

Information Requests of Dr. Yatchew on behalf of the Public Utilities Board

PUB/Yatchew - 1 Reference: Pg. 8 Oil and Natural Gas Markets and Exports

Preamble:

Continued low oil prices have a strong influence on the prosperity of Alberta and on future development of the oil sands, which indirectly affect the Manitoba economy. oil prices have an important impact on Canadian export revenues and on exchange rates. The precipitous decline in oil prices which began in mid-2014 has had a dramatic impact on the economy of Alberta and to a lesser degree on Saskatchewan and Manitoba.

Please elaborate on the linkages of oil prices and their indirect impact on the Manitoba economy in general and specific to Manitoba Hydro.

Response: Oil prices affect the Manitoba economy and Manitoba Hydro primarily through two macroeconomic channels: exchange rates and GDP.

Exchange rate effects: As depicted in Figure 12, page 46 of the report, oil prices and the Canadian dollar move closely together. Low oil prices drive down the value of the Canadian dollar. This, in turn, makes other Canadian and Manitoba exports more competitive (international exports comprise roughly a quarter of Manitoba GDP). When the Canadian dollar declines, revenues, including those for Manitoba Hydro electricity exports, rise.

GDP effects: There is a large and important literature on modeling the relationship between oil prices and GDP.¹ The analyses frequently focus on the recessionary impacts of oil price increases. For Canada, which is an oil exporting country, increases in world oil prices enhance export revenues and stimulate production. Conversely, in times of low oil prices, on balance, the effect on national GDP is likely to be negative. Alberta, the dominant oil producing province, is especially negatively affected, which in turn can reduce purchases from other provinces, including Manitoba.

For the Province of Manitoba, lower oil prices likely have a net beneficial effect: the stimulative impact on exports (resulting from a lower Canadian dollar) and lower expenditures on gasoline and diesel (which leaves more money for expenditures on other goods), likely outweigh the adverse GDP effect emanating from Alberta.

For Manitoba Hydro, lower oil prices and the consequent lower Canadian dollar increases export revenues (denominated in Canadian dollars). To the extent that Manitoba export industries are also stimulated, electricity sales also rise.

¹ Two of the leading contributors are James Hamilton at the University of California, San Diego, and Lutz Kilian at the University of Michigan.

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PUB/Yatchew - 2 Reference: Pg. 24, Paragraph 66 Grid Parity

- a) Please discuss how technology changes solar and energy storage and grid parity in adjacent markets may impact Manitoba Hydro energy demand.
- b) Please elaborate on how statistical models have been utilized for predicting the time path of technology adoption to predict future energy demand.

Response:

- a) As costs of wind and solar generation continue to decline, neighboring markets will increase their shares in the generation mix. These sources are intermittent and so require back-up, often in the form of natural gas generation, which is well-priced because of the surplus of natural gas resulting from the fracking revolution. Once the cost of storage declines to the point where it can be successfully paired with intermittent sources to produce reliable supply, the relative advantage of hydraulic resources in export markets, as a source of energy or capacity, deteriorates.

Furthermore, the scalability of solar and potentially storage may also erode domestic demand if Manitoba Hydro prices rise sufficiently.

- b) The simplest method for incorporating technological change into statistical models is by the inclusion of a trend term (which may be linear, nonlinear, or fully nonparametric). Trends in energy intensity, and electricity intensity are typically modelled this way. Trend terms implicitly (but not explicitly) capture the effects of technology adoption. Trends can then be extrapolated and combined with forecasts of other variables (such as GDP, population and energy prices) to project future energy demand.

Explicit modeling of technology adoption or diffusion often relies on 'S-curves'. Initially, a new device is adopted slowly. In time, as more users adopt and use the technology, unit costs of production decline (as a result of returns-to-scale and technological innovation in production) as do operating costs (a learning-by-doing effect). Once a tipping point is reached, the technology becomes widespread. Eventually, once a saturation point is approached, adoption decelerates until an equilibrium is reached.

For wind, solar and storage we are not yet at the tipping point. However, these are likely disruptive technologies which could lead to profound changes in energy systems, particularly if they lead to decarbonization of the transportation sector.

Short-term (say year-ahead) predictions of technology adoption in a given electricity market can be done with a reasonable degree of accuracy based on past trends, planned retirements of facilities, and carbon policies which in some cases set renewables targets. Longer term predictions are much more uncertain because of the difficulty in forecasting tipping points.

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PUB/Yatchew - 3 Reference: Pg. 29-30. Figures 6 and 7

Preamble:

Figure 6 and 7

p. 29 “Over that same time period, energy intensity in Canada declined at a rate in excess of 1% per year, while per capita energy use remained flat.”

p. 30 “Manitoba energy intensity declined by close to 2% per year, a number very similar to Ontario.”

p. 31 “Electricity demand continues to be very closely linked the level of GDP. Given the declining electricity intensity, a GDP elasticity of about 0.8 is a reasonable reference number for present purposes.”

Question:

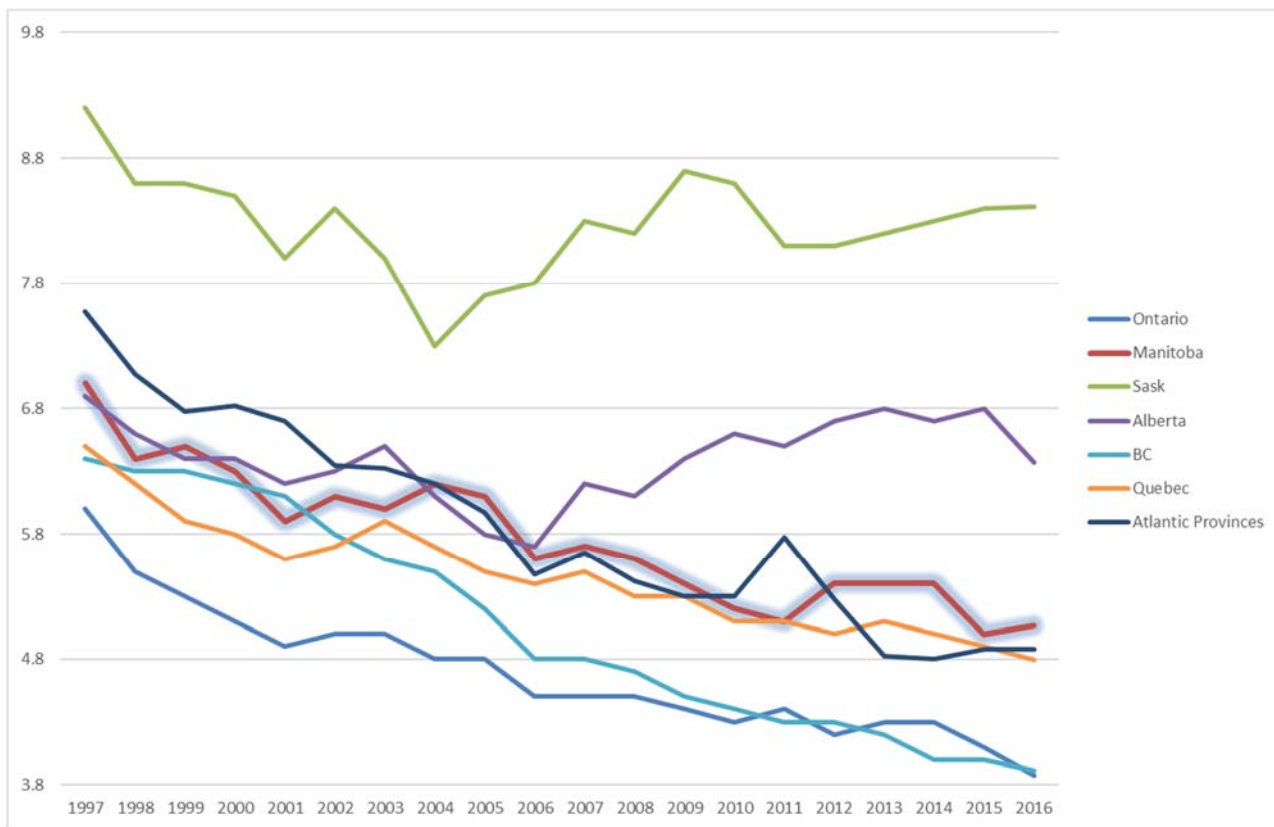
- a) If possible, please extend Figure 7 – Provincial Energy Intensity Trends to show the most current updated to 2017
- b) Please file the study cited in footnote 56.

Response:

- a) Figure 7 has been updated to include 2016 data (please see next page). These are the most recent data that were available on a consistent basis.
- b) The paper referenced in footnote 56, “Changes in Energy Intensity in Canada”, by A. Moshiri and N. Duah has appeared in 2016 in *The Energy Journal*, Vol. 37, Issue 4, pages 315-342. Due to copyright restrictions, I do not have the authority to circulate this paper. It may be purchased at the International Association for Energy Economics web-site <http://www.iaee.org/en/publications/scope.aspx>.

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**Figure 7 – Provincial Energy Intensity Trends
(Updated to Include 2016 data)**



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PUB/Yatchew - 4 Reference: Pg. 32 Paragraph 87

Preamble:

Manitoba electricity prices are low by national standards. Even the projected rate increases will not produce especially high rates compared to other provinces, with the exception of Quebec. It is possible that at low electricity prices, the response to an increase would be attenuated until the price crosses a certain threshold. The elasticities we are proposing should then be seen as an average response, keeping in mind that Manitoba Hydro projects a large cumulative increase in the coming years.

- a) At what threshold price would the response in your view be higher than the average proposed in your analysis, given the sustained increases being proposed.
- b) To what extent do differences in the cost of living and real wages in Manitoba versus other Provinces impact your comparison of the relative electricity rate differences between Manitoba and other Provinces.

Response:

- a) The statement “It is possible that at low electricity prices, the response to an increase would be attenuated until the price crosses a certain threshold.” implies a nonlinear response to price increases. Calibrating a threshold would be difficult, even with very good data. However, one would expect that industrial and large commercial users would respond to price changes more quickly.
- b) Electricity rate differences (as depicted in Figure 8, page 36 of the report) are independent of cost of living and real wages. However, median household incomes in Manitoba are close to the national median based on the 2016 Census. The cost of living in Winnipeg is considerably lower than in Toronto or Vancouver.

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PUB/Yatchew - 5 Reference: Pg. 32, Paragraph 88

- a) Please provide the long-term electricity demand growth based on a 3.95% rate increase trajectory over the next ten years and contrast with that provided in the analysis and comment on the incremental impacts of the change.
- b) Please indicate how the analysis changes over the next decade when one considers the GDP impact of the completion of construction spending on Bipole II and Keeyask G.S.

Response:

- a) Assuming a 3.95% rate increase in each of the next ten years and an inflation rate marginally below 2% on average, together yield a real increase in electricity prices of about 25%. Assuming a 2% annual growth rate in real GDP leads to an economy that is 22% larger ten years hence. Using price elasticity of -0.4 leads to a long-term effect of reducing electricity demand by about 10% ($-0.4 \times 25\%$); using an income elasticity of 0.8 leads to increased demand of about 18% ($0.8 \times 22\%$). The net effect is electricity demand growth of about 8% cumulatively over this period.
- b) Using Manitoba Hydro forecasts of real GDP growth (Manitoba Hydro 2017/18 & 2018/19 General Rate Application, Appendix 3.2 Revised, Economic Outlook 2016-2037, page 23) leads to a marginally lower level of GDP growth of 20% cumulatively over the next decade. The net effect is electricity demand growth of about 6% cumulatively over this period.

As noted, in the report at page iv, para. 14, we are in the ninth year of an expansion so that a recession sometime in the next decade is highly likely. Depending on its depth and duration, there could be significantly lower electricity demand growth.

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PUB/Yatchew - 6 Reference: Pg. 34 Paragraph 93 (c)

Preamble:

A ramped sequence of increases, perhaps linked to a clear demonstration of efficiencies achieved by Manitoba Hydro, may be a useful framework for promoting internal efficiencies, allowing time to adjust to electricity rates, and distributing costs more equitably over each generation of consumers.

Please illustrate and explain how a link to efficiencies tied to increasing rates as proposed by MH through 2027 will distribute costs more equitably over each generation of consumers.

Response:

The intention of the sentence is to suggest that a ramped sequence of increases will distribute costs more equitably across generations and allow time to adjust. A direct link of rate increases to efficiency improvements, as is common under incentive regulation (such as price-cap regimes) is designed to reward productivity improvements. By reducing costs through efficiency gains, such schemes benefit each generation of consumers.

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PUB/Yatchew - 7 Reference: Paragraph 96 – Re: Energy Poverty

- a) Please file provide the cited studies that place energy poverty at 10% and 6%.
- b) Please file the referenced studies for footnote 65 & 66.

Response:

- a) The NEB estimates energy poverty in Manitoba, defined by the 10% income threshold, to be at 7%. The document *Manitoba Hydro Bill Affordability Collaborative Process. Summary Report & Recommendations, January 2017*, page 26, available at <http://billaffordabilitymb.ca/> uses both 6% and 10% thresholds.
- b) The following documents are provided in the following pages:
 - i) The Government of the UK definition of energy poverty, available at <https://www.gov.uk/government/collections/fuel-poverty-statistics>.
 - ii) *Fuel Poverty, Methodology Handbook*, Department for Business, Energy and Industrial Strategy, UK Government, June 2017 Edition; available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/639120/Fuel_Poverty_Methodology_Handbook.pdf.
 - iii) “Market Snapshot: Fuel poverty across Canada – lower energy efficiency in lower income households”, National Energy Board, <https://www.neb-one.gc.ca/nrg/ntgrtd/mrkt/snpsht/2017/08-05flpvrt-eng.html>.

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PUB/Yatchew - 8 Reference: Paragraph 98 Figure 9

Please provide the Market Snapshot: Fuel Poverty Across Canada – lower energy efficient income households.

Response:

This document is provided in the response to PUB/Yatchew – 7 b).

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PUB/Yatchew - 9 Reference: Pg. 45, Paragraph 122, lines 19-21

Preamble:

“The current proposal, for large increases over a sequence of years, is more in the nature of a rate shock.”

Question:

Please define “rate shock” in context of previous and proposed Manitoba Hydro rate trajectory.”

Response:

In oil markets, a “shock” typically refers to an unexpected increase in prices, such as those that occurred during the 1970s. The largely unexpected and sustained decline which began in 2014 is not usually spoken of as a shock, though it came to the surprise of many.

Electricity prices are regulated in most jurisdictions, and regulators typically incorporate rate smoothing. However, the rate increases projected by Manitoba Hydro are large by historic standards, and sustained over a significant period of time, which may very well lead to realignments within certain industries.

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PUB/Yatchew - 10 Reference: Paragraph 147 Carbon Leakage Problem

Please file the referenced article in footnote 93 and explain how this problem relates to the proposed Manitoba Hydro rate increases.

Response:

The Government of Manitoba has released the attached document entitled “A Made-in-Manitoba Climate and Green Plan, Hearing from Manitobans”. The document addresses, in part, the energy sector, and sets out proposals that would promote decarbonization.

Manitoba industries are using a non-carbon electricity source. If, as a result of increases in the price of electricity, an industry transfers some or all of its production elsewhere, with high probability carbon emissions will increase. (For example, production which moves from Manitoba to China, where electricity generation is dominated by coal, would lead to dramatic increases of emissions from this production process.)

Furthermore, electricity intensive industries will have an increased incentive to depart because electricity is a significant portion of their costs.

Meaningful solutions to the carbon leakage problem are complicated, but do not necessarily require global agreements. From the perspective of Manitoba, a small but important contribution can be made by incorporating the leakage problem when considering retention programs for electricity intensive industries.

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PUB/Yatchew - 11 Reference: Paragraph 148, Appendix 3.8, GSS-GSM-KAP Evidence LE Report Pg. 30-32, Consumer Coalition - The Effect of the Proposed Hydro Rate Increase on the Manitoba Economy Pp. 13-16

Preamble:

The projected rate increases are likely to have a modest net effect on aggregate Manitoba output in the long-run, though there could very well be job losses and reduced output in the short-run. The immediate main effects will be distributional, impacting low income households and remote and First Nations communities more strongly. Such increases may also lead to structural changes in industry with the largest impacts on electricity intensive enterprises. Neither of these consequences constitute a basis for keeping rates inappropriately low for all purchasers, as there are superior mechanisms for handling distributional impacts in residential, commercial and industrial sectors.

- a) Please file or comment on analysis undertaken on short term job losses and the net impact on GDP over the next two year and the next six years (through 2025/26) based on the projected rate trajectory over that period.
- b) Please explain what is meant by keeping rates inappropriately low for all purchasers.
- c) Please elaborate on superior mechanisms for handling distributional impacts by affected sector.

Response:

- a) A quantitative analysis to determine likely *net* effects would require general equilibrium modelling which allows not only for job losses, but job creation and structural shifts. The magnitude of short term job losses can be estimated using partial equilibrium analysis, such as in evidence entitled "The Effect of the Proposed Hydro Rate Increase on the Manitoba Economy", co-authored by Drs. Simpson and Compton, on behalf of the Consumers Coalition, October 31, 2017. Some guidance can be gleaned from the response to oil price shocks and the time paths for employment recovery.
- b) Suppose that a rate increase of say x% would be deemed to strike the appropriate balance among the various objectives such as timely cost recovery, financial soundness targets, rate smoothing and so on. Suppose further that an increase of x% would have significant distributional impacts on certain customers. Economic theory suggests that proper price signals promote efficient resource use. Thus, rates that are constrained at levels that are too low, for purposes of protecting a minority of customers, would not be an appropriate rate

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setting policy.

- c) It is preferable to restrict support to those customers who are adversely affected to a sufficient degree, rather than maintaining low rates for everyone.

Residential customers, who experience energy poverty, can be protected through properly calibrated income supports based on their cost of living indices. Such indices need to take into account the *local* cost of living; for example, energy and food expenses are much higher in remote and isolated communities. Income supports do not alter price signals, but mitigate the impacts of increased electricity costs.

Those industrial customers which are at risk of leaving and have high electricity usage, can be incentivized to remain through selective governmental initiatives such as tax breaks and other concessions. Such approaches do not impair price signals, and target affected parties. Given the broader community and societal benefits (through job retention and GDP effects) there is an argument that such costs fall in the governmental realm.