KM CROSS-EXAMINATION
BOOK OF DOCUMENTS – PUB COUNSEL

1. Transcript pp. 3781-83
2. PUB/KM-14
3. Transcript p. 2545
4. Transcript (ICF/G. Lane) pp. 2752-2760
5. PUB/KM-11
6. MH GRA Tab 3, p. 8 of 11, Figure 3.2.1. (Organization) Structure Executive and Senior Management
7. KPMG Report p. 192, Exhibit 5-2
8. MH Exhibit 62 KPMG Middle and Back Office Assessment May 20, 2010, p. 37 and p. 6
9. Transcript 1979-1981
10. Exhibit MH #88
11. MH GRA Appendix 12.2
    ICF Report, p. 4
    MH Exhibit 81
    MH Exhibit 84
    Transcript 3777
12. CAC/MSOS Exhibit 18
13. MH Exhibit 55 – ICF direct testimony presentation pp. 15 and 17
14. PUB/KM-16
15. NYC Public Document p. 232
    PUB/KM-35
16. MH-KM-27
17. PUB/KM-24
    MH-KM-37

18. Transcript pp. 5660-5663

19. PUB/KM-32

20. Transcript p. 5355-56 and p. 5349

21. NYC Public Document, pp. 200, 201 and 203

22. PUB/KM-39

23. Transcript p. 5366, p. 5371-73

24. Risk Advisory Report January 18, 2005, p. 7

25. KM, Table 3.1, page 72, Forecast and Actual Generation (1999-2009)
KM, Table 3.2, page 73, Forecast and Total Export Revenue (1999-2009)
KM, Table 3.3, page 75, Forecast and Actual Total Cost (1999-2009)
KM, Table 3.4, page 76, Forecast and Actual Net Revenue (1999-2009)
KM, Table 3.5, page 77, Forecast and Actual Exports (1999-2009)

26. KM, Section 3.2.5.3, page 91/92, The Rule Curve Simulation, Figure 3.17, Lake Winnipeg Critical Period Trajectory

27. KM, Figure 1.11, page 16, Manitoba Imports and Exports, NEB-MISO/Buybacks

28. PUB/MH I-206(a)

29. Transcript pp. 5613-5617

30. MH-KM-16
Transcript pp. 5624-5626

MR. BOB PETERS: And Keeyask, if it's gone up a million dollars -- sorry, that's a billion dollars, that would work out to about $61 million a year of additional interest costs, correct?

MR. VINCE WARDEN: That's approximately right, yes.

MR. BOB PETERS: And so when we look at this net present value test, if the carrying costs of Keeyask go up $61 million what does that do to the -- at least directionally to the $153 million of lower bills over a thirty (30) year period?

MR. VINCE WARDEN: Well, I think you meant to say go down? The Keeyask, if it's not included in the alternative development's scenario.

MR. BOB PETERS: I'm sorry, I may have -- my mouth may have been well ahead of my brain. Yes, Keeyask is going to be included as you note in the preferred development scenario but not in the alternative development scenario, correct?

MR. VINCE WARDEN: That's right.

MR. BOB PETERS: And so there would be an extra $61 million a year of interest costs in the preferred development scenario?

MR. VINCE WARDEN: Yes, although there are some complications with not proceeding with Keeyask

inasmuch as there are quite significant sunk costs incurred with Keeyask already, and those costs would have to be disposed of if Keeyask wasn't proceeded with.

MR. BOB PETERS: But those sunk costs don't form part of the net present value test, do they?

MR. VINCE WARDEN: Well, when we're con - - comparing customer bill impacts they certainly would. They have to be recovered from somewhere so they would definitely be factored into that.

MR. BOB PETERS: Way back in the book of documents, I won't even guess at the tab, Mr. Warden, but you had provided the Board with an indication as to the costs incurred, or the CWIP to date on Keeyask and Conawapa, and my recollection is that at least up until the end of '09 it was in the range of $350 million for Keeyask.

Is that your recollection?

MR. VINCE WARDEN: Well, I think the number I put on the record was 400 million. That's the current costs incurred to date for -- for Keeyask.

MR. BOB PETERS: All right. So in the -- in the no-sale scenario, or the alternative development scenario, as we're calling it, those sunk costs will have to be recovered then from consumer's rates?

MR. VINCE WARDEN: Yes.

MR. BOB PETERS: And over what period of time would they have to be recovered?

MR. VINCE WARDEN: Well, it depends. It depends on whether we determine that Keeyask was to be built imminently, and by imminently I mean within an approximate ten (10) year time frame. But if it was determined that Keeyask was not required for the foreseeable future, then those costs would have to be written off almost immediately. So there would be a -- a charge against retained earnings.

MR. BOB PETERS: And a $400 million writeoff equates to about a 40 percent rate increase if it was all going to come from consumer's rates?

MR. VINCE WARDEN: Well, I wouldn't express it that way. Of course, we wouldn't be imposing a 40 percent rate increase on -- on consumers, so I wouldn't even attempt to make that comparison.

THE CHAIRPERSON: Isn't 1 percent 10 million?

MR. BOB PETERS: Yes, that was my rough rule of thumb, so I thought 400 million made it 40 percent, if my math is doing --

THE CHAIRPERSON: No, your math seems sound. It just seems startling.

PUB/KM- 14

Reference: Page 48 Risk Rewards and Penalties

a) Please provide a description of the concept of moral hazard and provide examples of this concept as applicable to MH

b) Please list the current system of rewards and penalties that exist at MH.

c) Please provide examples of systems of rewards and penalties that should be implemented by MH within its risk framework.

ANSWER:

a) Moral Hazard arises primarily in the insurance system. It focuses on the probability of an event that may be affected by the actions taken by the insured. An extreme case would involve an insurance company reimbursing an individual for stealing his bicycle; the individual ha no incentive to take care of his bicycle at all (e.g., locking it). In the health industry, a patient that is insured would have less incentive to take preventative actions to reduce his exposure to disease or injury. This lack of incentive to take care is called moral hazard.

b) KM did not review the system of rewards and penalties used; it simply noticed that no action was explicitly taken to hold a specific person or office responsible for what might be considered "avoidable mistakes" during the drought.

c) This is beyond the scope of KM's assignment.

I'll note that major advances in science occurred when there -- there was nomenclature and notation and mathematics -- nomenclature and notation that was adopted to describe things properly.

There is a term that has emerged in the last few years in the risk-management literature known as the Black Swan event. It turns out that my boyhood friend from college is the chief risk officer of the leading money manager in the world, and he has, outside his office, a Black Swan. Now, this is -- it's a -- it's one of those wooden things.

And he's done a lot of work on the mathe - - mathematical assessment of risk, but he has a lot of respect for the concept that when you examine what goes wrong in risk management, often it's things that were not quantifiable, and not addressable quantitatively.

And the Black Swan simply refers to the fact, What's the probability of seeing a Black Swan. Well, until they discovered one (1) in Australia all the swans were white, so the probability based on historical experience would have been zero.

Now, the Company is very sensitive to that Black Swan possibility. That sensitivity derives from the fact that, although the Company has more hy -- hydro data than most other entities, about -- about a hundred

years, there is a concern that, and I've been privy to -- not privy, but I've been fortunate to review the work of Drs. St. George and Drs. Leavitt on dendrochronology and lake sediment records on historical drought conditions.

I say I've been lucky because it was something that the Company allowed me to take a look at, and a dendrochronologist refers to the tree rings. I wanted to be able to testify once in my life on tree rings and I have achieved it. I'm not an expert but one (1) of the things in -- in speaking with them and reviewing their material is is that there is a concern, but there's not enough data to figure out exactly what the concern is, and so in that sense it looks like the Black Swan.

You don't have the sufficiently detailed historical record to eliminate the concern of seeing something that never has happened, or there's no ante -- historical antecedent for it, but you can't measure exactly what it -- how -- how likely is it.

And so again the ex -- I just want to drive home that the Company is sensitive to the existence of Black Swan events. It is appropriate that they do so, and they have built that into their strategy by reinforcing the transmission links, via the long-term export contracts, to link up Manitoba so that its ties

THE CHAIRPERSON: Mr. Peters, what's your plans for taking a break?

MR. BOB PETERS: This would be an appropriate time, sir, yes.

THE CHAIRPERSON: Okay. Just before I lose track of three (3) things that came up. Mr. Rose, you were talking about in the American recovery from the recession, Manitoba Hydro just released their nine (9) month report to December 31st, and it indicates that the energy sold in the export market was 8.6 billion kilowatt hours compared to nine point one (9.1) sold in the same period of last year.

How does that equate with your comment about the recovery in the States?

MR. JUDAH ROSE: I'm not sure, you know, what's driving the -- maybe there was less hydro available or lo -- greater local demand. I -- I don't know. What I was referring to, Chairman, was the fact that in many of my presentations I've made in various different locations people have been sceptical, and I think reasonably so, to say, you know, why would -- why do you think electricity demand is going to recover, what's your basis for that belief.

As I indicated, part of the basis was the historical record, which I'm intimately familiar with,

which is during past recessions the demand tended to recover very significantly.

And so I wanted to point out that my view that demand recovers is being at least partially substantiated by the increase in demand in 2000. Now, how that manifested itself in price and/or in quantity I think is a different issue. It's -- it's just related to the issue of we -- because we had almost a 5 percent decrease in demand in two (2) thou -- between 2007 and 2009. And as I indicated, it was unprecedented since the Great Depression.

So what I'm here to report is the latest data shows that there was an increase in demand, and that's consistent with a general trend of recovery. I can't comment though specifically on those numbers.

THE CHAIRPERSON: Okay, we'll leave that as a bit of a mystery, unexplored area for a second. The second one's also with respect to that same comment, and it's a little bit different. It relates to demand, the prospects for load increases into the future.

I don't know if you have any knowledge of the former chief economist of the CIBC here in Canada, Jeffrey Rubin, who is somewhat famous for making predictions on oil prices and things of that particular nature. In 2008, before the credit crisis ensued, oil

peaked out at one forty-seven (147), if I recall properly, and Mr. Rubin, just before his departure from the CIBC, predicted that oil could hit as high as two hundred dollars ($200) a barrel.

Since then, he hasn't actually dropped that particular line, but his suggestion as it relates to load is this. He suggests that as oil becomes increasingly expensive, the cost of shipping commodities, let's say to China, and then shipping the finish -- finished goods back will become such that manufacturing, if you like, would revive in North America. Do you have any views on that?

MR. JUDAH ROSE: I do, although I don't -- I'm not -- I don't know Mr. Rubin. I published two (2) articles in the last year with Ms. Surana, who's also Dr. Surana, and the articles were on -- on this: that the two (2) -- the way to predict the -- whether or not we're going to have a recession -- the best way to predict whether we're going to have a recession and the severity of the recession is a function of two (2) items. One (1) is the oil price.

So I think of the three (3) things that mani -- caused the Great Recession that we've been in. Like you've said, the hundred and forty-five dollar ($145) oil prices was a major phenomenon and to -- in my

view, it's not sufficiently appreciated.

One (1) of the things that -- the other thing is the yield curve. And the yield curve is the relationship between sort of -- the horizontal axis is the term of your loan and the vertical axis is your -- your interest rate, and normally that's an upward sloping, as you borrow longer you have to pay more. And that's the normal -- the normal condition is upward sloping. That's what it is today.

It's like zero percent versus 3 or 4 percent for a ten (10) year bond. As long as that stays positive we won't have a recession, but that the high oil prices constrain the federal reserve or the monetary authorities and eventually they have to then flip it to -- and when it inverts, within twelve (12) to eighteen (18) months you'll have a recession.

All recessions are followed by an inversion. There's no recession that's -- there's no inversion that doesn't lead to a recession, and there's no recession that's not preceded by an inversion of the yield curve, where you actually have -- short-term interest rates are higher, and that the severity is a function of the increase in the oil price.

So, you know, I'm here to say that you and I, looking at similar things -- and of course the news

from yesterday is not a happy thing, where oil prices went up. The yield curve is still extremely positive and I think the thing to be watching for is -- is whether or not the oil prices lead to an inversion of the yield curve and look at where the oil prices are at that time.

That's, I think, the total wisdom that is available on predicting recessions, and I don't think that there is a -- another set of metrics out there, in my experience, or a computer model that will give you a good sense of that, and -- now, that may be overly strong, but that's sort of the conclusion.

So in -- in -- in the main, I agree with you, with that -- with that caveat that we need to keep a clear eye on the yield curve.

And so, when you -- when you -- when you sort of ask the question of whether it's ten (10) to the minus sixteenth (-16th) of whether you'd have a repetition of these events, I think I was being perhaps unfairly whimsical and -- and/or maybe I was getting tired yesterday, but I still think that, you know, in those -- that you have cycles, there's a way to look at those, there's reasons to be concerned, but the idea that you would be -- you know, there's no evidence that I'm aware of that you have these, you know, ten (10) year events.

The -- we only had one (1) ten (10) year event, and that was the Great Depression of the '30s, and I -- I don't see that that's where we're at right now, and I don't think it's a -- again, a -- a good planning metric to -- to assume that we'd be in that for a very prolonged period of time.

THE CHAIRPERSON: The -- the other part of that question in Rubin's hypothesis was that, assuming that you -- that the high oil prices didn't create a massive recession, that the high cost of transpor -- transportation of the commodities overseas and then back in -- in manufactured goods would tend to put some life in the rebuilding of manufacturing in North America, which would be, of course, increased demand, industrial demand.

MR. JUDAH ROSE: You know, if I was the Platonic king, and President Obama and, you know, the Prime Minister of Canada came to my house and I asked them what -- and they asked me what I -- they should focus on, they should try to get lower oil prices and figure out how to do that. And whatever silver lining it is would be secondary to -- I think that it's -- it's a very important issue.

THE CHAIRPERSON: The -- the last question I wanted to ask in this series was, we've been

talking a lot about this Black Swan event, which this Board in various places have heard a lot about this lately, but -- and we were talking about the -- what -- what drought should one focus on as being the -- if you want to call it the worst-case scenario.

And it just hits me when I look at that graph that you produced that, between 1928 and 1941, you actually had a drought of twelve (12) of fourteen (14) years. That's -- so basically, you have a seven (7) year drought followed by two (2) years non-drought followed by five (5) years more of drought. That's a pretty significant event. Sort of reminds me of things that have gone on in Australia's hinterland.

MR. JUDAH ROSE: Without getting into that -- the details of that, you know, and it is -- it is worrisome when you look at that because I think about the dust bowl and the fact that we're on the northern part of the great plains here.

THE CHAIRPERSON: Yeah. You think of movies like The Grapes -- Grapes of Wrath.

MR. JUDAH ROSE: Right. You know, in some sense, it's a -- a non-enviable responsibility that you would have as -- as -- as a regulator -- whatever exactly the regulatory authority is I'm not an expert on -- but also for the management of the Company to -- to --

to -- to deal with something that is generally not have to -- you don't have to deal with.

You know, there -- I -- I've -- this is my twenty-first commission that I've had to -- the pleasure to testify in front of. I don't think really that most of them are worried about, you know, extreme drought conditions.

So it's not like you can go to the NARUC meetings, you know, the Regulatory Commissioner's meetings, and -- in the States, and have people say, you know, I'm worried about a -- you know, a major prolonged drought in the Great Plains, and the fact that we have just four (4) trans -- major transmission lines, or whatever it is, and we're, you know, 98 percent hydro generation.

And you get together with your -- your comrades, and they all -- we all -- you all are able to provide a support group. You're sort of on your own, and it's not -- and -- and it's not an enviable position, I don't know, when they gave you the job description they sort of said, You'll be in this unenviable position of, you know, being in a decades-long chain of people making decisions that have consequences for many, many decades, if not, you know, a hundred years.

Some of these hydro pl -- I guess your

oldest hydro plant goes back to the -- hundred years. So -- and, you know, your transmission lines that you have right now, as I understand it, were built in the '70s or so and related to specific hydro arrangements.

So -- so it's an unenviable position, but I am reporting to you that the Company does seem to be very sensitive to that, to transmission access, and it seems to me is part of the drought awareness, so that's a good thing.

And the difficulty is we don't have a probability system, and Mr. McCullough was right to be concerned about that, but I just don't think -- I think he was wrong in his characterization of the -- of the -- of the -- what we know and what -- the implications of that because the implications, I believe, are to strength the transmission grid and to do the -- take the steps that would allow that to happen.

And in general, one (1) of the major phenomenons that we -- phenomena that we have in -- in North America is underinvestment in transmission, and in this case, you know, it's a theme again.

THE CHAIRPERSON: Thank you, sir. We'll take the break now.

--- Upon recessing at 10:57 a.m.

PUB/KM-11

Reference: Page 34 & 47 Risk Management at MH

a) Based on the schematic provided (pg 34) reflecting best practices. please provide MH's schematic reflecting MH's current risk management framework and compare that framework against best practices.

b) Define MH's current deficiencies;

c) Please identify the areas MB is currently addressing.

ANSWER:

KM believes that there is an evident multiplicity of bodies dealing with risk (EPRMC, PSOMC, and CRMC, etc.). This is not a problem, but it becomes so in the absence of a well defined integrated and centralized structure that can harmonize the lines of authority, obligations and accountability. In the final analysis all of the risks must be combined and integrated. Dealing with all of them simultaneously is critical for the success of the Organization. KM argued for more visible and credible quantitative assessments of risks based on a simultaneous evaluation of the impacts of all identified risks on a coherent basis with a focussed approach and integrated administrative structure. KM suggested that this can best be achieved through Joint Risk Management Committees organized and supervised by the Middle Office through CRMC.

KM noted the absence of Risk Preparedness Plans and Manuals for all costly risks. KM believe that a Drought Preparedness Plan is a critical necessity. It must be completed and instituted in the working mechanisms of the organization immediately. The preparedness plans should not stop at the Drought Plan. There are many other emergencies and drastic events that may occur that need to be expected and plans made to deal with them. A broad preparedness plan can make substantial contributions to the effectiveness of risk management services and plans at MH.

KM observed that MH has set limits and tolerance levels quantitatively in the areas of Merchant Transactions and Customer Credit. The setting of quantitative targets and rules should be extended to all areas of operations particularly power trading and export sales. The Exposure versus Limits reports should cover all aspects of operations with financial implications for MH. Variance and Exception reports should be all encompassing and produced routinely.

Best practice requires that any business transaction should be evaluated on its own but particularly for all the risks that it may encounter. This should be done by the business unit directly involved (Front Office) but an independent review must be undertaken by the Middle Office. Before a business opportunity is approved the Middle Office should validate its appropriateness of the market research, models, curves used to value the opportunity. But more importantly, the Middle Office should independently identify and quantify the various risks

involved in accepting the new business. KM urged MH to direct the Middle Office to undertake such an assessment with every business opportunity above a certain dollar limit but particularly all Long Term Contracts.

Many functions and activities in the organization are operating with deterministic models and frameworks. This is not particularly helpful for an organization that has taken the challenge to manage and control effectively and proactively all of its risks.

Figure 3.2.1 - Organizational Chart

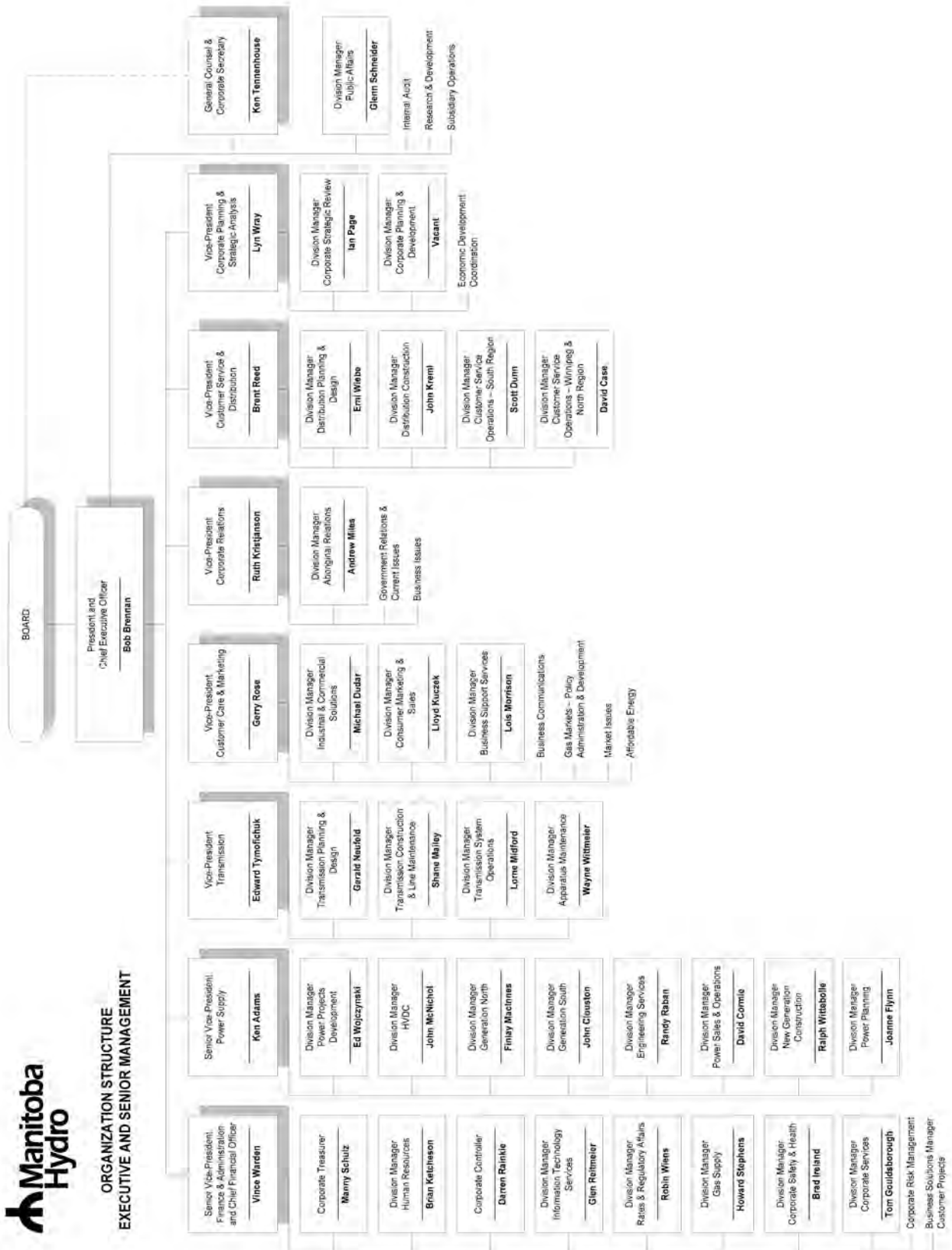
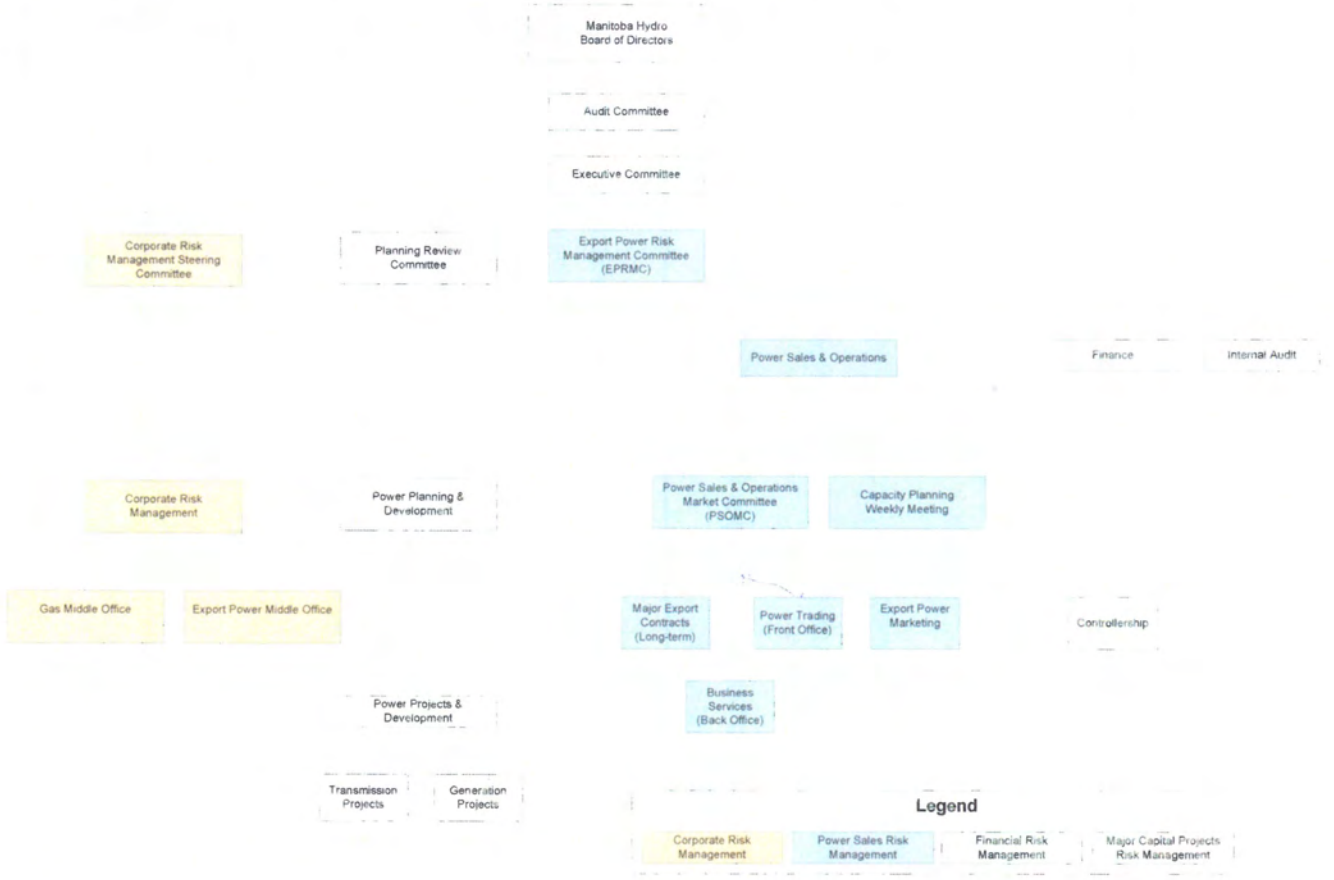


Exhibit 5-2: Manitoba Hydro – Power Sales Risk Governance Structure



Summary Recommendations

Recommendations

1. **Consolidate various policies and procedures into discrete documents – 1) Policies and 2) Procedures to improve risk governance communication and consistent operational processes.**

   Manitoba Hydro has a number of risk related policies and procedures. It is recommended that a Risk Policy be developed that amalgamates Export Power risks and includes an appendices to document approval authorities.

2. **Prioritize and define functional and technical requirements (risk analysis, valuation, control, and reporting requirements) to properly select an appropriate middle office technology solution**

   KPMG recommends that a detailed list of "business" requirements be developed to properly select a vendor solution. These business requirements should include all contemplated transaction types, audit and operational controls, consolidated near-time position management, as well as valuation and physical/financial exposure methodologies.

3. **Revise the reporting structure so the Credit Analyst positions report into the Middle Office**

   KPMG recommends that the Credit Analyst role, currently reporting to Export Power Marketing (Front Office), report into the Middle Office. Industry practice is for the credit function to be independent from the Front Office (See slide 34).

4. **Develop market risk analytic capabilities to perform stress testing, sensitivity analysis and model backtesting**

   The Export Power Middle Office is systematically evolving beyond its origins as a compliance monitoring function. As the Export Power Middle Office continues its efforts to strengthen its risk management capabilities, market risk analysis should be an immediate area of focus (See Slide 39 for further details). Establishing a market risk function will enable the Export Power Middle Office to provide more value-added support to PS&O and supplement its current risk control activities.

5. **Develop Export Power Middle Office reporting capabilities to include volumetric exposure/position reporting**

   The Export Power Middle Office should explore the ability to extract data directly from webTrader to build out interim risk analysis and exposure reporting functionality. Currently the Business Services Department is extracting information to compile a portion of divisional reporting requirements. This would be useful for assessment of net positions that are exposed to movements in market price.

6. **Consider performing a cost / benefit analysis to understand the potential benefits / limitations of an Earnings at Risk calculation**

   EaR is a complex analytic that may provide MH the ability to better determine its net income exposure to market and volume risk. However, EaR is not a widely adopted metric amongst regulated utilities and requires computational horsepower and a robust historical dataset to calculate an entity level EaR. A cost / benefit analysis would provide MH a good understanding of the potential benefits.

Conclusion

Conclusion

With respect to Manitoba Hydro's middle and back office structure, people, processes and technology, we conclude that Manitoba Hydro demonstrates prudent risk management practices in the following areas:

- Risk oversight and governance
- Delegation of authorities
- Counterparty credit and contract management
- Transaction processing controls
- Compliance and risk monitoring
- Risk reporting

In addition, we recognize that Manitoba Hydro has a number of initiatives underway to improve its risk management practices. practices. Manitoba Hydro should continue its efforts to keep pace with the dynamic energy markets and in doing so should consider our recommendations to further improve its middle and back offices.

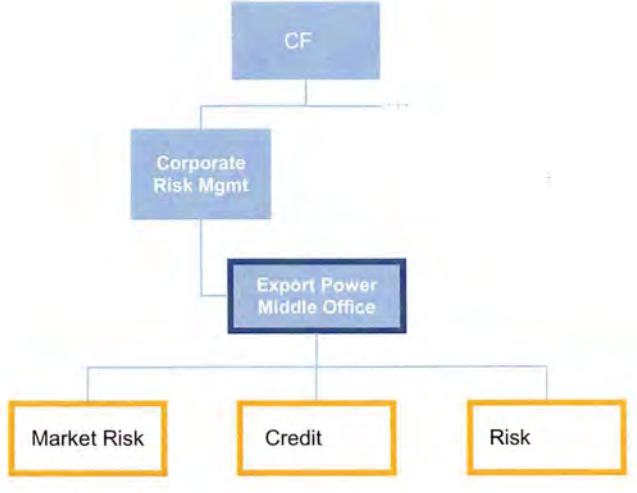
Recommended Middle Office Structure

Recommended Organization Structure

KPMG recommends revising the reporting structure so that the Credit Analyst positions report into the Export Power Middle Office. Office. The Credit Analyst role currently reports to Export Power Marketing (Front Office). Industry practice purports credit risk management report into the Middle Office or other independent function. KPMG also recommends an incremental Risk Analyst position to perform market risk analysis. The proposed structure promotes independence and specialization.

Current

Proposed



- Market risk analysis & modeling
- Valuation / MTM
- Price, volatilities, and risk system inputs
- Collaboration with commercial business

- Credit adjudication
- Monitoring
- Mitigation and collateral management
- Measurement

- Maintain risk policy and documentation
- Monitor authorities, limits and policy compliance
- Position tracking
- Risk reporting

Legend

Proposed

-- as we've been considering what role a drought management plan -- a specific document would be, we've came -- come to the conclusion that it would be redundant because all the corporate activities are -- have drought as a critical consideration. And so to -- to have these additional documents is -- is -- you know, I don't know what purpose it would serve. Maybe Mr. Warden wants to say something there.

MR. BOB PETERS: Well, he's always welcome to, of course. But what you're saying, Mr. Cormie, is that if the information responses suggested that Manitoba Hydro was working on preparing a written drought management plan, things have changed since then because now Manitoba Hydro doesn't see that it needs a written drought management plan.

MR. DAVID CORMIE: Well, I think we're still -- still trying to come to a conclusion on whether there is value in having that now. So not having -- giving it up, having someone make a suggestion that -- where it would by -- provide us additional value, we haven't -- haven't proceeded down that path because it's not clear to us what value it'd bring.

If -- if value can be -- can be got from such a document, then we would be happy to know what that value is, but we're still in the process of -- of making

that assessment.

MR. BOB PETERS: Mr. Warden, did you want to pipe in?

MR. VINCE WARDEN: Well, we -- we have been struggling with this issue a little bit. It would seem reasonable for a hydraulic utility like Manitoba Hydro to have a document entitled a drought management plan. But, as Mr. Cormie has been explaining, it really -- every -- everyday management of the Manitoba Hydro system, of -- of the complex system that Mr. Cormie's been describing, takes into account the current conditions, and -- and how the system is managed really depends very much on what those conditions are each and every day.

I think there would be value -- having said that, I think there would be value in having documented certain trigger points. If the -- if the level in the lake gets to a certain level, then this is the action that will be taken at that point in time, recognizing that it's -- it's extremely dynamic and -- and can change on day -- a day-to-day basis. Nevertheless, I think a drought management plan or plan -- reservoir management plan might be a better way of describing it, rather than a drought management plan, but a document like that we have been certainly

contemplating.

I don't think there's any risk -- in fact, I'm sure there's no risk to the consumer in Manitoba in the absence of such a document because the system is being managed as it is each and every day.

MR. DAVID CORMIE: Mr. Peters, there's one (1) other point that might be important to understand since the drought of 2003, and this is the role of Manitoba Hydro's Export Power Risk Management Committee that's made up of the senior executive of the company. And on a -- at -- at a minimum, on a quarterly basis, we present to the president and -- and the senior vice-president of Power Supply and Mr. Warden our current review of hydraulic conditions and what the potential financial risk to the company is should drought commence at that point in time. And on a quarterly basis, that -- that -- that review takes place, and -- and we identify what actions we need to take in order to protect the company -- company's interests.

And should conditions deteriorate from what we are -- what we would normally experience, that committee is available to provide guidance to the operations of the company, and -- and -- and they will -- they will be kept aware on a -- on a very regular basis, beyond the -- the minimum quarterly meetings that we

Exhibit # MH-88
Transcript Page #3916

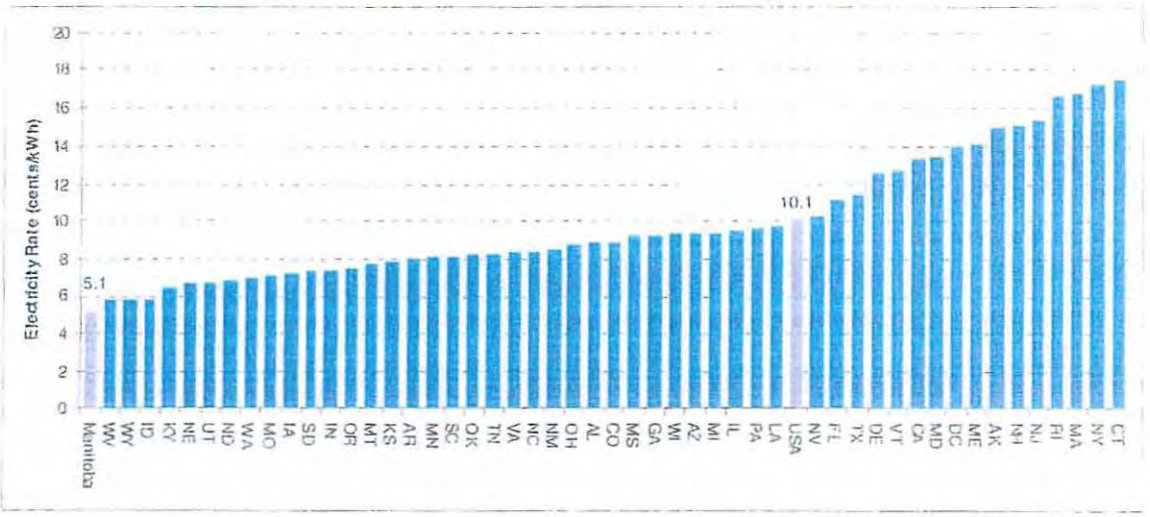
Manitoba Hydro to provide a table detailing each of the recommendations made by KPMG and the Corporation's position relative to each.

KPMG Recommendation	Management Action
Enhance the functionality and resourcing of the Export Power Middle Office.	
– Manitoba Hydro should transfer the credit risk function in Power Sales & Operations to the Middle Office.	The Middle Office has created a new position to assume duties of the credit risk function.
– Manitoba Hydro should also consider the transfer of the market risk function in Power Sales & Operations to the Middle Office.	The Middle Office has established the position of Senior Market Risk Analyst.
– Manitoba Hydro's process of reviewing export contracts and term sheets should include the Middle Office to perform a challenge function.	The Middle Office will participate in the review of proposed term sheets and export contracts.
– Responsibility for power risk management policy for opportunity sales should be consolidated in the Middle Office.	The Middle Office is participating in the review of all policies and will ensure that any required updates are fully documented and approved.
– Manitoba Hydro should consider adding resource(s) including risk analytic tools (i.e., software) to increase the risk analysis capabilities of the Middle Office.	The Middle Office is in the process of acquiring risk analytic tools and has engaged external consulting support to assist in software selection.
Develop formal identification of all significant risks in policies and procedures.	Manitoba Hydro is reviewing all policies and procedures to ensure that any required updates are fully documented and approved.
Manitoba Hydro should enhance the number of risk tolerance limits to include a Value at Risk (VAR)-based limit for Related Merchant Transactions, options limits and counterparty concentration limits.	The Middle Office Senior Market Risk Analyst has completed a forward price curve that will enable VAR analytics on portfolio exposure.

Manitoba Hydro should consider applying mark-to-market to its open short-term commodity positions Manitoba Hydro should also evaluate the benefits for measuring market risk in long-term export contracts which would require resources to develop forward price curves. Manitoba Hydro should document how the pricing was arrived at for export contracts and term sheets, as well as document the approvals of term sheets.	Mark-to-market is applied to short term open positions not physically backed by Manitoba Hydro generation assets. Manitoba Hydro will consider the potential benefits of this recommendation. The "Approval Authority Table for Power Related Transactions" has been amended to include term sheet approvals.
Manitoba Hydro should continue to further improve the HERMES and SPLASH models. Manitoba Hydro should consider formal peer review or benchmarking of the models to benefit from modeling developments elsewhere in the energy sector.	Manitoba Hydro will continue to review generation system model requirements and existing capabilities, and will continually assess the need to update modeling tools and methodologies Manitoba Hydro will continue to develop and test HERMES enhancements needed to evaluate operations planning decision methods. Manitoba Hydro will further consider the value of additional peer reviews and benchmarking of its models. Manitoba Hydro will continue to participate in industry forums such as workshops and conferences to remain current in the field of power system modeling.

Manitoba Hydro should conduct more scenario analyses and stress testing of its expansion plans and development sequencing. Manitoba Hydro should consider using back-testing to assist in further validating model outputs.	Manitoba Hydro continues to analyze drought scenarios on a routine basis. In addition, Manitoba Hydro will investigate methodologies for incorporating broader scenario analysis and stress testing into long-term planning. Manitoba Hydro continues to participate in a variety of studies related to the effect of climate change on available water resources and its financial impact. Manitoba Hydro will further consider the value of additional back-testing of its models.
Manitoba Hydro should formally document the HERMES and SPLASH models to preserve their proprietary information and assist new modelers.	Manitoba Hydro will further consider the format of additional documentation that could assist in preserving proprietary information and could assist new modelers in developing the required expertise related to the modeling function. In order to maintain a source of qualified graduates with advanced training in Power System Modeling, Manitoba Hydro will continue to support the Faculty of Engineering at the University of Manitoba through a Water Resources Senior Industrial Research Chair. This is a long-term strategic action to ensure Manitoba Hydro has access to Research and Development in the area of water resources systems.
Manitoba Hydro should review its capital structure on a regular basis.	Manitoba Hydro will continue to review its capital structure on a regular basis.

EXHIBIT 1-3
2007 Average Domestic Sales Price – Manitoba Hydro vs. US states



Source: US states data from EIA – Retail Sales of electricity by State and by Sector; Manitoba Hydro data from 2007 Annual Electric Power Generation, Transmission and Distribution Report, Statistics Canada
Note: The exchange rate used for converting currency from US dollars to Canadian dollars is an average of the daily exchange rates from April 2007 to March 2008 i.e., 1.03

- **Lower Rates in the Future** – MH is proposing to enter into new long-term firm contracts to export hydro power backed by the accelerated construction of new hydro facilities. These contracts are expected to provide several types of benefits including lower MH rates than would otherwise be the case without the contracts. The proposed prices are on average above MH costs and average expected spot prices. MH recently estimated that two of the three proposed long-term firm contracts will provide savings of $153 million on a present value basis by 2041.[1] This calculation is very conservative in that it addresses only two of the three long-term firm contracts.[2] It also does not account for the up to $2 billion (Canadian, as expended nominal dollars) in transmission costs that the buying US utilities will expend for the construction of expanded transmission between the utilities and the Canadian border.[3] While such division of transmission construction is a commercially reasonable allocation of costs, MH would likely bear the majority of these costs in the absence of the long-term contracts. These transmission linkages, as discussed below, can be crucial for the Corporation in the event of a drought that is worse than the worst-on-record, or if there are changes in MISO rules. For example, Hydro Quebec is effectively paying for new DC line construction in New England to support its exports. As well, the calculation does not factor in the benefits of lower volatility

[1] Dollars represent Canadian dollars unless otherwise specified.
[2] On a present value basis, discounted to 2008/09, the cumulative reduction in bills could be $153 million by 2041 in the sale case (includes contracts with NSP, MP, and WPS) relative to the no-sale case (considers only the contract with NSP). See Manitoba Hydro 2008/09 Power Resource Plan, p.31.
[3] For an initial assessment of the costs of transmission infrastructure see "MHEB Group TSR System Impact Study Out-Year Analysis; MH to US Requests", prepared for Midwest ISO, March 11, 2009.

Exhibit # MH-81
Transcript Pages #3765, 3770-3771

Manitoba Hydro Undertaking #78

Manitoba Hydro to verify what information went into calculating the $153 million referenced in the ICF Report statement that "present value basis possibly reducing bills by $153 million by 2041". What series of future cash flows would be required for that 32 year period which will result in a present value of $153 million at a 6.1% discount rate.

The terms of reference for the ICF International independent review did not require a comprehensive assessment of the strength of the business case for the new export transactions. In order to address the issue of "Should MH be in the hydroelectric power export business" ICF investigated whether the MP and WPS sales together with an interconnection would result in lower rates in the future. They utilized a financial analysis that was provided in the 2008/09 Power Resource Plan which indicates that the cumulative reduction in customers' electricity bills was estimated to be $153 million on a present value basis by 2041 as referenced in footnote 2, page 4 of the September 2009 ICF Report. This estimate was not intended to be representative of the total present value benefit of the sales scenario, but was sufficient information to draw the conclusion that lower rates could be expected in the future due to the sale scenario compared to the no-sale scenario.

It should be noted that the $153 million of present value cumulative customer savings is only one of a number of measures Manitoba Hydro uses in assessing the attractiveness of a resource plan option and does not represent the full economic net present value of the incremental benefits and costs of the sale scenario compared to the no-sale scenario. The more appropriate methodology for determining the economic benefits of a development plan is to utilize an economic approach which considers the present value of all the benefits and costs over the life of the investment. The financial evaluation complements the economic evaluation by assessing the impacts of a resource plan option on the financial strength and profitability of the Corporation, on-going financial self-sufficiency, as well as the impacts on customers' rates.

Since the $153 million represents only a portion of the total benefits of the sale scenario compared to the no-sale scenario, it is not meaningful to compare this to increases in capital cost of plants such as Keeyask. In addition, the determination of a levelized value over 32 years that corresponds to the present value of $153 million does not provide a meaningful quantity that can be compared to other costs.

As described above, the reduction in customers' electricity bills of $153 million on a present value basis by 2040/41 represents only a portion of the total benefits of the sale scenario compared to the no-sale scenario. Additional benefits would be derived from differences in retained earnings and a lower debt ratio at the end of the analysis horizon and an increase in assets at the horizon. The net present value benefit based on the economic analysis approach is more appropriate for determining the overall benefit of the sale scenario but this value is confidential. Manitoba Hydro cannot provide this publicly since it may harm its negotiation of export contracts but will be subject to the future "need for and alternatives to" process when it is initiated.

Exhibit # MH-84
Transcript Page #2883

Manitoba Hydro Undertaking #59

Manitoba Hydro to indicate what costs were included with the present value study, with respect to Conawapa, Keeyask and Bipole III.

The present value of customer rate savings analysis referenced in the ICF Report (p. 4, footnote 2) was prepared based on the January 2009 20 Year Financial Forecast. The capital costs underlying this forecast include: $6.3 billion for Conawapa, $4.6 billion for Keeyask and $2.2 billion for Bipole III.

Exhibit #MH-81 provides additional information with respect to the source of the present value calculation.

MR. VINCE WARDEN: Well, Mr. Peters, the capital costs are higher, which, of course, would result in a lower net present value benefit to Manitoba Hydro, with everything else remaining equal.

MR. BOB PETERS: So Keeyask going up $1 billion from CEF-09 to CEF-10, Conawapa going up $1.5 billion from CEF-09 to CEF-10, totals $2.5 billion of additional capital costs that would not have been included in the calculation that ICF was referring to.

Is that correct, Mr. Warden?

MR. VINCE WARDEN: Yes, but recall we are looking at this only over the sale period. Those additional costs that you reference would be amortized over the life of the facility, so the impact would -- on the sale versus no-sale comparisons would be not nearly so great.

(BRIEF PAUSE)

MR. BOB PETERS: Mr. Warden, when you say that, if the -- if the additional capital costs are $2 1/2 billion the interest costs alone on that mortgage, or on that payment, would be in the neighbourhood of $152 million a year, would they not, at 6.1 percent?

MR. VINCE WARDEN: Yes, the interest

CAC/MSOS Exhibit # 18

BIPOLE III
CAPITAL COST ESTIMATES
($ Thousands)

	PUB/MH I-59 (Previous Estimate)	CEF10-1 (Appendix 82)	2009 CPJ Addendum	New March 31, 2011 Cost
Lines				
- Base Cost ($2009)	814,312			
- Interest & Escalation	319,336			
Total	1,133,648	$1,162,800	$1,477,000	$1,451,000
Converters				
- Base Cost ($2009)	873,598			
- Interest & Escalation	$240,591			
Total	$1,114,189	$1,085,000	$2,477,000	$1,829,000
TOTAL	$2,247,837	$2,247,800	$3,953,749	$3,280,000
Contingency			$525,000	
Management Reserve			$334,000	
$ Base Year			($2009)	

Note: For CEFF10-1, the cost of Licensing & Properties (($123.5 M) and the northern collector lines ($80.9 M) are included in the Lines cost.

ICF Forecasts of Henry Hub Natural Gas Price are Lower (2010$/MMBtu)

Year	October 2010	February 2009	Percent Change
2011	4.1	7.6	-47%
2012	4.5	7.6	-41%
2013	4.6	7.8	-41%
2014	5.2	7.8	-34%
2015	4.6	7.9	-41%
2016	5.6	8.1	-31%
2017	5.9	8.3	-29%
Average	4.9	7.9	-38%

- ICF forecasts of Henry Hub natural gas spot prices in 2017 have decreased. ICF's October 2010 vintage forecast for 2017 is $5.9/MMBtu in 2010$, and $7.0/MMBtu in nominal dollars (i.e., those actually paid).
- ICF has recently lowered its gas price forecasts due to technological improvements in natural gas Exploration and Production (E&P).
- However, year-by-year price volatility is still expected. ICF does not typically forecast the volatility (even though it will be there) but rather focuses on the average expected price.
- ICF's updated long term forecast of average prices notwithstanding, there is also long term uncertainty about long term average gas prices.

ICF Forecasts of U.S. CO_2 Emissions Allowance Prices (2010 $/ton)

Year	Previous	Current
2011	0	0
2012	0	0
2013	0	0
2014	0	0
2015	22	0
2016	24	0
2017	25	0
2018	26	10 - 15

- ICF has also lowered its forecasts of likely CO_2 emission allowance prices due to political developments. This lowers interest in hydro supply all else equal. However, much environmental regulatory uncertainty remains, creating continued interest in low CO_2 options. For example, US EPA regulations on greenhouse gas emissions are still moving forward and regional initiatives are continuing. Also, concern about CO_2 still blocks new coal power plant options; none broke ground in the U.S. during 2009 - 2010. This eliminates an option that has low volatility in costs.

CHAPTER 3: Manitoba Hydro Models
PUB/KM-16

Reference: 3.2.11 Economic Outlook

a) Explain the 'centrality and criticality' of the Economic Outlook (EO) for MH.

b) What risk exposure arises from the current inputs to the ED.

c) How does the model factor in the economic considerations in export markets?

d) What should the economic model consider given the critical nature of exports and the export market that Manitoba Hydro participates in?

ANSWER:

The centrality and criticality of the EO is based on the use of its forecasts and analysis by all models within MH from Load Demand Model to HERMES, SPLASH and PRISM. This centrality of use and function KM believed should be enough to persuade MH to devote more resources and expertise to this strategic group. At this time, KM feel that there is an imbalance between the functions and status OF EO and EAD and this could be easily rectified. This Department could do more than just combining eclectic forecasts. KM were told that EAD conducts impact analysis and cost/benefit studies in conjunction with environmental impact qualifications. These functions can be extended to a greater familiarity and expertise in modeling and forecasting.

In March of each year the Economic Analysis Department (EAD) of the Corporate Strategic Review Division of MH prepares an Economic Outlook (EO) that becomes a reference for other departments and models. The forecasts included in the EO cover a wide range of variables from Gross Provincial Product to short and long term interest rates, the short term and long term exchange rate of the Canadian dollar, population, employment, unemployment rate, residential customers and commodity prices. Only a limited number of forecasts are made in-house. Most of the forecasts are derived from consulting companies (HIS Global Insight, Infometrica, and Spatial Economics), Canadian banks (BMO, CIBC, RBC, TD Bank, and the National Bank of Canada), and statistical bureaus (Manitoba Bureau of Statistics (MBS) and Statistics Canada) as well as the Conference Board of Canada.

KM noted that there are a number of issues that arise in connection with the use of multiple forecasts and forecasters. Most of these forecasts are made in the context of consistent models (e.g., Infometrica uses its CANDIDE model), and the Conference Board has its own model, as do many of the banks' economic departments. The forecasts they generate are outcomes of the use of their models' structures and assumptions. This fact makes it difficult and inappropriate to lift a single variable forecast from one model and to use it independently of the other forecasts that were simultaneously generated. This, of course, creates a dilemma. If one uses the Infometrica's

forecasts of interest rates or exchange rates, then one needs to use all other forecasts from Infometrica. If other forecast variables are drawn from other models this will amount to mixing apples and oranges.

KM also noted that the real issue is not the independence of forecasts and forecasters but their accuracy and consistency. EAD states, "...Forecasts from Consensus Economics, Province of B.C., Federal Finance, and Desjardins, will no longer be used as they are not considered statistically independent." KM would prefer to see an in-house macro econometric model. This may be asking too much given the resources it would require. It could be sourced out to a University in Manitoba or to a single consulting firm where tests of the accuracy of their forecasts have been carried out. The eclectic approach, if it is the only alternative, should be based not on a large number of forecasters but only on those that meet the accuracy criterion that MH must establish. Averaging their forecasts assumes that they are equally accurate, but they are not. Another way to deal with the problem of using an inappropriately specified forecast is for the EO to undertake a full @RISK specification of the underlying probability distributions that best capture the patterns of these forecasts. If this is not within the capacity and expertise available at EAD, then the experts using PRISM should work closely with EAD to re-generate the forecasts as a full probability distribution instead of a single deterministic vector (series).

The inaccuracies of forecasts would carry both operational and planning risks. Overestimation of revenues creates an optimistic atmosphere of complacency and over commitment. Underestimation would result in the opposite atmosphere; both are costly.

NYC/MH Issue # 232.

Source: NYC Risk

SubIssue: Risk

Subject: Only 1-2 select personnel know the source code in Hermes (EMMA) and the company is reliant on one person to fix "bugs". This is in itself a huge operational risk as sometimes transactions into MISO are delayed as numerous bugs are found in the system. The reports are also archaic and only one (1) person can fix them. There is no documentation in the system. It is known as a "blackbox" with "nobody knows what is going on in there". Errors in the $90 million dollar range were observed by NYC in just a one month period. This has had direct tangible losses to the company in FY0607.

NYC - MH - [91]

CHAPTER 5: Review of Risk Reports: A Critical Evaluation

PUB/KM-35

Reference: Section 52.O Page 167

a) Please provide a listing of issues that were not sufficiently addressed by previous parties. Please indicate the deficiencies by issue and by party.

b) Please provide a table listing the claims on pages 167 to 173 and in each case provide KM's reasons as to whether the claims are of substance and need attention.

ANSWER:

a) Issues related to models integration, stochastic and dynamic specifications, use of probability density functions instead of forecasts vectors, issues relating to the development of Internal Responsibility Matrix, internal generation of economic forecasts, environmental regulatory risks, etc.

b) the NYC still makes a number of serious allegations about defective, erroneous and stale inputs, flawed modeling structures particularly in the hydrology framework, manipulation of input and output data by Front Office, wrong forecasts, inappropriate use of the model outputs in power trading and FTR bids, the concealment of model data and results rendering the model a "black box". Furthermore, the Consultant also claims that the Front Office engages in self-evaluation without any vetting and validation by Middle Office raising serious issues about the lack of checks and balances in reviewing and validating the models, inconsistencies among the models inputs and outputs; HERMES and SPLASH use different model parameters, inappropriate use of the models in risk assessment, and the lack of any contribution to risk mitigation especially in PRISM. The Consultant also presents a number of estimates of the costs these mistakes would entail for MH and the rate payers of Manitoba.

The Consultant claims that not using current market prices in HERMES has resulted in inappropriate water releases that sub-optimised operations, resulted in lower revenues in the range of millions of dollars, and exposed MH to greater financial risks. Furthermore, the Consultant alleges that the prices used in the Generation Estimate Report and those used in HERMES are different. This gives rise to different financial results confusing decisions and engendering inefficiency at MH. The Consultant is particularly unhappy about the current MH use of antecedent forecasting. NYC believes that this method can be improved by back-testing and disregarding water flow data before 1942. Another allegation is about the critical assumption in SPLASH of perfect foresight, where the model assumes lake ending water levels that cannot be expected in the real world, raising concerns over using the SPLASH model to estimate the cost of drought. Furthermore, NYC alleges that there are serious discrepancies between SPLASH and HERMES in regard to lake level balances which has resulted in different financial forecasts used in the IFF.

KM argue that the quantity constraints are obviously more critical determinants of MH's operations, but this does not eliminate the concern that the correct and most up-to-date prices should be used. The financial implications of price-mistakes can not be exaggerated. KPMG created a number of scenarios where they use forecast prices versus actual MISO prices in the optimization runs. The differences they found ranged up to $45 million (KPMG, 104-108). This is not a small amount of money and serves to indicate that accurate price forecasts are a key determinant of forecast net revenues.

Furthermore, the Consultant alleged that MH assumes a 100% correlation between on-peak and off-peak prices. The actual prices in HERMES had a correlation coefficient of 0.59 and 0.62 whereas the actual market data (ex-post) show correlations of 0.81 and 0.84 for the MHEB node. The true correlations were higher than both MH's and the Consultant. The latter claimed that the correlation was only 40%. In this respect, neither party has used the correct correlations. The assumptions made about the presumed correlations between off-peak and on-peak prices need to be rooted in actual calculations.

The Consultant claims that the accuracy of the historical water flow data before 1942 is not high. However, in our opinion, to discard this series is unjustified. The use of the historical series as if it is the only reliable series on which to base calculations of dependable energy is also not recommended. By drawing over a 100 different samples of 94 year flows generated by a statistical process AR (3), which KM have complemented by an extreme value distribution, KM have demonstrated that the minimum of the actual historical series is consistent with the average of all the minima computed from the stochastically generated series.

Different production coefficients in HERMES and SPLASH are a problem. This problem pertains to the nonlinearity of the generation equation that links water flows to energy and the time strip differences between the two systems. Harmonising the two systems on a common platform will minimize these discrepancies. The revenue losses due to this problem are limited and nowhere close to NYC's exaggerated calculation of $26 million.

HERMES, SPLASH and PRISM are indispensable operational, planning and risk assessment tools at MH. These decision support tools are consistent with the standard systems currently used in many leading utilities in North America. They can be expanded, harmonized, and integrated. They should be reviewed internally and externally and upgraded and updated regularly. BC Hydro and Hydro Quebec have or are moving to dynamic and stochastic systems: MH may wish to follow suit. A hydrological sub-model to complement HERMES and even SPLASH should be considered seriously as water management issues become more complicated under possible climatic change.

The MH systems require formal documentation, more staff should be trained on using and supporting the systems, that external reviews are needed, and that the Middle Office should be involved (particularly in verifying and checking the results). The PRISM model should also be run in the Middle Office.

Notwithstanding the small dollar amount of discrepancy between the Generation Estimate and HERMES solutions, these discrepancies raise concern about the accuracy of the model and the

reporting system. The real problem is more profound. HERMES and SPLASH are static models and do not handle time in a manner consistent with dynamic programming. MH may wish to consider some of the existing dynamic programming systems in use in other utilities.

The predictive accuracy of HERMES can be improved. The antecedent forecasts need to be reviewed. Back-testing should be used. The practice of continuous adaptive forecasting reviews and fine tuning has its benefits.

HERMES is not directly linked to the trading floor and its forecasts are not used as bids on the floor. But whether HERMES is relied upon to inform decisions in the opportunity market is another matter; models are useful tools for informing users' decisions, not replacing them. It makes sense, however, to dispel this concern by streamlining and documenting trading decisions and practices.

KM are in agreement with ICF International, Dr. Bhattachryya, KPMG, RiskAdvisory, all share the general appreciation that MH's Middle Office is evolving and that major progress has been made towards best practice. We all also recognize that much is needed in terms of strengthening the HR expertise set at the Middle Office, the independence of its functions, the MTM measures of all risks, the expansion of risk limits standards and process control limitations to all aspects of MH functions, the development of an Internal Responsibility Matrix, the need for quantification of risks at Middle Office, and its involvement in contract risk assessment. Most of us recognize that there is some merit in NYC's comments about risk governance issues with respect to the independence of the Middle Office and the greater need for oversight, but we all disagree with her claims of lack of competence in the CRMC, and the concealment and manipulation of data by the Front Office.

MH-KM - 27

Reference: Chapter 5 - Page 221

"Second, the accuracy of the historical water flow data before 1942 is not high, but to discard this series is unjustified. The use of the historical series as if it is the only reliable series on which to base calculations of dependable energy is also not recommended." However, on page 285 a similar, but different, conclusion states "Second, the consultant claims that the accuracy of the historical water flow data before 1942 is not high."

a) Does KM agree with the consultant's claim that "the accuracy of the historical water flow data before 1942 is not high"?

b) If it is the opinion of KM that "the accuracy of the historical water flow data before 1942 is not high", please provide all studies, analysis and data relied on by KM to reach this conclusion.

ANSWER:

a) KM stated what the NYC had claimed about the accuracy of water flow data before 1942. KM's reply to NYC is in the first sentence "....the accuracy of the historical water flow data before 1942 is not high, but to discard this series is unjustified."

b) KM statement about water flow data being less accurate (in a relative sense) post 1942 is based on the fact that the earlier series includes intrapolation and extensions that are not based on actual readings and measurements of these flows from monitoring stations.

PUB/KM-24

Reference: Page 79 Model Synchronization

Please indicate to what extent the models use different data inputs, and coefficients and explain the actual consequences.

ANSWER:

NYC had raised questions about different energy production coefficients between HERMES and SPLASH. KM have noted and agreed with NYC's concern but not her calculations. Theoretically using the wrong production coefficient could drive a wedge between the actual and forecast values of generation. The wedge could lead to sub-optimization because it may use less or more water to produce a given amount of electricity or more or less electricity from a given amount of water. MH claims that system operators do not hold water flow or production of electricity to the forecast values of the model. If system operators were to hold more water than is necessary given the wrong production coefficient, this water represents forgone revenue particularly it would be spilled or sold at lower values than what could have been obtained.

The losses cannot be high and are pale by comparison to changes in export prices, water flow conditions, and load variations. It would be appropriate for MH to examine this issue and assess the accuracy or lack of it the calculations of the NYC and those made by KPMG.

KM are convinced that these issues would be resolved when the different models are integrated and put on the same platform.

MH/KM-37

Reference: Chapter 5 - Page 221 and Executive Summary page xxix

"Different production coefficients in HERMES and SPLASH are a problem."

a) Given that HERMES and SPLASH use the same source for water flow, water level and generation data but aggregate the data for the different time structures and generating station models, what do you consider the impact of the perceived problem to be in terms of loss of revenue or risk to the Corporation?

ANSWER:

a) NYC had raised questions about different energy production coefficients between HERMES and SPLASH. KM have noted and agreed with NYC's concern but not her calculations. Theoretically using the wrong production coefficient could drive a wedge between the actual and forecast values of generation. The wedge could lead to sub-optimization because it may use less or more water to produce a given amount of electricity or more or less electricity from a given amount of water. MH has asserted that its system operators do not hold water flow or production of electricity to the forecast values of the model. If system operators were to hold more water than is necessary given the wrong production coefficient, this water would represent forgone revenue particularly if it were to be spilled or sold at lower values than what could have been obtained.

KM have examined the implications of different production coefficients; their findings is that these losses cannot be high and are pale by comparison to changes in export prices, water flow conditions, and load variations. It would be appropriate for MH to examine this issue and assess the accuracy or lack of it in the calculations of the NYC and those made by KPMG. KM are convinced that these issues would be resolved when the different models are integrated and put on the same platform.

the new contracts, we need new generation in 2020/'21 -- 2020/2021.

If we didn't have the thermal resources, like Harold indicated -- Mr. Surminski indicated -- we -- we would need new generation resources now. So we'd have to advance Keeyask to today.

These -- these thermal resources allow us to defer that. But then having the sales means you need to advance them a little bit -- a few years -- in order to make the sales because they want the sales to be supported with hydraulic energy, not with thermal energy.

MR. ANTOINE HACAULT: Thank you. I'll move on to another small subject, and it's what I understand to be a criticism by Drs. Kubursi and Magee, which is dealt with. And, unfortunately, I haven't extracted that in my book of documents, but at page 78 they talk about the HERMES and SPLASH models, and at page 78 of Manitoba Hydro's rebuttal evidence at line 24, I'm quoting:

> "As opposed to KM's opinion that the real danger lies in the fact that they can and have produced different results, Manitoba Hydro is confident that HERMES and SPLASH produce very similar results as the different groups

use the same fundamental input data, compare model outcomes, and annually explain the variances as part of the IFF process."

I don't want to rehash a lot of the stuff that Mr. Peters has done, but how does Manitoba reconcile the overlap and discrepancies, and how does it deal with this criticism? Could you further explain it?

MR. DAVID CORMIE: And I'd like to just go back to what Mr. Rose said several weeks ago about the granularity of the modelling, and HERMES is very detailed, it models every generating station, it models the load at a much finer level of detail than in SPLASH. SPLASH uses monthly time steps, one (1) on-peak period and an off-peak period. SPLASH groups generating stations together. All the generating stations on the Winnipeg Ribber -- River are -- have one (1) representation, where in HERMES there'll be six (6) different stations. So the models are -- are -- are different, but they're calibrated to the -- to essentially the same system data. Every -- every day we collect the information on an hour-by-hour, we -- and we take that information, and you can either aggregate it monthly or you can average it out over a week, but you're -- in effect, you're -- you're using the same information

to develop the models.

And so there's no different database for HERMES than there is for SPLASH. It's just the level of detail in which the averaging occurs. And then -- and that's necessary because SPLASH has to run ten thousand (10,000) times, HERMES only has to run once. And Mr. Surminski can't wait. If we -- if we were to model the system at the level of HERMES and run it ten thousand (10,000), he'd -- you know, he'd -- he'd -- he would have to come back in a couple of weeks to get his answer, and that's not very -- not a very practical thing. And Mr. Rose referred to that as an implementation failure: great model, but results that, you know, are useless, because you wait forever.

But -- but we -- but because we are solving essentially the same problem, there is an opportunity during the integrated financial forecasting process for each of us to model the same year. And so HERMES produces a forecast for the second year, and SPLASH produces a forecast for the second year, and then we're able to compare those results, and we can compare the hydraulic generation. We're all using the same flow data, we're using the same curves, they've been aggregated differently, and we can start looking at why are the answers different and we can explain the

differences. And some of them have to do with techniques, but there are no surprises there. Every -- every difference is explainable, and we accept that those differences are a result of modelling, but they're not significant.

And so, by having two (2) independent models and two (2) different groups, it gives us confidence that -- that the outcome that we're getting is -- is robust. And rather than having a single model where you're not really able to check against something else to -- to get a comparison, we have two (2) independent groups, two (2) independent models driven off the same data that gives us confidence that our models have some -- you know, there's a cross-checking and they have some reliability.

So that's why we disagree that -- that -- they don't produce identical results, but the results are so close that we have high confidence in the model results.

MR. ANTOINE HACAULT: Thank you. For the ten (10) minutes or so that I have left, I have a -- I think I could make use of that to ask a couple of questions with respect to the OM&A. So if I could have people go to the exhibit that was produced this morning, which I believe is 112, the first meno -- memo by Mr.

PUB/KM-32
Reference: Section 2.2.5 Page 129 Weather

a) Please explain how weather is currently incorporated in the HERMES model and discuss the implications of it being included in only one equation. Please expand on KM's recommendations that MH should consider the inclusion of weather in other equations in the model.

b) Please identify the date. author. and file a copy of the Report on weather and climate effects on precipitation and evaporation.

c) Did KM request access to the models that generates the Report in (b) above.

ANSWER:

The weather here refers to temperature and it is included in HERMES on a weekly and daily basis. Given the high sensitivity of several load variables to temperature and weather, KM are convinced that this addition would bear fruits in terms of tracking accurately changes and could be reflected in more accurate forecasts.

Bill Girling, Resource Planning & Market Analysis. Status of Drought Research in Manitoba Hydro. DRI Workshop, Saskatoon, January 11, 2006.

Reference in the paper was made to SPIGOT: Stochastic Model. KM requested this Model but did not receive it.

Manitoba Hydro's evidence on these next two (2) pages, at a high level first and then I'll ask you to elaborate, what you suggest here is that it would be unfair to characterize your calculation of the drought, your -- your calculation of the actual costs of a drought, as seriously understated.

That would be an unfair characterization of your -- your -- your calculation?

MR. DAVID CORMIE: Yes, that's Manitoba Hydro's view, yes.

MR. BYRON WILLIAMS: And you can probably run this through me more effectively at a high level than I can -- than I can direct you through cross-examination, but what you essentially say, at least on the -- the rest of page 63 and -- and the rest of page -- top of page 64, is that there may be both a -- a possibility of underestimating the costs of a drought and also a possibility of overestimating the costs of a drought within SPLASH, and those tend to offset.

Would that be fair?

MR. DAVID CORMIE: Yes, and, you know, the fundamental reason is that SPLASH is only -- it's assuming that only firm imports are available. It doesn't assume that non-firm imports are available.

And it has to make that assumption because

we're talking about providing dependable energy to serve our load obligations. And so we set out a very conservative set of assumptions that -- that -- that -- that these are the energy sources that we're going to rely on, and then we allow the model to do the calculations based on those assumptions. If you change the set of assumptions, and now assume that non-firm energy sources can be relied on, you'll get a different answer. But the -- but the puts and the takes between the two (2) tend to offset each other.

And -- and what we said in the rebuttal evidence is that when you do the calculations assuming non-firm is -- energy is available, reservoir levels will be -- then be higher, but those reservoir levels will then be able to support generation in subsequent years. And -- and -- and there are factors like that that -- that tend to say that, you know, although SPLASH has got conservative assumptions, the -- the financial results are pretty close, and, you know, within, you know, there's a -- there's very small differences.

So it is unfair to say that -- that SPLASH underestimates the cost of the drought, and that's what we tried to lay out in that -- in that evidence.

MR. BYRON WILLIAMS: Okay, and -- and I -- I just wanted to run through that particular point at a

financial pain for Manitoba Hydro associated with shortage priceage, would -- pricing. Would that be fair?

MR. DAVID CORMIE: Yes, I think in our -- in our forecasts of drought costs, we had not, up to that time, included those types of costs in -- in our -- in our financial planning. For example, when you -- you realize that you -- you need to use the firm transmission coming north, and if you have to go and pay a fee for that, and you roll that fee into the cost of the energy, the energy starts looking pretty expensive.

And -- and we're not in that situation anymore. We don't have to pay those fees. We've got -- we -- we can go through a drought, and buy market priced energy, and not having to pay additional fees that -- that could be deemed to be, you know, shortage pricing.

But -- but there will still be higher prices under some circumstances at the Manitoba Hydro pricing node than -- than you would normally expect because the transmission system will be -- will be flowing in a manner that it -- that it normally doesn't flow, and so you'll see higher -- higher prices.

But those -- those have to do with transmission congestion costs, maybe additional losses, but they won't result from the extraction of additional rents by -- by -- for the use of transmission service or

NYC/MH Issue # 200.

Source: NYC Risk

SubIssue: Risk

Subject: The true external hedging requirements for Hydro's combined volume and market risk over a 5Year Period, with 95% statistical confidence, is under $1.25BN. The real range of expected losses with 95% on the current system is $0.76BN – $1.25BN. The overstatement of risks has allowed for internal avoidable losses to go unnoted.

NYC – MH – [A4e]

It should be noted that the above were calculated in 2006 prior to updated information being received in 2008 and the results are usurped with subsequent reports. Even larger problems were found in PS&O and the 2008 results should be used.

NYC/MH Issue # 201.

Source: NYC Risk

SubIssue: Risk

Subject: The $2.4BN number previously reported to the PUB as a measure of 5Y Drought exposure was found to be an inappropriate measure of "reliable" risk. It does not represent a reasonable 95% expected exposure to the Province.

NYC – MH – (B31e)

NYC/MH Issue # 203.

Source: NYC Risk

SubIssue: Risk

Subject: Manitoba Hydro has inadequately categorized and quantified its true 5Year Risk Capital exposure. The methodology being used to arrive at that $2 Billion Dollar number, that is in place to date, including the statistics is flawed in arriving at a true 95% exposure.

NYC – MH – [31B]

PUB/KM-39. Reference: Section 5.2.2 Page 189 Drought Risk

Please provide a table that compares the probability of a drought estimated by KM, the Consultant KPMG, and ICF. Also include the calculated cost of a five year drought from KM , the Consultant, MH, KPMG and ICF. Compare and contrast the results and provide KM's view of the reason for any differences in the calculated amounts.

Answer:

It is difficult to compare and contrast the estimates of the probability of a drought and its consequences of the different consultants. The estimates differ markedly because of the many different assumptions that underpin these forecasts.

ICF estimates are discussed in the ICF. Independent Review of MH Export Power Sales and Associated Risks on page 114. The details of the probabilities and confidence levels are as follows:

Case	Description	Probability %	Equivalent Confidence Interval %
Baseline	5 year drought	3.1	83.8
Longer Drought	7 year	1	98
base with high prices (HP)	5 year drought	1.5	97
Longer Drought HP	7 year drought	0.5	99

Source: ICF Independent Review of MH Export Power Sales and Associated Risks, p 114.

There are no independent estimates by ICF of the costs of these droughts. On the other hand, KPMG estimates costs of droughts in terms of the cumulative reductions in net income under different price assumptions and the sale no sales options. The estimated costs are on page 181 of the KPMG. MH External Quality Review. This data is redacted due to the Confidentiality Agreement. KM do not feel that displaying this data would be admissible.

KM estimates of the cost of a five year drought with expected prices is $3,342.5 million and that of 7 year drought with expected prices is $4,548.3 million. These estimates were based on picking a 5 year and a 7 year low water flows. This way these estimates capture the auto-correlation structure embedded in the historical water flow series. Thus, the 5 year is not a multiple by 5 of a given year. KM estimated the probability that a randomly chosen five-year period's average water flow is less than the average water flow observed during 1987-1991 is .013833 (one in 72). Furthermore, KM estimated the probability that a randomly chosen five-year period's average water flow is less than the average water flow observed during 1937-1941 is .008466 (one in 118). As well the probability that a randomly chosen seven-year period's average water flow is less than the average water flow observed during 1937-1941 is .012840 (one in 78).

KM feel it is inappropriate to compare and contrast estimates based on different methodologies and assumptions and that is why they did not build such a comparative table.

MR. BYRON WILLIAMS: And again, there's that one thousand (1,000) iterations comment in the next paragraph.

Using these averages and selected probability distributions for each of these many variables, they gen -- generated these Monte Carlo simulations, including the mean at the 5 percent and 95 percent confidence levels, correct?

MR. DAVID CORMIE: Yes.

MR. BYRON WILLIAMS: And without dwelling too much upon this, if we look at Figure 6.1 -- and I'll go to --through it with some -- in a -- with a couple more questions in a second -- 6.1 is a portrayal of that base case.

Would that be correct -- your understanding, sir?

MR. DAVID CORMIE: Yes, that's a histogram that shows the distribution of outcomes of net revenues for -- as a result of the one thousand (1,000) iterations of the calculations.

MR. BYRON WILLIAMS: And just -- you'll see that they arrive at an -- under this base case, an average revenue of around 445 million, sir.

Do you see that?

MR. DAVID CORMIE: Yes.

is, they had their -- they had their model. Then they changed -- normally, you would change one (1) assumption, and most of the sensitivities that they did were -- involved changing one (1).

But in this particular example, where it calculates a minus seven hundred and fifty-five (755), they've changed two (2) variables at the same time; they've changed -- they've made the -- the assumption on the flow, and they've made the assumption on the power prices. And there's -- and they've not talked about what's the probability of the flows and the prices being together at the same time in order to calculate that.

So there may be only a one (1) in a thousand chance that that scenario would arise, but there's nothing in this table that tells you what the probability of those two (2) events occurring. We know that the probability of the drought occurring, the 1940, is probably about 1 percent. And we know that the probability of high prices is probably -- maybe it's 10 percent. I -- I'm not -- I'm just guessing. But what's the probability of both of them occurring in the same year? There's nothing in this table that indicates what the -- the -- the probability of them both occurring at the same time. It's -- it just says, We've taken these two (2) assumptions. We've taken the -- made these two

(2) assumptions without regard to their correlation.

MR. BYRON WILLIAMS: And I'm going to suggest to you -- and if I'm putting too strong of words into it, you'll correct me -- but to simply add those two (2) results together without insight into their correlation presents a number that is essentially of very little value.

MR. DAVID CORMIE: Well, it -- it has value. It has just -- it's just a very low probability, or you don't know what the probability is. It might be high, it might be -- it -- it might be one (1) in a billion. We don't -- we don't know, because we haven't -- they haven't done the correlation analysis to relate prices to flows.

And when you start talking about many more variables than those two (2), it's really important that you -- that you know what -- whether they're correlated or not. And you just can't just pull the random variables, the assumptions, out of the air and say, Here's -- here's a number, because it may not have any meaning.

And -- and the normal way of doing that is, you run the model with the distribution of river flows and with the distribution of power prices, and you let the Monte Carlo tell you at, say, the 95 percent

confidence level what the result is. And then you that, well, the probability of this event occurring, this loss, which includes the combination of power prices and river flows, has a probability of -- of loss of -- occurring of -- of whatever that amount would be.

But you've defined the probability of that event occurring in combination, rather than taking two (2) independent variables, putting them into the model and -- and generating a number, because now you don't know what probability -- what level of confidence you have that number. The level of confidence with the 755 million is not indicated in this table. We don't know what the -- that is.

And you may be comparing, then, apples to oranges. You're comparing an event that has a one (1) in a hundred year probability to maybe an event that has a one (1) in a thousand year probability, and you -- you really shouldn't be making those comparisons.

MR. BYRON WILLIAMS: Thank you. I'm going to turn to your rebuttal, specifically starting at page 83.

And in terms of your -- in terms of your rebuttal, sir, at a preliminary level, as opposed to a high level, in terms of your rebuttal, essentially you outline two (2) significant concerns with the analysis

Private and Confidential January 18, 2005

MANITOBA HYDRO
2002-2004 Drought Risk Management Review
January 18, 2005

Prepared by Tim J. Simard and Jim R. Joyce
Principal Consultants, RiskAdvisory
610, 1414 – 8th Street SW
Calgary, Alberta, Canada T2R 1J6
Tel: (403) 263-7475
Fax: (403) 263-2945
www.riskadvisory.com

to make it more expensive to run Hydro's gas units and increased the cost to cover export sales commitments given the positive correlation between regional gas and power prices.

It should be noted that while the Company was feeling the financial impact of the drought, at no point was Manitoba load in immediate danger of being curtailed.

The '03 Drought

The '03 drought actually began in the summer of 2002. June 18, 2002 was the last major storm that Manitoba Hydro experienced until March '04. By mid-July '03, the Winnipeg River Basin was at 40% of normal production. Manitoba Hydro did draw some water out of the reservoirs during the winter of 2003. However, it was evident that there was very little snowpack in the winter and the failure of normal spring rains would result in a serious drought and significant losses.

In January '03, the Power Sales and Operations Division had estimated that the potential reduction in net revenue mainly caused by a drought and continued high natural gas prices could reach as much as $700 million. This figure was discussed with the Company's executive team.

The Manitoba Hydro Board of Directors was apprised of the potential for a drought in January 2003. However, the Corporation's financial exposure was not discussed in detail at that time given the probability of such an extreme deterioration in net revenues was still low. The Board of Directors was advised that there was nothing to indicate that the spring and summer rains

the forecasts is not of mere academic interest: the viability and reliability of the system depends upon them.

We have obtained from MH data on the discrepancies between annual forecast values and annual actual values for generation, total revenues, total costs, net revenues and exports between 1999 and 2009.

Positive errors (under-predicting) are not equivalent to negative errors (over-predicting). This fact is also contingent on the nature of the variable predicted. For example, under-predicting revenue is not a problem but under-predicting costs are a major problem. This is why different forecasting error measures have been devised to deal with this issue. We will here restrict our presentation to the simple variance of the predicted from the actual values. We will not use the average of the error variance because it is meaningless when positive and negative values are averaged (negative and positive errors cancel each other). A better measure would be one that takes the average of the absolute values of the errors, which in the case of the numbers in Table 3.1 would be an average of 3.3% instead of the 0% reported by MH.

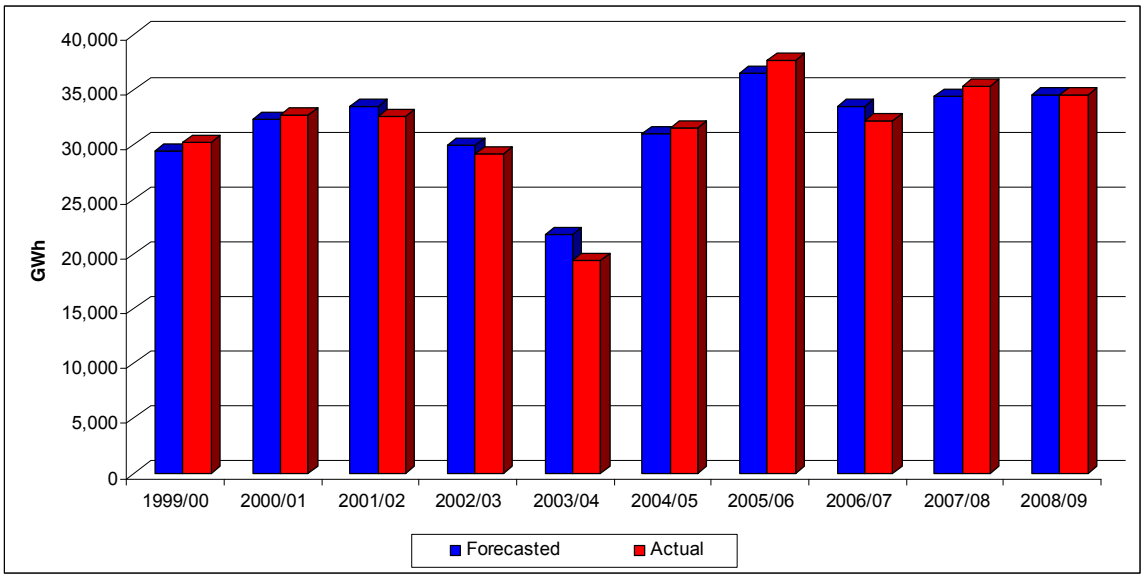
On average the HERMES model predicts annual generation well. It over-predicts almost equally to what it under-predicts. Where it failed, however, was in the crucial period of a critical year of low flow. The error in 2003/04 is large, with over 11% (see Table 3.1 and Figure3.5).

Table 3.1 – Forecast and Actual Generation, 1999-2009

FISCAL YEAR	TOTAL GENERATION			
END MAR 31	FORECASTED	ACTUAL	Variance	% Variance
1999/00	29,347	30,146	799	3%
2000/01	32,265	32,687	422	1%
2001/02	33,419	32,557	-862	-3%
2002/03	29,924	29,118	-806	-3%
2003/04	21,820	19,369	-2451	-11%
2004/05	30,918	31,534	616	2%
2005/06	36,516	37,629	1113	3%
2006/07	33,515	32,121	-1394	-4%
2007/08	34,330	35,354	1024	3%
2008/09	34,547	34,528	-19	0%
Average	31,660	31,504	-156	0%

Source: Manitoba Hydro. HERMES.

Figure 3.5 - Forecast and Actual Generation, 1999-2009



Source: Manitoba Hydro. HERMES.

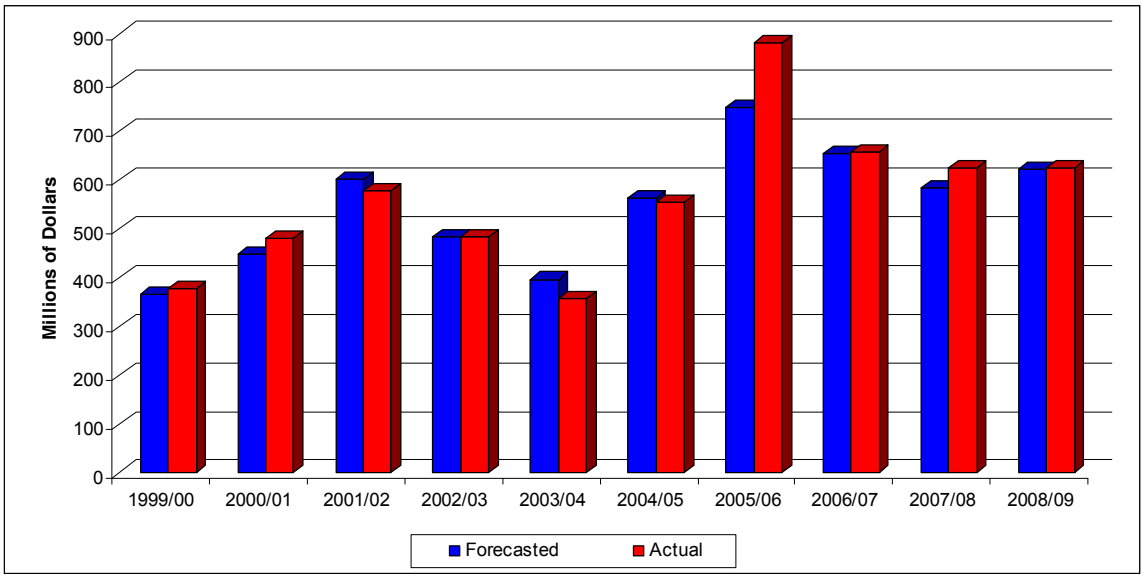
HERMES under-predicts total export revenues. For the ten year period of forecasts, it under-predicted three times (3 out of 10) in 2001/02, 2003/04 and 2004/05 (Table 3.2 and Figure 3.6). The overall error is relatively low except in 2003/04 and 2005/06--two widely different years. The average of the absolute errors is 5.1% instead of the 3% reported in Table 3.2.

Table 3.2 – Forecast and Actual Total Export Revenue, 1999-2009

FISCAL YEAR	TOTAL EXPORT REVENUE			
END MAR 31	FORECASTED	ACTUAL	Variance	% Variance
1999/00	365	377	12	3%
2000/01	448	481	33	7%
2001/02	602	578	-24	-4%
2002/03	485	485	0	0%
2003/04	397	357	-40	-10%
2004/05	564	555	-9	-2%
2005/06	748	882	134	18%
2006/07	656	657	1	0%
2007/08	583	626	42	7%
2008/09	621	624	3	0%
Average	547	562	15	3%

Source: Manitoba Hydro.

Figure 3.6 – Forecast and Actual Total Export Revenue, 1999-2009



Source: Manitoba Hydro.

The simple forecasting errors of total cost are large and, unfortunately, there is an obvious strong trend to underestimate the rise in costs. The forecasting errors are quite large in several years. In 2002/03 HERMES under-predicted total cost by 31% and in 2006/07 by 36% (Table 3.3 and Figure 3.7). Only in one year (1999/00) did HERMES over-predict total cost.

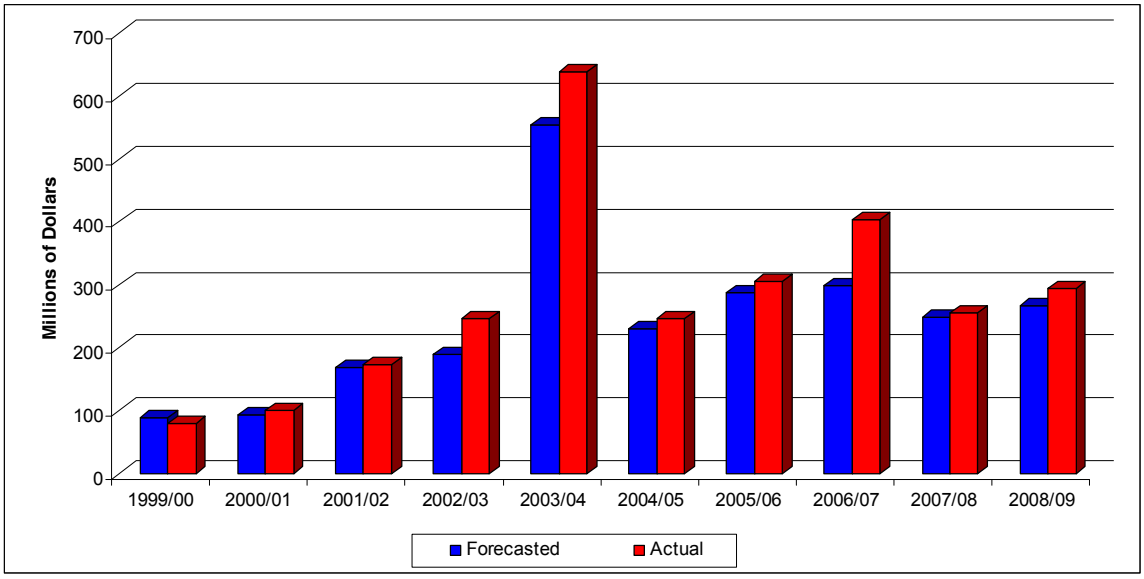
The absolute value errors (actual values minus predicted values irrespective of sign) are not large except in 2006/07, where the error exceeded $106 million--this is why the simple average of the errors (13%) is almost equal to the average of the absolute errors (12.8%).

Table 3.3 – Forecast and Actual Total Cost, 1999-2009

FISCAL YEAR	TOTAL COST			
END MAR 31	FORECASTED	ACTUAL	Variance	% Variance
1999/00	88	80	-8	-9%
2000/01	92	100	8	8%
2001/02	168	174	6	3%
2002/03	188	246	59	31%
2003/04	555	639	84	15%
2004/05	231	245	14	6%
2005/06	288	306	18	6%
2006/07	298	404	106	36%
2007/08	248	255	7	3%
2008/09	267	295	29	11%
Average	242	274	32	13%

Source: Manitoba Hydro.

Figure 3.7 – Forecast and Actual Total Cost, 1999-2009



Source: Manitoba Hydro.

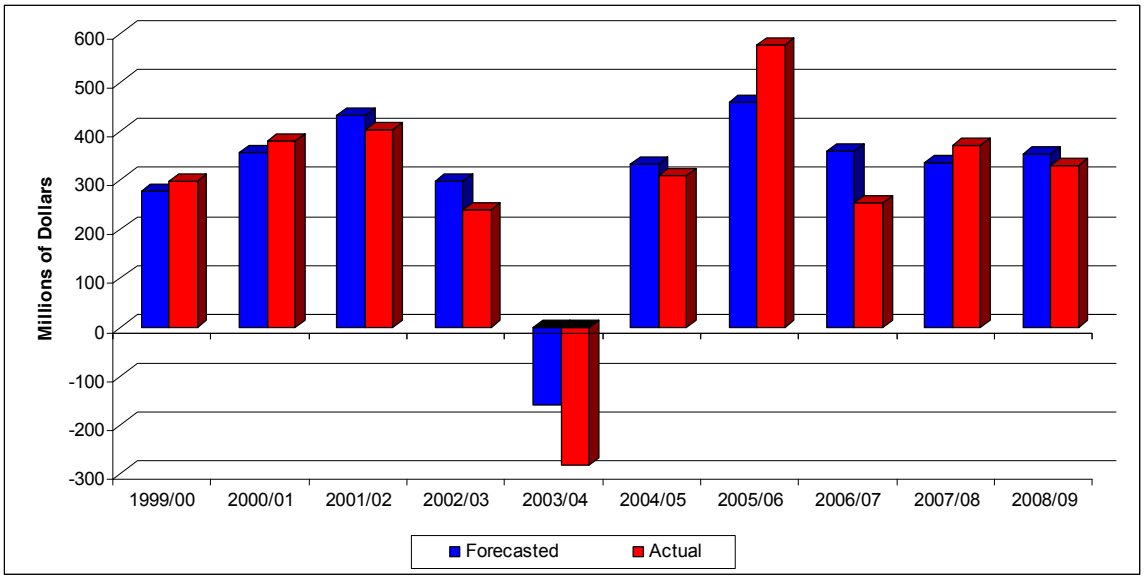
The prediction errors of net revenues are high and vary between over-predicting and under-predicting. There is a concentration of over-predicting in the latter year of the sample but with limited errors but large errors and over-predicting in the middle period around the drought. It is interesting to note that HERMES captures the turning points in the system. It predicts a loss when a loss occurs, although the magnitude of the errors is very large. The average of the absolute errors is almost 20% when it is only 6% when the simple average is used.

Table 3.4 – Forecast and Actual Net Revenue, 1999-2009

FISCAL YEAR	NET REVENUE			
END MAR 31	FORECASTED	ACTUAL	Variance	% Variance
1999/00	278	298	20	7%
2000/01	356	381	26	7%
2001/02	433	404	-29	-7%
2002/03	298	239	-59	-20%
2003/04	-158	-282	-124	-79%
2004/05	333	309	-24	-7%
2005/06	460	577	117	25%
2006/07	358	253	-105	-29%
2007/08	335	371	35	10%
2008/09	354	329	-26	-7%
Average	305	288	-17	-6%

Source: Manitoba Hydro.

Figure 3.8 – Forecast and Actual Net Revenue, 1999-2009



Source: Manitoba Hydro.

Another perspective on HERMES predictive accuracy is presented in Table 3.5 and Figure 3.9. It is clear that the second forecast is far better (lower prediction errors) than the first forecast. The accuracy of HERMES rises with time and the incorporation of more recent information improves the forecasts. It seems that when in the year the forecasts are made is crucial. Forecasts made in July are far better than those made earlier. By July the water conditions after spring rain are more reliable. Errors of the first

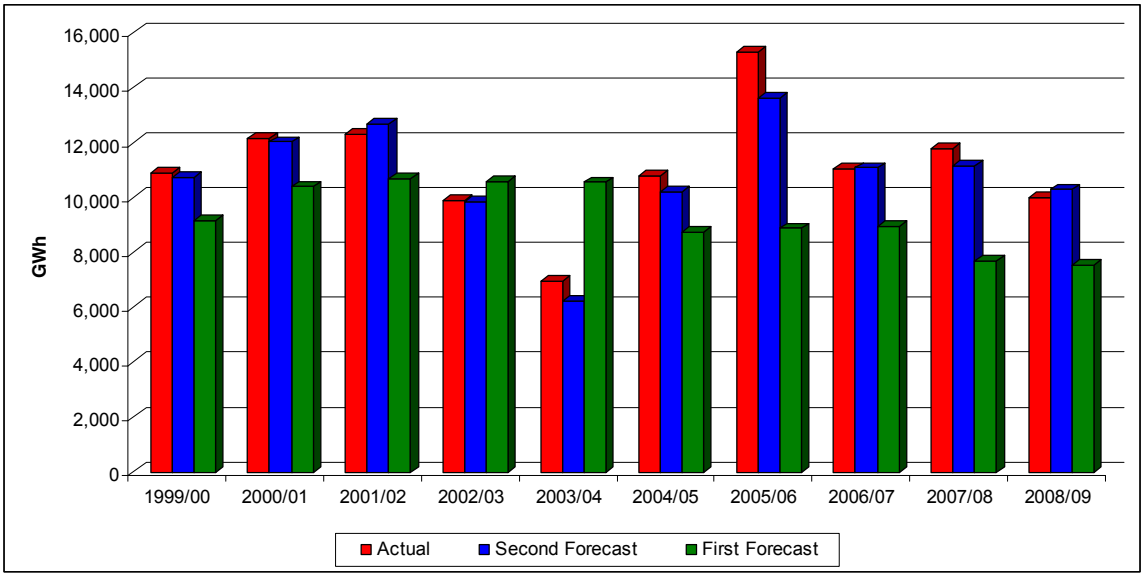
forecast are high and reveal over-prediction. The second forecast still suffers from over-prediction of exports but the relative magnitudes of the deviations decrease (Table 3.5 and Figure 3.9). The improvement in the second forecast over the first forecast could be an indication of a deficiency of HERMES lag structure. The concentration on a single lag in the flow equations may need some adjustment to improve the forecasts.

Table 3.5 – Forecast and Actual Exports, 1999-2009

Fiscal Year	Actual GWh	Second Forecast Variance GWh	Second Forecast Variance GWh	Second Forecast Issue %	Second Forecast Date mmm-yy	First Forecast Variance GWh	First Forecast Variance GWh	First Forecast Issue GWh	First Forecast Date mmm-yy
1999/00	10,881	10,704	177	2%	Sep-99	9,148	1,733	19%	Sep-98
2000/01	12,150	12,010	140	1%	Sep-00	10,383	1,767	17%	Sep-99
2001/02	12,293	12,676	-383	-3%	Sep-01	10,651	1,642	15%	Sep-00
2002/03	9,900	9,843	57	1%	Sep-02	10,578	-678	-6%	Sep-01
2003/04	6,975	6,220	755	12%	Sep-03	10,542	-3,567	-34%	Sep-02
2004/05	10,798	10,188	610	6%	Oct-04	8,731	2,067	24%	Sep-03
2005/06	15,290	13,597	1,693	12%	Aug-05	8,864	6,426	72%	Oct-04
2006/07	11,061	11,067	-6	0%	Aug-06	8,934	2,127	24%	Aug-05
2007/08	11,788	11,152	636	6%	Nov-07	7,707	4,081	53%	Aug-06
2008/09	10,008	10,279	-271	-3%	Sep-08	7,549	2,459	33%	Nov-07

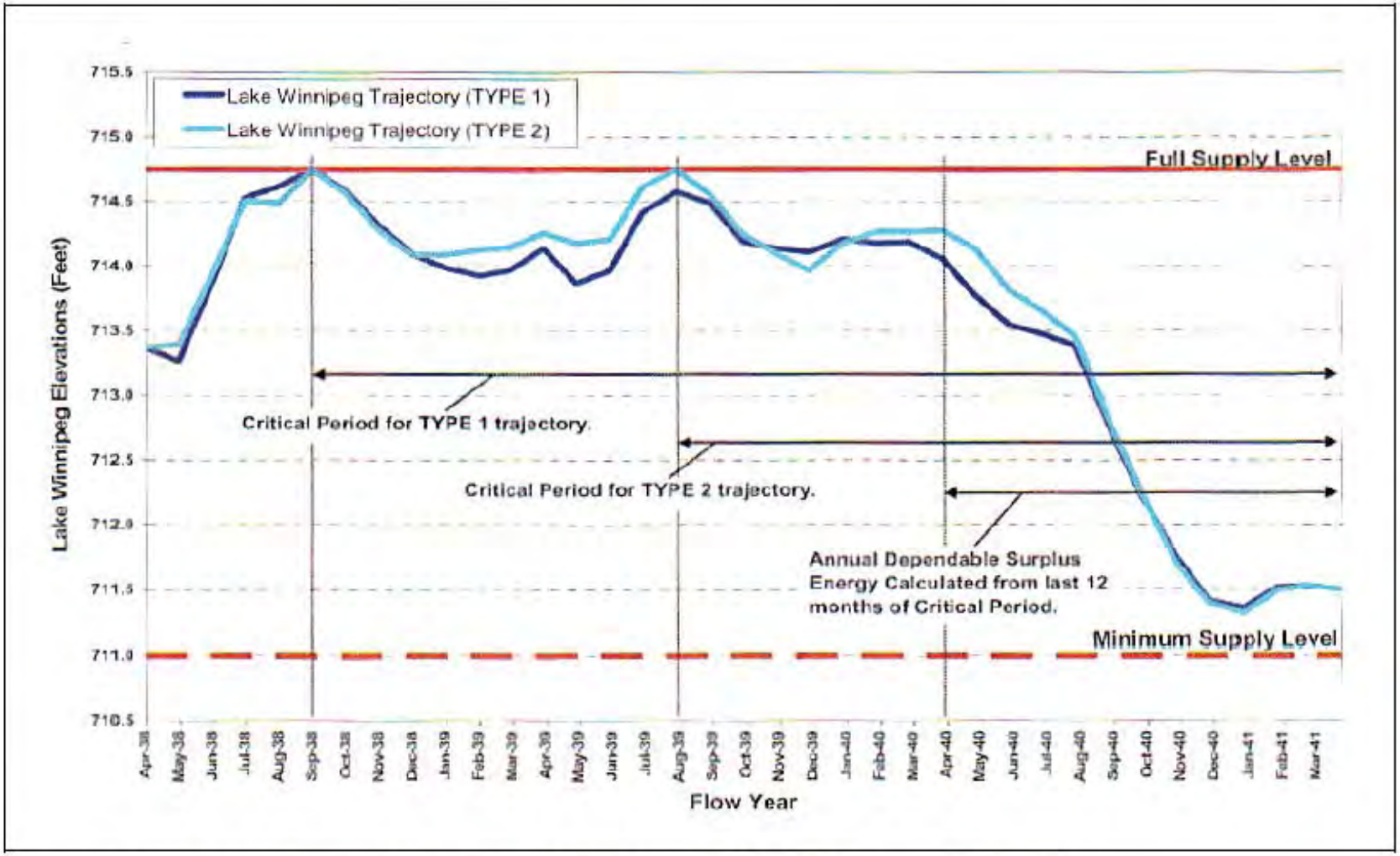
Source: Manitoba Hydro.

Figure 3.9 – Forecast and Actual Exports, 1999-2009



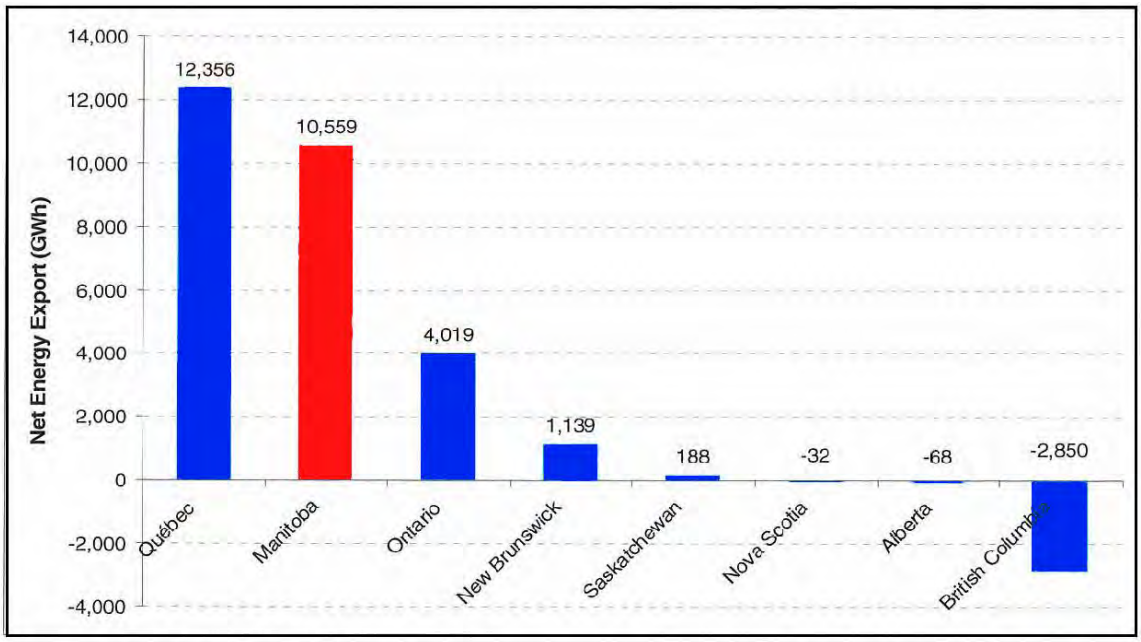
Source: Manitoba Hydro.

Figure 3.17 – Lake Winnipeg Critical Period Trajectory



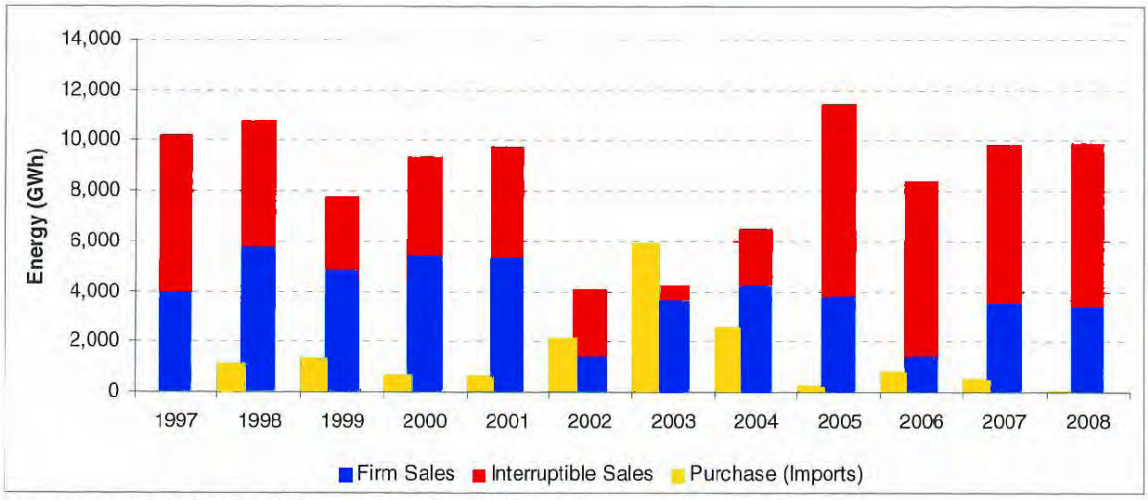
Source: Manitoba Hydro. An Introduction to the SPLASH Model. August 31, 2009.

Figure 1.10 – Net Electricity Exports to US from Canadian Provinces, 2007



Source: 2007 Annual Electric Power Generation, Transmission and Distribution Report, Statistics Canada, pp.11-12

Figure 1.11 – Manitoba Imports and Exports



Source: Canada National Energy Board website
Notes:
1. The annual Energy Import and Export values represent values for a calendar year i.e., January to December.
2. The Export values in the graph do not include exports represented under the 'Non-Revenue' category

PUB/MH I-206

Reference: Tab 13, 13.4 (3) 20 -Year Financial Outlook
Pages 14 & 15 - Five Year Drought

a) Please provide the assumptions (GWh, ¢/kW.h, carbon adder, natural gas prices) with respect to revenue and costs employed to define a 5-year drought impact.

ANSWER:

The impact of the 5-year drought beginning in 2011/12 is defined as the differential between 5-year drought chronology (1987/88 to 1991/92) and the expected financial consequences (i.e. average of all flow cases). The attached table summarizes the impact of the 5-year drought in terms of the difference in revenues and energy supply. Specific information on export price forecast, carbon adders or natural gas prices is not provided because this is commercially sensitive information.

		2011/12	2012/13	2013/14	2014/15	2015/16	Total
Impact of 5-Year Drought on Revenues (millions of $ Cdn)							
Revenue							
Extra-Provincial Sales		-220	-295	-186	-225	-198	-1124
Expense							
Water Rental		-24	-36	-17	-19	-16	-111
Fuel & Power Purchase							
Thermal		103	317	-20	1	-5	396
Import	On-Peak	14	40	7	7	4	71
	Off-Peak	107	127	93	106	90	523
	Total	223	483	80	114	89	990
Net Revenue (Excluding Finance Expense)		-419	-742	-249	-320	-271	-2003
Impact of 5-Year Drought on Energy (GWh/yr)							
Extra-Provincial Sales		-3542	-4190	-3162	-3408	-3016	-17318
Hydro Generation		-7117	-10707	-5060	-5584	-4779	-33246
Fuel & Power Purchase							
Thermal		972	3130	-184	3	-71	3850
Import	On-Peak	208	521	94	90	76	990
	Off-Peak	1841	2007	1605	1654	1391	8498
Total		3021	5658	1515	1748	1396	13338

adjusted in proportion to deviation of retained earnings from their targeted minimum. The closer the retained earnings are to their minimum desirable level, the higher the water that should be left in storage for drought-mitigation purposes."

I'd like to explore with you, sir, the practical implications of following that recommendation. I don't know whether there's a particular example that might be used to try and illustrate what issues arise from this statement, but let's -- would using the 2003/2004 drought, which caused a reduction in the retained earnings followed by a good year of flows, help us understand what this would be? So let me go through the example.

If you were at $2 billion of retained earnings and you have the 2003/2004 drought -- say, for illustration purposes, that's half a billion dollars hit on the retained earnings -- retained earnings are now lower. It appears that what the doctors are saying is because we have one (1) year of bad drought, you have to keep the levels in the lake and your reservoirs really high because now you have less retained earnings.

I don't know if I'm understanding their

statement correctly. But if that's so, I'm trying to lead to the logic, and you've just explained that retaining high water levels in your lake increases the risk of spill. I don't know if you're following me so far. Does following their recommendations increase the potential risk of lost revenue to Manitoba ratepayers?

MR. DAVID CORMIE: I -- I believe it -- I believe it does. And you -- you have to think of -- of their being two (2) bank accounts. One is the one in which the retained earnings are notionally kept. The other one is the bank account in which the water storages are kept, and you can put a value on those.

The difference between the two (2) is the money that you have in the bank or of the notional retained earnings that you have can't be spilled, so you have what you have. The -- the -- the assets that you have in reservoir storage are subject to being washed away if you end up having -- if you have -- if you put the water into storage, and then a subsequent year high-flow conditions occur and you've spilled the water, the incremental water, that you could have otherwise generated and sold at an earlier date.

And so, from a perspective of -- of -- of protecting the company financially, it's better to protect it through retained earnings than to hold water

in reservoir storage, because that -- that asset may end up being worthless because it -- it -- it -- it ends up being spilled.

In Manitoba Hydro's situation, we have a very large volatility in our water supply relative to our reservoir size, and so there's -- there's great frequency in which carryover water is subsequently spilled. And I believe in -- probably in the last ten (10) years, almost every megawatt hour that we purposely held back into storage would be -- was subsequently spilled because of a high-flow year.

And so it's with great caution that you would make the decision to hold back a reservoir storage because you -- be -- because we just don't have big enough reservoirs to absorb, most of the time, the high-flow conditions that can occur. Our -- our reservoirs are too small relative to the volatility we face in our water supply. So it's actually a relatively inefficient way of ensuring the financial future of -- of the Company as compared to retained earnings.

MR. ANTOINE HACAULT: Is it your opinion based on your experience then, Mr. Cormie, that if the recommendations of Drs. Kubursi and Magee were followed as a long-term planning objective and way of operating the reservoirs, that their recommendations would cost the

Manitoba ratepayers millions of dollars over the long-run?

MR. DAVID CORMIE: I -- I haven't done the -- the calculation, but I'm not sure that it will make a significant difference to the size of -- of the -- the desired amount of retained earnings. For example, a foot on Lake Winnipeg is 2,000 gigawatt hours, 2 million megawatt hours. If you valued that at fifty dollars ($50) a megawatt hour, there might be $100 million in reservoir storage relative to our desired level of retained earnings, which is in the billions of dollars.

So it could -- it could be part of a -- minor part of a strategy, but I think it's a more expensive strategy than -- than targeting a fixed amount of equity relative to debt. And I haven't figured -- I haven't determined what the long-term cost of that would be, but we know that, at times, individuals have approached Manitoba Hydro saying that we should change the res -- the level -- the -- the limits at which our reservoirs are allowed to operate. And we've done those calculations, and those are very significant costs to the Corporation if we were to lose -- lose storage.

And so storage has a significant value. And if we were to hold back storage, in effect, deny us the use of the bottom part of the reservoir, it would be

expensive, whether it's for managing financial risk or for managing stakeholder concerns with water levels.

MR. ANTOINE HACAULT: Now, I just want to make sure I follow and try to tie some of this in. If your holding reservoir level is high, does that limit your ability to secure export sales on average? Would it cause more spillover, and as a result of spilling it, you're not selling it?

MR. DAVID CORMIE: Yes, that's -- that's fair.

MR. ANTOINE HACAULT: Okay. Do you think it would affect -- I think we've seen that there's some shorter-term -- I don't know if I'm calling it correctly, firm export sales there, like a couple weeks, or perhaps going into a month or two (2). Do you think it would affect your ability to secure prices for those types of contracts?

MR. DAVID CORMIE: No, I don't think that would affect. I think it -- and it just ends up in that less energy goes to the spot market than would otherwise because you've held water back in storage to achieve some predetermined target level. And that would result, in -- in many years, to be a bad decision because water flows turned out to be high and spillage of that storage decision was required.

MH-KM - 15

Reference: Chapter 3 - Page 65

"Seventh, we would like to formulate the objective function to minimize cost of generation and delivery rather than maximizing net revenues. The public nature of the utility puts it outside profit maximization strictures. This is not an issue of semantics: the concerns are far deeper. The public utility is a natural monopoly; the last thing the citizen shareholder would like to see is the utility using its market power to maximize its rents, especially given the inherent concern about the implicit trade off between domestic load and exports."

a) Please confirm that MH models Manitoba firm load as a constraint such that Manitoba firm load always has priority over any external load obligation, regardless of economics.

b) If the statement in a) is not confirmed, please describe your understanding of when an external load obligation would be served in priority to Manitoba firm load?

c) If a) is confirmed, please describe in what circumstances maximization of net revenues would not maximize overall benefits to the domestic ratepayer.

ANSWER:

a) KM confirms that meeting domestic load is an equality constraint that must be met regardless of economics. But in the same vein, if firm exports were not committed to, any decline in hydro generation that may threaten MH's ability to meet the domestic demand could be met by diverting exports to domestic load. This is done automatically in the case of opportunity exports but its firm exports are different.

b) Maximization of profit is usually undertaken to the production function that underlies the generation, other balance and upper and lower bound constraints. There is no output constraint. In cost minimization, a given output is stipulated whose costs would be minimized. In rare circumstances are the two the same (except when a saddle point exists). No output constraint in the profit maximization (or sale maximization) may tempt over selling and therefore greater risk exposure.

minimizing costs.

MR. ANTOINE HACAULT: And now that I had confused everybody, this actually deals with some of the recommendations that had been made by Drs. Kubursi and Magee to -- and which are stated in the immediately preceding page, so page 291 in our book of documents.

You've just explained then Manitoba Hydro's perspective of a formula that would have, as an objective function, to minimize cost of generation. So what you've just talked about is an illustration of why that objective would cause problems, is that correct?

MR. DAVID CORMIE: Yes. We think our objective should be maximizing profitability, not minimizing cost.

(BRIEF PAUSE)

MR. ANTOINE HACAULT: Next, could you turn to Tab 68, please. I guess it's, in -- in part, the same topic. At Tab 68, page 297, of our book of documents, the very last sentence reads as follows:

> "No output constraint in the profit maximization (or sale maximization), may tempt overselling and, therefore, greater risk exposure."

What's your view on that particular statement, Mr. Cormie?

MR. DAVID CORMIE: There's two (2) types of risk exposure. One (1) is the risk that entering into a transaction in the export market might put the domestic customer at risk because there not -- may not be sufficient supplies to serve Manitoba loads.

Manitoba Hydro manages that risk becau -- with curtailment provisions in every one (1) of its contracts, and so that -- that is not a risk. So the only risk is the -- is the financial risk. And -- and that risk is that we might enter into a transaction that -- with the expectation that it will be profitable but that circumstances vary from what was expected and -- and the outcome is then a transaction that -- that showed a loss rather than a profit.

There -- the -- to manage the overselling risk in the export market we use -- we -- we determine the surplus capacity on the system assuming a very high Manitoba load. So let's say that we have 5,000 megawatts of generating capacity. We look at what the Manitoba load is going to peak at during that month, not at the 50 percent probability of exceedance, but at the 95 percent probability of exceedance, so we go to a high level of certainty on what the Manitoba load means.

And -- and let's say that was 4,400 megawatts. So that means we're 95 percent sure that the surplus that Manitoba Hydro would have in the month of January might be 600 megawatts. On average, it might be 900 megawatts, but on a conservative basis we use the -- the 95 percent level. So we're very conservative in determining.

And then we'll -- to the extent that we can sell that surplus, we will until it's all gone. And then we stop because we're now -- that transaction is no longer asset-backed. There's -- there's no -- that would be now assuming that we would be serving that sale from the market rather than from generation assets that Manitoba Hydro controlled. And that would be a pure speculative transaction rather than one that we can point to surplus generation on our system.

So we manage the risk of overselling by -- by using a very high Manitoba load. And -- and I don't believe it is -- it is an issue. It doesn't guarantee that every transaction turns out profitable, but at the end of the -- our record has shown that on average they -- they are -- they are profitable transactions when considered as a whole.

MR. ANTOINE HACAULT: Thank you.