a number of the towers and conductors. Did Teshmont get that right this time in your opinion?

MR. WOODFORD: I don't think that we have been saying anything different than that. We know that if we keep Bipole I and II together at Dorsey, yes, that could all go out with an extreme condition. We also know that all of the towers could go down with Bipole I and Bipole II, as has done in 1996. So I don't see what is new here.

MR. BEDFORD: Well, as I understand it, if we accept the recommendation which requires Bipole III to be built eight years after you

separate Bipoles I and II, we are to live with the reality, the possibility, or the probability that for a period of some eight years Teshmont's probability predictions could well come true, and that the response is, take a chance. Those were the words I heard. Better to take a chance than to incur the enormous expense of building Bipole III.

MR. WOODFORD: Now, I thought we had resolved the issue of Bipole I and II converter stations going down by separating them. So that we, as Mr. Derry has indicated, that if someone worked out the probability of both of them going out at the same time, that would be a probability of great insignificance -- is that the word?

We also know that there is a probability of the lines going out, one in 17 years, and we have had one in 40 years. So we are expecting one any day now. So that will go out. And so we are living with it. And since Manitoba Hydro is going to take eight weeks to fix it, we are in trouble.

MR. BEDFORD: I've heard for over a decade now that in 1997, Manitobans experienced a 1 in 700 year flood. I will tell you, I do not

conclude from that fact that for the next 700 years there is absolutely no possibility of another flood because the event happened to us in 1997. So I suggest to you that when Teshmont says to my client there is a 1 in 20, or a 1 in 200 probability, but it is 1 in 20 for a natural event damaging Bipoles I and II, that we could experience two or three such events in the next five years, or none at all, could we not?

MR. WOODFORD: That's correct. And first I heard about 1 in 700 for the 1997 flood, I always thought it was 1 in 100 years. So that's news to me. And I hope this is not another example of Manitoba Hydro's worst case scenarios taken to the extreme. Do you have evidence to show me it is 1 in 700?

MR. BEDFORD: No, but ten minutes ago I warned you that I was not a star pupil in statistics.

MR. WOODFORD: All right.

MR. BEDFORD: Good afternoon, Dr. Lawson. If I was listening correctly, I understand that you spent a part of your youth in a city that's one of favourites, Edinburgh?

MR. LAWSON: One of my favourites too,

yeah, I did.

MR. BEDFORD: Now, as I noticed with respect to Mr. Woodford, Mr. Derry and Mr. Woodford, I read your paper more than once. I found it frankly very informative. I listened to your presentation, and I conclude that obviously putting conductors underground, still in the year 2013, is more expensive than putting them overhead?

MR. LAWSON: Correct.

MR. BEDFORD: And you've suggested to us today about four times more expensive to put the conductors underground?

MR. LAWSON: Um-hum.

MR. BEDFORD: You have had an opportunity to read my client's rebuttal, and my client thinks that the difference is higher than four times, but obviously more expensive by a factor, a considerable factor?

MR. LAWSON: Right.

MR. BEDFORD: I could not tell from looking at the three estimates that you have provided to us whether any of the three estimates included an effort on your part, or someone else's, to include the costs of environmental

studies and the acquisition of rights or interests in land?

MR. LAWSON: Absolutely not. And it is never the usual approach, when you ask what a project will cost as far as cable is concerned, to go into these issues. We should have probably stated that our estimates had not included these things, yeah.

MR. BEDFORD: So, we would all have to prudently understand that if we were to proceed with the recommendation that you and your colleagues are advancing, that the costs would go up by whatever those costs are estimated to be?

MR. LAWSON: Yes.

MR. BEDFORD: Now, I did notice in your picture of a submarine cable that the core is copper?

MR. LAWSON: The core is copper, yes.

MR. BEDFORD: Why, with these underground cables, are the cores copper?

MR. LAWSON: Standard practice, because the electrical resistivity of copper is much -- conductivity I should say is much higher than aluminum. Aluminum though is being used for underground cables more in connection with the

XL-DC type of cable, the VIC type of cable, more so than the mass impregnated.

MR. BEDFORD: You will recall that your estimate number 1 is based on a budget you've told us from a project in 2007?

MR. LAWSON: Um-hum.

MR. BEDFORD: In a common sense way, you have brought that budget amount relevant to the year 2007 forward by including an inflation factor, correct?

MR. LAWSON: Correct.

MR. BEDFORD: Now, I understand that since 2007, one of the challenging realities of purchasing copper in the world is that the price of copper has doubled, 100 per cent increase, well beyond the price of inflation. Does that sound familiar to you?

MR. LAWSON: Copper goes up and down, yes. And generally when you get a bid from the manufacturer, he will tell you what price the copper was when you made the bid, yeah.

MR. BEDFORD: So we would be wiser to follow your estimate number 2, which I gather was a current estimate based on an inquiry that you made privately?

MR. LAWSON: Right.

MR. BEDFORD: Because undoubtedly that estimate would reflect the current price of copper?

MR. LAWSON: I fully agree, yes.

MR. BEDFORD: Nominal life for an HVDC cable underground, you've acknowledged at page 8 of your report, is 40 years. You addressed that briefly in your oral presentation.

MR. LAWSON: Yes.

MR. BEDFORD: Can I fairly conclude then that any utility such as my client, Manitoba Hydro, that's considering the use of MI cable and trying to compare that with what we are proposing to do, which is an overhead cable, would wisely have to factor in the reality of replacing the underground in about 40 years?

MR. LAWSON: Yes.

MR. BEDFORD: I'm looking at your presentation, I think the same information in different form appears in your written report, but I'm looking at the page that summarizes various projects worldwide involving, I will call it underground cable. But my colleagues who have a greater interest than I do in this subject tell me

that all of these projects are submarine links, with the proviso that in some cases the submarine links, I would think in all of the cases eventually the cable emerges from the depths of the sea and is land, so that there will be some segment at each end presumably that's underground, but they are focused on submarine cables.

MR. LAWSON: I think I told you this already. The title underground cable refers to the project that we are considering. The fact that it is here doesn't mean to say that these are underground cables.

MR. BEDFORD: No, that wasn't my point. My point was that in our experience on planet earth to date, with using underground conductors for high voltage transmission --

MR. LAWSON: Right.

MR. BEDFORD: -- the experience is almost exclusively with submarine, because there are no examples, and I'm assuming if there was a good example you would have had it in your table, of an underground, that is strictly underground and not submarine?

MR. LAWSON: I did touch on that, and I think I have already said that, but, yes, I

agree.

MR. WOODFORD: Might I just say that the lower voltages, there are plenty of instances of underground cable, DC, going long distances. I have quoted that one, the Murray link.

MR. BEDFORD: The qualification, though, Mr. Woodford and Dr. Lawson, was low voltage. When we get to high voltage DC or AC, it is a real challenge, I gather, because of the heat that these conductors generate?

MR. LAWSON: It is not a question of low voltage. Because the France and Spain project is 320 kV, 2000 megawatts. The problem is it is cross linked DC cable and not mass impregnated cable. You are correct, there is not that much on land, especially at 500 kV. We do have two very significant projects, one which has already been completed in 2007, the Neptune project on Long Island. And we do have Skagerrak 4 going in now in Denmark, which is 90 kilometres. And that's 500 kV. So these are very significant projects.

MR. BEDFORD: To me equally, perhaps more interesting observation that my colleagues have made about the examples that you have given us, Dr. Lawson, is that they say with only one

exception, all of these projects are not examples of transmission lines being constructed for the purposes of reliability, but they are being built to, I will use the word exploit opportunities to sell energy from a seller willing to a willing buyer, often if it is in Europe, from one country to another?

MR. LAWSON: Correct.

MR. BEDFORD: And I understand that one of the concerns still to date that utility companies with wanting to use underground, when their primary motive for construction is reliability, is that it can be a challenge, depending on the particular circumstances and location of the project, to access the underground cable when it stops working. True?

MR. LAWSON: Access is slightly more difficult, yes, than the overhead lines.

MR. BEDFORD: And a particular challenge, obviously, if one lives in the climates such as we do in Manitoba, where the ground does freeze, and that makes accessibility for approximately four months, perhaps five months of the year virtually impossible, correct?

MR. LAWSON: Not necessarily.

MR. WOODFORD: Can I just make a suggestion on this? They are always digging up in my neighborhood the ground in the middle of winter to try and get the pipes working. What is the difference?

MR. BEDFORD: I'm sorry, I was looking at my --

MR. WOODFORD: The City of Winnipeg has problems in the winter with pipes, underground water pipes, and they are always digging up in my neighborhood anyway, which is River Heights, in the middle of winter, down into the frozen ground to get at those pipes. So why can't we get down to a cable one metre down, and not two or three metres down, you know, that's -- I don't see this is a big issue. Maybe you do, maybe Manitoba Hydro does, but I certainly don't.

MR. BEDFORD: Dr. Lawson may be telling me temperature and underground cables and splicing is a concern. My understanding was that you can't splice and construct in sub zero temperatures.

MR. LAWSON: My information from the industry is that minus 5 centigrade would be the limiting temperature for installation and

splicing.

MR. WOODFORD: But couldn't you put in a tent?

MR. LAWSON: Absolutely, yes.

MR. WOODFORD: For heaven sakes, we put it in a tent, we put a heater in it, and confound it all, we can run it for weeks and warm it for splicing.

MR. LAWSON: As a matter of fact, you always have a tent, always, and it is heated and ventilated. So it is quite a sophisticated operation. But I think the minus 5 centigrade is more from the point of view of bending the cable. They don't want to be bending the cable for splicing purposes when the sub zero temperature is lower than minus 5.

MR. BEDFORD: I saw the acknowledgment, it is page 13 of your paper, Dr. Lawson, that you were alert to the fact that my client has said, were we ever to consider putting a high voltage DC conductor underground, because of our need to improve reliability, we would put a third cable.

MR. LAWSON: Yes.

MR. BEDFORD: But refresh my memory,

is the cost of the third cable included in any of your estimated prices?

MR. LAWSON: No. In my opinion it is absolutely not necessary and it is never done. Why would Manitoba Hydro be the exception?

MR. BEDFORD: But the point is, if one could persuade whoever it is one might have to persuade that we are right, and your opinion is just a little bit too challenging for us to accept, the price would go up?

MR. LAWSON: Okay. Thank you.

MR. BEDFORD: Now, one of the things I learned reading your paper was just how few manufacturers and suppliers of MI cable there are in the world. I learned also that those that do exist, a handful, are located in either Europe or Japan, and you mentioned today Korea has come on board with a new plant.

MR. LAWSON: Right.

MR. BEDFORD: I've also learned that most of these plants seem to be fully occupied and booked supplying the current order. But I did try and sort out in my own mind that if one could find a plant with some capacity this afternoon, and place an order for say 65 kilometres of MI cable,

my conclusion was that between the date of placing the order today and actually seeing delivery materialize at a rail yard in Winnipeg, I would have to allow about a year. Would I be correct in that conclusion?

MR. LAWSON: Absolutely, that's about right, I would say. And if I just say what I have been noting down here, yes, Prysmian will be fairly busy, they have two recent, fairly recent contractor awards, one for the western link between Wales and Scotland, that's 400 kilometres, and one for the Montenegro link between Italy and Montenegro is 450 kilometres. So they have about 850 kilometres.

Nexans should be finishing Skagerrak 4 beginning of next year, which is 215 kilometres, but that should be finished.

Other than that, all I can find is the Straits of Belle Isle, 108 kilometres. And Montenegro, the second Montenegro cable is actually being manufactured in Japan, because Nexans owns more than half of the viscous plant in Tokyo Bay. So that's where that is coming from. That's not a Nexans project.

ABB, I don't know that they have very

much on their books at the moment. And J-Power, in Osaka, Japan, probably have nothing on their books at the moment, yet they have a plant there, and they are fully qualified for this 600 kV very high voltage mass impregnated cable. They have done type testing, and I have visited the plant while they were type testing, and they have plenty of experience with the oil field cable submarine work, but not with mass impregnated cable as such, but they have the capability. And there is also the Korean plant. They put in a 250 kV Bipole between the Korean mainland and holiday island of Jeju completed last year. So they have manufacturing capability in that plant.

MR. BEDFORD: So in my mind I was allowing at least a year before I saw the cable arriving in Winnipeg?

MR. LAWSON: Sure.

MR. BEDFORD: And then I was trying to visualize where and how one now handles it and moves it, and puts it in the ground. And I keep coming back to not being able to fully visualize splicing. Splicing, I have learned through two reads of your paper and listening to people, is not what I do when I try and do some home repair

work with a pair of pliers and a bit of wire, much more complicated it seems. So can you help us out briefly with explaining to us what happens with splicing?

MR. LAWSON: I thought I did that already but I can do it again. It is a flexible splice, one thing that's difficult from your ordinary underground cable, which is generally a splice which has a much larger diameter than the cable itself, and is rather short. But this is an inheritance, the flexible splice is an inheritance from the requirement that they have for submarine cables to have flexible splices for laying in particularly deep water. So we have this at the moment. As I said this morning, the industry has not yet considered the development of a more suitable splice for a fairly rapid splicing procedure for land cable specifically. So we are talking, in my opinion, something like four days per splice.

MR. BEDFORD: Did your four day estimate factor in the likelihood in the case of my client having to have three cables spliced at a time?

MR. LAWSON: No, I was working with

two cables.

MR. BEDFORD: Would the third cable then take your confidence in four days and move it up to perhaps five days?

MR. LAWSON: No, the spare cable still would be four days, except it would be an additional four days, wouldn't it? You would have three times four in that situation.

MR. BEDFORD: Splicing done by, I don't know, crews of two, four, a dozen, 50?

MR. LAWSON: Generally two, probably a labourer as well.

MR. BEDFORD: So that the two key persons on the crew are highly skilled labour?

MR. LAWSON: Oh, absolutely, um-hum.

MR. BEDFORD: And we have heard about temperature, your written report said you would have to factor in your construction schedule the fact that you would shut down and not be splicing and putting cable in presumably in the winter sub zero months.

MR. LAWSON: Correct.

MR. BEDFORD: Although, I heard Mr. Woodford, to use heated tents to carry on.

MR. LAWSON: It is the bending of the

cable. The splice itself is five metres long, but in order to make that splice you have to be moving cable a long way either side of that five metre section. And they don't want to move the cable if the temperature is below minus 5 centigrade.

MR. BEDFORD: So, I factored into my calculation of years an allowance for three to four years once we got the cable to Winnipeg, to do all of the splicing, the trenching, the digging, the laying of the conductors and filling in the excavations. Does four years sound reasonable?

MR. LAWSON: Three years sound good.

MR. BEDFORD: In addition, I know, and I will respect the fact that it is not work that you do, but I know that one has to go through environmental assessment licensing and hearings and so forth, so I factored additional time for that. But unless you tell me to the contrary, I suspect that's beyond the kind of work you do, so you wouldn't want to give an opinion on the topic?

MR. LAWSON: Obviously, I'm aware of the situation and I know that in some cases permitting, et cetera, et cetera, has taken quite a long time, yes.

MR. BEDFORD: My conclusion when I add up the numbers that I've just been referencing is that 2017 is impossible if one were to use underground cable, but I say that less for your benefit and more for some others.

MR. LAWSON: Well, I think we have to leave that open. I don't think that we can really say that at this moment.

MR. BEDFORD: Turning to your presentation, given what I have lived through in the last 24 hours in the province where I live, I found it most interesting that you start us off with a picture of Australia. And I concluded very quickly you would have started me off with a picture of frozen tundra if there were any example in the planet of underground cable being used in a climate with sub zero temperatures.

MR. LAWSON: Well, I think it is not so warm in New Jersey or Long Island, and in Denmark in the winter, where the 90 kilometre long cable is going in.

MR. BEDFORD: Given the fact that the ground does freeze here, one metre deep, probably not a safe enough margin to put the cable in?

MR. LAWSON: I already discussed this

with the industry and they are not concerned, once it is installed, if the temperature goes below the 5 degrees, minus 5 degrees. It is not a problem.

MR. BEDFORD: And I confess that I misunderstood your motivation for showing us a map of the proposed line from Perpignan to Figueres. I thought it was because of the length, 65 kilometres was coincident with what is being proposed here. You revealed you had different motivation for doing that. Nonetheless, you will agree with me, given the description beside the map that you provided, this is cross linked polyethylene cable that's being used in that project, and you told us that is just not -- it doesn't exist for a high voltage conductor at this time?

MR. LAWSON: Right.

MR. BEDFORD: One of the projects in the presentation is NorNed. I gather that's a submarine cable leading from a site in Norway to a site in the Netherlands, Dr. Lawson?

MR. LAWSON: Correct.

MR. BEDFORD: Can you confirm for us that that cable failed after it was initially commissioned?

MR. LAWSON: Yes.

MR. BEDFORD: And can you confirm for us that the outage in that case was some three months?

MR. LAWSON: No. You obviously have confirmed that for yourself, so maybe I don't need to. But, yes, this must have been some problem during installation. I must say, very unusual.

MR. BEDFORD: That was the final question. Do you know, because my sources don't, what the cause of the failure was?

MR. LAWSON: No.

MR. BEDFORD: Thank you. I have no more questions for you.

MR. LAWSON: I have a comment, if I can?

MR. BEDFORD: Of course.

MR. LAWSON: Manitoba Hydro stated that the overhead line cost is in the order of .8 million dollars per kilometre. Now, I know nothing about overhead line costs, so I consulted some specialists. And I find that in the U.S. a major consultant, major, who has done a recent study on an overhead line cost, 500 kV, 2000 megawatts, and gives me a cost of

$1.2 million per kilometre.

I also understand that when you are making this sort of estimate there is a 25, 35, range. I conclude therefore that the .8 of Manitoba Hydro is at the lower end of the range and it would be just as well to consider 1.2.

MR. BEDFORD: Thank you. My comment would be that two gentlemen sitting beside you, Mr. Derry, Mr. Woodford, hired the best engineers to succeed them at Manitoba Hydro, and we have such wonderful and highly trained staff at Manitoba Hydro that we can bring this project in at the 800,000 price point.

MR. LAWSON: I'm just saying that there is range, and I believe that's at the lower end of the range. It doesn't mean it is incorrect, but it does mean it is not so conservative.

MR. WOODFORD: Can I comment on that?

I have understood in reading previous transcripts, I don't know whether it was the PUB or the CEC, but the question was asked of Manitoba Hydro, what is the variation, let's use the word variation, on the costs of the transmission line? And I can remember them saying plus or minus 35

per cent. Now, that may be an incorrect value, but that's what was written somewhere in the transcripts. And if we are talking about $.8 million plus or minus 35 per cent, I don't know. Is it plus or minus 35 per cent? Has to be something, because you can't be right on, and if you are, you are super human. So what is it? And is it plus or minus 35 per cent, plus or minus 25 per cent, plus or minus 15 per cent? So when you state $.8 million per mile, there has to be a variation attached to that. What is it?

MR. BEDFORD: I have no further questions. Thank you, all of you.

THE CHAIRMAN: Thank you, Mr. Bedford.

Before we take a short break, I would just like to comment on the issue of flooding in Manitoba. You should know that the Commission conducted a similar review a number of years ago into the expansion of the Floodway around Winnipeg. The 1 in 700 figure comes from the capacity of the expanded floodway. 1997 was about 1 in 100. 1996, one year before, was also about 1 in 100. And since 1997, there have been one or two more almost 1 in 100 year floods.

We will take a break and come back

just after 3:15.

(Hearing recessed at 3:03 p.m. and reconvened at 3:15 p.m.)

THE CHAIRMAN: Okay. We will reconvene. The Consumers Association has a few questions. Mr. Williams.

MR. WILLIAMS: Yes, and good afternoon, members of the panel, and good afternoon, Mr. Lawson, Mr. Derry, and Mr. Woodford, and Ms. Friesen, of course.

Dr. Lawson, I don't think that I have any questions for you, so you will forgive me. Mr. Derry, I'm going to start with you and certainly -- Ms. Desorcey is here, and she certainly wants to extend her appreciation to the Bipole witnesses for this thoughtful piece of work.

Mr. Derry, I want to start really with a question similar to what the Chairperson of the Board of the CEC asked you. You made reference in your evidence today and in your written evidence a number of times to a 2010 report. Do you recall referencing a report?

MR. DERRY: I have the report in front of me here.

MR. WILLIAMS: Mr. Derry, when you referenced the 2010 report, is that the report, Ultimate HVDC Development in Manitoba, is that the report?

MR. DERRY: It is called Ultimate HVDC Development in Manitoba, SPD, 2010/14.

MR. WILLIAMS: And, Mr. Derry, I have a good familiarity with the record. That's not a report that I am familiar with. Is that on the record somewhere and I have --

MR. DERRY: No, it is not on the record.

MR. WILLIAMS: Would you be willing to undertake to file that report on the record?

MR. DERRY: I think you should ask Hydro to file it.

MR. WILLIAMS: It is a Hydro produced report?

MR. DERRY: It is a Hydro report.

MR. WILLIAMS: So you have no objection, but you think it should come from Hydro? Is that your point, sir?

MR. DERRY: No.

MR. WILLIAMS: I guess I will defer until Thursday then in terms of how I ask Manitoba

Hydro, unless Mr. Bedford wishes to volunteer to file that report now?

THE CHAIRMAN: Go ahead, Mr. Williams, and request it of Manitoba Hydro. If you don't, we will.

MR. BEDFORD: The hearing is obviously gone on too long, because we believe it was filed quite some time ago, but we will look into it.

THE CHAIRMAN: The Commission secretary scanned through the documents that have been registered and doesn't find that one.

MR. WILLIAMS: And Mr. Bedford, if I am hearing if it is not on the record, that Hydro will quite happily put it on the record?

MR. BEDFORD: I will look at the report and consider, and we will let you know.

MR. DERRY: If they don't put it on, I can get a copy for you.

MR. WILLIAMS: So, Mr. Derry, I have your undertaking that if Manitoba Hydro won't agree to put it on the record you will do so? Is that what I have?

Mr. Derry, this is not the first regulatory proceeding that I have seen you at. I have seen you at the Public Utilities Board as

well from time to time.

MR. DERRY: Once I think.

MR. WILLIAMS: And, Mr. Derry, would it be fair to say that you certainly have followed -- and I want to talk about load forecasting for a couple of minutes -- but would it be fair to say that you certainly have some familiarity with the discussion of load forecasting between Manitoba Hydro and the Public Utilities Board? Are you familiar with any of the discussions?

MR. DERRY: I have been keeping up on the transcripts actually, even this last year.

MR. WILLIAMS: And going back one hearing, sir, you will be aware indeed that the Manitoba Public Utilities Board has raised some concerns with the reliability of Manitoba Hydro's load forecasts?

MR. DERRY: Yes, I am.

MR. BEDFORD: And the suggestion being, sir, with regard to the 2011 and 2010 load forecast, that they overestimate future load for Manitoba Hydro. You are familiar with those comments by the independent regulator?

MR. DERRY: I don't quite remember

those. I can't say yes.

MR. WILLIAMS: Fair enough. Turning, if we could, to figure 1.5 of your Powerpoint. Mr. Derry, it is not on this figure, but when you were discussing this figure in your presentation to the Clean Environment Commission this morning, you made the comment that you -- you had some concern that the Manitoba Hydro load forecast might be overestimating the load in future years. Do you remember making a statement to that effect?

MR. DERRY: I did say that and I compared it to the 20 year load growth from '92 to 2012, 44 megawatts per year and the new forecast, 2012 to 2032 is using 83 megawatts per year.

MR. WILLIAMS: And thank you for that, Mr. Derry. Those figures that you have cited with the much lower historical forecast as compared to the very aggressive future forecast, are those on the record of this proceeding, sir, or did you derive it from the Public Utilities Board?

MR. DERRY: I actually got these from the PUB -- no, the 2012 forecast was put in as information for this hearing.

MR. WILLIAMS: So if I looked for that information I will find it based in the 2012 load

forecast?

MR. DERRY: There is another table in here that I used for the peak versus the monthly. It comes out of the 2012 forecast.

MR. WILLIAMS: I'm going to come to that in just a second.

Mr. Derry, just as I look at figure -- staying with figure 1.5, and this is, if I look to the 2017/18 year and using the Manitoba Hydro load forecast, I'm correct in suggesting to you that as of 2017/18 based upon Hydro's most current forecast it is not at that 1500-megawatt hour deficit in that particular year?

MR. DERRY: No, I think I mentioned in my testimony it is around 1400.

MR. WILLIAMS: And it is really based upon the more current Manitoba Hydro forecast, not until 2019/20, that it begins to approach that 1500-megawatt deficit; correct?

MR. DERRY: That's correct.

MR. WILLIAMS: And, sir, rather than taking what some might call an optimistic Hydro load forecast, if we took the more conservative purple estimate that you have provided on this same figure, would I be correct in suggesting to

you that it is not really until the 2023/24 year that Hydro is beginning to approach that 1500-megawatt deficit, would that be correct, sir?

MR. DERRY: Can you give that to me again?

MR. WILLIAMS: Yes. Mr. Derry, what I'm asking, and just to make sure I understand your table correctly, if I take the more conservative purple estimate, it is really not until 2023/24 that Hydro begins to approach the 1500-megawatt deficit?

MR. DERRY: That's correct, yeah.

MR. WILLIAMS: And I may have misspoke and said megawatt hour previously and I did mean to say megawatt.

MR. DERRY: You mean megawatt, yeah.

MR. WILLIAMS: This can go either to Mr. Derry or Mr. Woodford, but both of you I believe used in terms of the relocation of Bipole II to Riel the words in quotation marks "window of opportunity". Do you recall making those statements?

MR. DERRY: Yes, I put that in my report, that's a portion of my report.

MR. WILLIAMS: Thank you, Mr. Derry.

And I'm not quite sure that I understood what you meant by window of opportunity?

MR. DERRY: Okay. What we are saying is that because Bipole II at Dorsey in the Hydro alternative is going to be refurbished, means that they are going to replace the valves and transformers and everything else, and it is to start in 2019. So if we don't take that window of opportunity now and look at relocating it by building a new Bipole at Riel, they will keep refurbishing that for the next 30 or 40 years. It is going to be that long before you will be able to look at redoing it again somewhere else. That's the window of opportunity.

MR. WILLIAMS: Thank you for that. Figure 1.6, Mr. Derry, you presented this and I will ask you to confirm without elaborating, you presented this figure in addressing some of the concerns that Manitoba Hydro had expressed in terms of transmission loss?

MR. DERRY: That's correct.

MR. WILLIAMS: And in terms of developing this table you use -- you talk about, or in your evidence you talk about using 80 per cent of peak, do you recall that, sir?

MR. DERRY: Yes, I do.

MR. WILLIAMS: And why 80 per cent of peak per month?

MR. DERRY: That's what I call the shoulder month. If you look at the chart and look at March, April and November, they are all around 80 per cent. Now when we did the calculation for the figure 1.7, we don't want to do three separate months, we just used an average for those three months, and it is around 80 per cent, so that table 1.7 represents those three months at 80 per cent of the peak. The load has come down that 20 per cent.

MR. WILLIAMS: And my question to you, Mr. Derry, is why is it more appropriate to use 80 per cent of peak as opposed to peak?

MR. DERRY: Because we are looking at the months that are off peak. The peak is in January or December or February. So when you think of the peak month, it could be any one of those three. In this case of the figures that I used, it was a January peak that Hydro has made up, that comes from the load forecast of 2011. It is a forecast that they have estimated the peak in every month of the year. And that's what this

chart shows. Do you understand?

MR. WILLIAMS: That point I think I understood before, Mr. Derry, but why is it more appropriate -- and maybe I misunderstood the point for these two tables, but have you chosen 80 per cent of peak as compared to peak because there is a lower -- you know, what I'm going to ask before I'm asking it.

MR. DERRY: No. The peak volume was used primarily to show the elevation of Dorsey to tie in with Hydro's chart that they had put up earlier, shown in figure 1.4. So if you looked at figure 1.4 and 1.5, they show the same thing. I just showed the deficit. I haven't tried to show the load. You can't tell what it is from there, you have to count the squares and try and figure out what it is. So in this one I have used this for the Dorsey outage peak load, that's what 1.5 load is. Those are the peak load months. And that could be December, it could be January, it could be February. The peak can happen in any one of those months. But for the corridor outages I used the shoulder months and the off peak months in the summertime. And it is my feeling, and I don't know if they have asked Hydro have they ever

had an outage of the corridor in the winter period? And I don't know if they have or not. Maybe they will come back and say they have. I don't think they have. I don't know of any.

MR. WILLIAMS: And so you have used less than peak or 80 per cent of peak because your view is that an outage is more likely to occur in the non-peak months in terms of transmission; is that right?

MR. DERRY: Those shoulder months are representative of ice storms. That's -- that would have a 1 in 50 year, I think Hydro came up with a 1 in 20 year, not Hydro, Teshmont, with a 1 in 20 later, but that's the probability of outage in those months, and it would be weeks, not months or years like the Dorsey station.

MR. WILLIAMS: Thank you for that. So when I turn to figure 1.9, Mr. Derry, instead of using peak or 80 per cent of peak, in this particular figure you have used 65 per cent of peak load.

MR. DERRY: That's correct.

MR. WILLIAMS: And presumably you have done that because you are trying to reflect the risk of more summer associated adverse events,

such as tornado and storms, is that correct?

MR. DERRY: That's correct.

MR. WILLIAMS: Now, Mr. Derry, stay with figure 1.9 for a second. And while Mr. Bedford has freely admitted he is not a statistician and I believe he demonstrated that today, I struggle with reading charts. And when I look at this figure 1.9, what I see is that the excess capacity is actually reflected towards the bottom of this graph rather than towards the top.

MR. DERRY: Yes. The reason I did this is all of the other graphs that you see, the excess is positive, we show it is positive. So taking the -- the deficits I should say are positive, so we kept that same rule. Now the ones that you see on the bottom are surpluses.

MR. WILLIAMS: So when I see all of those colours, Mr. Derry, for the early years from 2013/14, through to 2021, 22, below the zero, that's actually a good news story in terms of capacity?

MR. DERRY: No, no, that's the projection of the 2012. I haven't got any historic ones in here.

MR. WILLIAMS: Okay. I think I have

the point of that table.

Mr. Derry, you had a discussion with my friend, Mr. Bedford, about a capacity shortfall around the year 2025, do you recall that discussion?

MR. DERRY: That's right.

MR. WILLIAMS: And you made a statement something to the effect, I will ask you to recall, that you have to do something by 2025 to increase capacity. Do you remember making a statement to that effect, Mr. Derry?

MR. DERRY: Yes, I do.

MR. WILLIAMS: And, Mr. Derry, what I understand by that dialogue that you had both with Mr. Meronek and my friend Mr. Bedford, was that if you are going to do a true comparison of the costs of the different options, you are going to have to put in the expense associated with additional capacity in 2025, one way or the other; agreed?

MR. DERRY: That's correct, to compare it to the D and E option that we have proposed in the report, you have to do something in 2025 to get an excess again.

MR. WILLIAMS: And in your written report you chose to -- to provide an appropriate

comparator, you used the 500 AC line?

MR. DERRY: That's correct, yes.

MR. WILLIAMS: But the point that you were making, as I understand in your evidence to Mr. Bedford today, is you could have just as easily put in a 2,000 megawatt natural gas generator, correct?

MR. DERRY: That's correct.

MR. WILLIAMS: Or you could have put in the cost associated with increased capacity from the United States?

MR. DERRY: In the EIS Hydro actually used those two options to compare it against Bipole III.

MR. WILLIAMS: So whether or not the AC line is in their capital plans, the thrust of your point, sir, is that there is going to be an additional cost there, whether it is related to natural gas generation, to import capacity, or an AC line, correct?

MR. DERRY: That's correct.

MR. WILLIAMS: Mr. Woodford, about the seventh page, and I just have a couple of questions for you, about the seventh page of your Powerpoint presentation, you make reference to the

Cigre, C-I-G-R-E, August 2012 paper. Do you recall that, sir?

MR. WOODFORD: Yes.

MR. WILLIAMS: And in directing the attention of the Commission to the bottom of that paper, you noted that there were drawing inward two future 500 kV lines, one to Riel and one to Dorsey. Do you recall that, sir?

MR. WOODFORD: Yes, but I would suggest that the top 500 kV line is the one in existence, and the second one is the completion of the ring, in my understanding and interpretation of this paper and this diagram. The second lower one is the completion of the ring around the south of Winnipeg.

MR. WILLIAMS: And, Mr. Woodford, I suspected when you were highlighting that, that that was of some significance, but I'm not sure that I totally grasped your point. So what is the significance of that, sir?

MR. WOODFORD: The significance that I see on it is that this has been contemplated by Manitoba Hydro engineers. And I think the Manitoba Hydro has said that they have contemplated a second 500 kV line ring around

Winnipeg. It is certainly not being declared as being a future consideration. Our position has been that you need it when you bring in Bipole III located at or near LaVerendrye. And that would interconnect on to that second lower 500 kV line.

MR. WILLIAMS: And presumably address some of the concerns expressed about the limitations of the LaVerendrye site?

MR. WOODFORD: Yes, that would address some of the concerns, and particularly at the blue line, which is the contemplated second 500 kV line to the United States, rather than take it out of Dorsey, you would probably take it out of the interconnection point where Bipole III meets the 500 kV ring. So you would have three DC lines coming into that interconnection point.

MR. WILLIAMS: Just a couple more questions. Mr. -- back to you for a second, Mr. Derry. You recall both in your discussion with Mr. Meronek as well as your discussion with Mr. Bedford the possibility was raised of the risks associated with a joint failure, both of Dorsey and LaVerendrye. Do you recall that discussion?

MR. DERRY: Yes, I do.

MR. WILLIAMS: And Mr. Derry, I just

want to make sure I have your point from both of those conversations. As I understand it, the point you were making was that if we anticipate a 1 in 200 probability of a failure with Dorsey, and let's say a 1 in 200 probability of a failure associated with LaVerendrye, it would be incorrect and simplistic to say that there is a 1 in 200 probability of a joint failure, it would be more accurate to suggest that it is a 1 in 4,000 event in terms of probability? Was that your point, Mr. Derry?

MR. DERRY: The point was that -- what is the probability of having both Dorsey and LaVerendrye go out for the same wind storm? So the probability most likely would go from 1 in 200 to 1 in 4,000 to have both out with the same storm. And I don't think that anybody has done a calculation of this, maybe Teshmont could redo it. It is not 1 in 200 -- it is 1 in 200 in each location to lose one Bipole, do you understand?

MR. WILLIAMS: Yes, I do, and I think it relates to the point that Mr. Woodford has made, and I just want to make sure I have his point as well.

Mr. Woodford, you have spoken a couple

of times about Manitoba Hydro's proclivity to present the worst case scenario as compared to reasonable scenarios. Do you recall that, sir?

MR. WOODFORD: Yes.

MR. WILLIAMS: And in terms of modern risk assessment, Mr. Woodford, would it be fair to say that best practice says that we should look at the magnitude or quantum of potential adverse events, but we should also look at the probability of those adverse events?

MR. WOODFORD: Absolutely. You would look at the worst case scenario, but you would also want to look at a more probable scenario and try to evaluate the risks associated with that, and do what you can to plan accordingly.

MR. WILLIAMS: And you made an eloquent point in your conversation with my friend Mr. Bedford to look at the -- you said it was not good engineering. I don't know if you remember making that statement. But the point I took from that, sir, is that when one is looking at potential adverse events, in accordance with good engineering principles, you should look at the worst case scenario, you should look at the reasonable scenario and then you should address

your mind to the costs and benefits associated with addressing those problems?

MR. WOODFORD: That's what I would do as an engineer in this situation, yes, indeed.

MR. WILLIAMS: Mr. Chairman, I thank the panel for its time, and I certainly thank the Bipole III witnesses as well. Thank you.

THE CHAIRMAN: Thank you, Mr. Williams. Any other participants have any questions? Any members of the public have any questions? Members of the panel? Mr. Gibbons.

MR. GIBBONS: And I will beg everyone's indulgence that I would like to start with perhaps clarifying two assumptions before I go to the question. One of the assumptions that I'm working under in understanding the presentations of, in this case Mr. Derry and Mr. Woodford, is that the reason for incorporating a cost for a 500 kV AC line, north/south line, for alternates B and C is because you would have two of the three Bipole lines running to Dorsey, hence increasing the possibility of an outage that would create a deficit and that you need to make up that 500 deficit for that reason? I'm trying to figure out why there is a 500 kV AC line posed for those

two alternates but not for the D and E alternate? Perhaps you could clarify that for me before I get to my next question.

MR. WOODFORD: That is the 500 kV line that you are talking about, the top where it says 500 kV AC line.

MR. GIBBONS: Okay.

MR. WOODFORD: This is the Hydro alternative, okay, where they redo Riel -- Bipole III is refurbished at Dorsey. This is the CEC alternative actually. If you go to the top line, you see 500 kV AC line.

MR. GIBBONS: This is a Hydro --

MR. WOODFORD: That's a Hydro figure that we have put the different lines on, that's been -- the red line and the extensions out to the end of the graphs were done by us. We just extended them out to show you where the deficit becomes a problem. If you look at the -- if we can get the light working. Okay. We extended that out to show that there is a problem starting in 2025, and that's with Bipoles I and II at Dorsey. So you would have to do something to increase the excess capacity to get into the surplus position. And one of the things that you

could do is build that north/south AC transmission line at 500 kV, which was one of the comparisons made by Mr. Mazur with the HVDC line versus a 500 kV AC line from the north. And that's where I got the 4.8 billion. So this assumes that you would build a north/south 500 kV AC line to make it comparable to the recommended one in our report, which is having three different locations that gives you the same result. In other words, you could go to 2050 if you had three locations, and you wouldn't need that 500 kV line. So we have to have something that we can compare it to, and this is a comparison that we are making.

MR. GIBBONS: What I'm missing and perhaps it is because I'm not an engineer, I am something of a statistician, so that's maybe actually worse, I am not sure, is that the amount of power, the number of megawatts produced and distributed, it strikes me remain the same whether you have Bipoles I and II going through Dorsey, as Hydro proposes, and Bipole III going to Riel, or in the CEC idea of one in three going to Dorsey and two being rerouted to Riel, or in the proposal that you are making it is still the same amount of power, so where is the deficit coming from is I

guess what I'm asking?

MR. DERRY: If you look at that graph, take that line again that goes down to 2025, with that alternative of putting Bipole III at Riel, then you are short of capacity.

MR. GIBBONS: I guess what I'm not clear on is I'm interested in your idea about having three terminals.

MR. DERRY: I think where the problem is, this assumes that Dorsey is out of service, it is not there.

MR. GIBBONS: So that was my point then, the reason for that --

MR. DERRY: Dorsey is not there, and you only have Bipole III at Riel.

MR. GIBBONS: That was my original question, was it because those proposals had 2 lines --

MR. DERRY: For the Dorsey station we are looking at, not the corridor.

MR. GIBBONS: That's what I was trying to get at, because if they are knocked out, you are knocking out two lines rather than one.

MR. DERRY: That's right.

MR. GIBBONS: Okay. The second

assumption is the window of opportunity that you discussed regarding the moving of Bipole II, for example, at Dorsey, does that run out before 2025? In other words, are there significant changes expected to be made in equipment before then or could it be done then?

MR. DERRY: If -- well, go to E and D. If you relocate Bipole II at Riel, then if you lose Bipole I at Dorsey, you would have Bipole at Dorsey, I'm sorry, then you could go to 2025, okay, and then you would add Bipole III at LaVerendrye, which would take you up to the top line. You could only lose one. We are only assuming the outage of one Bipole in this one.

MR. GIBBONS: The reason I'm asking this, or trying to sort out these assumptions --

MR. DERRY: I think I'm not explaining it right to you. If you relocate Bipole II to Riel, and you still have got Dorsey, Bipoles I and are still there, okay?

MR. GIBBONS: Okay. Let me do this a different way, and I will come to what is really my main question. What if the chronology were changed, and what you had instead was a situation where, for the sake of argument only, this is just

off the top of my head, Bipole III was completed perhaps to LaVerendrye or thereabouts, and you then took Bipole II after Bipole III was completed and moved it to Riel?

MR. DERRY: According to when they want to start refurbishing Bipole II in 2019, so you lose that window of opportunity, they are going to continue to refurbishing it, you no longer have the chance to do that.

MR. GIBBONS: That was part of my earlier question, does the window of opportunity close before 2025? And you are saying from their own information it does, because they are going to start the refurbishing by that point?

MR. DERRY: Right.

MR. GIBBONS: The difficulty then of doing Bipole III first and then moving Bipole II is that they will have already then spent an exceptional amount of money on it.

MR. DERRY: Yes. They are still spending money on it, a couple of million dollars for the valves, and then they have to replace the transformers, they are getting older. They have to replace the smoothing rackets, controls, auxiliary equipment. So you have lost that window

of opportunity. So the logical way of doing it is to move Bipole II first and then follow it by Bipole III.

MR. GIBBONS: I just wanted to get that logic sorted out. So 2019 is sort of the critical year.

MR. DERRY: Have I helped you?

MR. GIBBONS: Yes. I think the blame is more on me than you, but that's okay.

THE CHAIRMAN: You are done?

MR. GIBBONS: Yes.

THE CHAIRMAN: Ms. MacKay.

MS. MACKAY: Yes. I have a couple of questions related to the questions that Mr. Gibbons was just asking. I would like to go to the first slide of Mr. Woodford's presentation. The first slide, first of all, could you just remind me when Bipole II came into service, roughly?

MR. WOODFORD: Well, the first part of it came in -- I have got it written down somewhere. These guys could tell us -- it was '78 was the first pull.

MS. MACKAY: Okay. Then looking at this figure, if we look at the percentages over

the period of time, you very quickly get up over 100 per cent. Could you just confirm for me that the percentage of replacement of equipment is not cumulative? That, for example, there is some pieces that get replaced say in ten years, and the same thing might be replaced again in 20 years?

MR. WOODFORD: The life time of components varies in a DC converter station. Okay. Some are short periods of time relatively, some are long. And in that 30 or 40 or 50 years, there will be a number of components that will be replaced several times.

MS. MACKAY: Okay.

MR. WOODFORD: And that's just what happens.

MS. MACKAY: Okay. I thought that was the case but I just wanted to make sure. For Mr. Derry or Mr. Woodford, in your consideration of your proposal, have you considered at all the impact of delaying Bipole III on issues around construction of Keewatinoow and Keeyask?

MR. DERRY: Yes, I can comment on that. If I guess the NFAT that's approved on Keeyask and Conawapa, and we are suggesting that Bipole III can be delayed until 2025, then Bipole

III NFAT should become part of the Keeyask and Conawapa NFAT, because it is required by those two stations. So if they want to do that, and you would accept the conditions for reliability that we have put forth of having Bipole III come in in 2025, then they are going to have to put that into their NFAT because it is a cost against the sale.

MS. MACKAY: Thank you. Just one more question, this is of Mr. Lawson. In terms of underground cables as opposed to underwater cables, it seems to me they are still in a relatively early stage of development particularly for the high kV, such as 500 kV DC cables. If Bipole III were to go ahead on the Coalition's suggested routing, were to go ahead immediately rather than be delayed as the Coalition's proposal suggests, would you consider, and maybe other panel members would like to answer as well, would you consider that the state of advancement of underground cables is far enough along that it would be reasonable for Bipole III going ahead immediately?

MR. LAWSON: In my opinion there is really no difference between an underground cable and a submarine cable. So the fact that the

particular cable that we are interested in, the 500 kV mass-impregnated cable has not been used very significantly in underground applications. The only difference that I can see is that whereas for submarine cables you are delivering -- you can deliver your cables and install them in lengths of up to say 120 kilometres without any splices, although there are splices which are made in the factory, and then if you have a longer length than that, then you have a submarine cable splice made at sea. The only difference in my opinion is the number of splices and you are able to -- well, that is a significant difference, splices are always considered to be a weak point. In fact, we have no indication that these splices are any different to the cable itself, because they are actually reconstituted and they are made like the cable, so the design is not different to the cable itself. So there is no reason for splices to be any different from the cable, and in practice we don't find that any of these installed splices have ever failed in the submarine situation. Although, there are rather few that you use on land. So I think the only difference is the number of splices. The quality of the cable is

identical.

MS. MACKAY: In fact, there aren't that many of these underground splices in operation at this point?

MR. LAWSON: Correct. Yes.

MS. MACKAY: Thank you.

THE CHAIRMAN: Thank you. I just have a couple of very short questions and I think, Dr. Lawson, you may have answered the one question I had just now in response to Ms. MacKay. I thought when you made your presentation, and you were referring to the slide that showed the Europacable 320 kV, I thought you said that the technology for 500 kV was a few years away. Did I hear you correctly or --

MR. LAWSON: Well, the technology is there. And I have no doubt that in three or five years we will have 500 kV, XLDC cables. The problem is that in order to commercialize the standards, say that you have to undergo at least a one year pre-qualification test. And since there is a lot of business at the moment, even at 320 kV, the industry is not rushing to carry out this one year test in order to fully qualify the cables before commercializing them. So that's the delay

really. I think the material and the technology is already there. We just have to prove them in a long term test, and this will take, according to at least one supplier, between three and five years.

THE CHAIRMAN: Thank you. And, Mr. Woodford, one of the examples you gave was the Murray link in southern Australia. That's 320, isn't it?

MR. WOODFORD: No, I think it is 150.

THE CHAIRMAN: 150, okay.

MR. WOODFORD: Plus or minus.

THE CHAIRMAN: And it runs 70 or so K?

MR. WOODFORD: From northwestern -- state of Victoria, northwestern Victoria, parallel to the Murray River into south Australia. It is the link between the two states.

THE CHAIRMAN: Okay.

MR. WOODFORD: The point I wanted to make there is the reason they put it in and spent the extra money, capital cost upfront, was they made that up by the fact that they didn't have to spend about five years permitting and were able to make sales in those five years that they wouldn't have been able to do if they had to wait until

they got DC or AC lines overhead.

THE CHAIRMAN: Thank you.

MR. LAWSON: There is a similar project at 320 kV going in now in Sweden. That's a 2,000-megawatt again. And the length is something like 200 kilometres, the route length. There are four cables, so that's 800 kilometres of cable going in Sweden.

THE CHAIRMAN: Still 320?

MR. LAWSON: 320, yes.

THE CHAIRMAN: Thank you. Mr. Meronek, before we close for the day, do you have any final comments or questions you wish to ask of your witnesses?

MR. MERONEK: I was going to ask about garden hoses, but I think I will defer. Thank you.

THE CHAIRMAN: Garden hoses late in winter or --

MR. MERONEK: Probably in the summertime.

THE CHAIRMAN: Thank you. Well, thank you all for your presentations today and for your written presentations earlier. Are there any administrative matters to deal with? Yes, there

are. So, Madam secretary.

MS. JOHNSON: We have another pile of documents that we have collected up today. I would like to put on the record for the Bipole Coalition notice of motion, BPC, number 7. Outline of Mr. Derry's presentation is BCP number 8. That of Mr. Woodford is BCP number 9. That of Mr. Lawson is number 10.

The actual report by Mr. Derry is BP11. That of Mr. Woodford is BP12, BPC12. Mr. Lawson's is BCP13. And Mr. Derry's presentation is 14. Mr. Woodford's presentation is BCP15. And Mr. Lawson's is 16 -- oops, I missed Mr. Lawson's here. Sorry, no, number 16 is the letter from Mr. Meronek to the Commission regarding these reports. And I missed -- so Mr. Lawson's will be 17. I also have a leftover one here from CAC that I missed yesterday or this morning, it is the vegetation report, CAC 11. And two more documents from Manitoba Hydro, the rebuttal to the parts one and two, is MH-115, and to Mr. Lawson's report is 116.

(EXHIBIT BPC-7: Bipole Coalition notice of motion)

(EXHIBIT BCP-8: Outline of Mr.

Derry's presentation)
(EXHIBIT BCP-9: Outline of Mr. Woodford's presentation)
(EXHIBIT BCP-10: Outline of Mr. Lawson's presentation)
(EXHIBIT BCP-11: Report by Mr. Derry)

(EXHIBIT BCP-12: Report by Mr. Woodford)
(EXHIBIT BCP-13: Report by Mr. Lawson)
(EXHIBIT BCP-14: Mr. Derry's presentation)
(EXHIBIT BCP-15: Mr. Woodford's presentation)
(EXHIBIT BCP-16: Letter from Mr. Meronek to the Commission regarding reports)
(EXHIBIT BCP-17: Mr. Lawson's presentation)
(EXHIBIT CAC-11: Vegetation report)
(EXHIBIT MH-115: Manitoba Hydro rebuttal to parts one and two)

(EXHIBIT MH-116: Manitoba Hydro

rebuttal to Mr. Lawson's report)

THE CHAIRMAN: Thank you. While we are talking about reports, I would hope that by the end of the day tomorrow, from whatever source, whether it is Manitoba Hydro or Mr. Derry, we have a copy of the Ultimate HVDC Development in Manitoba. It would be helpful to be able to read it before Thursday morning's presentation and questioning.

If there is no other business, then we have a little bit of bonus time and we will adjourn for the day. See you tomorrow morning at 9:00 a.m. Thank you.

(Adjourned at 4:08 p.m.)

OFFICIAL EXAMINER'S CERTIFICATE

Cecelia Reid and Debra Kot, duly appointed Official Examiners in the Province of Manitoba, do hereby certify the foregoing pages are a true and correct transcript of my Stenotype notes as taken by us at the time and place hereinbefore stated to the best of our skill and ability.

Cecelia Reid

Official Examiner, Q.B.

Debra Kot

Official Examiner Q.B.

C