KPMG

cutting through complexity™

KPMG Direct Evidence

Before the Public Utilities Board of Manitoba

28 February 2011

KPMG's Terms of Reference

KPMG was retained by Manitoba Hydro's Board of Directors to carry out an independent assessment of its risk management practices.

There were 4 primary tasks in the Terms of Reference which in essence are as follows:

- To review existing internal and external reports related to matters of MH's risks as well as the source data for each of the reports
- Provide a conceptual outline to MH for an independent study of these matters
- Conduct the independent study
- Prepare a report summarizing our findings, conclusions and recommendations

Our scope was limited to the hydro-electric operations of MH and related corporate functions.

Conduct of the Work

Initiation

- Mobilization and reading background material commenced on November 18, 2009.
- Our final proposal letter was submitted on November 20 and was executed by MH on November 26.
- Early start to shorten the time necessary to conduct the work.

Process

We undertook a two-phased approach to our work.

- Phase 1
    - Produced the conceptual outline of the in-depth study carried out in Phase 2
    - Designed to get us quickly up to speed on the relevant issues and to identify the key questions to be addressed in Phase 2
    - Assembled and reviewed a variety of background materials
    - Received briefings from a variety of MH personnel
    - Developed a set of analytical tools for our Phase 1 work
    - Used those tools to conduct a variety of analyses
    - Documented the conceptual outline
    - Organized ourselves to be able to begin work immediately on Phase 2 upon acceptance of the Phase 1 work

Phase 1 report was dated December 4, 2009 (slightly more than 2 weeks after commencing our work) and is reproduced as Appendix B in our final report

Conduct of the Work (cont'd)

Process (continued…)

- Phase 2 (team organization)
  - Our Phase 2 work is described in detail in our final report
  - In order to carry out Phase 2 within the tight time constraints and to ensure that the right expertise was being brought to analyze the various types of issues identified in an efficient and effective manner, we organized ourselves into four core teams:
    - Power Risk Management Team – headed by Frank Chen
    - Forecasting Models Teams – headed by Jonathan Erling
    - Power Sales Management Team – headed by Anurag Gupta
    - Risk Governance Team – headed by Craig Fossay
  - These core teams were supported by a Project Management Team (led by Will Lipson), a Due Diligence and Oversight Team, and a Task Execution Team.

Conduct of the Work (cont'd)

Process (continued…)

- Phase 2 (methodology)
  - The various methodologies used in carrying out the work included:
    - Additional interviews of MH staff
    - Additional review of MH documentation and data
    - Conduct of the case studies of other utilities contained in Appendix E
    - Accessing the expertise of two sub-consultants (NERA and CDD Howard) to supplement our expertise in specific technical matters related to contract structure and hydraulic modeling
    - Literature review
    - Analysis of model logic
    - Directed model runs
  - Our Phase 2 report was delivered on April 15, 2010.

Key Conclusions

Our key findings were:

- There is no material risk that MH is facing bankruptcy as a direct consequence of MH's export power sales practices;
- There is no material risk that Manitoba is facing power outages as a direct consequence of MH's export sales practices;
- MH's drought management strategies are prudent in the context of a hydro-based generation system;
- There is no evidence to support an assertion of losses approaching $1 billion in the five years preceding our work, based on our analysis of MH's modeling, export sales contracts and risk management practices;
- MH has prudently utilized a strategy based on entering into long-term contracts and the securing of transmission rights in the development of its system; and
- MH has operated in accordance with its legislative mandate.

Overall, in the context of the nature, size and business model of its hydroelectric power operations, we are satisfied that MH is following sound practices in its use of forecasting models, long-term power sales contracting, risk governance, and power risk management.

MH's Risk Governance Practices

Risk governance addresses independent risk oversight, organization structure, and policy documentation. It specifically examines risk management roles, responsibilities and reporting relationships as well as risk management policies.

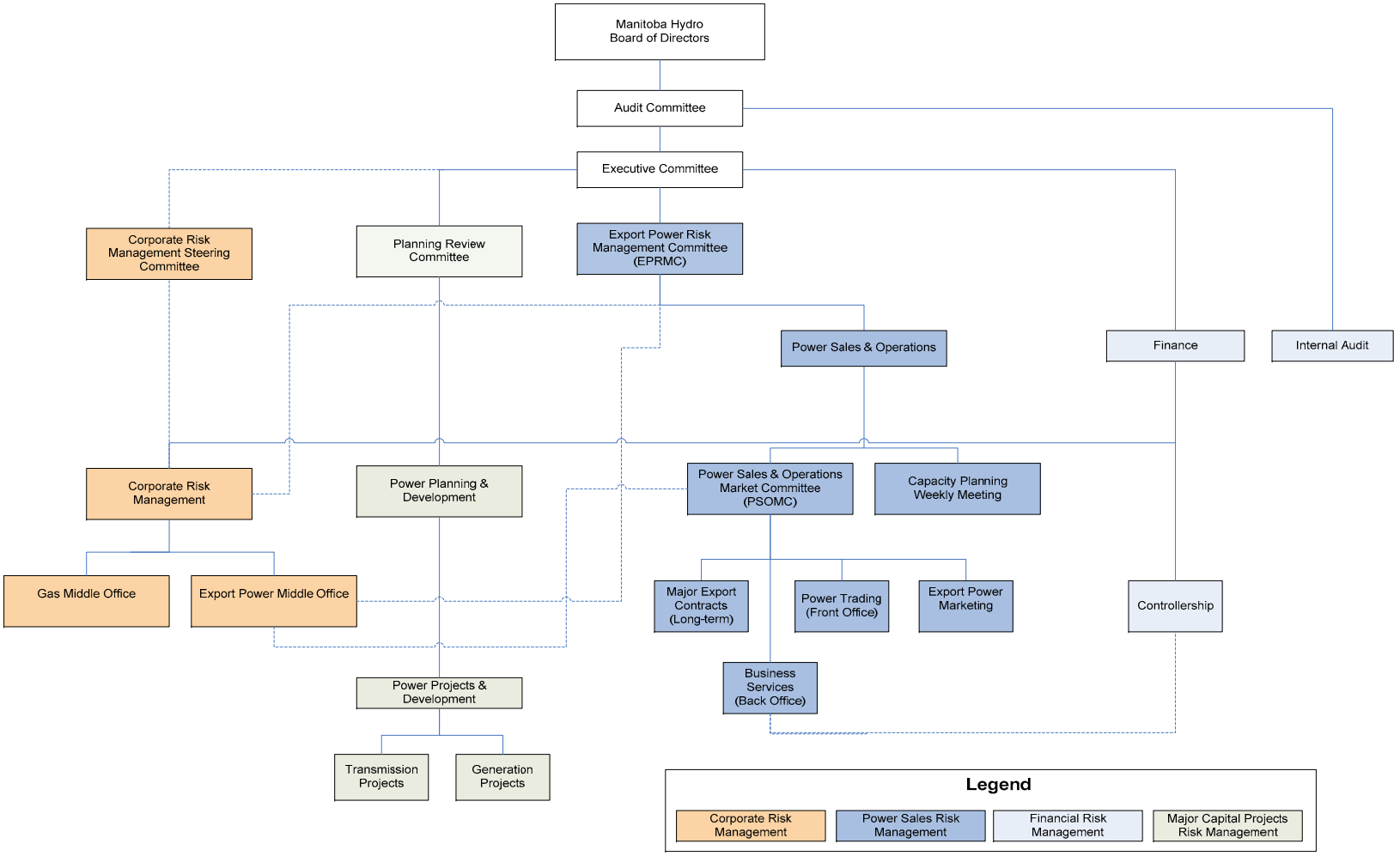
MH's risk governance structure addresses the following four risk management functions:

1) Corporate Risk Management
2) Power Sales Risk Management
3) Financial Risk Management
4) Major Capital Projects Risk Management

Each of these risk management functions is compared to industry leading practices, as well as prevailing peer practices.

MH's Risk Governance Practices (cont'd)

MH Risk Governance Structure



MH's Risk Governance Practices (cont'd)

Corporate risk management refers to MH's enterprise risk management (ERM) program and its approach in identifying, assessing, measuring, mitigating and reporting key risk categories at the corporate entity level.

Key business risks include market, financial, environmental, infrastructure, business operational, reputation, governance / regulatory / legal, aboriginal, alternative technology, and strategic.

MH's corporate risk management function is consistent with leading and prevailing practices as follows:

- Key business risks are assessed across two variables: likelihood and severity of financial/operational loss
- Actions are taken to reduce both the likelihood and severity of key business risks to acceptable levels
- Key business risks are reported to the Corporate Risk Management Steering Committee, the Executive Committee, the Audit Committee and the Manitoba Hydro Electric Board

MH's Risk Governance Practices (cont'd)

Power sales risk management refers to how MH measures, monitors, controls and reports key power transacting risks (i.e., market, credit and operational).

MH's power sales risk management function is consistent with leading and prevailing practices as follows:

- A dedicated, independent risk committee (EPRMC) is responsible for overseeing the management of the energy supply and financial risks resulting from MH's participation in the export power market
- EPRMC is chaired by the CEO with representation from the CFO and other relevant senior management members
- Key responsibilities include:
  - Review and approve criteria associated with electrical energy planning and operations, long-term export marketing initiatives and opportunity export marketing and trading initiatives
  - Review and approve MH's export risk management program, including risk tolerance, risk measurement methodologies, risk management strategies and instruments
  - Review and approve general drought management strategies, including securing energy supplies, hedging objectives and tools
  - Review and approve trading and export market policies and procedures
  - Receive and review reports and audits of market activities and transactions

MH's Risk Governance Practices (cont'd)

Definitions of Export Activities

- Long-term is defined as dependable power transactions with term length greater than one year
- Short-term is defined as power transactions with term length less than or equal to one year
- Day-ahead is defined as power transactions with term length no longer than the next calendar day.
- The PS&O Scope of Authorized Transactions are summarized on the next slide

Key Observation Regarding MH Export Activities

- Day-ahead sales transactions are not exposed to long-term price volatility due to immediate settlement.
- Price volatility does exist in spot markets but poses minimal risk to MH due to its natural long positions (i.e., selling excess supply).
- MH does not undertake speculative trading.
- MH policies stipulate the scope of authorized transactions and the Middle Office is responsible for monitoring PS&O compliance with policies.

MH's Risk Governance Practices (cont'd)

PS&O Scope of Authorized Transactions

Product	Commodity	Counterparty	Purchase	Sale
Real time	Electricity	Bilateral, Market	☒	☒
Day ahead	Electricity	Bilateral, Market	☒	☒
Short-term (x ≤ 1 yr)	Electricity	Bilateral	☐	☒
Long-term (x > 10 yrs)	Electricity	Bilateral	☐	☒
Short-term	Natural gas	Bilateral	☒	☒
Exchange-traded products (futures, options)	Electricity and Natural Gas	Market	☒	☒
Over-the-counter products (forwards, options, swaps)	Electricity and Natural Gas	Bilateral	☒	☒
Financial Transmission Rights	Transmission	Market	☒	☒
Ancillary Services	Electricity and Transmission	Market	☒	☒

MH's Risk Governance Practices (cont'd)

Financial risk management refers to the internal controls over the financial reporting process (i.e., accounting and financial disclosures). MH financial reporting internal controls span across people, processes and technology.

MH's financial risk management function is consistent with leading and prevailing practices as follows:

- Audit Committee oversees financial reporting risks
- Independence between accounting and commercial personnel is maintained
- Standards and protocols for financial performance reporting (e.g., P&L, AP/AR, cash flow) support senior management oversight and strategic planning decisions

MH's Risk Governance Practices (cont'd)

Major capital projects risk management refers to how MH manages inherent risks associated with significant infrastructure projects such as the development of new generation and transmission capacity.

MH's major capital projects risk management function is consistent with leading and prevailing practices as follows:

- A dedicated, independent committee (PRC) is responsible for overseeing major capital project risk and making recommendations to the Executive Committee
- PRC members are appointed by the CEO and are drawn from MH's senior management group
- PRC review key major capital risk matters such as:
  - Forecasts (e.g., economic outlook, energy price outlook, system load forecast and avoided cost)
  - Integrated resource plans (e.g., demand side management plans, supply side management plans, generation development plans, transmission development plans and import/export plans and contracts)

MH's Risk Governance Practices (cont'd)

We understand that MH has undertaken the following initiatives in line with suggestions in our report:

- Market risk specialist has been added to perform analytic function
- MH is in the process of obtaining additional risk software to support risk quantification
- Credit risk officer has been added to middle office
- MH plans to include middle office review in its long-term export contracting process

Power Risk Management

MH demonstrates prudent power risk management practices:

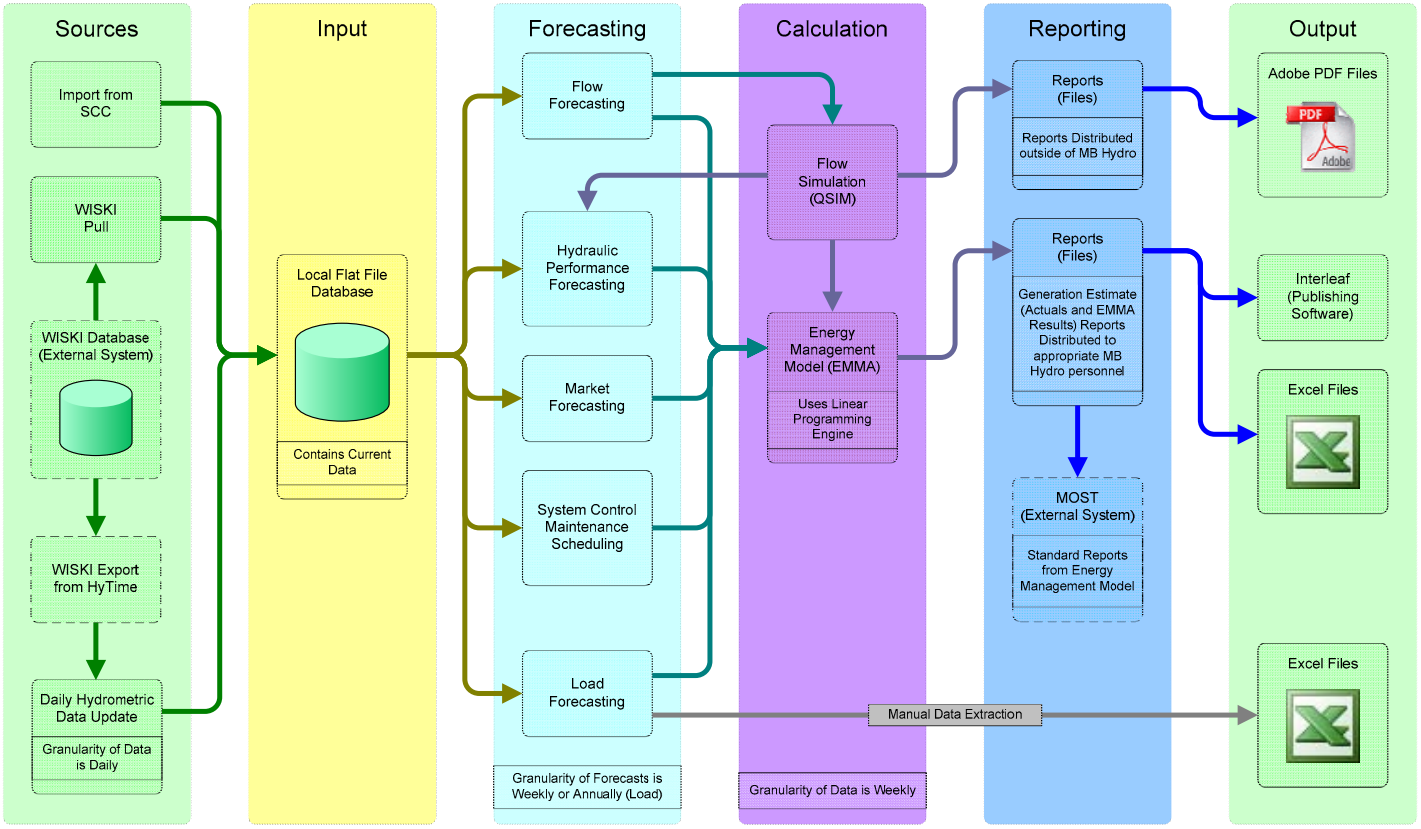
- Extensive corporate oversight and a deliberate internal review process related to major export contracts and term sheets;
- Conservative stress testing assumptions and methodology;
- Transaction processing controls consistent with prevailing practices to mitigate human error and operational risk;
- Compliance and risk monitoring performed by an independent middle office; and
- Comprehensive suite of management and performance reports.

Purpose and Use of HERMES at MH

- HERMES is used for a variety of purposes. These include supporting decisions with respect to:
  - Production scheduling.
  - Financial forecasting.
  - Short-term export sales commitments.
- In short, HERMES is used to plan the operations of the system in the near term.
- HERMES is the model that ensures that MH will have energy resources available to cover its firm load.
- At any point in time, MH ensures that it is in a position to cover its firm demand over the near term even in a scenario in which low water flows re-occur.

Purpose and Use of HERMES at MH (cont'd)

HERMES Application Architecture



Source: Manitoba Hydro

Purpose and Use of SPLASH at MH

- SPLASH is used for planning purposes.
  - It examines the economics of different options for system expansion. It is thus used to establish the business case for new generating plant additions.
  - It provides input for medium to long-term financial forecasting.
- SPLASH is also used for analytical studies: i.e. the value of DSM programs or of additions of new wind generating capacity.
  - Has somewhat less detail than HERMES with respect to the configuration of the system.
  - Also has less detail, or granularity, with respect to demand fluctuations within the year. Monthly peak and off-peak versus 5 time slices within a 1-week or monthly time step.

Key Conclusions Re: System Operation & Planning Models

Pricing and Market Rules

- MH takes significant care in modeling developments over time in external markets (e.g. MISO) and in analyzing the factors that influence the prices for export / import transactions.
- Key factors: natural gas prices, economic downturn, increasing wind generation in the US Midwest, MH export/import activity at MHEB node.
- Actual prices received reflect the timing of transactions.

Water Volumes

- The antecedent forecasting process is a reasonable basis for forecasting future water volumes.

Key Model Parameters

- MH has taken appropriate care and due diligence in setting model parameters (e.g., production coefficients for hydro-electric plants vary over time with water levels and ice conditions).

Key Conclusions Re: System Operation & Planning Models (cont'd)

Lake Water Balances

- MH takes appropriate care in modeling lake water level balances.
    - Small discrepancies were observed in HERMES model runs in the 2007 Generation Estimate Report. These were insignificant in the overall context of MH operations and have been eliminated.

Treatment of Optionality

- The models take into account the ability to use storage in identifying appropriate production schedules.
- Models also take into account the potential value of using water in storage in future periods to generate revenue.
- The models do not provide an explicit estimate of the market "value" of storage, although the value of storage is implicit in the identification of production schedules.
- MH does not calculate the "option value" of storage, which is the value associated with the flexibility to change these schedules. Estimate of market value or of option value would only be necessary if MH was trading access to storage in external markets

Validation of Models

- MH has taken appropriate care and due diligence in developing, operating, and maintaining the models.
- Our analyses considered the approximations in the HERMES models, the use of adjustment factors, and the on-going calibration and updates to both SPLASH and HERMES.

MH's Use of Antecedent Forecasting of Water Flows

- It is reasonable for MH to forecast water flows using the antecedent forecasting methods:
  - Approach is based on a statistically valid relationship between current water flows and flows in the near future.
- An alternative approach is to forecast flows based on actual weather data and on weather forecasts. Precipitation data are then used in a hydrological model that models run-off and the flow of water through the water basin.
- Such an approach would be difficult for MH:
  - Water basin covers a very wide area. Much of the water flowing into the system in the near future is already on the ground.
  - Because of the wide area, evaporation and run-off time are relatively more important than for other systems. These are hard to model.
  - Water basin is sparsely populated, meaning that there is low density with respect to weather monitoring stations.
- Hence, antecedent forecasting is a useful and reliable approach.
- Also, MH takes into account snow-pack and recent and forecast weather conditions in selecting flow scenarios within the antecedent forecasting process.

“Perfect Foresight” in the context of SPLASH

- SPLASH uses linear programming algorithms to identify optimal production schedules assuming that all inputs are known in advance. (e.g. prices, water flows, load).
- In periods of low flow, SPLASH will draw down reservoirs to meet demand because it does not have access to non-firm exports and can rely on future increases in water volumes.
- In practice, MH does not know the ultimate depth or duration of a drought and therefore operates the system more conservatively when low flows occur:
  - MH maintains reservoir levels and draws on imports and fossil-fueled resources (which are high cost) more than SPLASH assumes.
  - May result in higher actual costs in the period of the drought than predicted by SPLASH.
- In general, many of the differences between SPLASH and actual practice simply reflect the shifting of costs across time periods:
  - The practice of keeping reservoirs higher means that MH enters future periods with a higher amount of energy in storage.
  - Thus, relative to SPLASH prediction, costs in future periods will be lower.

“Perfect Foresight” in the context of SPLASH (cont’d)

- Most of the financial losses associated with a drought are inevitable:
  - A drought means that the expected amount of hydroelectric energy is not available.
  - The shortfall will ultimately result in some combination of fewer exports, additional imports and/or fossil-fuel purchases.
- Differences in storage decisions will result mostly in a shift in when these costs appear.
- There are, however, a number of differences between the results of SPLASH and actual operations that are not just the shifting of costs across time periods:
  - Ability to schedule non-firm imports reduces the need for MH to rely on expensive thermal generation.
  - Keeping water levels higher will result in greater risk of spill in the future, assuming water flows return to normal. This has an offsetting impact relative to the point above.
  - Hard to know which of these two “real” impacts will be greater.
  - Also, import and input fuel prices may differ across time periods, and this could result in differences in either direction.

Validation of HERMES and SPLASH Models

HERMES

- HERMES is used to support production scheduling and, as such, is operated on a frequent basis.
- Parameters within the model are calibrated on an ongoing basis to reflect actual system conditions and performance. These calibrations are extensive.
- Accordingly, we find that model components are appropriately validated.

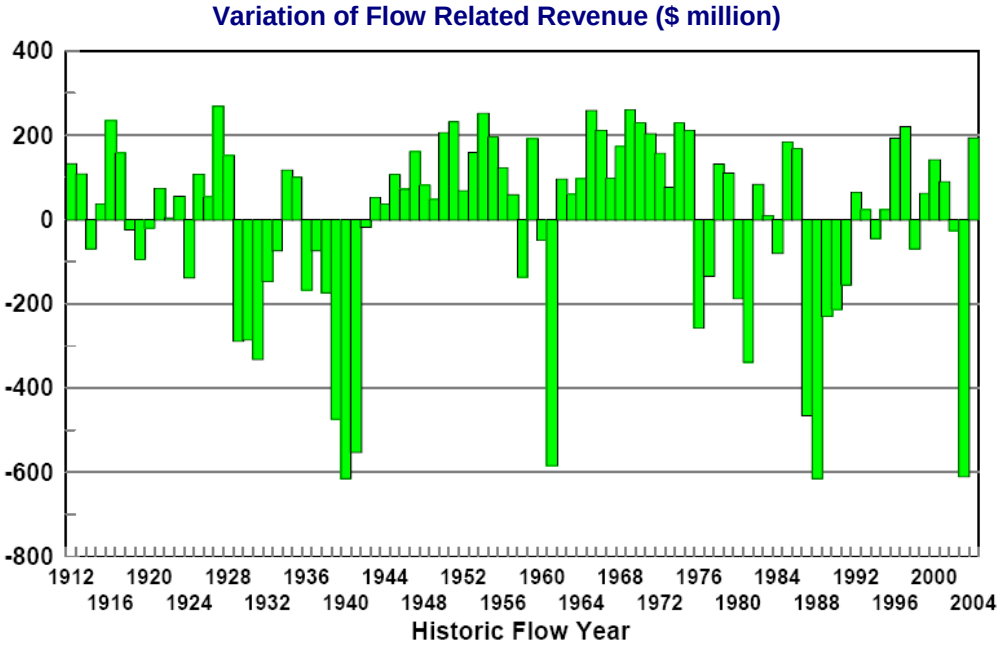
SPLASH

- SPLASH is more difficult to validate overall, since it is used to forecast performance in the medium to longer-term.
- SPLASH operators do not have the benefit of immediate feedback in the same way as do the operators of HERMES.
- Nevertheless, SPLASH personnel develop inputs to the model based on actual system performance:
    - They develop price-quantity relationships for export transactions from real price data.
    - System parameters are developed that are consistent with those embedded in HERMES.
- These provide comfort that SPLASH is a good representation of actual system performance.

Dependable Energy

- Dependable Energy is the amount of energy that will be available in a low-flow year.
- In addition to output from hydro-electric facilities, it includes imports available under firm contract, purchases from wind farms under long-term contract, and output from Manitoba Hydro fossil units.
- Dependable Energy is the key planning metric because the MH system is energy, rather than capacity, constrained.
- Dependable Energy is significant to the planning process because it defines the amount of firm load that MH Hydro can reliably serve.
- Subtracting projected domestic load from the amount of Dependable Energy provides an estimate of the amount of energy that can be sold out of province through firm export contracts.

Dependable Energy (cont'd)



Notes:

•The calculations for the graph above assume current generation capability and a single base case for other parameters.

•The years 1937 to 1941 are the worst five years of drought in MH's historical water record.

Source: Manitoba Hydro

Use of 1937-42 Drought for Determining Dependable Energy

MH's use of this drought as the basis for determining dependable energy is appropriate.

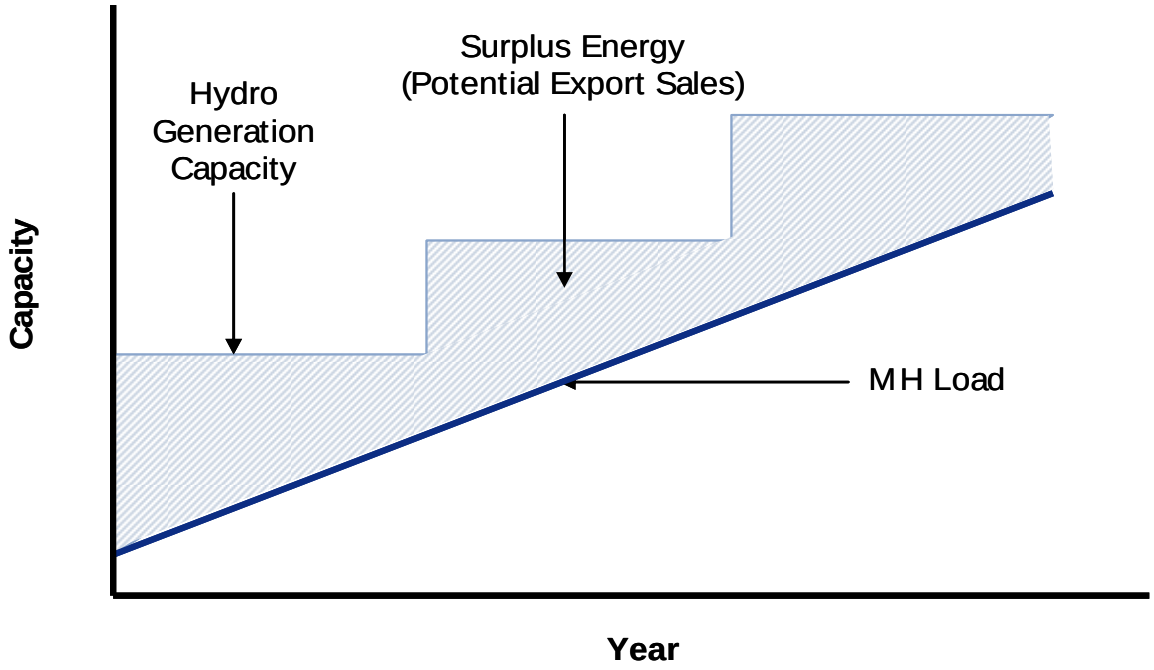
- The appropriate approach to determining Dependable Energy depends on risk tolerance.
- Having a more stringent definition of Dependable Energy would, in effect, result in more short-term exports and likely, lower revenues, on average.
    - Expected value would be lower, although the approach would provide a lower shortfall from expected results in the event of a drought.

Long-Term Fixed Price Contracts for Export Power Sales

Overview

- Capacity is added in ‘lumps’
- Domestic load grows at a more or less steady rate, year over year
- Thus, it can be many years before domestic load catches up to the extra energy generated by the added capacity

Manitoba Hydro Generation Energy vs. Load



Long-Term Fixed Price Contracts for Export Power Sales (cont'd)

Overview, contd…

- MH thus has to decide how to sell the extra energy; sales of extra energy can be used to partly finance the cost of the new plants

- Spot – key issue/risk is volatile prices thus volatile revenue; difficult to secure long term financing; other risks include "missed opportunity regret" risk, sales volume risk, credit risk and FX risk

- Short/Long term – key issue/risk is potentially lower pricing than spot at times but more stable revenue stream can facilitate securing long term financing; other risks include "sellers regret" risk, sales volume risk, credit risk, foreign exchange risk and potentially amplified drought risk

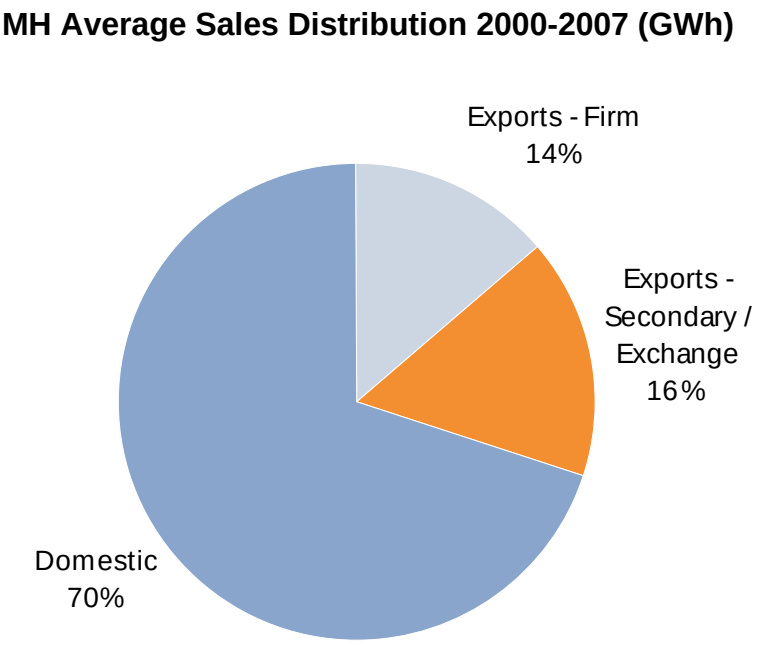
- Expansion of cross border Transmission with the US, currently a transmission capacity constraint, is another important objective for entering into Long-Term Contracts ("LTC's").
- MH's counterparties will be more willing to invest in new transmission build if they are assured of a LTC.
- KPMG looked at pricing of LTC's, structuring of LTC's and risk capital reserves

Long-Term Fixed Price Contracts for Export Power Sales (cont'd)

MH's rationale for entering into fixed price long-term sales commitments:

- Risk Mitigation
  - Stability and matching of cash flows
  - Diversification
  - Foreign exchange risk hedge
- Securing Access to Firm Transmission
- Lower Rates for Manitoba Ratepayers

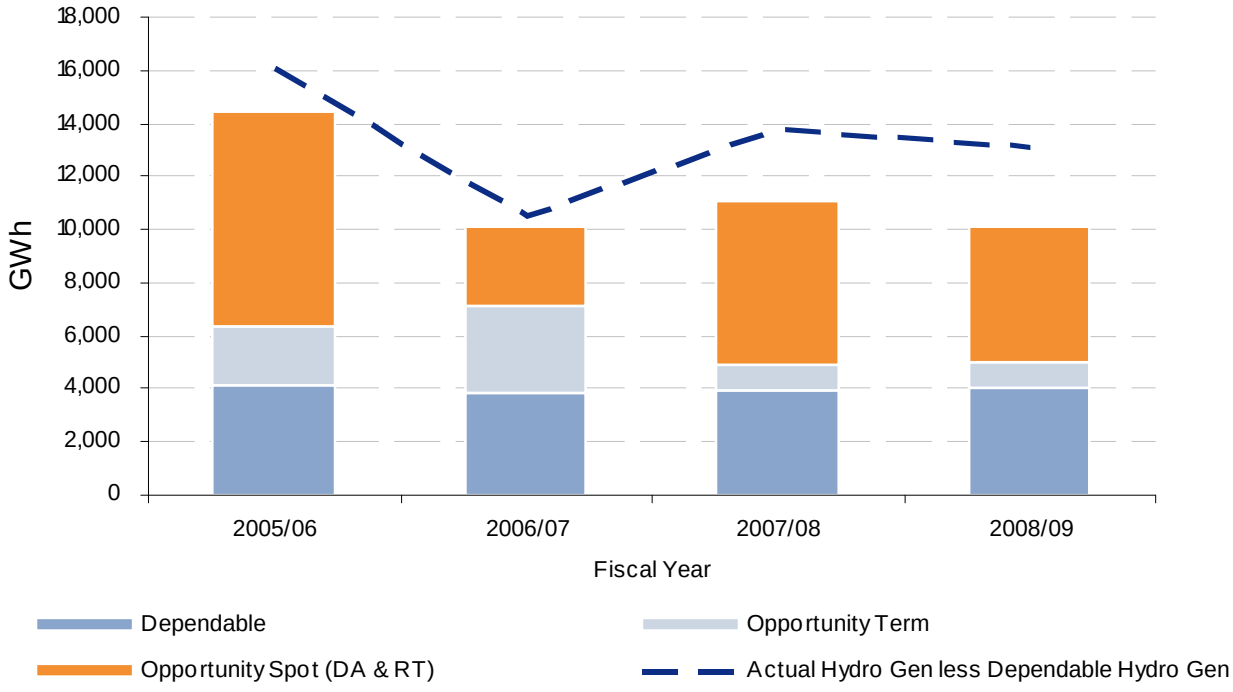
Long-Term Fixed Price Contracts for Export Power Sales (cont'd)



Source: Statistics Canada, 2000-2007 Annual Electric Power Generation, Transmission and Distribution Reports.

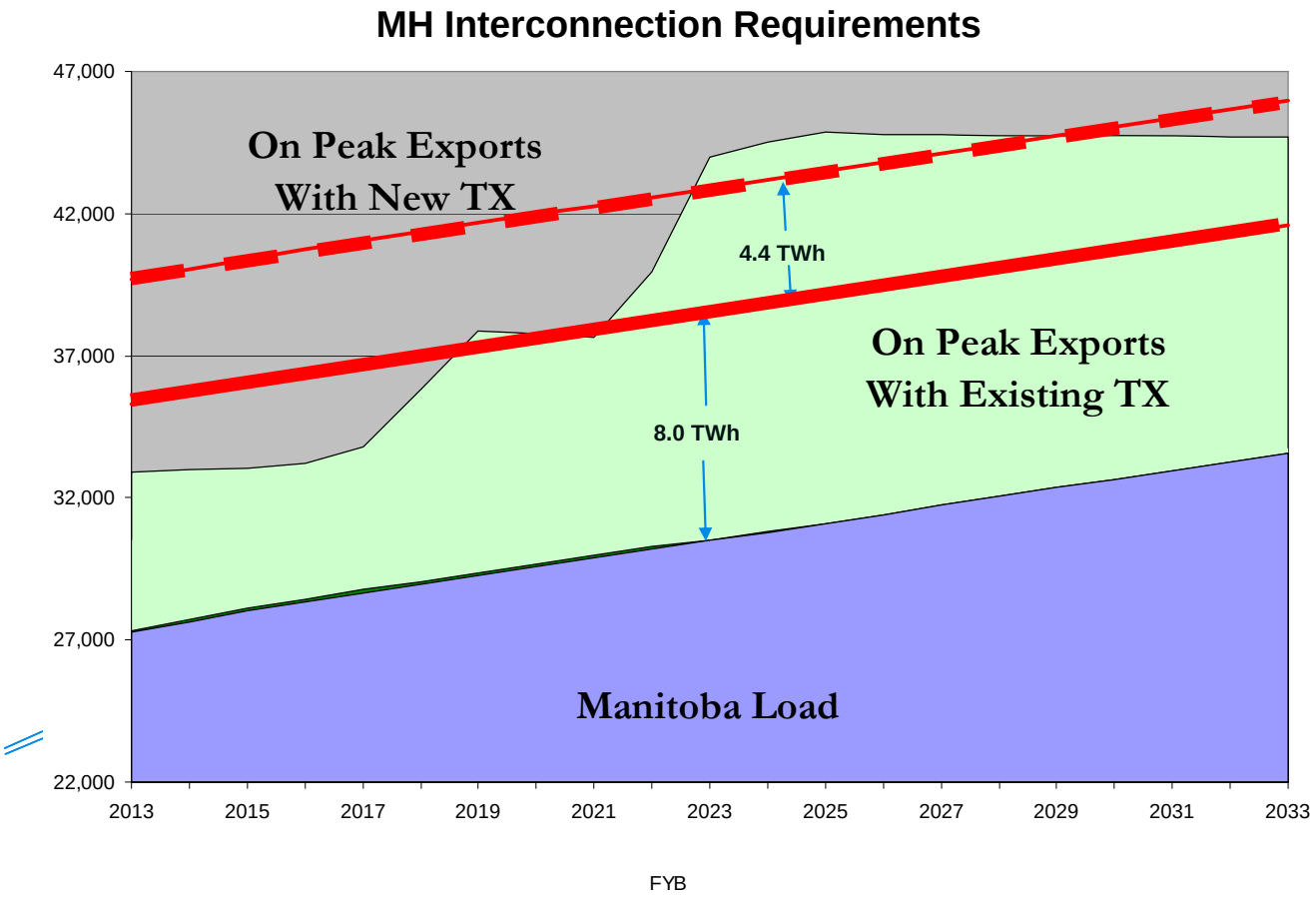
Long-Term Fixed Price Contracts for Export Power Sales (cont'd)

Breakdown of Export Sales



Source: derived from MH data

Long-Term Fixed Price Contracts for Export Power Sales (cont'd)



Source: Manitoba Hydro

Long-Term Fixed Price Contracts for Export Power Sales (cont'd)

Methodology for Pricing Firm Power Sales

- Prices in long-term contracts are a matter of negotiation between the parties, and must be acceptable to both parties for a deal to be done.
- In the course of negotiating these contracts, Manitoba Hydro develops reference prices based on two methodologies; avoided cost analysis and use of forecasts purchased from consultants.

- Developing these two price estimates provides Manitoba Hydro with an indication of the potential range of a contract's price.

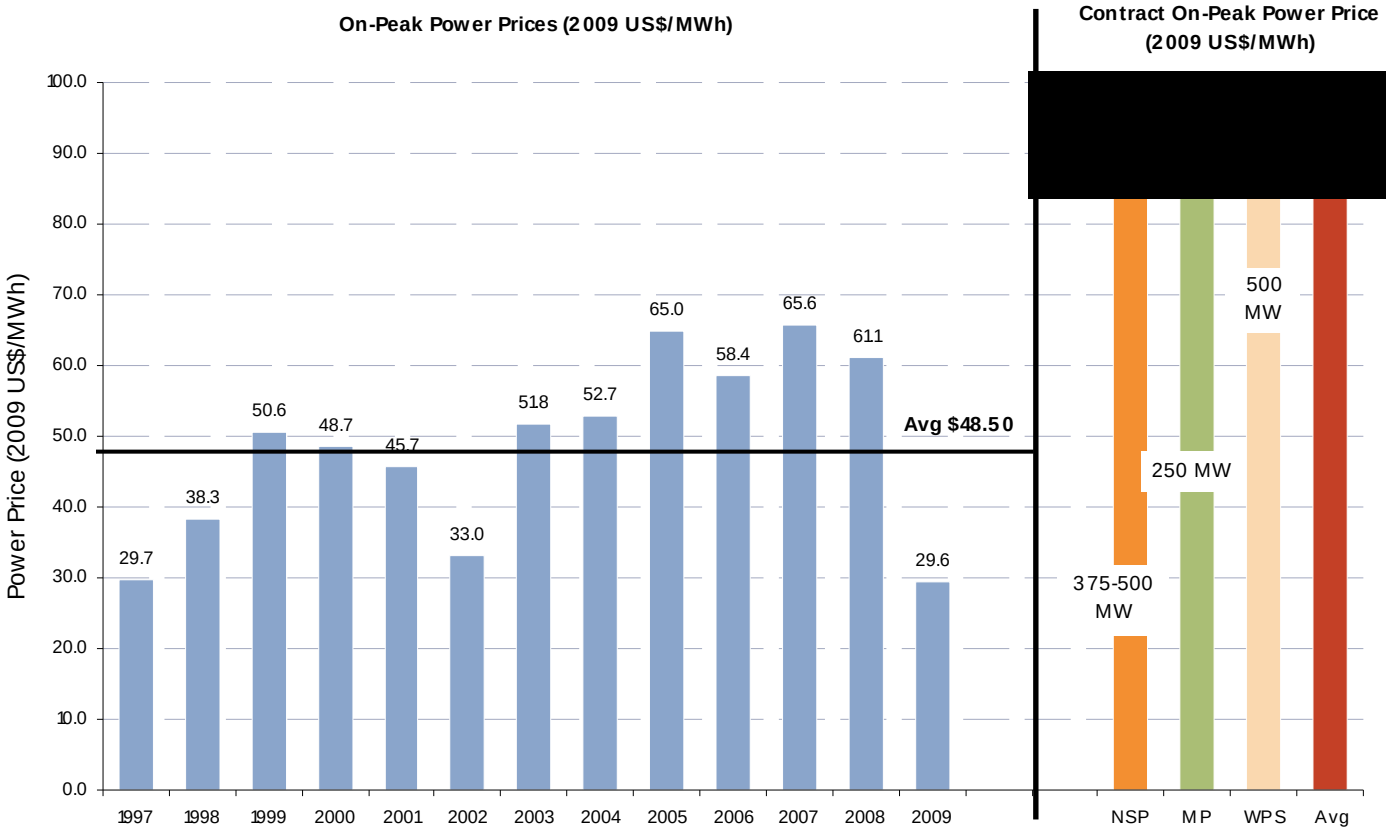
- Based on this information and leveraging the considerable industry experience of the key Manitoba Hydro personnel involved with the negotiations, a mutually agreeable price is set in the term sheets for new long-term contracts.
  - Based on our analysis of this pricing process, Manitoba Hydro has an appropriate methodology for arriving at the sales price in its long-term contracts.

- As mentioned previously, the pricing methodology explicitly incorporates relevant market pricing forecasts and, further, includes a premium.

- LTC's mitigate Manitoba Hydro's market risk through diversification of its export sales mix, and mitigate its drought risk because of both the returns generated by the contracts and the creation of the transmission capacity.

Long-Term Fixed Price Contracts for Export Power Sales (cont'd)

Comparison of Contract Prices with Historical MAPP/MISO On-peak Spot Power Prices



Source: 1997-2004 ICF Independent Review of Manitoba Hydro Export Power Sales and Associated Risks (2009 09 11); 2005-2009 MHEB RT Monthly Average Prices.

Long-Term Fixed Price Contracts for Export Power Sales (cont'd)

Long-Term Contract Structure

- As with prices, contractual terms in long-term agreements are a matter of negotiation between the parties, and must be acceptable to both parties for a deal to be done.
- Optimal risk sharing in a contractual arrangement dictates that risk should be allocated to the party that is best able to manage that risk. In this context, many of the potential novel terms that could be considered in a long-term firm sales contract between Manitoba Hydro and a counterparty involve shifting a particular risk to the counterparty.
    - In many cases, however, Manitoba Hydro would generally be in a better position to assess and/or manage the risk than the counterparty, and would therefore generally be better off in the long run if it retained the risk (e.g., by being compensated for retaining the risk or avoiding the costs associated with transferring the risk).
- Overall, we found no basis to conclude that Manitoba Hydro had sub-optimized its contractual provisions.
    - We are satisfied with the methodology used by Manitoba Hydro in arriving at the sales prices in its long- term contracts.

Drought Risk Analysis

- To determine the preferred development sequence, we understand that MH compares the economics of various development sequences.
- Analysis is done by examining differences in the net present value (NPV) under the different sequences.
- MH's preferred development sequence is described in their development plans in the 2009/10 Power Resource Plan (PRP).
    - The 2009/10 PRP establishes that the preferred option (development sequence) to meet projected Manitoba load is to build both Keeyask (in 2018) and Conawapa (in 2022/23), and enter into new export contracts with Wisconsin Public Service ("WPS") and Minnesota Power ("MP") that bring with them additional US transmission interconnection capabilities; "**Sale Scenario**"
- We asked for additional stress tests of MH's preferred expansion plans (i.e., the Sale Scenario) incorporating various drought scenarios and market price scenarios.
- We also asked for corresponding stress tests to be conducted for an alternative expansion plan that did not include new long-term contracts; "**No Sale Scenario**".
- An example of an alternative development sequence in MH's 2009/10 PRP is one that excludes the export sales related to the WPS and MP contracts, and thus the planned new US transmission interconnections.
- This alternative development sequence requires Conawapa to be advanced by a year to 2021/22 and includes a combined cycle combustion turbine in 2033/34. The construction of Keeyask is no longer in this sequence.

Drought Risk Analysis (cont'd)

- We analyzed the results of the various drought scenarios we had requested to address the question: ***Does the Sale Scenario still provide a positive value over the No Sale Scenario to MH, even in the event that a drought event occurs sometime during the period of the sale?***
- This analysis thus addresses the concern that long-term contracts could be uneconomic under certain scenarios, even if they do not result in undue risk of financial stress.
- We asked for 36 scenarios to be run under "low water flow" conditions and "high water flow" conditions lasting for 5-year, 10-year, and 15-year periods commencing in 2011, 2013, 2019 and 2025; and each in combination with low, expected and high export power prices and natural gas prices; e.g.,

Incremental NPV of Sale Scenario vs. No Sale Scenario under Low Flow Conditions commencing in:	**5-year Period**		
	Low Prices	Expected Prices	High Prices
Commencing in 2011	$	$	$
Commencing in 2013	$	$	$
Commencing in 2019	$	$	$
Commencing in 2025	$	$	$

Drought Risk Analysis (cont'd)

- **Under all scenarios, Sale NPV's remained significantly greater than No Sale NPV's**
  - This means that drought events do not impair the economics of MH's preferred development sequence and associated proposed long term contracts
- This result is not unexpected.
- The new generating facilities and transmission assets associated with the contracts are long-lived assets that will generate positive returns for many years into the future.
  - A drought, even one starting at the beginning of a hydroelectric plant's life, will likely not offset the long-run benefits of the additional generating capacity.

Drought Risk Analysis (cont'd)

- We also examined the potential impact of the proposed long-term contracts on the drought risk faced by MH, examined from the perspectives of impacts on Net Income and Retained Earnings
- On the "Sale Scenario" and the "No Sale Scenario", we requested MH to run drought flows (a reoccurrence of the worst five years of drought on record), commencing in 2013, 2019 and 2025 in combination with low, expected and high export power and natural gas prices
- A comparison of the financial impacts of drought conditions under a Sale Scenario and a No Sale Scenario allows us to isolate the financial risks associated with the development of additional generation (Keeyask and Conawapa), new US transmission interconnection, and the related long –term export contracts with WPS and MP.
- A summary of the results, in terms of **impact on Net Income** and **Retained Earnings at the end of the drought** is:
  - For droughts commencing in 2013, the differences between the Sale Scenario and a No Sale Scenario are nominal
  - For droughts commencing in 2019 or later, Net Income falls by a larger amount (though from a higher base) in the Sale Scenario as compared to the No Sale Scenario
  - However **importantly**, for droughts commencing in 2019 or later, Retained Earnings at the end of the drought are **higher** in the Sale Scenario as compared to the No Sale Scenario
- Thus, as compared to the No Sale Scenario, the Sale Scenario provides greater Retained Earnings to MH and thus provides MH **with improved ability** to withstand the impact of a five year drought