MCCULLOUGH RESEARCH

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Date: December 2, 2009

To: McCullough Research Clients

From: Robert McCullough

Subject: Review of the ICF Report on Manitoba Hydro Export Sales

Recent press reports have highlighted the issue of firm hydroelectric generation at Manitoba Hydro. At the center of the discussion is an undisclosed report by an unidentified risk manager (a consultant to Manitoba Hydro) summarizing a variety of unaddressed risks. While the report has not been released, an undated letter from the unidentified risk manager was distributed to the press.[1] Manitoba Hydro has responded by releasing a report from ICF, dated September 11, 2009,[2] and CEO Bob Brennan made a presentation to the Standing Committee on Crown Corporations of the Legislative Assembly of Manitoba on November 17, 2009. I have included the Brennan presentation and the risk manager's letter as Attachments A and B.

In sum, the ICF report appears to be a hastily prepared redraft of an earlier document, using outdated information and spending little time analyzing the underlying risk of future droughts or Manitoba Hydro's planning methodology. Overall, the risk manager's concerns appear consistent with current academic research on long-term drought risks and impacts, and deserve further public scrutiny.

Background

Manitoba Hydro is a mid-sized publicly owned utility based in Winnipeg. The vast majority of Manitoba Hydro's generation is hydroelectric with average generation of 3,300 average megawatt-hours (aMW). The basin that provides inflows to Manitoba Hydro's generating stations ranges from Alberta to Ontario and south into Montana and Minnesota. Inflows are relatively variable with historical flows as low as 2,250 aMW in 2003. Traditionally, Manitoba Hydro has overbuilt to pursue export markets in the United States.

[1] http://www.cbc.ca/iteam/includes/whistleblower_letter.pdf.
[2] Independent Review of Manitoba Hydro Export Power Sales and Associated Risks, ICF, September 11, 2009.

The only unusual characteristic of Manitoba Hydro is the secrecy with which it conducts its everyday operations. Manitoba Hydro provides very limited materials to the Manitoba Public Utilities Board. Hydroelectric operations, export sales, and even the Manitoba Hydro resource plan are shrouded in secrecy. Manitoba Hydro has never provided a convincing reason for its unwillingness to follow industry practice accepted elsewhere in the U.S. and Canada. It appears likely that its level of secrecy reflects an unwillingness to risk a repeat of the scandal uncovered by the Tritschler Commission in the late 1970s.[3] The Tritschler Commission identified weak planning practices and deception by Manitoba Hydro management. It should be noted that Manitoba Hydro has released information to possible competitors that would not be released to its own ratepayers and voters.[4]

The Risk Manager's Letter

We do not know the exact substance of the risk manager's concerns other than an undated letter to the press. While the letter makes clear that the author is new to the industry, a number of her points reflect concerns that have been raised in other venues:

1. "The multi-year drought analysis on this 'future generation' build, including in-service dates, and contract dates, showed exposure to the Province of $7BN."[5]
2. "While it may be shocking to learn these problems exist, what was uncovered was there were 'systemic and massive' computer system flaws - with obsolete computers maintaining the calculations. Massive system errors and inadequate mathematics were found in the power calculation of 'blackouts' or reliability conditions – which could lead to faulty results in keeping the lights on."
3. "It was being replaced with a rubber-stamp consultant report, who's analysis blatantly omitted any look at the bi-pole III and exposure to the Province of the future generation system. (see Page 21 of the publicly disclosed summary)"[6]

[3] Commission of Inquiry into Manitoba Hydro, December 1979.
[4] See for example, the discussion of Manitoba Hydro's marketing partnership with Enron at page 6, Affidavit of Robert McCullough and Ian Goodman on Behalf of the Pimicikamak Cree Nation, August 11, 2003, http://www.mresearch.com/pdfs/20030811.pdf.
[5] http://www.cbc.ca/iteam/includes/whistleblower_letter.pdf, undated, page 1.
[6] Ibid., page 1.

Points 1 and 2 closely match those of the Pimicikamak Cree Nation's consultants reported during the Wuskwatim consultation earlier in the decade.[7] Point 3 is amply demonstrated by a reading of the ICF report.

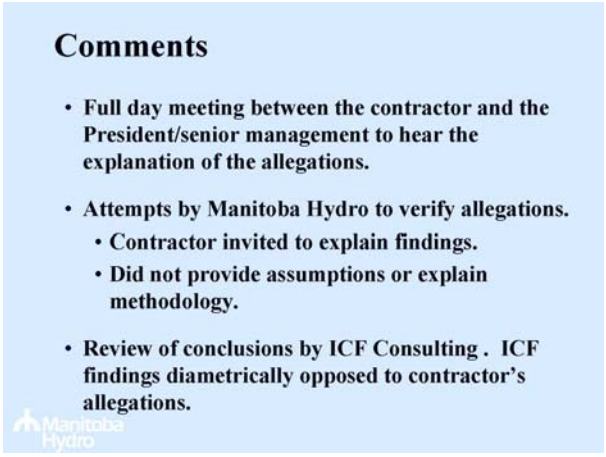
Brennan Presentation, November 17, 2009

Manitoba Hydro CEO Bob Brennan made a presentation to the Standing Committee on Crown Corporations of the Legislative Assembly of Manitoba on November 17, 2009 concerning, in part, the statements made by the risk manager.[8] To a degree, Mr. Brennan's comments parallel those of the risk manager. The following slide entitled "Purpose of the Consulting Contract" gives the project's scope:

The most significant phrase is "beyond just drought which we fully understand". Clearly, the risk manager was not expected to review drought issues – a difficult problem considering that the product being exported is subject to significant recurring shortages. Both the risk manager and CEO Brennan agree on the existence of this limited scope.

CEO Brennan also cites the ICF report, but misstates the outcome. As noted by the risk manager, the ICF report does not address the issue of drought and cannot be said to have findings that are "diametrically opposed" (see slide entitled "Comments" below). In fact, the most interesting facet of the ICF report is the issues that have not been addressed:

[7] Affidavit of Robert McCullough and Ian Goodman on Behalf of the Pimicikamak Cree Nation, August 11, 2003, pages 9-11.
[8] Update to the Presentation Given to the Standing Committee on Crown Corporations on June 1, 2009, 23 through 34.



It is not clear to what degree Manitoba Hydro understood the risk manager's concerns; CEO Brennan reports that the risk manager "Did not provide assumptions or explain methodology".

The ICF Report

The ICF report was apparently repurposed from an earlier study with much of the data only current through 2007.[9] The critical issues raised by the risk manager – drought risk and computer technology – are addressed briefly. Hydrology risk is discussed on pages 59 through 62. The computer modeling capability is addressed on pages 118 through 120.

The only real discussion of the risk of drought occurs on page 108:

> ICF considers Manitoba Hydro's quantification of risk exposure to drought to be reasonable. The scenario examined by the Corporation is reasonably stressful. It is almost equivalent to adopting a 95 percent confidence interval. In any given year there is only a 3.1 percent chance of the onset of a drought equal to or worse than the five year drought examined; 62 a 95 percent confidence interval would have a 2.5 percent chance of occurring or being worse.
> 62 The available historical record indicates that in any given year, assuming that each future year has the same chance of being the first year, there is a 3/97, or 3.1 per-

[9] Independent Review of Manitoba Hydro Export Power Sales and Associated Risks, September 11, 2009. See pages 2, 3, 4, 14, 21, 29, 32, 33, 34, 36, 37, 38, 39, 40, 41, 42, 43, 45, 48, 49, 51, 57, 61, 94 and 132 for charts and calculations using outdated data. It should be noted that the outdated analysis is largely irrelevant. The initial chapters were apparently written for an external audience, since Manitoba Hydro management is familiar with its own rates and operations.

> cent chance that the year will be the first of a drought of five years duration or longer. This is discussed further in Section 9.3.

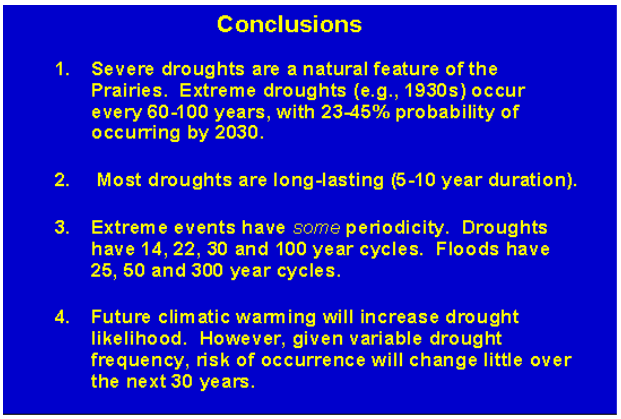
Section 9.3 conducts no additional analysis, but does include the reassuring assumption that:

> An event outside the historic record has a low and unknown probability, but a potentially large impact. In the risk management literature such an event, for example, the possibility of a worse drought than in the historical record, is referred to as a "Black Swan" event. This is based on a book entitled "The Black Swan: The Impact of the Highly Improbable" by Nassim Taleb. The probability of seeing a black swan was considered in Europe as zero until Australia was settled, since all swans seen to that point were white. But a black swan was discovered in Australia. Given the adverse consequences of an event worse than has ever been recorded or seen, Manitoba Hydro is wise to consider Black Swan events and plan for it as it has done.[10]

Translated into ordinary language, the paragraph above says (my quotes): "Droughts are infrequent since, if we eliminate consideration of the major short-lived drought of 2004, we only have had three in the past 97 years. Moreover, this is the only data available."

A careful reading of the ICF report provides no evidence that ICF was supplied with the risk manager's conclusions or more current hydrological research than the "rule of thumb" analysis above. In reality, Manitoba Hydro has sponsored extensive research into additional data in the past decade – some of which is publicly available in the academic literature – and hydrological research has vastly progressed beyond simply counting the droughts over the past century.[11] For example, one project with very different conclusions than those of ICF with which Manitoba Hydro was involved concluded:[12]

[10] Ibid., page 102.
[11] See for example, Manitoba Hydro's 2007 presentation on the status of hydrological research in Manitoba at http://www.drinetwork.ca/Presentations/WS2/partner_girling and teklemariam.pdf.
[12] The Past, Present and Future of Prairie Droughts: How Bad is Bad?, Peter Leavitt, Gemai Chen, Jim Rusak, Sybille Wunsam, and Brian Cumming, July 17, 2001, page 42.



The ICF report also contains a limited discussion of the computer modeling that sets Manitoba Hydro's reliability standards:

> The corporation also uses this historical hydrological record to limit firm power sales to a level that does not threaten, in a given year, its ability to supply domestic load. This is achieved by basing the firm export sales on its dependable energy net of domestic load, where dependable energy is defined as the Corporation's system energy under the worst recorded water flow conditions with its reservoirs at full supply at the onset of a drought.[13]

The correct terminology for this type of planning is determination of the critical period using the historical record. The critical period is the number of months that elapse between the onset of a drought and the date when reservoirs are drawn down to their minimum operating levels. The critical period criterion sets the dependable firm energy output of the system. Manitoba Hydro uses the critical period planning with one very unusual deviation: it assumes the existence of imports available to sustain firm Manitoba loads during the drought. The industry term for this type of planning is "leaning on your neighbors" and the practice is generally discouraged.

The short section on Manitoba Hydro's computer modeling explains little other than the name of the computer programs used. The significant program for hydroelectric reliability is the Simulation Program for Long-term Analysis of System Hydraulics model pr "SPLASH". ICF's review of SPLASH is quite superficial:

> The SPLASH system is used to forecast output in the long run - for greater than two years, and calculates system performance across the full historical record.[14]

[13] Ibid., page 112.
[14] Ibid., page 119.

In the course of the Wuskwatim consultation we had the opportunity, over great objections, to receive a bare minimum of information on the model. The comments below are based on Manitoba Hydro's brief responses during the consultation.[15]

SPLASH is a relatively simple multi-reservoir model, roughly comparable to similar models used elsewhere in North America written in the 1980s. Modern models using more sophisticated hydroelectric stochastic assumptions are now the norm in the industry. Implementation of SPLASH dates to 1995. The model, written in FORTRAN and C, is small by current standards and would fit handily on a standard notebook computer. Data files would fit easily on an USB flash drive.

During the Wuskwatim consultation we were informed that the model had little in the way of documentation or backcasting capability.[16] The basic algorithm follows standard critical period planning methodology except for the assumption that imports will assure hydroelectric reliability:

> Manitoba Hydro determines its resource requirements utilizing the dependable energy criterion which requires that sufficient energy must be available to meet all firm demand requirements should the lowest flows on record occur at any time In the future. The lowest flow period (critical period) in the Manitoba Hydro system corresponds to the sequence of historical low flows that occurred from approximately August, 1939 to March, 1941. The dependable energy is defined as the maximum energy that the Manitoba Hydro system can produce during the critical period. This energy is derived from water inflow as well as water removed from storage during this period, Any available dependable energy above the total firm demand requirements is called 'surplus dependable energy'.
>
> To calculate the dependable energy of the Manitoba Hydro system, a simulation of system operation is undertaken during the critical flow period. The simulation leading up to the critical flow period is required to store as much water in reservoirs as possible such that the storage in controlled reservoirs (i.e., Lake Winnipeg and Cedar Lake) is at a maximum. This requirement is created by proportionately increasing the load demand throughout the period to the point of firmness becoming critical. Figures 3 and 4 illustrate sample lake level trajectories during the critical period for Lake Winnipeg and Cedar Lake, respectively. The last month in which it is possible to maintain full reservoirs is determined to be the beginning of the critical drought period. This usually corresponds to flows of August, 1939 as shown in Fig-

[15] Utilization of the SPLASH Computer Simulation Model to Represent Water Regime in the Manitoba Hydro System, Manitoba Hydro Power Supply Business Unit, March 21, 2005.

[16] Computer models often depart from realistic results due to numerical computation problems. To protect against reporting nonsensical results, it is critical that the model be run with historical data to check whether the modeled historical results match actual observed data. This is called "backcasting."

> ure 3. The load growth in the years corresponding to flow years 1938, 1939 and 1940 is the factor that determines the pattern of the trajectory.[17]

Manitoba Hydro's treatment of imports as drought insurance has been reported in many places. The SPLASH documentation states:

> The modeling of import contracts assumes that as much energy as possible is imported during the low cost off-peak period before utilizing any high cost on-peak period imports. During a critical flow period, nearly 100% of the import contract energy may be utilized to ensure system firmness.[18]

This assumption is problematical, since Manitoba Hydro's imports might well be compromised by reliability problems elsewhere. A case in point is the difficulty Pacific Northwest utilities had receiving contracted-for imports during the California energy crisis of 2000-2001. Litigation concerning such issues is still underway at the U.S. Federal Energy Regulatory Commission and in U.S. courts.

Overall, the risk manager's criticism of the ICF report appears to be correct – little attention was spent on the hydrology and the computer programs.

The Use of Imports to Firm Inflows

In principle, reliability is determined on a plant-by-plant and system-by-system basis. Relying upon neighboring systems to ensure hydroelectric reliability tends to be discouraged, since the ability to force a neighboring system to deliver energy during a crisis might be difficult. To the degree that a "hell or high water" guarantee exists, it is worthy of very detailed documentation.

In 2000 and 2001 a variety of abuses took place at the California Independent System Operator, the model from which the Midwest Independent System Operator is derived. In the years since, criminal convictions, fines, and settlements have recaptured some of the losses that neighboring systems experienced during this period. Litigation for additional recovery continues to this day.

A major issue for neighboring systems was the interruption of legal contracts by the California ISO as well as a series of orders from the U.S. Secretary of Energy allowing the California ISO to capture energy from neighboring states. I note that this is an area of risk that Manitoba Hydro and ICF have chosen to ignore.

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[17] Ibid., page 9.
[18] Ibid., page 8.

Hydroelectric Flows and Paleoclimatological Data

Manitoba Hydro calculates the level of "dependable firm" as approximately 2,400 aMW in recent resource plans.[19] This is approximately 70% of average flows and less than 10% higher than the minimum flows experienced in 1940 and 2003. Firm sales above this level have significant financial risk, since any interruptions to wholesale customers would expose Manitoba Hydro to substantial penalties. It is reasonable to be concerned with whether the historical data collected over the past 100 years gives an accurate picture of the hydroelectric risks faced by the utility. If droughts are deeper or more frequent than the recent data might indicate, Manitoba Hydro should recognize the additional risk.

Much of North America was explored by trappers whose only interest in rivers was as a means of transportation. Actual data on many of the continent's major rivers was only collected after 1900. In many cases, especially in Canada, data sets are often even shorter. Extension of the data sets is a priority when planners are required to evaluate whether such a short historical record adequately represents the true probabilities of future droughts.

An extensive effort has recently been placed in the collection of climatological data, frequently tree ring data, which will allow planners to extend hydroelectric data before 1900. While Manitoba Hydro has frequently stated that it is investigating such data, it has not released any results of its investigations.[20]

Calibrating such data to actual inflows is challenging. Wet years generally mean more robust tree growth. Wider tree rings mean more precipitation, yet the problem is complicated by the vast size of the drainage basins. As mentioned above, Manitoba Hydro's system encompasses an area stretching from the Rockies in Alberta to Minnesota in the south and Ontario in the east.

[19] The 2007/08 Power Resource Plan, Table A.1.
[20] See, for example, Manitoba Hydro discovery responses at http://www.hydro.mb.ca/regulatory_affairs/wuskwatim/presentations/nfaat/nfaat_pcn.pdf, http://www.hydro.mb.ca/regulatory_affairs/wuskwatim/presentations/nfaat/nfaat_cnf.pdf, http://www.hydro.mb.ca/regulatory_affairs/electric/gra_08_09/information_requests/PUB.pdf, and a variety of Manitoba Hydro presentations at the Drought Research Initiative at http://www.drinetwork.ca.

A recent study by Scott St. George et al in the *Journal of Climate* provides sufficient geographic scale to begin to offer some insights.[21] The authors extend precipitation data to 1528 for the Eastern Rockies and three other locations (Saskatchewan, Southern Manitoba, and Northwestern Ontario) with a reasonable correlation to observed precipitation data.

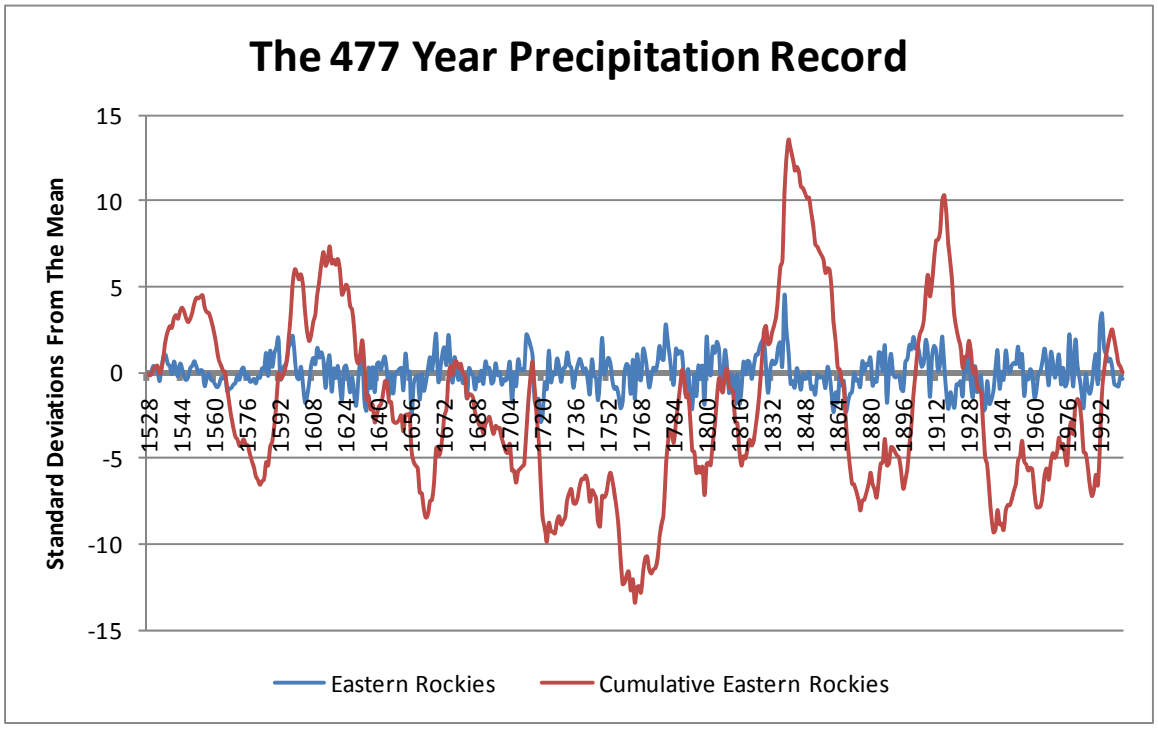
There is only a moderate correlation between the paleoclimatological data and the inflow data Manitoba Hydro has reported to the Manitoba Public Utilities Board. This is hardly surprising, since the relationship between precipitation and inflows is neither perfect, nor is the relationship likely to have remained stable over time. For example, water use in Manitoba, Saskatchewan, and Alberta was very different prior to 1900.

Our analysis below uses the Eastern Rockies series, normalized to a mean of zero, as a proxy for inflows. There needs to be an extensive effort to determine whether the paleoclimatological data has been developed sufficiently to reflect streamflows. Clearly, our use of the data is purely illustrative, and we apologize to Dr. St. George and his colleagues for using their data to illustrate how it may be used in the future when more extensive studies have been completed.

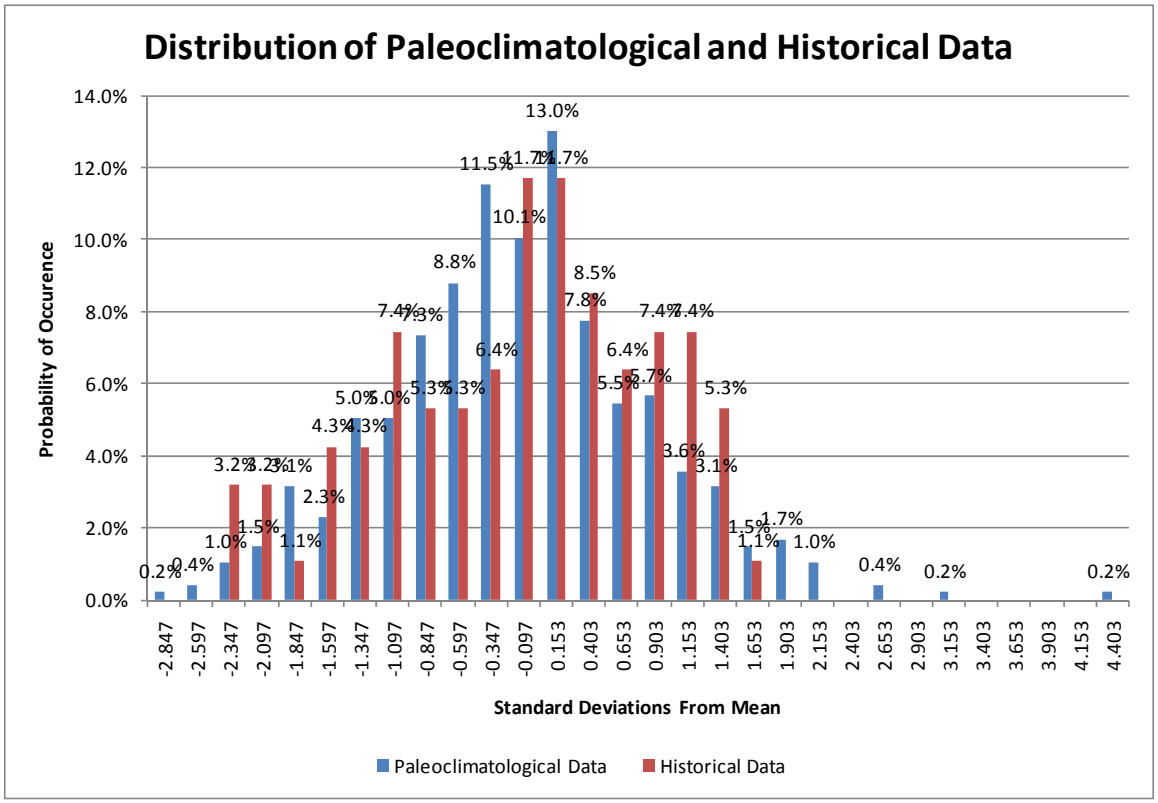
Planning the System Using 477 Years of Record

The period from 1528 through 2004 provides 477 sequential water years. Of these, only the data since 1912 can be compared with actual inflow data. The following chart shows yearly precipitation in terms of standard deviations from the mean plus cumulative values over time:

[21] The Tree-Ring Record of Drought on the Canadian Prairies, Scott St. George, David M. Meko, Martin-Philippe Girardin, Glen M. Macdonald, Erik Nelsen, Greg T. Pederson, D Avid J. Sauchyn, Jacques C. Tardif, and Emma Watson, *Journal of Climate,* February 1, 2009.



The paleoclimatological record indicates that the worst sustained drought occurred during a fifty-year period from 1716 through 1766. Viewed in terms of a cumulative deviation from the mean, this drought was twice as extensive as the drought in the late 1930s. The distribution of data from the paleoclimatological record largely mirrors the historical data, but, as we would expect, the more extensive data has higher maximum and minimum flows than we have observed since 1912:



While use of this data in a critical period analysis is certainly speculative, it is worth noting that flows in 1720 and 1721 would produce critical period dependable firm values approximately 400 aMW lower than the 2,400 aMW from Manitoba Hydro's power resource plans.

This finding clearly corroborates the risk manager's concerns and is also appropriate for further public discussion.

Conclusions

The risk manager's concerns appear consistent with the limited data available for Manitoba Hydro. In addition, the risk manager's criticisms of the ICF report are accurate. A thorough public review of Manitoba Hydro's methodology and data is overdue.

Attachment A: Brennan Presentation

Details on Contractor's Allegations

Purpose of Consulting Contract

- Post 2004 - new export market
  - Greatly increased export opportunities
  - New and growing risks: price, credit, transmission
- 2005 – MH identified need for outside advice
  - Assist in the understanding, measurement and reporting of overall export earnings at risk - i.e. beyond just drought which we fully understand
  - Examine feasibility of a single comprehensive measure
  - Assist in development of policy and procedures to manage

Risk Contractor

- Contract Awarded early April 2006
- By September 2006
  - Limited progress
  - Reached impasse over proprietary information
  - Contractor refused to take direction
  - Advised Contractor the contract would not be extended
- The December 4th, 2006 report
  - Ignored original assignment
  - Dealt entirely with matters out of scope – did not deliver what was asked for
  - Provided no assumptions or details on method
  - Contractor recommended purchase of millions of dollars of software, and offered to satisfy this requirement with software in which the firm had a personal interest

Comments

- Contractor claimed staff support for their opinions.
- Staff were invited to come forward if they agreed with contractor, without fear of retribution. None did so.
- Reviewed by Power Supply and also by Risk Management group, they found no basis for the findings.

Comments

- Attempts to arrange a meeting with the contractor to review concerns were met with repeated demands for consulting fees.
- Contractor was paid to review Manitoba Hydro's analysis of the December 2006 report.
- Contractor was paid to prepare for January 2008 meeting with senior management.

Comments

- Full day meeting between the contractor and the President/senior management to hear the explanation of the allegations.
- Attempts by Manitoba Hydro to verify allegations.
  - Contractor invited to explain findings.
  - Did not provide assumptions or explain methodology.
- Review of conclusions by ICF Consulting . ICF findings diametrically opposed to contractor's allegations.

Further Reviews

- Board and senior management of Manitoba Hydro want an definitive answer to the question, "Is there any merit to any of the allegations?"
  - At this point, MH has reliable, independent advice that the most significant allegations are not correct – ICF Report.
  - Manitoba Hydro has requested that KPMG conduct a detailed review. The Terms of Reference have been reviewed by the PUB and Crown Corporations Council.

Manitoba Hydro

Allegation of Blackouts

- No compromise on security of supply to Manitoba Hydro customers
- Only serious transmission problems could lead to blackouts – built-in redundancy
- Manitoba customers have priority over all exports
- Firm export contracts actually increase reliability
  - Enable new interconnections to an enormous pool of generators
  - Exports can be curtailed if necessary
  - Import capability

Manitoba Hydro

Allegations on 2003/04 Drought

- 3rd worst drought since 1912
- Hydraulic generation 40% below normal
- Net revenue down over $600 million simply due to low water
  - $436 million loss on the year
- External Reviews
  - 2004 PUB
    - *"The Board is satisfied that MH took reasonable steps to mitigate its loss during the drought"*
  - 2005 Independent Consultant Report (Risk Advisory)
    - *"The Company did an outstanding job in managing the drought"*

Manitoba Hydro

Corporate Management Conclusion

- Lowest electricity rates in North America
- Highest customer satisfaction in Canada
- System reliability among highest on Continent
- Greatly improved safety record
- Strongest financial position ever
- Highest aboriginal representation in industry
- Best energy conservation program in Canada
- Environmental responsibility record is second to none

Manitoba Hydro

- Hydro Management and Boards have always wanted to make changes to improve Manitoba Hydro

Manitoba Hydro

Questions and Discussion

Manitoba Hydro

Attachment B: Risk Manager Letter (uncorrected, undated)

Dear Editor
There have been some who think that the notion of bankruptcy and blackouts is incredulous for a Utility like Hydro.
In response, I would like to point out some facts. Even though Hydro is a Crown Corporation the word "bailouts" does not interchange with "bankruptcy" unless you are following the US model of companies like AIG.
To be specific, the risk reports that were sent to the CEO, looked at the numbing $18BN spend out and proposed new debt, as the Utility embarks on an ambitious spending spree to which includes sizable export contracts to the US. The multi-year drought analysis on this "future generation" build, including in-service dates, and contract dates, showed exposure to the Province of $7BN.
Obviously, this is more than the retained earnings, and under any definition, would wipe out the entire "solvency" of the Utility.
This $7BN was great cause for concern, and no responsible risk assessment would include that the public health of the company as being fine. Subsequent consultants hired to supposedly "look at the problems" were specifically given a scope that not looked at any of the new generation build out, Conowapa, or bi-pole III!
The risk number of $7BN was also being "withheld" from the PUB. The CFO also agreed and signed off on the number.
It was being replaced with a rubber-stamp consultant report, who's analysis blatantly omitted any look at the bi-pole III and exposure to the Province of the future generation system. (see Page 21 of the publicly disclosed summary)
It did not include Government "bailouts" as a word to replace "bankruptcy".
The comments about "blackouts" being impossible are also not based on fact.
To keep the lights on in the Province, Hydro's computers rely on a complex formulae, which operates not just the reservoirs like Lake Winnipeg and Cedar Lake, but of course looks at the import tie-lines from the US, and Hydro's ability to the run expensive gas units.
While it may be shocking to learn these problems exist, what was uncovered was there were "systemic and massive" computer system flaws - with obsolete computers maintaining the calculations. Massive system errors and inadequate mathematics were found in the power calculation of "blackouts" or reliability conditions – which could lead to faulty results in keeping the lights on.
This could be seen as the equivalent of using rotary phones in the age of wifi and Bluetooth technology.
Manitoba Hydro now operates in US deregulation and the Midwest ISO. The rules of the game have changed. If it was learned, that the safety methods for keeping the lights on were programmed only by 1 or 2 persons (with source code and changes known to only them), on an outdated computer which hasn't been changed since the 80's, I think you too would be worried.
The ICF consultants were told not to look at the computers.
Don't be took quick to assume the seriousness of the problem. In California ISO, no-one thought these things were possible – till they happened.
Further, the Province, needs new generation like Wuskwatim, as quickly as possible to

maintain enough energy to meet domestic demands (in other words to keep the lights on). Beyond 2018 the shortage of generation in the Province is so extreme, that the new bipole III is in essence a "lifeline" to the Province.

Without it – you can't stay afloat. That line, is not just a political talking point, it is an absolute necessity to keep the lights on in the Province. So who cares if it's built west side or east side? Without it – the lights cannot stay on in a multi-year Drought. You will face blackouts. So build it now, and build it quickly.

The risk analysis, shows catastrophic consequence, even from "slight delays" to bi-pole III going in service. Any setbacks, or any problems, would simply mean there is not enough generation to meet demand.

Just one delay in having that line come into the service is also of catastrophic risk to the Province.

In addition, the shortage of generation is so severe, that if the Export Power Marketing contracts (these US contracts being a huge contributor to Provincial risk and the bankruptcy problem) aren't signed, the Province will need to go against its carbonfriendly mantra and expedite the building of new gas turbines – dirty-old polluting thermal units – just to keep the lights on. These would have to be scheduled for 2019. (Say bye-bye to low Rates!)

These are facts. This information was also not being sent to the Public Utilities Board. The Province will need to build, potentially new gas turbines to keep the lights on and rates would sky-rocket!

Even in 2011 and 2012 there are resource problems and a multi-year Drought would threaten keeping the lights on. The same issue the PUB was raising.

Problems had accumulated in hundreds of pages of well-documented reports over 3-4 years. The CFO even paid me a bonus in Jan 2008 for my hard work and contribution!

During the fall of 2008, when I uncovered the computer-system errors in blackouts, I was so worried, I emailed the CEO directly.

The "Hydraulic Computer Report" which would have itemized line-by-line errors in massive computer system failures, which could cause the lights to go out, was sabotaged 24 hours after it was notified to the CEO, that such problems exist.

The report was midway.

Computer failures of other exorbitant magnitude have also contributed to the billion dollars losses and the misforecasting of blackouts. Financial forecasts being incorrect also impact the Nisichawayasihk Cree Nation and profit sharing. I was told not to put any more in writing.

I realize now, that what the Crown Corporation of Manitoba Hydro wants, is just a "rubber stamp" consultant who will echo the publicity statements.

And I am proud to have been fired, for having the courage to stand up for the truth and not just "yes" management to cover up such serious problems.

Contrary to the comments from the CEO, if I cared about money, I would have just "yessed" management to keep my job – but instead, ethics and integrity was more important. That's called honesty ... not greed.

And that's what WhistleBlower Protection laws are for…

Very sincerely,

A very ethical risk consultant in NY