Manitoba Hydro Needs For and Alternatives To (NFAT) Review of Manitoba Hydro's Preferred Development Plan Presentation by Dr. Garland Laliberte on behalf of the Bipole III Coalition

Precis

This presentation questions Manitoba Hydro's load forecast upon which its preferred development plan is absolutely reliant. It analyzes recent trends in both energy and peak load that reveal a flattening of growth in Manitoba load that began in 2005/06, well before the 2008 recession, trends which continue until today. It points to a similar flattening of demand in the region into which Manitoba seeks to export electricity and beyond. It proposes replacing Manitoba Hydro's load forecast with a moderate forecast that is more reflective of these trends. It considers the risk of proceeding with the preferred development plan in terms of rates that escalate even more rapidly than projected. It even raises the spectre of the utility's solvency coming into question, should the preferred development plan proceed. It proposes a pause in the implementation of any plan, a pause which would allow the utility to take advantage of the extended timeline that a more moderate load forecast would permit.

This presentation relies on a reading of the body of Manitoba Hydro's (Hydro's) August 2013 submission to the Manitoba Public Utility Board and a detailed review of many of the nearly 5,000 pages of appendices.

In the opinion of the presenter, the analysis described in the submission has much to commend it. The use of incremental net present value to compare Hydro's preferred development plan and 14 alternative plans to a reference plan represents a unique and creative approach to informing an important decision that will affect not only Hydro's future but also that of Manitoba's ratepayers and the general economy.

A number of key risk factors that can affect the choice of a development plan have appropriately been included in the analysis[1]. One of these factors is categorized as "energy prices" which includes electricity prices, natural gas prices, load growth in Hydro's export market, provincial, national and US carbon policy and other US environmental policies.

[1] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 10, Table 10.15, Economic Evaluation – Uncertainty Matrix, pages 61-62.

Another, categorized as "capital cost", includes the estimated costs of the various generation and provincial transmission facilities included in the plans considered in the analysis. A third key risk factor, categorized as "economic indicators", includes exchange rate, inflation rates, long-term Canadian interest rates and the provincial debt guarantee fee. A number of specific risk factors are also considered, including drought, climate change, Manitoba load and demand side management and in-service delay of generation plants. And, finally, a number of other risk factors that are not assigned to any specific category are considered.

Assumptions are required to judge the relative impact of most of these factors in system planning. Some have greater impact than others. The energy prices, capital cost and economic indicators categories were subjected to economic uncertainty analyses in Chapter 10 of the submission.

While one could take issue with many of the assumptions made in assessing the impact of the various individual parameters within each of these categories, there is one variable that stands out above the rest as the most important planning parameter—Manitoba load and demand side management. Misjudge Manitoba load and demand side management and the rest doesn't matter. More specifically, misjudge Manitoba load and the entire analysis breaks down because the analysis is carried out on a scenario that is far from the likely reality.

Before proceeding further, it is necessary to take a moment to consider terminology related to load. Counter-intuitively, the glossary[2] in the 2013 Electrical Load Forecast states that "Net Firm Energy" and "Net Total Peak" are the same as "Gross Firm Energy" and "Gross Total Peak", except that the former exclude "Station Service". It also explains that "Station Service" is the net energy used by power plants to generate power and service their own load. Elsewhere,[3] "Station Service" is shown to be a relatively minor factor, typically contributing less than 0.5% to load and so, for the purposes of this presentation, it will be assumed to be negligible. It is noteworthy that this assumption is validated later in that no allowance is made for "Station Service" in the tabulation in Hydro's analysis of supply and demand in Appendix 4.2.

The glossary[4] also explains that, starting with Hydro's 2012 forecast, "only the 'Gross' is presented". Notwithstanding this explanation, Hydro's analysis is inconsistent in its discussion of load. For example, the energy forecast is referred to as "Gross Firm Energy" in the 2013 Electric Load Forecast[5] and the

---

[2] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, page 69.
[3] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, Figure 17 and Table 26, page 35.
[4] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, page 69.
[5] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, Figure 18 and Table 29, 2013 Electric Load Forecast, page 38.

peak load is referred to as “Gross Total Peak” in the 2013 Electric Load Forecast[6]. But the same parameters are referred to as “Base Load” under Manitoba Domestic Load in Hydro’s analysis of supply and demand tables in Appendix 4.2[7].

While on the subject of terminology, “Manitoba Net Load”, whether in reference to the energy forecast or peak load, is calculated in Hydro’s analysis[8] as “Base Load” less reductions due to “Demand Side Management (DSM)”. This calculation is done, of course, only for forecast values for which estimates of DSM are used.

Historic values of energy and peak load are considered to reflect the benefit of historic DSM. The terms “Gross Firm Energy” and “Gross Total Peak” as well “Base Load” and “Manitoba Net Load” will be used in this presentation in the same way as they are in Hydro’s analysis.

Let’s examine Hydro’s base load forecast for Manitoba. Figure 1 presents historic data and Hydro’s forecast for Gross Firm Energy, in GW.h[9]. Hydro’s analysis states the following:

Weather adjusted Gross Firm Energy has grown 334 GW.h (1.6%) per year for the past 20 years and 266 GW.h (1.2%) per year during the past 10 years reflecting the recent economic downturn. This historical growth includes the effect of past Demand Side Management (DSM) initiatives. Energy is forecast to grow 420 GW.h (1.6%) per year for the next 10 years and 413 GW.h (1.5%) per year for the next 20 years.[10]

A forecast for annual growth in Gross Firm Energy of 413 GW.h (1.5%) over the next 20 years represents a significant escalation compared to the annual growth of 334 GW.h for the past 20 years, even allowing for the fact that the annual growth for the past 20 years has been reduced by DSM activities.

Noting Hydro’s analysis of Gross Firm Energy acknowledged a slowing down of growth in the past 10 years prompted a closer look at the entire 20-year historic period. Examination of Figure 1 reveals that the historic period is better represented by three different periods, a slow-growth period from 1993/94 until 2000/01, a rapid-growth period from 2001/02 until 2004/05 and a slower period from 2005/06 until 2012/13.

---

[6] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, Figure 19 and Table 31, 2013 Electric Load Forecast, page 39.
[7] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix 4.2, Manitoba Hydro Supply and Demand Tables, pages 119-173.
[8] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix 4.2, Manitoba Hydro Supply and Demand Tables, pages 119-173.
[9] All data points, both historic and forecast, were taken from Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, Table 29, 2013 Electric Load Forecast, page 37. They are displayed graphically in Figure 18 of Appendix D. The exact forecast values can be obtained from Appendix 4.2, Manitoba Hydro Supply and Demand Tables, pages 119-173.
[10] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, page 37.

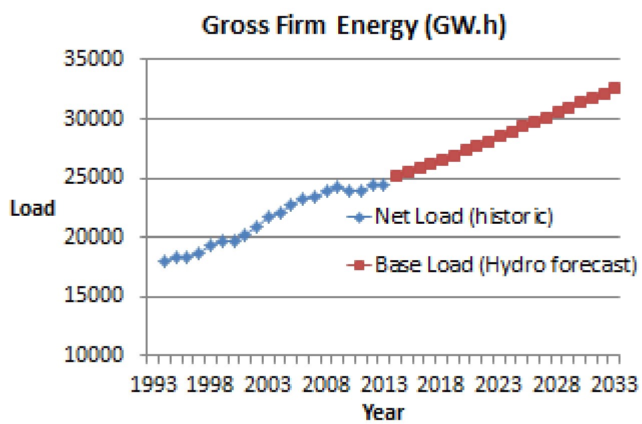

Figure 1: Historic and forecast values of Gross Firm Energy required for serving Hydro's Manitoba customers on the Integrated System.

Accordingly, a linear regression analysis was run for Gross Firm Energy (net load) for the recent eight-year period from 2005/06 until 2012/13. Good practice with linear regression analysis requires at least five points to ensure that the analysis is representative of the correlation between the variables. With eight points, the current analysis easily satisfies that criterion.

The linear regression analysis was conducted, revealing that the annual growth rate in Gross Firm Energy during this recent historic period was 189 GW.h, much less than the 266 GW.h annual increase reported in the Hydro analysis for the past 10 years, but that is because the first two years of that 10-year period were really part of the previous rapid-growth period.

An annual increase of 189 GW.h represents a 0.77% annual increase based on the value of Gross Firm Energy yielded by this analysis for 2012/13. If this regression were projected forward, the forecast value for 2032/33 would be 29,140 GW.h. Figure 2 presents the results of the analysis graphically.

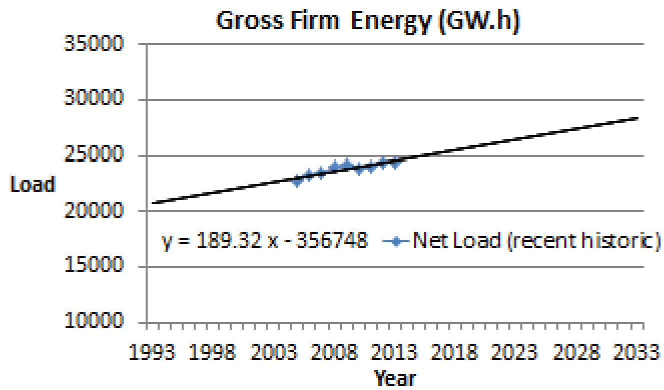

Figure 2. Gross Firm Energy for a recent nine-year period beginning in 2005-06.

Continuing the examination of Hydro's base load forecast for Manitoba, Figure 3 presents historic data and Hydro's forecast for Gross Total Peak, in MW. Hydro's analysis states the following:

Weather adjusted Gross Total Peak has grown from 3,547 MW in 1993/94 to 4,559 MW in 2012/13 at an average growth of 44 MW or 1.2% per year. It is forecast to grow to 5,959 MW at 76 MW (1.5%) per year by 2032/33.[11]

Although this statement doesn't square with the tabulated figures[12] for either the weather-adjusted or the unadjusted historic figures for Gross Total Peak, it does draw attention to the significant escalation assumed for the average annual increase in the Gross Total Peak for the forecast period (76 MW or 1.5%) compared to the average annual increase for the historic period (44 MW or 1.2%).

As with Gross Firm Energy, a slowing down of growth in Gross Total Peak in the past 10 years prompted a closer look at the entire 20-year historic period. Examination of Figure 3 reveals a period of slower growth from 2005/06 until 2012/13. Accordingly, a linear regression analysis was run for Gross Total Peak (net load) for the recent eight-year period from 2005/06 until 2012/13. With eight points, the analysis would have easily satisfied the criterion for good practice with linear regression analysis requiring at least five points to ensure that the analysis is representative of the correlation between the

[11] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, page 39.

[12] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, Table 31, 2013 Electric Load Forecast, page 39.

variables. However, because the 23 December 2013 peak of 4,547 MW provided a year-to-date peak value for 2013/14, that data point was added to the eight points already available.

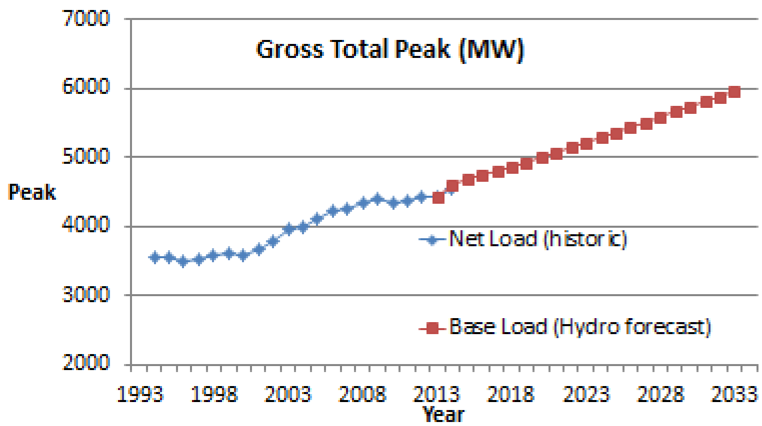

Figure 3. Historic and forecast values of Gross Total Peak required for serving Hydro's Manitoba customers on the Integrated System.

The linear regression analysis was conducted using these nine values, revealing that the annual growth rate in Gross Total Peak during this recent historic period was between 32 and 33 MW, this being less than the 44-MW annual increase reported in the Hydro analysis for the past 20 years. An annual increase of 32.5-MW represents a 0.73% annual increase based on the value of Gross Total Peak yielded by this analysis for 2012/13. If this regression were projected forward, the forecast value for 2032/33 would be 5,085 MW. Figure 4 presents the results of the analysis graphically.

A stronger case can be made for using annual increases projected from the recent eight-to-nine year historic record than from the entire 20-year record during which there was a variety of influences that are no longer operating.

This perspective will be discussed in fuller detail later, when the assumptions that underpin Hydro's forecasts will also be examined. But first, Figures 5 and 6 fill in the early historic record and present extrapolations for the forecast period using annual increases for the recent historic period for Gross Firm Load and Gross Total Peak, respectively.

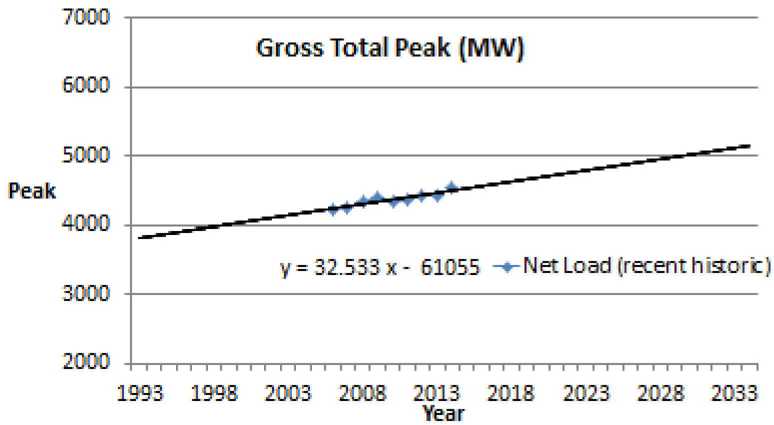

Figure 4. Gross Total Peak for a recent nine-year period beginning in 2005-06.

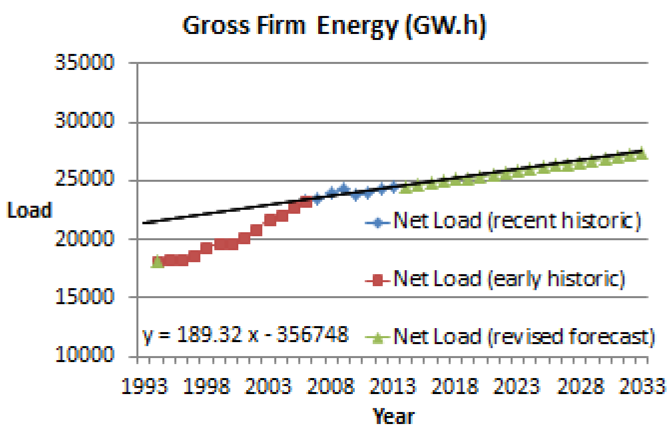

Figure 5. Gross Firm Energy for the 20-year historic period with a 20-year forecast based on an extrapolation of the growth rate for the most recent eight-year historic period (identified as the Revised Forecast).

Probably not surprisingly (because they derive from the same recent historic record but nevertheless noteworthy because they are calculated from two different data sets), the analyses for the annual growth in Gross Firm Energy and Gross Total Peak produce similar values: 0.77% and 0.73%. Henceforward in this presentation, these annual increases will be referred to nominally as 0.75%.

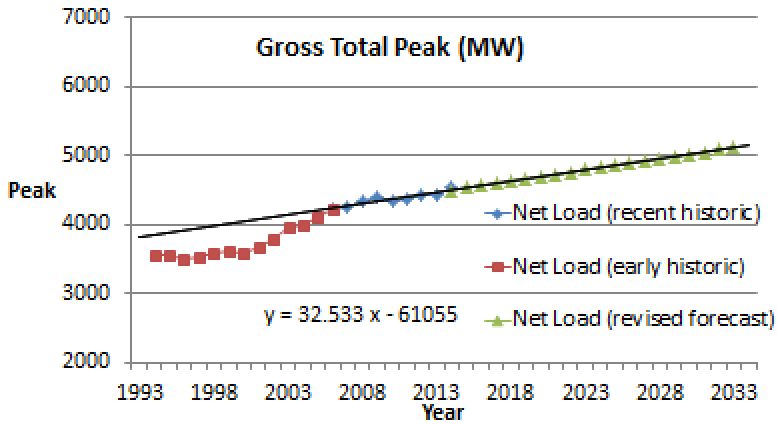

Figure 6. Gross Total Peak for the 20-year historic period with a 20-year forecast based on an extrapolation of the growth rate for the most recent nine-year historic period (identified as the Revised Forecast).

How do these projections compare with Hydro's forecasts? The following quotes are taken directly from Hydro's 2013 Electric Load Forecast.

Energy is forecast to grow 420 GW.h (1.6%) per year for the next 10 years and 413 GW.h (1.5%) per year for the next 20 years.[13]

Weather adjusted Gross Total Peak has grown from 3,547 MW in 1993/94 to 4,559 MW in 2012/13 at an average growth of 44 MW or 1.2% per year. It is forecast to grow to 5,959 MW at 76 MW (1.5%) per year by 2032/33.[14]

At 1.5% or greater, the annual growth rates forecast by Hydro for both Gross Firm Load and Gross Total Peak are at least double the 0.75% growth rates for net load that can be projected from a recent eight-or-nine-year historic period (the Revised Forecast in Figures 5 and 6). For comparison, Figures 7 and 8 add Hydro's forecasts to the Revised Forecast for Gross Firm Energy and Gross Total Peak as presented in Figures 5 and 6, respectively.

[13] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, page 37.
[14] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, page 39.

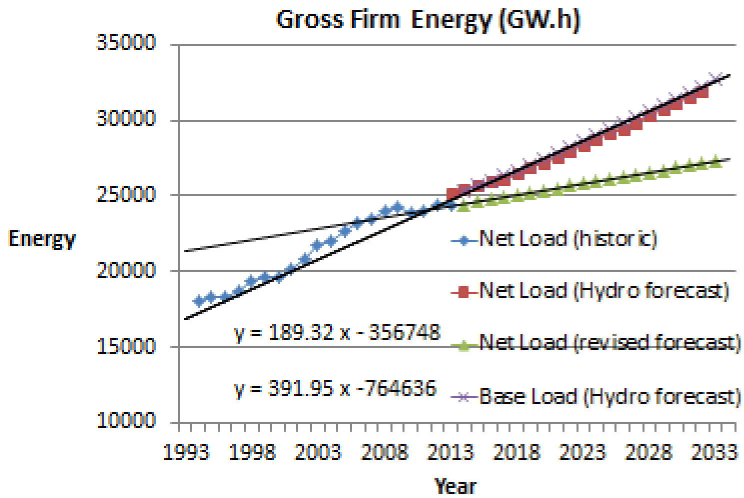

Figure 7: Historic and forecast values of Gross Firm Energy required for serving Hydro's Manitoba customers on the Integrated System, including both Hydro's Forecast and the Revised Forecast.

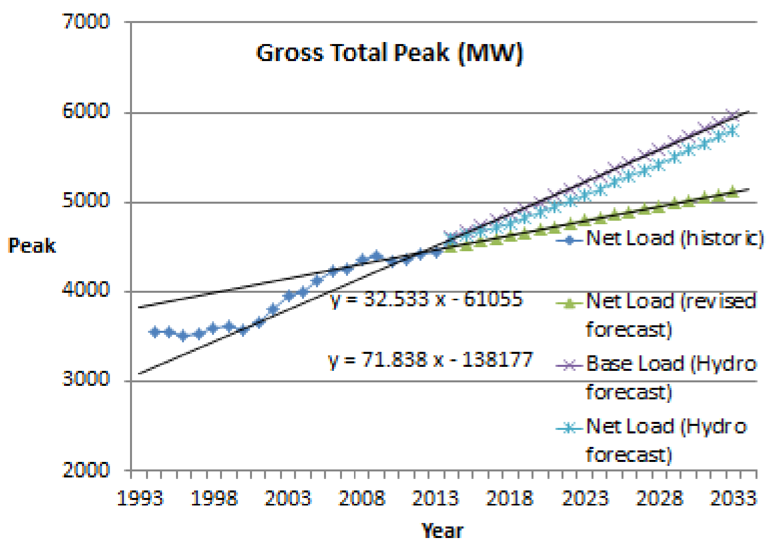

Figure 8: Historic and forecast values of Gross Total Peak required for serving Hydro's Manitoba customers on the Integrated System, including both Hydro's ad Forecast and the Revised Forecast.

It is recognized that projections using historic net load that already reflect the benefits of historic Demand Supply Management (DSM) will more logically produce forecasts of net load in the Revised Forecast. Stated otherwise, the Revised Forecast is a more logical projection of load that is already reduced by the projected benefits of future DSM programming.

Accordingly, projections of future DSM taken from Manitoba Hydro Demand and Supply Tables[15] were used to reduce Hydro's Forecast of Gross Firm Energy and Gross Total Peak. The forecast values are presented in Figures 7 and 8 demonstrate the relative contribution of DSM to net load values.

Let's examine what the utilities are forecasting in the northern states region into which Hydro is seeking to further expand its exports. Consider the following quotes:

State of Wisconsin: Strategic Energy Assessment 2018 compiled by PSC of Wisconsin issued June 2012

A*fter an increase of almost 2.5 percent from 2010 to 2011, which appears to largely be the result of a hotter-than-normal summer in 2011, utilities estimate increases in non-coincident peaks to be between approximately 0.5 and 1.3 percent. Non-coincident peak refers to the sum of two or more peak loads on a system that do not occur in the same time interval. Peak demand is much more responsive to weather than total energy use is, and it is not clear at this time that the recession will have the same percentage impact on peak demand that it has on total energy sales. In the last SEA, docket 5-ES-105, Wisconsin utilities forecasted approximately 1% growth per year through 2016. The current SEA shows similar forecasts for peak demand growth.*[16]

and

Northern States Power: Resource Plan update filed with MPUC on 1 December 2011:

We now expect 0.7% annual demand growth and 0.5% annual energy growth over the Resource Plan horizon, down from 1.1% and 0.9%, respectively, included in our initial filing. The magnitude of the reduced forecast is such that it prompts us to reconsider some components of our Five Year Action Plan. Thus, this update presents our new sales forecast and provides the Commission with commendations on some revisions to our plans going forward.[17]

and

Minnesota Power: Resource Plan filed with MPUC on 1 March 2013:

In the longer term, energy sales are expected to generally track previous forecasts, growing at an annual growth rate of 0.6% in the forecast period (2012-2026). Minnesota Power expects to continue to be a winter-peaking utility, and anticipates that seasonal peaks will grow at 0.6% per year in the forecast horizon. Historical (2004-2011) average annual rates of growth in energy sales and peak demand averaged 0.9% and 0.5% respectively.

---

[15] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix 4.2, Manitoba Hydro Supply and Demand Tables, pages 119-173.

[16] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 6, The Window of Opportunity, page 8.

[17] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 6, The Window of Opportunity, page 8.

These neighbouring jurisdictions and utilities into which Hydro is seeking to further expand its exports are forecasting annual growth in energy ranging from 0.5% to 1.0% and in peak load ranging from 0.6% to 1.0%. Clearly, at 0.75%, the Revised Forecast is well within the ranges of load growth being forecast in neighbouring jurisdictions.

What is the situation in the entire Midcontinent Independent System Operator (MISO) region? According to the 2012 Long-Term Reliability Assessment conducted by the North American Electrical Reliability Council, the compound annual load-growth rate over the next ten years is forecast to be 0.95% as recorded in the following paragraph.[18]

MISO has estimated a compound annual load-growth rate of 0.95% over the next 10 years in its 2012 Transmission Expansion Plan. A gradual regional load growth expectation is generally consistent with the expectations of Manitoba Hydro's major export customers.

All of these forecasts are radically less than Hydro's Forecast.

Let's now examine how Hydro arrived at a forecast load growth rate that is double the load growth rate of recent years and, also, evidently out of line with the expectations of neighbouring jurisdictions.

Appropriately, Hydro's load forecast utilizes projections of General Consumer Sales by consumer sector over the forecast period. The largest sector, General Service Mass Market (small and large commercial and industrial consumers) accounts for 39.3% of energy sold. The second largest sector is Residential Basic which accounts for 33.6% of energy sold. The next largest sector is the General Service Top Consumer sector which accounts for 25.9% of energy sold. A residual of miscellaneous consumer categories - such as roadway lighting - accounts for the remaining 1.2% of energy sold.

General Consumer energy sold is projected by Hydro to grow over the next 20-years at an annual rate of 1.5% for the General Service Mass Market sector, 1.4% for the Residential Basic sector and, although in a highly variable way, 2.0% for the General Service Top Consumer sector[19]. Reflecting the volatility of the General Service Top Consumers sector, Hydro states:

A loss of a major load is expected by 2016. This loss is more than offset by confirmed plans and expected increases of other Top Consumers. In the long term, GS Top Consumers is expected to grow at a rate reflective of its historic growth.[20]

A number of other users of energy must be added to these three consumer sectors to arrive at Total General Consumer Sales. They are: General Service Diesel, General Service Seasonal, General Service Flat Rate Water Heating, General Service Surplus Energy Program, Plug-in Electric Vehicles and Area and Roadway Lighting. As mentioned above, together they account for only 1.2% of consumer sales. Clearly, accounting, as they do, for 98.8% of consumer sales, the parameters affecting the Residential Basic, General Service Mass Market and General Service Top Consumer sectors can be taken as the factors that can be expected to affect Total General Consumer Sales.

---

[18] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 6, The Window of Opportunity, page 342.

[19] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, page 2.

[20] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, page 21.

Beginning with Total General Consumer Sales, load forecasts are arrived at by adding Distribution Losses, Construction Power, Transmission Losses and Station Service. Because these latter items account for a relatively small fraction (about one eighth) of the total load and also because they are affected by the same parameters that affect Total General Consumer Sales, little error is introduced by considering the main parameters affecting Total General Consumer Sales to be those also affecting load.

If the load parameter under consideration is energy, the result is called Gross Firm Energy and it is reported on an annual basis in units of GW.h. If it is winter peak power, the result is called Gross Total Peak and it is reported in MW.

Hydro is forecasting the load to grow by 1.5%[21], before accounting for future-based DSM programs.[22]

Hydro identifies population growth (Resident Basic and General Service Mass Market sectors), per capita use (Residential Basic sector) and the economy (General Service Mass Market sector) as major drivers of load growth.[23]

Very little rationale for linking load growth to population growth is advanced in Hydro's analysis. The reviewers are evidently just expected to believe that the two are positively correlated.

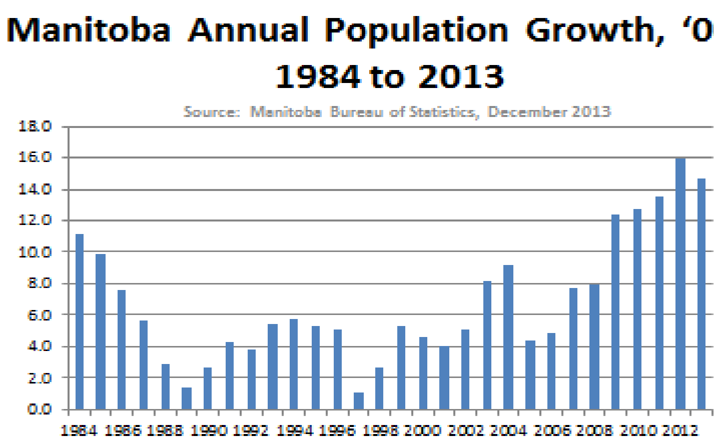

Figure 9. Manitoba annual population growth for the 12-month period ending on 1 October 1984 until the 12-month period ending on 1 October 2013.

---

21 Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 4, The Need for New Resources, page 2.
22 Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, page 8.
23 Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix D, 2013 Electric Load Forecast, pages 17, 20.

Figure 9 presents Manitoba annual population growth for 12-month periods ending on 1 October each year from 1984 until 2013.[24] Intuitively, it seems reasonable to expect that load would grow with population and Hydro's analysis appears to rely on that expectation. But a comparison of population growth in Figure 9 with the historic pattern of load growth, both Gross Firm Energy in Figures 1 and 2 and Gross Total Peak in Figures 3 and 4, reveals that load in Manitoba trended historically opposite to that expectation.

The period of slowest growth in load coincided with the period of most rapid population growth. There seems to be little correlation between population growth and load. Certainly, there appears to be no case for Hydro's assumption that load can be forecast on the basis of the population forecast.

Of perhaps even greater concern, population growth in Manitoba is, to some considerable extent, a matter of public policy. The rapid increase in population since 2008 is, in major part, a reflection of the current Government's participation in the Provincial Nominee Program. This participation is required in part to compensate for net extra-provincial emigration from the province which almost entirely offsets natural growth in population (births minus deaths).

An immigration policy of this nature is necessary to provide the workforce for an economy that is supported to a major extent from the public purse (deficit budgeting and the federal/provincial tax transfer program). Such a strategy is not sustainable in the longer term. It would be dangerous to expand the electrical generation and transmission system on the assumption that it is.

Even less rationale is provided for the assumption that load will be significantly affected in the future by increase in per capita consumption. With very little justification (other than unsubstantiated projections that the number of customers using electricity for space heating is forecast to grow from its current province-wide value of about 35% to about 40% in 2031/32[25] and that the number of residential customers using electricity to heat water is forecast to grow from about 47% to about 69% in 2031/32), the analysis projects that average energy usage per residential customer is expected to rise by 0.4% per year.[26]

The irony is hard to miss with Hydro advertising in city newspapers in January 2014 communicating the superior cost effectiveness of natural gas over both electricity and geothermal while at the same time forecasting increasing use of electricity for space heating.

The assumption of an increase in per capita consumption does not adequately take into account that increasingly tougher building codes are being adopted to force builders to better seal homes, so heat or

[24] Manitoba Bureau of Statistics, Latest Population Estimates: October 2013, 18 December 2013. Weblink: http://www.gov.mb.ca/asset_library/en/statistics/de_popn-qrt_mbs3a6_n.pdf.
[25] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 4, The Need for New Resources, page 12.
[26] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 4, The Need for New Resources, page 12.

air-conditioned air doesn't leak out so easily, and to use low-heat-loss windows in new homes and retrofits.

Nor does it reflect the more efficient gadgets, televisions, large appliances and air conditioners that are being purchased, the incandescent bulbs that are being replaced by compact fluorescent bulbs and even light emitting diode technology, and the energy-saving mobile devices that are replacing stationary computing and communicating devices.

Hydro's analysis does take into account the offsetting effect that electric vehicles will have in the future on per capita consumption of electricity. Yet, the analysis does not provide adequate justification that the net effect of all of these factors will be a 0.4% annual contribution to load.

On the supply side, it does not take into consideration the widely expected load-modifying trend to distributed generation from solar, wind and biomass sources.

The question arises: what is an appropriate model, going forward, for forecasting load?

One possibility is to ignore recent trends and to forecast growth that is even more optimistic than the recent historic record. That is an extreme and it is what the Hydro Forecast does. Another is to assume that the trend of the recent historic period will continue. That is what the Revised Forecast presented in Figures 5, 6, 7 and 8 does. Another is to assume that the recent historic trend is a transitional phenomenon and a harbinger of a period of flat or even declining growth, also an extreme scenario.

Considered in that context, the Revised Forecast is a moderate approach to forecasting.

What are the current country-wide trends in the United States? The U.S. Energy Information Administration[27] reports that:

Total U.S. electricity sales have declined in four of the past five years, and are on track to continue to decline in 2013. The only year-over-year rise in electricity use since 2007 occurred in 2010, as the country exited the 2008-09 recession.

The flattening of total electricity sales has been driven by declining sales in the industrial sector and flat sales in the residential and commercial building sectors, despite growth in the number of households and commercial building space.

Clearly, Hydro's recent experience with a flattening of load growth is far from unique. In fact, it reflects a nation-wide trend in the U.S., the country into which Hydro seeks to expand its exports.

---

[27] U.S. Energy Information Administration, Monthly Energy Review, 20 December 2013. Weblink: http://www.eia.gov/todayinenergy/detail.cfm?id=14291.

Hydro's analysis does recognize the potential for variation from Hydro's "best estimate of Manitoba's future electricity requirements". The methodology used for establishing Low and High Load Forecasts is set out in Appendix C of the NFAT submission.

Basically, this was approached by calculating the standard deviation of historical load, presumably for the entire 20-year history and presumably assuming a linear fit of 20 years of data, and then applying that variability to the "best estimate of future load". A range of +/-1.28 standard deviations was considered to cover a range of 80% centered on the best estimate. The "best estimate" was termed the "reference load", the load at -1.28 standard deviations was termed the Low Load Forecast and the load at +1.28 standard deviations was termed the High Load Forecast. This approach is applied to Hydro's "best estimates" of energy and peak.[28] The limits of the confidence band on either side of the reference values for energy and peak are also referenced as the 10% and 90% probability values.

While it is appropriate that the analysis provides a means for dealing with the uncertainty of determining the best estimate of the reference value, the whole exercise becomes meaningless when the best estimate is so over-estimated. Using Hydro's best estimate of the annual growth in energy (1.6% in the first 10 years and 1.5% for the next 10 years), the Low Load Forecast for Gross Firm Energy becomes 1.2% in the first 10 years of the forecast period and 1.1% for the next 10 years.

Using Hydro's best estimate of the annual growth in peak (1.5% for the entire 20-year forecast period), the Low Load Forecast for Gross Total Peak is 1.1% over the entire forecast period. These Low Load Forecast values are well above the Revised Forecast values for both Gross Firm Energy and Gross Total Peak determined by extrapolating recent historic trends. They illustrate how the probability analysis breaks down if the reference values are poorly substantiated.

Hydro's analysis incorporated changes in the assumptions about load between 2012 and 2013. Illustrating the importance of assumptions made in estimating load growth, changes in assumptions between 2012 and 2013 resulted in a "reduction of almost two years of load growth" for winter peak demand in 2031/32 and a "reduction of almost three years of load growth" for energy.[29]

Applying this same logic to the Revised Forecast, the revised values of load produce a reduction of 21 years of growth in Gross Total Peak and 25 years in Gross Firm Load in 2032/33. Because the Revised Forecast is a forecast of net load which reflects the reductions due to future DSM, Hydro' projections of load after reduction due to future DSM are used in arriving at these reductions in years of growth.

---

[28] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Appendix C, 2012 Electric Load Forecast, page 45.

[29] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 12, Economic Evaluation—2013 Update on Selected Development Plans, pages 2 and 3.

Considering a date nearer at hand, 2023/24, which is the revised required in-service date for Keeyask,[30] the Revised Forecast suggests that, on the basis of Gross Total Peak, a delay of seven years for the in-service date for Keeyask and, on the basis of Gross Firm Energy, a delay of nine years is possible. This would enable setting back the in-service date for Keeyask at least until 2030-31. Again, this demonstrates the importance of justifiable and justified estimates of load growth.

During the time period in which Hydro's analysis was conducted, a new set of assumptions was adopted. The 2013 assumptions replaced the 2012 assumptions. The 2013 assumptions introduced a reduction of load, expanded and increased DSM options, concomitant delays of the in-service dates for Keeyask and Conawapa, a 7% increase in export prices for electricity, an increase in the real discount rate from 5.05% to 5.40%, a five-year extension of a diversity agreement with Great River Energy and a 50-MW increase in a sales contract with Minnesota Power.[31] The reduction of load in the 2013 set of assumptions for energy was 2.4% in 2022/23 and 3.5% in 2031/32.[32]

Little or no reason is provided for the changes in the assumptions. It is pointed out that the assumed changes in load pale in significance compared to the differences between Hydro's Forecast and the Revised Forecast presented here. And so it is not surprising that the Revised Forecast produces a change in the date when new power resources are required that is so much greater than the changes in the 2012 assumptions.

The impact of the new assumptions in 2013 is determined for five of the 15 development plans considered in this analysis.[33]

The plans considered included: Hydro's preferred development plan with different levels of DSM, the so-called All-Gas plan, a hydro-gas hybrid plan without an additional export tie line (Plan 2 with different levels of DSM), a hydro-gas hybrid plan with an additional 250-MW export tie line (Plan 4 with different levels of DSM) and a variation of the preferred development plan in which a high level of DSM is introduced to permit a delay of the in-service date for Conawapa.

Hydro's analysis makes the point that, of the five plans considered, there was no change in the economic ranking of the plans.[34] It does not, however, point to the significant change in the incremental

[30] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 12, Economic Evaluation—2013 Update on Selected Development Plans, page 1.
[31] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 12, Economic Evaluation—2013 Update on Selected Development Plans, pages 1 and 2.
[32] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 12, Economic Evaluation—2013 Update on Selected Development Plans, pages 2 and 3.
[33] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 12, Economic Evaluation—2013 Update on Selected Development Plans, page 1.
[34] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 12, Economic Evaluation—2013 Update on Selected Development Plans, page 24.

Net Present Value (from $1,696 million to $1,462 million)[35] calculated for Hydro's preferred development plan, even with such relatively minor changes in the load forecast and with the other changes in the 2013 assumptions. Evidently, the assumptions chosen can significantly affect the outcomes.

A statement in Hydro's analysis that gives no comfort is the following:[36]

As a further observation, the 2013 planning assumptions were well within the range of uncertainty analyzed in Chapter 10. (The probabilistic analysis described in Chapter 10 captures a range of uncertainty around energy prices, discount rate (cost of capital) and capital cost.)

This is analogous to continuing to shoot at where the goal cage used to be, in a game of street hockey, because a part of the goal cage is still within the original space before it was moved sideways. A more rational approach, but one not used in Hydro's analysis, would have been to incorporate the 2013 assumptions into new economic evaluations.

So, with Hydro's more-than-700-page submission to the NFAT review panel and its almost 5,000 pages of appendices, what do we have? An analysis that is based on an unjustified assumption about the need.

What are the consequences? The analysis produces a "manufactured" crisis and then proposes a response to that crisis. The response results in building generation seven to nine years before it is required.

Worse than that, the conclusion that new resources are required by 2023/24 (adjusted from 2022/23 during the course of the study as a result of new assumptions in 2013) has resulted in expenditures of $1 billion on Keeyask and $0.3 billion on Conawapa "to protect in-service dates" for those facilities, expenditures a good part of which would have been unnecessary with more realistic load forecasts.

Hydro's load forecast is out of line with recent historic trends experienced by the utility and with utilities and jurisdictions in Hydro's export market, and, in fact, with the entire Midcontinent Independent System Operator market.

An added problem caused by the unnecessarily early expenditures on Keeyask and Conawapa is that these expenditures were treated in Hydro's analysis (along with the estimated cost of Bipole III) as sunk costs. Together, these costs are charged, in Hydro's analysis, against all plans, including gas-based plans which do not require these facilities.

At this point, it is reasonable to charge some part of the cost of Bipole III as a "reliability cost". That said, there are less expensive ways to achieve reliability. Assumptions made in Hydro a few years ago

---

[35] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 12, Table 12.4, Economic Evaluation—2013 Update on Selected Development Plans, page 11.

[36] Manitoba Hydro, Needs For and Alternatives To Submission, August 2013, Chapter 12, Economic Evaluation—2013 Update on Selected Development Plans, page 24.

that the future was in dams not gas plants caused these early expenditures to be made, thus tipping the balance in favour of dams.

Any comparative analysis of competing development plans after part of the costs of building the dams has already been expended doubly penalizes gas plants. In Hydro's analysis, dams start out with part of their cost already transferred to liabilities and only the residual needs to be paid for over time. Gas plants, on the other hand, have to earn enough revenue not only to pay for themselves over time but also to contribute to general revenues to help cover the costs transferred costs for the dams.

This situation occurs because preparation for this NFAT analysis should have been launched immediately when the Public Utilities Board first requested it in 2009, now five years ago. That would have facilitated the completion of the NFAT analysis in 2011 or 2012, thus avoiding some of the costs for securing the in-service dates for Keeyask.

In the view of the Bipole III Coalition, Bipole III is not exclusively a "reliability project". It is not just a "standby facility" to be used only in case of a catastrophic failure of Bipoles I and II. It is an HVDC facility that, once Keeyask is built, will be available to share the transmission function to southern conversion points for serving domestic load and export opportunities. Accordingly, Bipole III should have been included in an NFAT review that began three years ago and it should have been included in the current review.

Without adequate revenue to service the debt incurred by building capacity long before it is needed, the temptation will be to request annual rate increases even higher than are already proposed. But the domestic market is not inelastic and so rate increases can produce an offsetting reduction in load. At some point, rate increases become counter-productive. The export market is independent of the utility's costs and, therefore, offers no solution, especially considering that export prices do not currently, and will not for a long time, match incremental unit costs of energy produced by expanded capacity. In the extreme, Hydro's solvency can come into question.

Given the arguments presented here, what should the PUB panel's advice to Government be?

(1) Bipole III should be delayed pending a further review based on a more credible load forecast.

(2) Alternate means of achieving reliability should be studied and implemented as soon as possible; these means could involve building a southern gas plant near southern load.

(3) Domestic load should continue to be monitored and the load forecast and the power resource plan should be updated annually.

(4) Bipole III should be re-scheduled with an in-service date as close as is practical to a just-in-time completion date dictated by the then-current power resource plan.

(5) Keeyask or an alternate power resource[37] should be re-scheduled with in-service date as close as is practical to a just-in-time completion date dictated by the then-current power resource plan.

(6) Conawapa should be put on hold with no further early expenditures and it should be re-scheduled with an in-service date as close as is practical to a just-in-time completion date dictated by the then-current power resource plan.

(7) System upgrading and refurbishment should proceed strategically, beginning at an early date in order to spread out capital outlays over time.

Hydro’s analysis makes the point frequently that “doing nothing” is not an option. The Bipole III Coalition wants to make it clear that this is not a proposal to “do nothing”. It is a proposal to “slow down”. A more defensible load forecast underpinning a new power resource plan would provide the necessary lead time to do a better job in responding to the challenge of meeting the electrical load needs of Manitobans, taking advantage, at the same time, of export opportunities for the benefit of Manitobans. This may involve choosing alternatives different than those set out in Hydro’s preferred development plan.

[37] In comparing alternate power resource choices, a real discount factor greater than 5.40% should be employed in any net present value analyses in order not to disadvantage choices with low capital cost and short service life and in order not to exaggerate the differences among choices. Full advantage should be taken of updates in projections of the prices of natural gas and electricity in the export market, particularly taking into account the effects on both of any introduction of carbon pricing. Finally, any future analysis of alternative power resource choices should incorporate a price elasticity that recognizes that consumption will respond inversely to rates.