Review of Manitoba Hydro's general rate application on behalf of the small and medium general service customer classes and Keystone Agricultural Producers

prepared for Hill Sokalski Walsh Olson LLP

October 31st, 2017

The potential for rate increases of nearly 50% over a five-year period will have a significant negative impact on the general service small ("GSS") and general service medium ("GSM") customer classes in Manitoba. Upon review of Manitoba Hydro's general rate application, responses to information requests and minimum filing requirements, London Economics International LLC ("LEI") finds that the proposed rate increase should be held in abeyance until (i) comprehensive macroeconomic modeling is performed; (ii) a robust independent analysis of whether Keeyask should be postponed, modified, or cancelled is submitted; and (iii) an additional independent review of Manitoba Hydro costs, staffing, and operating procedures is developed.

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Figure 1. List of Acronyms

Acronym	Definition
AUC	Alberta Utilities Commission
BC Hydro	British Columbia Hydro and Power Authority
BCG	Boston Consulting Group
BOMA	Building Owners and Managers Association of Manitoba
CAD	Canadian Dollar
CAIDI	Customer Average Interruption Duration Index
CAP	Canadian Agricultural Partnership
CEF16	Capital Expenditure & Demand Side Management Forecast
CME	Canadian Manufacturers & Exporters Manitoba Division
COS	Cost-of-Service
DR	Demand Response
DSM	Demand Side Management
EE	Energy Efficiency
EFP	Environmental Farm Plan
EIA	Energy Information Administration
ESM	Earnings Sharing Mechanism
FTE	Full-time Equivalent
GRA	General Rate Application
GSM	General Service Medium
GSS	General Service Small
GWh	Gigawatt hour
HOST	Hotel Operating Statistics
HSWO	Hill Sokalski Walsh Olson
HVDC	High Voltage Direct Current
IBR	Incentive-based ratemaking
IDACORP	Idaho Power Company
IEEE	Institute of Electrical and Electronics Engineers
IFF	Integrated Financial Forecast
I/O	Input-output
IMPLAN	Economic Impact Analysis for Planning
KAP	Keystone Agricultural Producers
KPIs	Key Performance Indicators
kVA	Kilovolt amperes
kW	Kilowatts
kWh	Kilowatt hour
LEI	London Economics International
LRZ	Local resource zone
MH	Manitoba Hydro
MIPUG	Manitoba Industrial Power Users Group
MISO	Minnesota Independent System Operator
MW	Megawatt
MWh	Megawatt hour
MW-km	Megawatt-kilometre
NACS	National Association of Convenience and Fuel Retailing
NB Power	New Brunswick Power Corporation
NERC	North American Electric Reliability Corporation
NPV	Net Present Value
OPG	Ontario Power Generation
OIC	Order in Council
PBR	Performance-based ratemaking
POD	Point-of-delivery
PPA	Power Purchase Agreement
PUB	Public Utilities Board
RCC	Revenue to Cost Coverage
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SAM	Social Accounting Matrix
SaskPower	Saskatchewan Power Corporation
SQIs	Service Quality Indicators
TFP	Total factor productivity
UFG	Unaccounted-for gas
USD	US Dollar

1 Key findings

- ***Compound impact of this request and projected following requests must be considered:*** The proposed rate increase cannot be examined in isolation from assumptions regarding subsequent rate increases; combined, these proposed rate increases result in a nearly 50% increase in rates.
- ***GSS and GSM ratepayers are large contributors to meeting the revenue requirement:*** GSS and GSM ratepayers pay over 30% of Manitoba Hydro's annual revenue requirement, while accounting for a significant portion of the province's economic activity and employment.
- ***GSS and GSM ratepayers will face harm from the rate increase:*** Rate increases of this pace and magnitude are likely to have a significant impact on GSS and GSM ratepayers, both directly and indirectly due to the fact that their own customers will also have less to spend.
- ***Rates in key competing jurisdictions may not increase as fast:*** Manitoba's competitive advantage will be diminished; because cheaper electricity rates help to offset other challenges of operating in Manitoba, even if Manitoba continues to be moderately "cheaper", rates will be less of a compensating factor for climate and geographical hurdles to doing business in the province.
- ***The size of the rate increase could be reduced:*** The pace and magnitude of the rate increases are artifacts of Manitoba Hydro's insistence on continuing with the Keeyask project and its reversal of its long held positions on the timing to increase its equity thickness.
- ***Keeyask analysis needs to be revisited:*** Manitoba Hydro's own analysis prior to announcing further increases to the budget and diminishing need showed Keeyask was a marginal project; factoring those aspects into Manitoba Hydro's analysis shows that the decision to continue is flawed.
- ***Commercially (and even socially) oriented enterprises would be unlikely to engage in projects with negative impacts for over two decades:*** No GSS or GSM customer would invest in a project that was going to produce losses for 20 years and face uncertain need thereafter; they should not be forced to do so through their electricity bills.
- ***Keeyask decisions cannot be ignored in considering the GRA:*** Arguments that Keeyask should not be discussed in the context of this General Rate Application ("GRA") are flawed; for the Manitoba Public Utility Board to "consider and set rates that balance the interests of Manitoba ratepayers with the financial health of Manitoba Hydro"[1] it <u>must</u> discuss the impact of Keeyask.
- ***The pace of rate increases should be slowed and prudency of ongoing investment programs should be further reviewed:*** Ratepayers and the province of Manitoba will benefit both from a more gradual pace of rate increases and a fully independent and thorough review of options, costs, and benefits related to Keeyask.

[1] Government of Manitoba. *Manitoba gives Public Utilities Board authority to review Hydro's capital program when setting rates*. April 18, 2017.

2 Background

2.1 Manitoba Hydro's requested rate increase

Pursuant to *The Crown Corporations Public Review & Accountability* Act, Manitoba Hydro applied to the Public Utilities Board of Manitoba ("PUB") on May 12, 2017 seeking the following:

- final approval of Order 59/16 which approved, on an interim basis, an across-the-board increase of 3.36% effective August 1, 2016, and final approval of any other interim rate Orders issued subsequent to May 12, 2017;
- interim approval of a 7.9% across-the-board interim rate increase to be effective August 1, 2017; and
- approval of an additional 7.9% across-the-board rate increase proposed for April 1, 2018.

However, Manitoba Hydro envisions a total of five annual increases of 7.9% in total, as per their May 12th, 2017 Integrated Financial Forecast ("IFF"), page 3, among other documents.

2.2 Application description and scope

Manitoba Hydro's current 2017/18 & 2018/19 general rate application ("GRA") proceeding provides an opportunity to examine its strategic and operational decisions to date and the utilities financial projections going forward. The Manitoba government has passed an Order in Council ("OIC") providing the PUB with special authority to access information on Manitoba Hydro's financial health and capital expenditure.[2] The PUB has outlined following issues to be in the scope for the hearing: bill affordability issues, rate design issues (specifically Manitoba Keewatinowi Okimakanak's Rate Design issues), and base/sustaining capital and asset assessment.[3] This proceeding adopts the updated cost-of-service ("COS") methodology determined in PUB Order 164/16 and marks the second intervention of the representatives of general service small and general service medium customer classes ("GSS/GSM").[4]

Following approval of the GSS/GSM request to intervene in this proceeding in PUB Order 70/17, London Economics International LLC ("LEI") was retained by Hill Sokalski Walsh Olson ("HSWO") to provide independent evidence to assist the PUB in understanding the views and positions of the GSS/GSM customers in this proceeding.[5] In a PUB letter dated September 15,

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[2] Government of Manitoba. *Manitoba gives public utilities board authority to review hydro's capital program when setting rates*. April 18, 2017.

[3] Manitoba Public Utilities Board. *Order No 70/17.* June 30, 2017.

[4] Manitoba Public Utilities Board. *Order 164/16.* December 20. 2016.

[5] Manitoba Public Utilities Board. *Order 70/17.* June 30, 2017.

2017, the scope of LEI's role was expanded to include key issues for the Keystone Agricultural Producers ("KAP").[6] LEI credentials appear in Appendix C of this report.

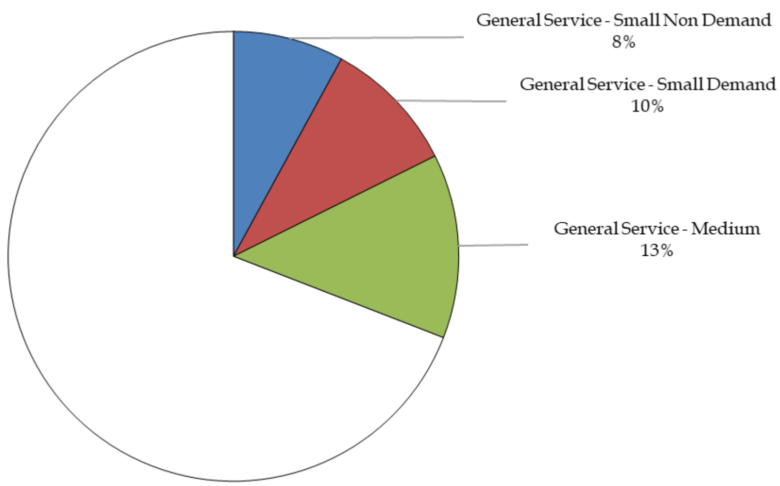
2.3 Class descriptions

2.3.1 General service small and general service medium customers

The GSS class is comprised of non-residential, predominantly small commercial customers using utility-owned transformation and with demand not exceeding 200 kilovolt amperes ("kVA"), or approximately 200 kilowatts ("kW"). Further, this class is divided into Demand and Non-Demand sub-classes. Customers in the Demand sub-class pay a Demand rate, based on the peak demand each month, in addition to a basic monthly charge and an energy charge. The GSS Demand and Non-Demand subclasses together account for 9.5% of Manitoba Hydro's customers and contribute 17.6% to the utility's total cost.[7,8]

The general service medium class includes non-residential, predominantly large commercial customers using utility-owned transformation with a billing demand exceeding 200 kVA. This group accounts for 0.3% of Manitoba Hydro's customers and contributes 13.2% to the utility's total cost.

Figure 2. GSS and GSM account for over 30% of total system costs in PCOSS18



Source: Manitoba Hydro. GRA: Tab 8 – Cost of Service and Load Research

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[6] Manitoba Public Utilities Board. *Re: Manitoba Hydro 2017/18 & 2018/19 General Rate Application – GSS/GSM and KAP Request to Intervene and Intervener Budgets.* September 15, 2017.

[7] Manitoba Hydro. *Manitoba Hydro 2017/18 & 2018/19 GRA: Appendix 8.2 PCOSS18 Allocation Program.* May 26, 2017. P.9.

[8] Manitoba Hydro. *Manitoba Hydro 2017/18 & 2018/19 GRA: Tab 8 - Cost of Service and Load Research.* May 26, 2017. P.26

Examples of ratepayers in these classes include the members of the Building Owners and Managers Association of Manitoba ("BOMA"), the Canadian Manufacturers & Exporters Association - Manitoba Division ("CME"), the Manitoba Hotel Association, and Keystone Agricultural Producers ("KAP"), which is discussed further in Section 2.3.2. It is important to note that GSS and GSM customers are a major source of employment for Manitobans. In 2015, businesses with fewer than one hundred employees accounted for 71% of private employment or 275,000 Manitobans.[9]

The members of BOMA own, develop and manage the bulk of the commercial and institutional real estate in Manitoba. The CME represents businesses in the manufacturing sector. This sector directly employs approximately 64,000 Manitobans. The Manitoba Hotel Association is a not-for-profit organization comprised of the majority of hotels located throughout Manitoba.

2.3.2 Keystone Agricultural Producers

KAP is an organization that initiates and advocates farm policy changes, promoting the interest of over 7,000 farm families and 23 commodity associations. KAP's mandate is to "ensure primary production in Manitoba remains profitable, sustainable, and globally competitive".[10] The organization was founded in 1983 and is wholly run and funded by its members, with policy set by producers throughout Manitoba. Currently there are 4,000 members in KAP ranging from farmers to farmer commodity groups.[11] Members not only speak to their commercial operation but are also residential customers often using electricity for space heat. The organization works with governments, industry, and relevant stakeholders to raise issues affecting farmers.

2.4 Inter-class collaboration and stakeholder engagement

In view of the potential for greater efficiencies in intervenor participation, the PUB approved the combined intervention of the representatives of the GSS/GSM customer classes and KAP. Among the issues LEI examines in this paper, issues critical to KAP include: (i) the impact of rate increases on consumers, including intergenerational impacts which are discussed in Section 3.6; (ii) the macroeconomic impact of energy rate increase on investment in agriculture and related industries in Section 3.5; and (iii) service levels and quality in Section 5.3. LEI also examined the interplay between carbon pricing and the proposed increases in electricity prices; the proposed price electricity price increases will further diminish agricultural sector competitiveness on top of increasing costs associated with implementing carbon pricing in Manitoba. Keeyask is also not the most cost-effective means for Manitoba to meet its future goals in this area.

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[9] Statistics Canada. *Table 2.1-1: Total Private Employment by Province and Establishment Size.* 2015

[10] "Policy Development." *Keystone Agricultural Producers of Manitoba*. Web. October 17, 2017. <http://www.kap.mb.ca/policy.cfm>

[11] KAP. *About KAP*. 2016 <http://www.kap.mb.ca/>

2.5 Role of the agricultural sector in Manitoba's economy

Manitoba has a diverse economy with key industries that include aerospace, advanced manufacturing, agribusiness and food processing, electricity and natural gas, and financial services and insurance. The agricultural sector accounted for 3% of Manitoba's GDP in 2015, and contributed to the employment of a substantial number of Manitobans.[12]

Manitoba accounts for approximately 12% of the national primary agricultural production annually.[13] In 2015, the agricultural sector contributed $1.98 billion to the provincial GDP and $2.98 billion, or 21.7%, to provincial exports.[14] The industry is the second largest in terms of exports, after manufacturing (i.e. $8.92 billion, or 65.1%, of 2015 provincial exports).[15] The extent of the export focus means that Manitoba farmers are sensitive to changes in relative costs, such as significant increases in electricity bills. An estimated 1 in 10 jobs are provided by the industry, directly and indirectly, thereby contributing 62,000 jobs to Manitoba's economy.[16] Of those, approximately 50% consist of direct employment.[17]

With regards to key outputs of the agricultural sector, major crops include wheat, barley, oats, rye, canola, flax, soybean, and canary seeds. Wheat serves as the crop with the largest source of farm cash receipts provincially. Major livestock produce includes cattle and calves, dairy, sheep, hogs, poultry, goats, bison, and other specialty animals. Of those, hogs serve as the second largest source of livestock farm cash receipts provincially, after cattle and calves. More specifically, Manitoba plays a key role in pig production and exports nation-wide, accounting for approximately 30% of Canada's production.[18]

Given Manitoba's role as a top wheat producer, LEI reviewed the electricity rates of the top five competing producers of wheat across Canada and the US. LEI examines the erosion of Manitoba's relative competitiveness as a result of electricity price increases, as detailed in Section 3.2.3.

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[12] "Economy: Manitoba GDP by Industry (Basic Prices)." *Government of Manitoba*. October 2016. Web. October 13, 2017. <https://www.gov.mb.ca/jec/invest/busfacts/economy/gdp_all.html>

[13] "Agribusiness." *Economic Development Winnipeg*. Web. 2017. <http://www.economicdevelopmentwinnipeg.com/key-industries/agribusiness>

[14] Government of Manitoba. *Invest in Manitoba*. "Economy: Manitoba's Exports by Industry." Web. Accessed October 31, 2017. <https://www.gov.mb.ca/jec/invest/busfacts/economy/exp_by_ind.html>

[15] Ibid.

[16] Government of Manitoba. Manitoba Agriculture. *Agriculture Statistics: State of Agriculture in Manitoba.* 2017.

[17] Ibid.

[18] "Manitoba Agriculture – Livestock Production." *Government of Manitoba*. Web. October 13, 2017. < https://www.gov.mb.ca/agriculture/livestock/production/index.html>

2.6 Use of power in hog farming, irrigation, and dairy automation

The use of electricity plays a major role in achieving farm production goals. The following sections briefly discuss the use of power in hog farming, irrigation, and dairy automation.

2.6.1 Hog farming

The process of hog farming consists rearing, butchering, processing, and selling. Within the first three steps of the process, there are various direct and indirect uses of power. The key uses of electricity on most hog farms occur in the following areas:

- heating the farrowing and first stage weaner pens to facilitate a suitable temperature for piglets;
- ventilation and fans to control levels of gas (e.g. carbon dioxide, ammonia, methane and hydrogen sulphide) and pathogens;
- lighting for production facilities;
- power washing to disinfect surfaces;
- feed and water delivery to the hogs; and
- manure pumps to process and/or dispose waste products.[19]

As noted by James Battershill, General Manager of KAP, "*farmers may also use other technologies in their operations that require hydroelectric power, such as [automated systems]…and sanitization equipment*."[20] Nonetheless, heating, lighting, and ventilation are the three most dominant uses of electricity on hog farms.[21] In Manitoba, electricity can account for approximately 1.7 – 1.9% of the total annual operating costs of a hog farm, depending on whether feed is purchased or home-mixed.[22,23] Impacts of the rate increase on electricity use in hog farming are discussed later in Section 3.3.1.

2.6.2 Irrigation

Irrigation systems allow farmers to apply water to crops in a controlled and systematic manner. There are several methods farmers can implement to achieve their desired output levels including

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[19] Khakbazan, M. *A Comparative Study of Energy Use in Hog Barns on the Prairies*. September 1999.

[20] Manitoba Public Utilities Board. *Manitoba Hydro 2017/18 and 2018/19 General Rate Application Pre-Hearing Conference.* Transcript, p. 151. June 12, 2017.

[21] Teagasc Agricultural and Food Development Authority. *Energy Use on Pig Farms*. August 2016.

[22] Government of Manitoba. *Guidelines for Estimating Swine Farrow-Finish Costs 2016.* November 2015.

[23] Hog farms that use purchased feed, as opposed to home-mixed feed, have higher total feed costs, resulting in higher total operating expenses. LEI notes that the percentage of electricity share represents the portion used in hog farming operations that do not include the production of feed.

center-pivot, drip, flood, gravity, rotation, and travelling gun systems.[24] The center-pivot system is widely used for large-scale farms and the mass production of crops. It allows for automated sprinkler irrigation, where the sprinkler pipe is automatically rotated and supplies water to nozzles. The pipe is mounted above the targeted crops by uniformly-spaced towers.

Therefore, within irrigation systems, electricity is used to drive the irrigation pivot system, as well as to pump water to the sprinklers. Farmers can run such systems solely on electricity, in combination with diesel, or solely on diesel. Irrigation costs can vary depending on the electricity-to-diesel ratio, as well as the amount of water required for the crop. For an irrigated potato farm that uses diesel for 40% of the pumping and hydroelectricity for 60% of the pumping, for instance, electricity for irrigation can account for approximately 1.8% of the total annual operating costs.[25,26] Impacts of the rate increase on electricity use in irrigation and irrigated potato farms are discussed later in Section 3.3.2.

2.6.3 Dairy automation

The use of electricity in dairy automation varies greatly from farm to farm. Typical direct uses of electricity on dairy farms include vacuum pumps for milking, cooling of milk, lighting, ventilation, water and space heating, irrigation, and cleaning equipment. Typical indirect uses include the electricity used to manufacture all the machinery, equipment, and products used on the farms (e.g. tractors and milking equipment used in the barn). The extent of usage depends on the farm itself; for example, on irrigated dairy farms, most of the electricity usage is on irrigation, followed by pumps and water heating. On the East Coast of the US, power is used most for milk cooling, followed by ventilation, vacuum pumps, and lighting.[27] On the West Coast of the US, electricity usage is dominated by milk cooling, manure handling, and lighting.[28]

In Manitoba, the electricity use on the average dairy farm can account for 2.6% of the total annual operating costs.[29] Impacts of the rate increase on electricity use in dairy production are discussed later in Section 3.3.3.

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[24] "Some Irrigation Methods." *The United States Geological Survey Water Science School.* December 02, 2016. Web. October 13, 2017. <https://water.usgs.gov/edu/irquicklook.html>

[25] Government of Manitoba. *Guidelines for Estimating Potato Production Costs – 2016*. January 2016.

[26] LEI notes that this does not include other uses of electricity on a potato farm and only accounts for the share used for irrigation.

[27] "Our Position on Dairy Farm Energy Consumption." *DeLaval Corporation*. June 13, 2016. Web. October 13, 2017. <http://www.delavalcorporate.com/sustainability/our-position/our-position-on-energy-consumption/>

[28] Ibid.

[29] "Statistics on Revenues and Expenses of Farms – Average Operating Revenues and Expenses by Province (or Region) for Selected Farm Types – Dairy Cattle and Milk." *Statistics Canada*. Web. October 23, 2017. <http://www.statcan.gc.ca/pub/21-208-x/2012002/t069-eng.pdf>

3 Rate increase and impacts

In its May 12, 2017 GRA filing, Manitoba Hydro is seeking approval of a 7.9% across-the-board interim rate increase to be effective August 1, 2017 as well as an additional 7.9% across-the-board rate increase proposed for April 1, 2018.[30] Taken together, the two 7.9% rate increases amount to a 16.4% increase after two years over 2016 rates. However, Manitoba Hydro has noted that it requires five years of consecutive rate increases of this magnitude.[31] Extending this rate trajectory to look at the 5-year growth rate relative to current rates amounts to an approximately 46.3% increase by 2021/22.[32]

With respect to the requested increase for August 1, 2017, the PUB approved a 3.36% interim increase which may be varied up or down following the Board's determinations in this proceeding.[33] As noted in the order, this decision continues Manitoba Hydro on a rate trajectory similar to that in Order 59/16 where it approved a 3.36% interim increase effective August 1, 2016.[34]

In the following sections, LEI examines the bill impact of the proposed increases on an annual and aggregate basis for select customer groups. Manitoba Hydro's use of monthly bill increases obscures the magnitude of their proposal. Next, LEI presents a more in-depth jurisdictional comparison of electricity rates, and assesses the impact on examples of typical agricultural and commercial consumers.

3.1 Residential bill impact

Manitoba Hydro's proposed rate increases will see the monthly bill for a residential consumer using 1,000 kilowatt-hours ("kWh") rise from $87.12 under 2016 rates, to $94.00 as of August 1, 2017, and to $101.43 as of August 1, 2018. On an annual basis, this amounts to bill totals of $1,045.44, $1,128.00, and $1,217.16 in the years 2016, 2017, and 2018 respectively as shown in Figure 3. By 2018, annual bills increase by $171.72. LEI calculated the post-2018 rates by factoring in three further annual increases of 7.9%. Following along this rate trajectory to 2021 amounts to an overall increase of $483.85 over 2016 rates.

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30 Manitoba Hydro. *Manitoba Hydro 2017/18 & 2018/19 GRA: Tab 2 – Key Messages & Compelling Reasons for a Rate Increase.* May 12, 2017.

31 Ibid.

32 LEI calculated the 5-year percentage rate increase as: $1.079^5 - 1 = 46.25\%$

33 Manitoba Public Utilities Board. *Order 80/17.* July 31, 2017.

34 Manitoba Public Utilities Board. *Order 59/16.* April 28, 2016.

Figure 3. Bills for a residential consumer using 1,000 kWh per month under 7.9% rate increases

Year	Monthly electric bill	Cumulative monthly increase	Annual electricity bill	Cumulative Annual Increase
2016	**$87.12**		**$1,045.44**	
2017	$94.00	$6.88	$1,128.00	$82.56
2018	$101.43	$14.31	$1,217.16	$171.72
2019	$109.44	$22.32	$1,313.32	$267.88
2020	$118.09	$30.97	$1,417.07	$371.63
2021	$127.42	$40.30	$1,529.02	$483.58

Note: LEI calculation
Source: Manitoba Hydro GRA: Appendices 9.5 and 9.6

To add a layer of context, LEI compared the proposed rate increases to the historical growth rate of disposable income.[35] Between the years of 2011 and 2015, Manitoba's median family income grew by 2.89% on a compound basis. During the same time frame, Manitoba Hydro's electricity rates grew at a compound rate of 3.2% annually.[36] Said another way, both median family income and electricity rates grew at a similar pace over the five years between 2011 and 2015.

As per the economic outlook in Appendix 3.2 of Manitoba Hydro's General Rate Application, the percentage change of disposable income fell from 3.80% in 2012 to 2.40% in 2016, with a growth rate of only 0.6% in 2014.[37] The data, reproduced below, implies that the average percentage change of Manitoba's household disposable income was roughly 2.64% between 2012 and 2016, making Manitoba's proposed rate increase of 7.9% three times higher than the historic disposable income growth.[38]

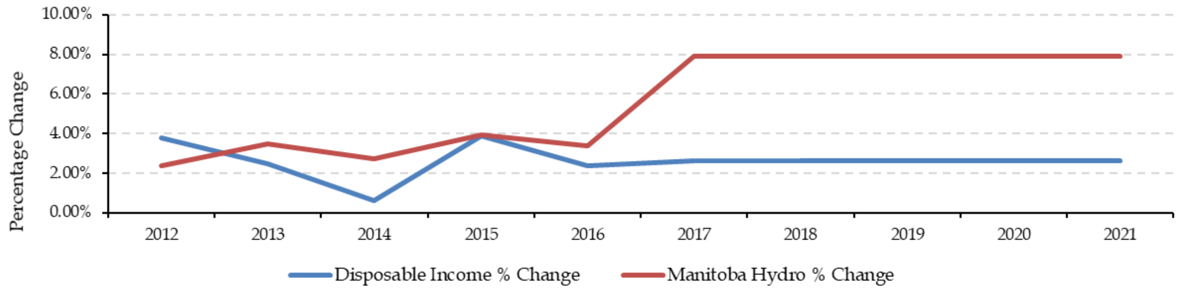
[35] Disposable income is defined by Statistics Canada as the total household income less property income paid, current transfers to government, non-profit institutions serving households, and non-residents. Source: "*Reconciling Canadian-U.S. measures of household disposable income and household debt.*" Statistics Canada. November 27, 2015. Web. October 27, 2017. <http://www.statcan.gc.ca/pub/13-605-x/2012005/article/11748-eng.htm>

[36] Manitoba Hydro. *Manitoba Hydro GRA: PUB MFR 12*. May 26, 2017

[37] Manitoba Hydro. *Manitoba Hydro 2017/18 & 2018/19 GRA: Tab 2 – Appendix 3.2*. May 12, 2017.

[38] Using a less prolonged period (four years rather than five) of 7.9% rate increases, PRA estimated that, depending on the definition of energy poverty, the percentage of households experiencing energy poverty would increase by more than 30% by 2021. As such households spend a higher proportion of their income, the effect on consumption could be more pronounced.

Figure 4. Historical and proposed percentage change of disposable income compared to percentage change of Manitoba Hydro electricity rates (2012-2021)



Note: LEI shows the higher of the two rates approved, 2.4%, for 2012/2013 fiscal year; future growth rates assume disposable income growth is consistent with recent averages
Source: Manitoba Hydro GRA: Appendix 3.2

Based on this projection, electricity rates will take up an increasingly greater portion of Manitoban families' disposable incomes, leaving less for other expenses. To express the increase tangibly, the cumulative annual increase of $483 by 2021 is roughly equivalent to one month's worth of groceries for the average Canadian household.[39] It is reasonable to assume that a portion of this is money that would have otherwise been spent at establishments that are part of the GSS-GSM rate class.

3.2 Commercial customer bill impact

3.2.1 General service small

For small businesses using 5,000 kWh per month within the GSS class, Manitoba Hydro's proposed rate increases will see monthly bills increase from $437.65 under 2016 rates to $472.22 as of August 1, 2017 and $509.53 as of August 1, 2018. On an annual basis, this amounts to bill totals of $5,251.80, $5,666.64 and $6,114.36 in the years 2016, 2017 and 2018 respectively as shown in Figure 5. By 2018, annual bills increase by $862. LEI calculated the post-2018 rates by factoring in further annual increases of 7.9%. Following along this rate trajectory to 2021, GSS ratepayers face an overall annual increase of $2,429 over bills calculated using 2016 rates by 2021.

Figure 5. Bills for a GSS consumer using 5,000 kWh per month under 7.9% rate increases

Year	Monthly electric bill	Cumulative monthly increase	Annual electricity bill	Cumulative Annual Increase
2016	**$437.65**		**$5,251.80**	
2017	$472.22	$34.57	$5,666.64	$414.84
2018	$509.53	$71.88	$6,114.36	$862.56
2019*	$549.78	$112.13	$6,597.39	$1,345.59
2020*	$593.22	$155.57	$7,118.59	$1,866.79
2021	$640.08	$202.43	$7,680.96	$2,429.16

Note: LEI calculations; data source: Manitoba Hydro GRA: Appendices 9.5 and 9.6

[39] Statistics Canada. *Average household food expenditure, by province (Canada)*. 2015.

3.2.2 General service medium

For medium-sized businesses in the GSM class connected at 500 kVA with a 50% load factor per month, Manitoba Hydro's proposed rate increases will see the monthly bills increase from $12,056 under 2016 rates to $13,007 as of August 1, 2017 and to $14,033 as of August 1, 2018. On an annual basis, this amounts to bill totals of $144,672, $156,084, and $168,396 in the years 2016, 2017, and 2018, respectively, as shown in Figure 5. By 2018, annual bills increase by $23,724. LEI calculated the post-2018 rates by factoring in further annual increases of 7.9%. Following along this rate trajectory to 2021 amounts to an overall increase of $66,870 in GSM bills over 2016 rates.

Figure 6. Bills for a 500 kVA GSM consumer at a 50% load factor per month under 7.9% rate increases

Year	Monthly electric bill	Cumulative monthly increase	Annual electricity bill	Cumulative Annual Increase
2016	**$12,056.00**		**$144,672.00**	
2017	$13,007.00	$951.00	$156,084.00	$11,412.00
2018	$14,033.00	$1,977.00	$168,396.00	$23,724.00
2019*	$15,141.61	$3,085.61	$181,699.28	$37,027.28
2020*	$16,337.79	$4,281.79	$196,053.53	$51,381.53
2021*	$17,628.48	$5,572.48	$211,541.76	$66,869.76

Note: LEI calculation
Source: Manitoba Hydro GRA: Appendices 9.5 and 9.6

Using an average hourly wage of $25.75, excluding benefits, for a full-time employee in Manitoba as of September 2017 from Statistics Canada, LEI estimated the pre-benefits cost of a full-time equivalent ("FTE") as $53,560.[40,41] Accordingly, a five-year increase in electricity bills of $66,870 is equivalent to 1.25 FTEs on a pre-benefits basis. For illustrative purposes, if the approximately 2,000 general service medium customers were all connected at 500 kVA with a 50% load factor, the overall cumulative five-year rate increase is $133.7 million or 2,500 FTEs. While LEI does not suggest a 1-to-1 relationship between costs and employment, GSS and GSM customers may be limited in their options to reduce costs in other areas.

3.2.3 Retail rate levels

On page 55 of Manitoba Hydro's Tab 2 submission entitled *"Key Messages & Compelling Reasons for a Rate Increase"*, the utility provides a comparison of Manitoba rates to other jurisdictions. To augment the information provided by Manitoba Hydro, LEI undertook to review this assessment to provide additional context for the Board. LEI calculated the average retail rate for commercial customers as the total revenue generated from commercial sales divided by the total amount of energy consumed by commercial ratepayers using Manitoba Hydro annual reports.

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40 Statistics Canada. *Average hourly wages of employees by selected characteristics and occupation unadjusted data, by province (Manitoba).* October 6, 2017.

41 The annual salary assumes 8 hours per day, 5 days per week and 52 weeks per year. This amounts to 2,080 hours in a year

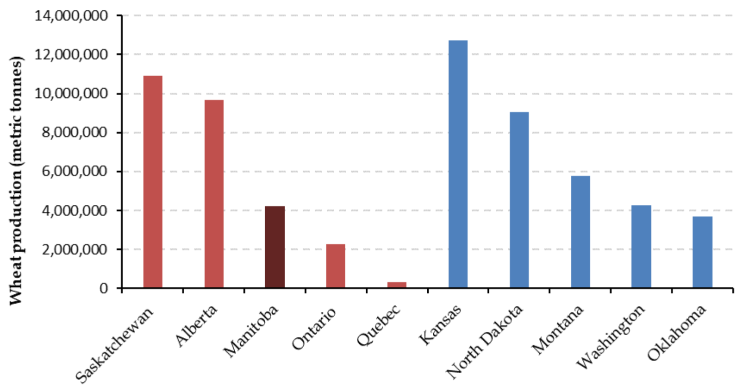
Figure 7. Manitoba Hydro average commercial retail rates in 2017

Parameter	2017
Commercial sales (nominal, $CAD)	496,000,000
Commercial consumption (kWh)	6,876,000,000
Average commercial rate (CAD cents per kWh)	$7.21

Source: Manitoba Hydro annual reports

In comparing Manitoba Hydro's rates to other jurisdictions, LEI examined the province's top export products, specifically wheat Manitoba's output for these products were compared to competing jurisdictions in across Canada and the US. From this, LEI assessed how the relative competitiveness is affected by the proposed rate increases. Figure 8 below presents the top 5 Canadian and US producers of wheat.[42,43]

Figure 8. Top 5 Canadian and US wheat producers in 2016



Source: Statistics Canada, AgMRC

To account for five years of rate increases out to 2021, LEI escalated the average commercial rates in competing jurisdictions with inflation of 2% while Manitoba's rate increased at a rate of 7.9% annually as shown in Figure 9 below. This is similar to the approach taken by Manitoba Hydro. Next, LEI computed the average of all competing jurisdictions over the 2016-2021 period. Taking the difference between the average of competitors and Manitoba Hydro's rates as a percentage of the average of competitors, LEI determined Manitoba's average competitive margin. LEI notes that this competitive margin will be eroded from 37% to 16% over the 2016-2021 horizon due to the proposed increases, an average drop of 21%. This occurs during a period when Manitoba agricultural producers are facing other competitive challenges, such as the lack of carbon pricing in most US jurisdictions relative to explicit carbon pricing in Canada and attacks on the supply management system (albeit this is applicable to dairy farmers rather than wheat producers).

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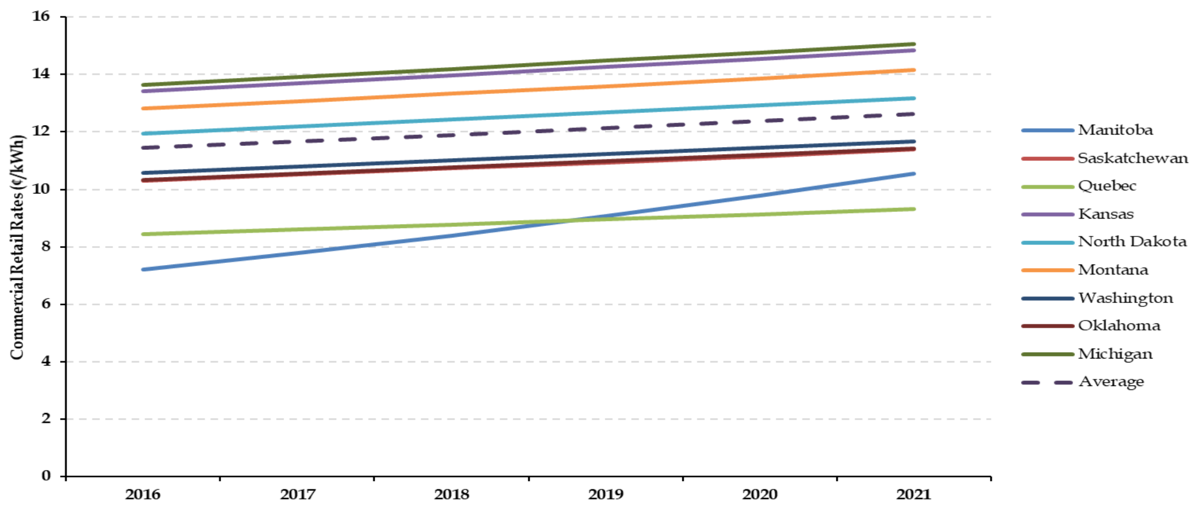
42 Agricultural Marketing Resource Center. *Commodities & Products: Wheat*. 2016

43 Statistics Canada. *Production of principal field crops*. 2017

Figure 9. Commercial retail rates of Manitoba compared to other jurisdictions



Source: SaskPower, Manitoba Hydro, Hydro Quebec, EIA

3.3 Impact on typical agricultural customers

Total gross operating expenses of farms Canada-wide have ranged from approximately $35.4 billion to $44.7 billion annually from 2010 to 2016.[44] Of these operating expenses, electricity expenditures accounted for about $783 million to $982 million each year.[45] In other words, electricity comprises for approximately 2.1 – 2.2% of the total gross farm operating expenses annually in Canada.

In Manitoba alone, total gross operating expenses have ranged from $3.8 billion to $4.7 billion annually from 2010 to 2016.[46] Electricity expenditures accounted for $68.8 million to $89.1 million, comprising of 1.7 – 1.9% of total gross farm operating expenses provincially each year from 2010 to 2016.[47] Figure 10 shows electricity's share of the gross operating expenses for 2016.

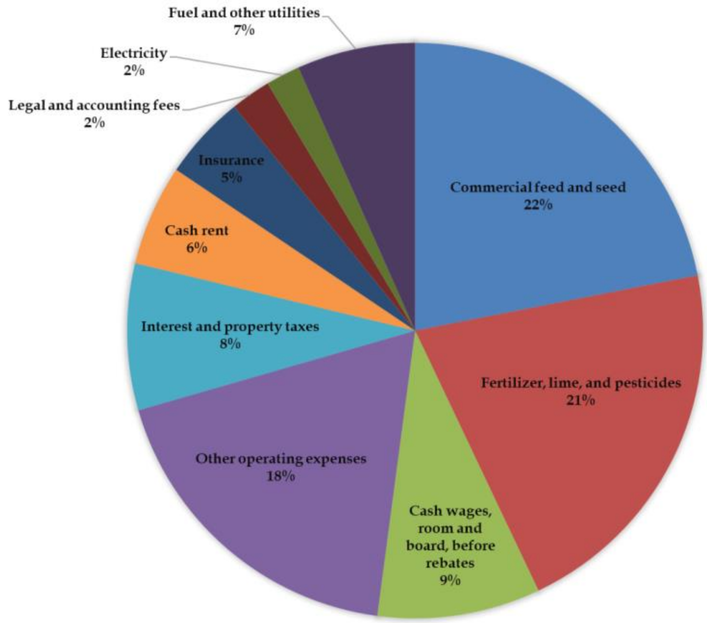
[44] "Farm Operating Expenses and Depreciation Charges." *Statistics Canada.* Web. October 22, 2017. <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=20005#F>

[45] Ibid.

[46] Ibid.

[47] Ibid.

Figure 10. Total gross operating expenses for farms in Manitoba in 2016



Note: Other utilities include heating fuel and telephone. Other operating expenses include twine, wire, and containers, share rent, stabilization premiums, irrigation, livestock and poultry purchases, repairs to buildings and fences, artificial insemination and veterinary fees, machinery repairs and other expenses, and custom work.

Source: Statistics Canada

Consequently, Manitoba Hydro's proposed rate increase of 7.9% could cause the share of electricity to increase by approximately 8%.[48] With regards to the increase in overall gross operating costs, the rate increase could result in a $5.4 million to $7 million increase Manitoba-wide.

3.3.1 Hog farming

As per Statistics Canada's estimates of hog farming in 2016, Manitoba has approximately 615 reporting hog farms, with an average of 5,041 hogs per farm.[49] Using the Government of

[48] LEI calculated the percentage change in share of electricity of gross operating costs by first calculating the average historic shares of electricity from 2010 to 2016. This was done by taking ratios of the electricity expenses of each year to the total gross operating expenses of each year. LEI then averaged the ratios and converted said average into a percentage. These steps were repeated once more once the rate increase was applied to the electricity expenses for each year, while the total gross operating expenses were assumed to be unchanged. LEI then calculated the percentage share in electricity of gross operating costs by taking the difference between the percentage share of electricity before and after the rate increase, divided the quotient by the percentage share of electricity before the rate increase, and converted the result into a percentage.

[49] "Table 003-0103 Hog statistics, number of farms reporting and average number of hogs per farm, semi-annual (number)." *Statistics Canada*. 2016. Web. October 26, 2017. <http://www5.statcan.gc.ca/cansim/a01?lang=eng>

Manitoba's *Guidelines for Estimating Swine Farrow-Finish Costs 2016,* LEI found that the cost of utilities for hog operations that use purchased feed and home-mixed feed were $271,391 per farm per year, each.[50] This represents approximately 1.7% and 1.9% of the total operating expenses of purchased feed and home-mixed feed hog farms, respectively.[51]

In 2016, purchased feed and home-mixed feed hog farms had average net sales of about $20.05 million and $19.76 million, respectively, with operating margins per dollar of revenue of 0.218 and 0.282, or average margins of $5.57 million per hog farm.[52] With an electricity rate increase of 7.9% over five years, the average hog farm sees a $125,529 drop in operating profit, or a 2.87% and 2.25% drop for purchased feed and home-mixed feed hog farms, respectively.

To put this into perspective, the operating profit drop per average hog farm equates to the purchase of 2,728 weanlings, assuming the farmer were otherwise reinvesting the profits.[53,54] Figure 11 shows the declining average operating profit per hog farm in dollars per year from the base year (2016) to the fifth year of the 7.9% rate application (2021). The declining average operating profit per hog farm in the five-year period can be attributed to the increasing portion of electricity share from 1.7% to 2.5% and from 1.9% to 2.8% of the total purchased feed and home-mixed feed hog farm operating expenses, respectively. LEI notes that these estimates may be conservative as the effect of electricity rates on feed production, and thus cost of feed, is not accounted for.

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[50] The hydro and propane costs for hog operations is $133.06 per sow per year, as per the *Guidelines for Estimating Swine-Farrow-Finish Costs 2016* which were based on 500 sows. LEI calculated the hydroelectric portion of these costs by multiplying the rate of hydro and the amount of hydro used (i.e. $0.053 per kWh and 512,058 kWh, respectively), also provided in these guidelines. This amounted to a hydro cost of $54.28 per sow per year. As the guidelines were based on 500 sows and the average Manitoba hog farm carries 5,041 sows (i.e. approximately 10 times 500 sows), the hydro cost per sow per year was multiplied by 500 sows and by 10, resulting in the cost of utilities for both farms that purchase feed and that home-mix feed (i.e. $271,391 per farm).

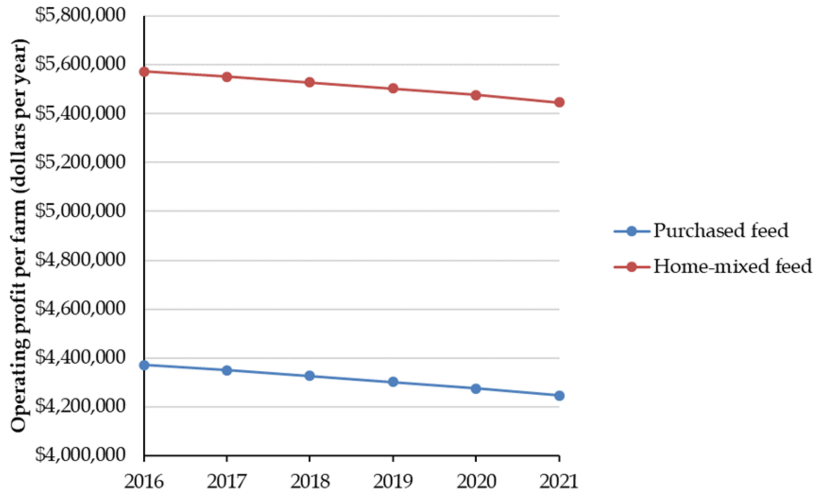
[51] Hog farms that use purchased feed, as opposed to home-mixed feed, have higher total feed costs (i.e. approximately $2,407 per sow per year and $2,152 per sow per year, respectively), resulting in higher total operating expenses (i.e. $15.68 million and $14.19 million per year, respectively).

[52] Government of Manitoba. *Guidelines for Estimating Swine Farrow-Finish Costs 2016.* November 2015.

[53] The cost of a weanling is approximately $46.00 (Source: Government of Manitoba. *Guidelines for Estimating Swine Farrow-Wean to 6 kg Costs in Manitoba*. 2016).

[54] A weanling is a pig that has been weaned. Weaning is the process of introducing and accustoming a piglet to what would be its adult diet to slowly disaccustom it of its mother's (i.e. a sow's) milk supply (Source: Milan Shipka. *Recommended Practices for Raising Pigs from Birth to Weaning.* Cooperative Extension Service, University of Alaska Fairbanks. Alaska Livestock Series. May 2015).

Figure 11. Average operating profit per hog farm



Source: Government of Manitoba.

3.3.2 Irrigated potato farming

As the province with the second largest potato industry in Canada, Manitoba produces almost a quarter of Canada's total production.[55] Irrigation is a vital component of potato farming, as potatoes are shallow-rooted plants that are sensitive to even the slightest deficiency of water.[56] Electricity usage in irrigation is an important part of total farm electricity use, and the need for irrigation may increase with climate change.[57]

As per Statistics Canada's estimates of 2016 potato production, Manitoba has a harvestable area of approximately 64,000 acres.[58] According to the Government of Manitoba's *Guidelines for Estimating Irrigated Processing Potato Costs 2016,* the cost of utilities for general use and the cost of irrigation is approximately $105.38 per acre per year and $54.94 per acre per year, respectively.[59] For irrigation costs, the guidelines assume that 40% of the pumping is done with the use of diesel,

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[55] "Agricultural and Food Processing – Commodities: Special Crops." *Government of Manitoba*. Web. October 24, 2017. <https://www.gov.mb.ca/trade/globaltrade/agrifood/commodity/potatoes.html>

[56] "Irrigation – Potatoes." *Agriculture Victoria.* Web. October 24, 2017. <http://agriculture.vic.gov.au/agriculture/horticulture/vegetables/vegetables-a-z/potatoes/irrigation-potatoes>

[57] Manitoba Public Utilities Board. *Manitoba Hydro 2017/18 and 2018/19 General Rate Application Pre-Hearing Conference.* Transcript, p. 148. June 12, 2017.

[58] Statistics Canada. *Service Bulletin – Canadian Potato Production 2012*. Vol. 10, no. 2, Catalogue no. 22-008-X. 2012.

[59] Government of Manitoba. *Guidelines for Estimating Potato Production Costs – 2016*. January 2016.

whereas the remaining 60% is done with electricity.[60] LEI thus assumed 60% of the irrigation costs to be attributed to electricity. In other words, utilities for irrigation cost approximately $44.31 per acre per year, leading to a total cost of utilities (i.e. for irrigation and general use) of $149.69 per acre per year. Furthermore, by multiplying the total cost of utilities per acre with the harvestable area in 2016, a total cost of utilities for all harvestable land for potato farming was determined (i.e. approximately $9.58 million per year). LEI then divided this value by the number of potato farms in Manitoba in 2016 (i.e. 163 potato farms) to find that the average total cost of utilities per farm amounted to approximately $58,774 per year.[61] This represents approximately 6.1% of the total operating expenses of an irrigated potato farm (i.e. $964,586 per year on average).[62]

Moreover, the average irrigated potato farm earned approximately $1.32 million with an operating margin per dollar of revenue of 0.268 in 2016, or average margins of $353,154 per irrigated potato farm.[63] With a rate increase of 7.9% over five years, the average farm sees a $27,185, or 7.7%, drop in operating profit, with the operating margin per dollar of revenue falling from 0.268 to 0.247.

The following figure shows the declining average operating profit per farm in dollars per year from the base year (2016) to the fifth year of the 7.9% rate application (2021). The declining average operating profit per farm can be attributed to the increasing portion of electricity share from 6.1% to 8.7% over the five-year period.

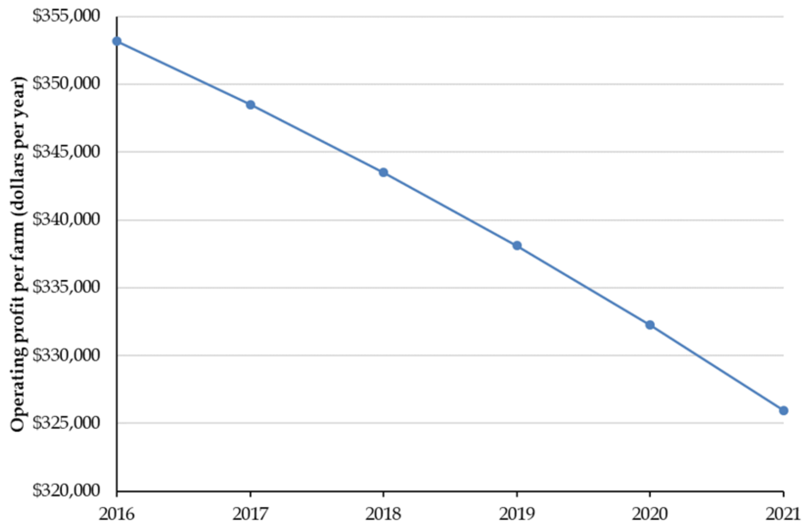
[60] Ibid.

[61] "Table 004-0213 Census of Agriculture, hay and field crops." *Statistics Canada*. 2016. Web. October 26, 2017. < http://www5.statcan.gc.ca/cansim/a01?lang=eng>

[62] The average total operating expense per farm was calculated by first multiplying the total potato irrigated farm operating costs per acre for Manitoba in 2016 (i.e. $2,457 per acre), from the *Guidelines for Estimating Potato Production Costs*, by the total harvestable area for irrigated potatoes in 2016 (i.e. 64,000 acres) to determine the total operating expenses for the harvestable area (i.e. approximately $157.23 million). Next, LEI divided the total operating expenses for the harvestable area by the number of irrigated potato farms in Manitoba in 2016 (i.e. 163 farms) to obtain the average total operating expense per farm per year (i.e. $964,586).

[63] The operating margin was calculated with the following formula: Operating Margin = 1 – Operating Expense Ratio. The Operating Expense ratio was provided in the *Guidelines for Estimating Potato Production Costs - 2016* by the Government of Manitoba. LEI then calculated the net sales with the following formula: Net Sales = Operating Expenses / (1 – Operating Margin). This value was assumed to stay constant during all years of rate increases.

Figure 12. Average operating profit per irrigated potato farm



Source: Government of Manitoba.

3.3.3 Dairy production

Statistics Canada released average operating revenues and expenses by province for dairy cattle and milk production farming in 2010. As per the results based on 325 dairy farms in Manitoba, the average cost of utilities is approximately $15,190 per farm per year, representing approximately 2.6% of total annual operating expenses (i.e. $582,400).[64]

The average dairy farm in Manitoba had net sales of $776,533 in 2016, with an operating margin per dollar of revenue of 0.25, or average margins of $192,933 per dairy farm.[65] With a rate increase of 7.9% over five years, the average dairy farm sees a $7,026, or 3.6%, drop in operating profit. This is equivalent to the cost of approximately 23 heifer calves, assuming the farmer were otherwise reinvesting the profits.[66,67] The operating margin per dollar of revenue falls from 0.25 to 0.24. Figure 13 shows the declining average profit per farm in dollars per year from the base year (2016) to the fifth year of the 7.9% rate application (2021). The declining average operating

[64] "Statistics on Revenues and Expenses of Farms – Average Operating Revenues and Expenses by Province (or Region) for Selected Farm Types – Dairy Cattle and Milk." *Statistics Canada*. Web. October 23, 2017. <http://www.statcan.gc.ca/pub/21-208-x/2012002/t069-eng.pdf>

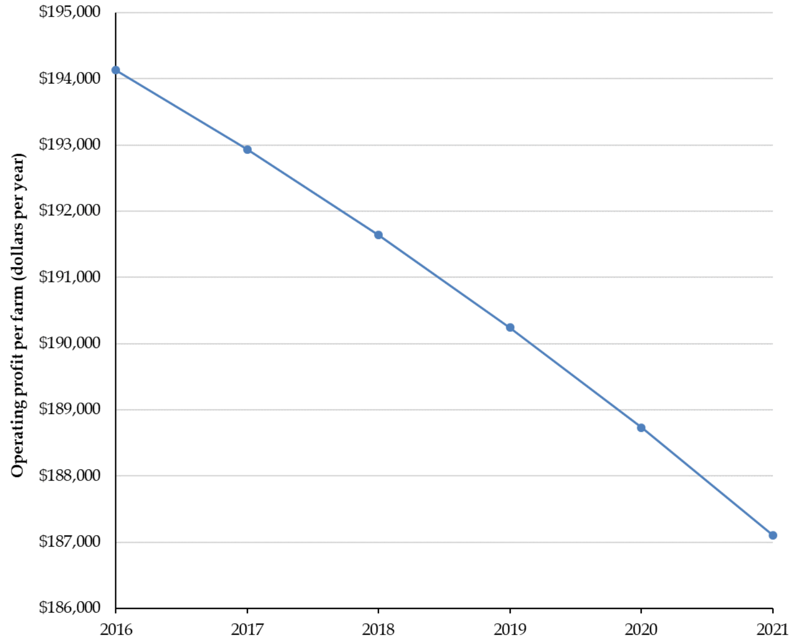
[65] Ibid.

[66] The cost of a heifer calf is approximately $300 (Source*:* Government of Manitoba. *Guidelines for Estimating Dairy Cow Production Costs in Manitoba.* 2017).

[67] A heifer calf is female calf that has not given birth yet (Source: US Department of Health and Human Services. *Changes to Approved NADAs – New NADAs vs. Category II Supplemental NADAs.* Food and Drug Administration, Center for Veterinary Medicine. May 2015).

profit per farm can be attributed to the increasing portion of electricity share from 2.6% to 3.8% over the five-year period.

Figure 13. Average operating profit per dairy farm



Source: *Statistics Canada.*

3.3.4 Indirect impacts

The above calculations refer to the impact of the electricity rate increase on the average size farm; however, smaller facilities would not benefit from the same economies of scale and would likely be more significantly impacted on their margins.

The increase in electricity rates would conceivably also exert an upward pressure on other inputs such as feed production. Canada produces roughly 30 million tons of feed annually, of which 20 million comprises of commercial production and 10 million of on-farm production.[68] Of the 500 feed mills in Canada, approximately 22% are in the Prairies.[69] Moreover, the cost of feed is one of the largest input costs for livestock producers; depending on the livestock being produced, feed

68 "Canadian Feed Stats." *Animal Nutrition Association of Canada (ANAC).* 2012. Web. October 23, 2017. <https://www.gov.mb.ca/trade/globaltrade/agrifood/commodity/potatoes.html>

69 Ibid.

can account for up to 75% of total costs.[70] The share of production steps in percentage per tonne of compound feed in the overall energy consumption is as follows:

- reception (4%);
- compressed air (4%);
- milling and mixing (29%);
- pelleting and cooling (61%); and
- loading (2%).[71]

Depending on feed requirements (e.g. mix and refinement), the energy consumed in its production can vary from 15 to 80 kWh per ton.[72] Thus, with increasing rates, commercial feed producers may be compelled to increase prices, thereby increasing the overall expenses of the average livestock farm. These rising costs could also apply to on-farm producers of feed.

Additional indirect impacts that could also be induced because of the rate increase are the pressure on salaries in the long run and the limitation of value-added activities (e.g. automation).

3.4 Impact on typical commercial customers

3.4.1 General service small

To understand the impact of Manitoba's proposed rate hike on GSS customers, LEI assessed the change in gross margins for convenience stores. According to Statistics Canada, the current gross margin for convenience stores in Manitoba is 21.2%. [73] This was calculated by subtracting operating expenses from the revenue, and dividing by the operating revenue.

For data on the breakdown of convenience store expenses, LEI used data published from the US National Association of Convenience and Fuel Retailing ("NACS") 2015 State of the Industry Summit reports. This data was considered an appropriate proxy to show potential impacts on Manitoba Hydro's general service small customers.

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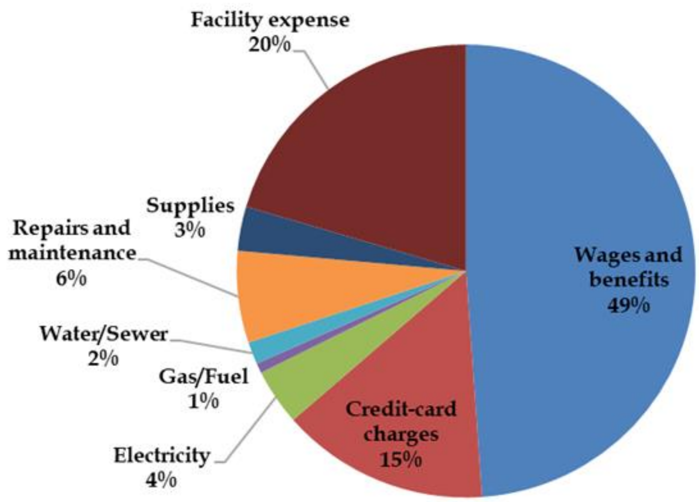
[70] Ibid.

[71] BINE Information Service. *Producing Animal Feed with Less Electricity and Heat*. ProjektInfo. Bonn, Germany. July 2014.

[72] Ibid.

[73] Statistics Canada. *Retail trade, operating statistics, by province and territory (Manitoba)*. 2014

Figure 14. Convenience Store Monthly Operating Expenses



Source: NACS 2015 State of the Industry Summit report

For data on the breakdown of convenience store expenses, LEI used data published from the US National Association of Convenience and Fuel Retailing ("NACS") 2015 State of the Industry Summit reports.[74] This data was considered an appropriate proxy to show potential impacts on Manitoba Hydro's general service small customers. Figure 14 illustrates that currently, electricity accounts for 4% of the total monthly operating expenses for convenience stores, and amounts to $1,957. With the requested rate increases over a 5-year period, electricity bills are expected to increase from $1,957 to $2,862. Assuming that all other costs and revenue remain in equal, gross margins will fall by 4%, from 21% to 17%.

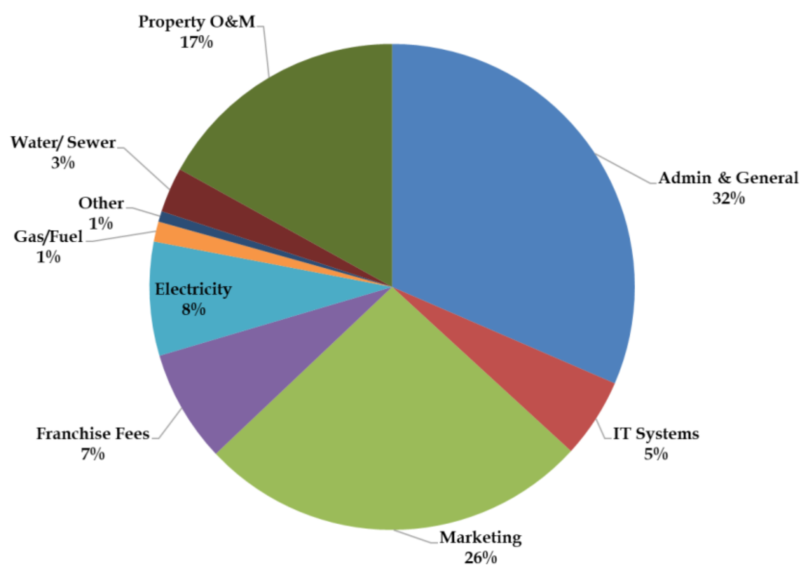
3.4.2 General service medium

To illustrate the impact of electricity rate hike on the GSM customers, LEI examined the change in gross margins of hotels in Manitoba. For this assessment, LEI relied on data from Statistics Canada and Smith Travel Research data completed for the hotel sector in the US. LEI considered this would be a reasonable proxy to show potential impacts in Manitoba. The dataset was pulled from the 2017 Hotel Operating Statistics ("HOST") Almanac which reports the operating statements of more than 5,200 US hotels for the year 2016. Figure 15 shows the breakdown of monthly operating costs of hotels across the US. According to the HOST Almanac, in 2016, the average hotel of 201 rooms spent a total of $1,240 per night on electricity costs, equivalent to $6.17 per room per night. Over the course of a month, electricity accounts for a total of 8% of all

[74] NACS. *NACS State of Industry Summit 2015.* 2016

operating expenses.[75] LEI computed the gross margin by subtracting the operating expense from the operating revenue, then dividing that by the operating revenue. Currently, the gross margin for the travel accommodation sector is at 17.97%.[76] Under Manitoba Hydro's proposed rate increase of 7.9%, electricity costs for the average hotel with 201 rooms is expected to increase by $204 to $1,444 per night, or $7.18 per room. By adding the new cost of electricity to the operating expense, we can compute for a new gross margin reflective of the proposed rate increase. LEI expects a 2.77% decrease in gross margin from 17.97% to 15.20 % over the next five years. LEI notes that this analysis is based on US hotel operating expense data as of 2016 and is an illustrative example that is indicative of potential results for counterparts in Manitoba.

Figure 15. Hotel Monthly Operating Expenses



Source: HOST 2017 Almanac

3.5 Macroeconomic impact

The above examples provide insights on how the increases in electricity costs could impact particular types of GSS and GSM consumers. For the purposes of providing an example of how to examine the impact of Manitoba Hydro's proposed rate increases on the overall economy, on small and medium-sized businesses and on the agricultural sector, LEI has opted to use the Impact Analysis for Planning ("IMPLAN") economic model. LEI has seen no evidence that Manitoba Hydro has performed such analysis on a detailed, academically sound basis to identify the trade-offs between the impact of the rate increases on its financial health on the one hand and that of the province and ratepayers on the other. Given the short time available to LEI, the results

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[75] Smith Travel Research. *HOST Almanac 2017*.

[76] CSI Market. *Hotels & Leisure Industry Profitability*. 2017.

provided here are of necessity illustrative.[77] LEI recommends that further such analysis be required before finalizing consideration of a rate increase of this magnitude.

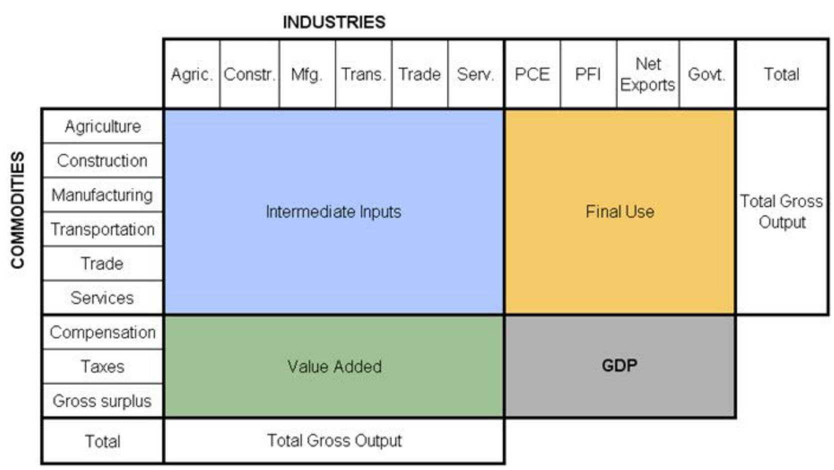
3.5.1 Overview of IMPLAN

IMPLAN is an input-output ("I/O") model developed under the direction of the United States Forest Service in 1976 and currently maintained by the IMPLAN, formerly known as Minnesota IMPLAN Group ("MIG"), now based in Huntersville, North Carolina. With over 40 years of experience, IMPLAN has served academics, governments, economic developers, corporations, nonprofits, and consultants conducting economic impact analysis.

I/O models trace the flow of goods and services through the economy based on a dollar flow I/O table known as the Social Accounting Matrix ("SAM"). Using this information, IMPLAN models the way a dollar injected into one sector is spent and re-spent in other sectors of the economy, generating waves of economic activity, or so-called "economic multiplier" effects. The model uses national industry data and county-level economic data to generate a series of multipliers, which in turn estimate the total economic implications of economic activity.

In an I/O table or SAM, such as the one presented in Figure 16, the rows represent the amount spent on a commodity or service by all other industries or institutions, including businesses and government.[78] Conversely, the columns denote the amount that an industry or institution spends on the various commodities and services as well as the wages as taxes paid.

Figure 16. Structure of the social accounting matrix



Source: Bess, 2011.

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[77] The budget for the combined intervention of the representatives of the GSS/GSM customer classes and KAP was approved on September 15, 2017. This provided less than six weeks to perform analysis that normally takes several months.

[78] United States Department of Agriculture. *Guidelines for Economic Impact Analysis with IMPAN.* December 5, 2014.

In addition to measuring the purchasing relationships between industry and household sectors, SAM also measures the economic relationships between government, industry and household sectors, allowing IMPLAN to model transfer payments such as unemployment insurance.

3.5.2 Data sources

IMPLAN's data for Manitoba is taken from Statistics Canada for the year 2012 and covers 103 sectors of the provincial economy. LEI has included a list of these sectors in Appendix B. Given the time available LEI was not able to update the model with more recent Statistics Canada data.

3.5.3 Model approach and assumptions

For the purposes of this analysis, LEI examined Manitoba Hydro's proposed rate increases in terms of the impact on aggregate household spend and its impact on business expenditures. In this exercise, LEI assumed government spending was unchanged as its expenditures are less tied to income compared to households and businesses. Next, LEI assumed consumption by households and businesses is reduced to shift spending to electricity. Further, this analysis assumed incremental revenues collected by Manitoba Hydro are used to cover the cost of past investment decisions and do not result in new expenditure, such as developing new capital projects (beyond those already assumed) or hire more staff.[79] Furthermore, LEI did not consider the impact of increase in revenue to Manitoba Hydro on the utility's taxes or payment in lieu of taxes, and therefore any secondary impact of change in government spending due to this change revenue has not been considered.

Household spend approach

LEI used the incremental revenue requirement derived from the residential customer class as an input representing the total household expenditure diverted to cover electricity bills. This total amount was assumed to be diverted from other areas of aggregate household spend. As seen in Figure 17, incremental revenues from the residential customer class after two years of successive 7.9% rate increases amount to $54.2 million. This impact would be still greater if a five-year period were examined, given the additional projected rate increases.

Figure 17. Incremental revenue derived from rate increases in 2018/19

($)	Calculated revenue at current rates	Calculated revenue at proposed rates	Difference in revenues
Residential	687,357,292	741,631,347	54,274,055
General Service	930,221,552	1,003,123,242	72,901,690
Area & Roadway Lighting	25,537,757	27,598,083	2,125,804
less: DSM Reduction	*(33,137,511)*	*(35,756,939)*	*(2,619,428)*
Misc. Revenue & Adjustments	7,135,375	7,698,803	563,428
Domestic revenue	**1,617,114,465**	**1,744,294,536**	**127,180,071**

Source: Manitoba Hydro. GRA: Updated Appendix 9.2

[79] Specifically, revenues collected will be put towards funding "the vast majority of new major generation and transmission capital expenditures through debt financing." Source: Manitoba Hydro. *2017/18 & 2018/19 GRA: Tab 2 – Key Messages & Compelling Reasons for a Rate Increase.* May 12, 2017.

Next LEI considered the ability of households to cover a portion of these costs by dipping into savings. The average of total household savings in Manitoba over the 2010-2015 was $211 million.[80] While this total is significantly larger than $54.2 million, LEI notes that these savings are not equally distributed across households. As such, LEI considered three scenarios where households used 0%, 10% and 20% of their savings to cover electricity costs. LEI deducted these amounts from the incremental revenue requirement to determine the reduced consumption. Figure 18 presents LEI's calculations of aggregate household savings in each scenario and the resulting reduction in consumption. The net result on reduced consumption is presented in Figure 18 and the resulting impacts are discussed in Section 3.5.4.

Figure 18. LEI calculations of savings usage scenarios and reduced consumption

Parameter	Value ($)
Annual household savings	211,000,000
Savings usage scenarios:	
High savings usage case (20%)	42,200,000
Mid savings usage case (10%)	21,100,000
Low savings usage case (0%)	-
Incremental Revenue requirement	54,272,055
Reduced consumption:	
High savings usage case (20%)	12,072,055
Mid savings usage case (10%)	33,172,055
Low savings usage case (0%)	54,272,055

General service small and medium class approach

In order to determine the impact on the GSS and GSM customer classes, LEI first identified the sectors of the economy in which these customers are involved. As shown in Figure 19, the sectors include agriculture, transportation and postal services, wholesale and retail trade, professional services as well as government, education and health care facilities.

[80] Statistics Canada. *Table 384-0040 - Current accounts - Households, provincial and territorial.*

Figure 19. GSS and GSM sectors

Industry Code	Description
1	Crop and animal production
3	Fishing, hunting and trapping
4	Support activities for agriculture and forestry
33	Printing and related support activities
60	Wholesale trade
61	Retail trade
62	Air transportation
63	Rail transportation
64	Water transportation
65	Truck transportation
66	Transit, ground passenger and sightseeing, and support activities for transportation
67	Pipeline transportation
68	Postal service and couriers and messengers
69	Warehousing and storage
70	Motion picture and sound recording industries
71	Radio and television broadcasting
72	Publishing, pay/specialty services, telecommunications and other information services
73	Depository credit intermediation and monetary authorities
74	Insurance carriers
77	Rental and leasing services and lessors of non-financial intagible assets
78	Other finance, insurance and real estate services and management of companies and enterprises
79	Legal, accounting and architectural, engineering and related services
80	Computer systems design and other professional, scientific and technical services
81	Advertising, public relations and related services
82	Administrative and support services
83	Waste management and remediation services
84	Educational services
85	Health care and social assistance
86	Arts, entertainment and recreation
87	Accommodation and food services
88	Repair and maintenance
90	Professional and similar organizations
91	Non-profit education services
92	Non-profit social assistance
93	Non-profit arts, entertainment and recreation
94	Religious organizations
95	Miscellaneous non-profit institutions serving households
96	Public educational services (except universities)
97	Public universities
98	Public hospitals
99	Public nursing and residential care facilities
100	Other federal government services
101	Other provincial and territorial government services
102	Other municipal government services
103	Other aboriginal government services

LEI used IMPLAN's 2012 breakdown of value added or Gross Provincial Product ("GPP") to determine the percentage share attributed to each sector. LEI allocated the $72.9 million incremental revenue requirement for the 2018/19 fiscal year of all general service customers across the sectors of the province's economy using the shares of GPP.[81] For sake of simplicity, LEI assumed sectoral electricity consumption to be correlated with sectoral contribution to GPP. By filtering for the GSS and GSM sectors identified in Figure 19, LEI isolated the incremental revenue requirement belonging to these activities as $47.5 billion.

In Manitoba Hydro's 2016 electric load forecast, the utility estimated that a one-time 1% in real electricity price would result in a 0.18% decrease in consumption by GSS and GSM customers.[82] Taking two years of rate increases of 7.9% and inflation of 2.0%, LEI calculated a real price increase of 12.4%.[83] This triggered GSS and GSM demand to decrease by 2.23%, reducing sector consumption to $46.5 billion from $47.5 billion.[84] LEI applied this reduction across all GSS and GSM sectors to generate the inputs for IMPLAN.

LEI used the incremental revenue requirement derived from the each GSS and GSM sector as an input representing the business expenditure diverted to cover electricity bills. Each sector's reduced consumption was allocated by its industry spending pattern, excluding spending on electricity bills. As stated previously, LEI assumed that the increase in electricity bills would be used to cover the cost of Manitoba Hydro's past investment decisions, and would not result in increase in Manitoba Hydro's capital expenditure or hiring decisions. As such, the increase in electricity bill to GSS and GSM customers were not added back into the I/O model as they are pure transfers to Manitoba Hydro, instead of changes Manitoba Hydro's spending patterns.

Agriculture sector approach

Given that the adjusted incremental revenue requirement for all sectors was calculated in the GSS and GSM approach, LEI isolated the portion corresponding to the crop and animal production sector. LEI modelled the impact of a 2 years of 7.9% rate increases as the reduced consumption of this sector, based on its industry spending pattern in IMPLAN. The results of this analysis are provided in Section 3.5.4.

3.5.4 Model results

LEI's model results are divided into three sections: residential, GSS/GSM and the agricultural sector.

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81 Manitoba Hydro. *Updated Appendix 9.2.* September 2017.

82 Manitoba Hydro. *Appendix 7.1 – 2016 Electric Load Forecast.* May 12, 2017.

83 Real two-year price increase was calculated as (1.079^2) - (1.02^2).

84 Consumption reduction was calculated as the real rate increase multiplied by the GSS and GSM price elasticity. i.e. 12.4% * -0.18.

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Residential impact

A summary of the model across the three scenarios is provided in Figure 20. The increase in rates on residential consumers will result in employment decreases ranging from 93 to 418 jobs across the scenarios examined. In terms of labor income, LEI expects a reduction of $4.6 -$21 million. Lower consumption from households is also expected to drive down value added by $9.4 – 42.4 million while output is project to fall by $17.3 - $77.5 million.

Figure 20. Summary of results by residential consumption impact type and scenario

Impact	0% savings used	10% savings used	20% savings used
Employment	(418.71)	(219.39)	(93.13)
Labor Income ($)	(21,079,692)	(11,044,958)	(4,688,708)
Value Added ($)	(42,485,004)	(22,260,529)	(9,449,843)
Output ($)	(77,561,490)	(40,639,276)	(17,251,826)

GSS/GSM impact

As seen in Figure 21, a $46.5 billion hike in electricity bills could result in the loss of 352 jobs with labor income falling by $19.8 million. In terms of contribution to the GPP, GSS and GSM customer value added is expected to decrease by $33.0 million. Likewise, total output declines by $63.5 million.

Figure 21. Summary of GSS/GSM impacts

Impact Type	Employment	Labor Income ($)	Value Added ($)	Output ($)
Direct Effect	-	-	-	-
Indirect Effect	(269.55)	(15,624,652)	(24,605,100)	(48,241,857)
Induced Effect	(82.41)	(4,139,529)	(8,416,846)	(15,287,475)
Total Effect	**(351.96)**	**(19,764,181)**	**(33,021,947)**	**(63,529,332)**

Agricultural impact

A 2-year rate increase will also result in negative impacts on the agricultural sector with reductions across-the-board. The rate increases are expected to eliminate 16 jobs and lower labour income by approximately $0.8 million. In terms of value added, reductions of approximately $1.5 million are expected, translating to $3.4 million in output reductions.

Figure 22. Summary of agricultural sector impacts

Impact Type	Employment	Labor Income ($)	Value Added ($)	Output ($)
Direct Effect	-	-	-	-
Indirect Effect	(12.78)	(653,409)	(1,134,460)	(2,769,092)
Induced Effect	(3.45)	(173,122)	(352,007)	(639,349)
Total Effect	**(16.23)**	**(826,532)**	**(1,486,467)**	**(3,408,442)**

3.6 Intergenerational impacts

The structure of the proposed rate increases poses significant questions of intergenerational equity. Manitoba Hydro proposes to front-load five years of 7.9% per year annual increases, with the vague suggestions that thereafter increases will revert to the rate of inflation. However, for some GSS-GSM businesses, the impact of the potential rate shock of a nearly 50% increase over a five year period means that those same businesses may not be around to enjoy the period of lower rates if it occurs. While Manitoba Hydro seeks to draw an analogy to the period when its existing hydro stations were built in noting that current customers benefit from prior investments, this analogy is flawed. Manitoba Hydro has presented no evidence to suggest that when its existing assets were built there was an expectation that they would have negative cash flow for 20 or more years.

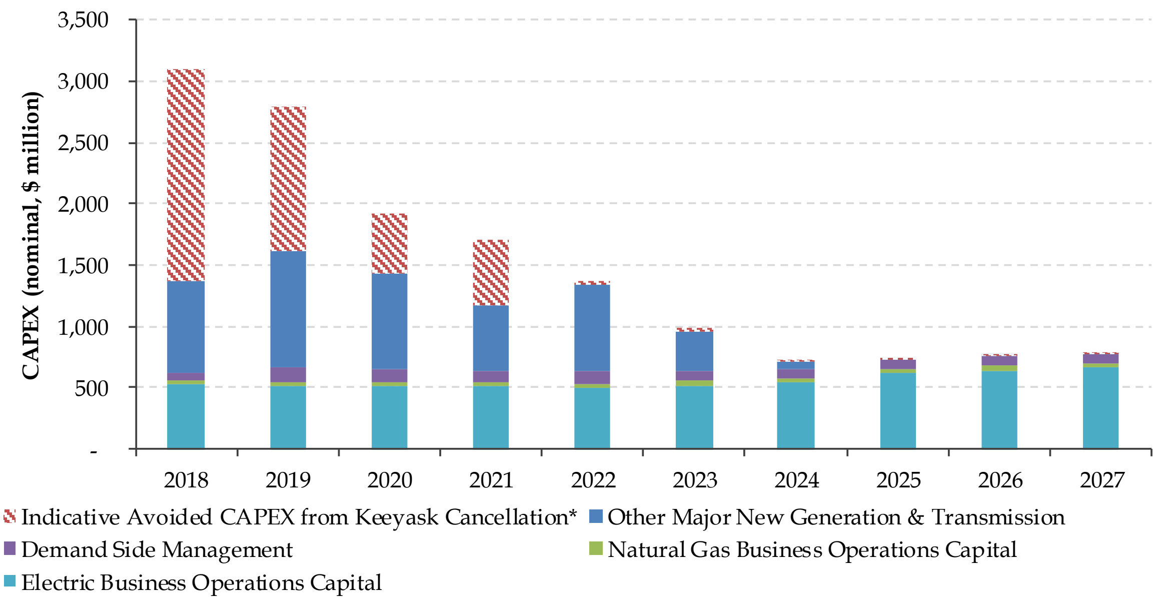
Manitoba Hydro is asking customers today to pay for assets that may not even be valuable for their grandchildren. Given the potential for changes in the way in which electricity is generated, stored, distributed, and used over a two decade period, the current trajectory of rate increases places an undue burden on current ratepayers for an uncertain benefit for future ratepayers. Furthermore, Manitoba Hydro's argument that rate increases are needed to avoid the potential for future rate shock is of questionable value to ratepayers. Manitoba Hydro's capital planning process raises the possibility that such additional funding may not be deployed wisely; ratepayers are providing additional funding in order to maintain financial metrics in the face of events that may or may not occur. Ratepayers may be better served through a policy that builds up fewer reserves, and deals with rate impacts of unexpected events as and when they occur, rather than providing Manitoba Hydro increased flexibility to potentially make poor decisions.

4 Capital plan

4.1 Proposed capital plan is a significant driver of proposed rate increases

Under Manitoba Hydro's current Capital Expenditure & Demand Side Management Forecast ("CEF16"), the company anticipates total capital expenditure of $14,884 million for the 10-year period 2016/17 through 2026/27. Of this sum, $8,134 million is categorized as major new generation & transmission, $5,549 million for electric business operations capital, $343 million for natural gas business operations capital, and $858 million for demand side management ("DSM"). Figure 23 presents Manitoba Hydro's 10-year capital expenditure and DSM forecast.

Figure 23. Manitoba Hydro capital expenditure and DSM forecast (2018-2027)



* 'Indicative avoided CAPEX from Keeyask cancellation' was calculated by subtracting 'Major new generation & transmission' (numbers shown in table below) by Keeyask's capital expenditure and adding indicative Keeyask cancellation costs. Indicative Keeyask cancellation costs estimated as $1.35 billion spread evenly over four years; note that Conawapa cancellation costs are proposed to be amortized over 30 years.

($ Millions)	2017 Outlook	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2018-2027 Total	2017-2036 Total
Major New Generation & Transmission	2,355	2,476	2,126	1,274	1,066	746	358	75	4	4	5	8,134	10,491
Electric Business Operations Capital	574	526	517	516	511	499	521	544	616	640	659	5,549	12,835
Natural Gas Business Operations Capital	51	31	32	29	31	33	35	34	39	39	40	343	812
Capital Expenditures Total	**2,980**	**3,033**	**2,675**	**1,819**	**1,609**	**1,278**	**914**	**652**	**659**	**683**	**703**	**14,026**	**24,138**
Year End OutlookAdjustment	(45)	0	0	0	0	0	0	0	0	0	0	0	(45)
Revised Capital Expenditures Total	**2,935**	**3,033**	**2,675**	**1,819**	**1,609**	**1,278**	**914**	**652**	**659**	**683**	**703**	**14,026**	**24,093**
Demand Side Management	60	66	111	105	100	98	77	71	73	77	81	858	1,762
CEF16 & Demand Side Management Total	**2,995**	**3,099**	**2,786**	**1,924**	**1,708**	**1,376**	**991**	**723**	**732**	**760**	**784**	**14,884**	**25,855**

Source: Manitoba Hydro GRA: Appendix 5.4 – Capital Expenditure and Demand Side Management Forecast.

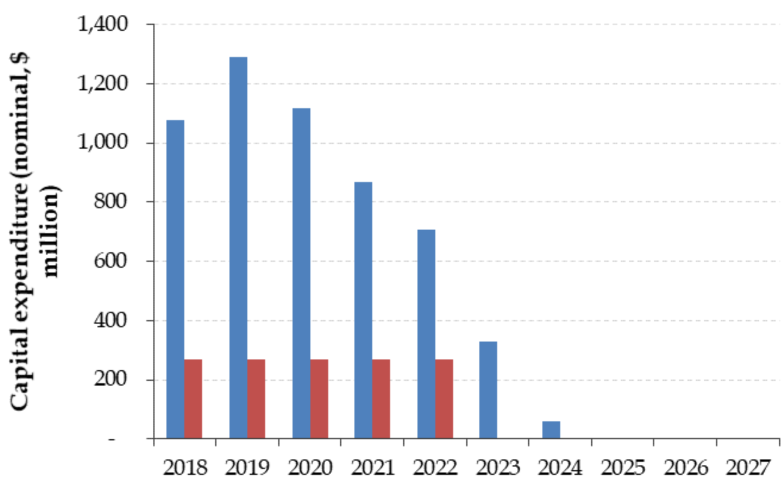
Major new generation and transmission, the primary driver of capital expenditure, includes investments in Keeyask generating station, Bipole III 500 kV High Voltage Direct Current

("HVDC") transmission line, the Manitoba-Minnesota 500 kV transmission interconnection, and the Manitoba-Saskatchewan 230 kV transmission project. Despite the significant capital expenditure expected over the 2-year period covered in this proceeding, Keeyask's expected in-service date was pushed back from November 2019 to August 2021, delaying the potential introduction of this asset into rate base.[85]

While Bipole III is a significant portion of future capital expenditure, and additional non-transmission alternatives may not have been fully explored, LEI has focused on Keeyask because investment is less far along on Keeyask than Bipole III, Bipole III appears to have demonstrated reliability benefits, and Keeyask is not needed to meet Manitoba load until 2040.[86]

Figure 24 compares Manitoba Hydro's 10-year capital expenditure forecast for Keeyask generating station to the case where LEI assumes the project's cancellation costs are spread over a 5-year period. Over the 10-year forecast horizon, Keeyask-related capital expenditures total $5,453 million while cancellation costs amount to $1,350 million.[87] The cancellation of Keeyask would lower total capital expenditures by $4,103 million over the 10-year period.

Figure 24. Keeyask-related capital expenditure and cancellation costs (2018-2027)



($ Millions)	2017 Outlook	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2018-2027 Total	2017-2036 Total
Keeyask capital expenditure	914	1,078	1,291	1,117	868	707	330	58	2	2	1	5,453	6,367
Keeyask cancellation costs	-	270	270	270	270	270	-	-	-	-	-	1,350	1,350

Source: Manitoba Hydro GRA: Appendix 5.4 – Capital Expenditure and Demand Side Management Forecast.

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[85] Manitoba Hydro. Manitoba Hydro 2017/18 & 2018/19 GRA: Tab 2 – Key Messages & Compelling Reasons for a Rate Increase. May 12, 2017.

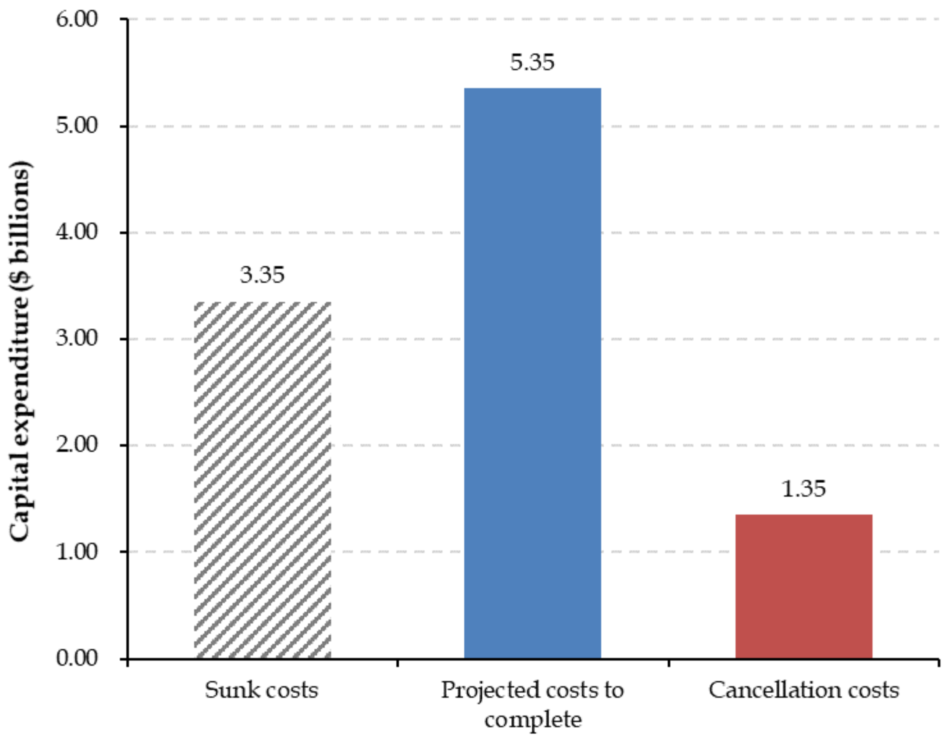
[86] In Manitoba Hydro's response to GSS-GSM/MH I-5a-b, Manitoba Hydro notes "using the 2016 MH16 Update assumptions, the need for new generation changes to 2039/40."

[87] Manitoba Hydro response to GSS-GSM/MH II-3.

4.2 Presentation of cancellation costs is inadequate

In GSS-GSM/MH I-4, LEI requested a current and detailed breakdown of cancellation cost estimates. In its response, Manitoba Hydro conflated sunk costs – those amounts already spent and therefore unavoidable – with what it termed "additional cancellation costs." As any first year finance student knows, sunk costs are not used in making a determination of whether to proceed with a project: only remaining costs are relevant to such a decision.[88] Consequently, the only relevant number to consider is Manitoba Hydro's high level estimate of $1.35 billion of cancellation costs, compared to the net present value of project benefits taking into account only unspent amounts. Figure 25 presents the sunk costs, projected costs to complete and cancellation costs of Keeyask.

Figure 25. Sunk costs, projected costs to complete and cancellation costs of Keeyask



Note: Projected costs to complete were calculated as $8.7 billion budget less $3.35 billion sunk costs
Source: GSS-GSM/MH I-4

While Manitoba Hydro listed several categories of cancellation costs, it did not itemize these costs, nor did it provide a sense as to whether any of these costs could be negotiated down or otherwise ameliorated. Furthermore, no detailed evidence has been provided on the cost of mothballing, rather than completely abandoning, the project. The cancellation cost estimates are

[88] See for example, among many others "*Current choices must be based on the costs and benefits expected in relation to current and future market conditions, if mistakes are to be avoided.*" Gwartney, James D. et. al. *Economics: Private and Public Choice. 2003.* P.497.

striking; Manitoba Hydro is suggesting that it would cost nearly half as much again as has already been spent in order to terminate the project. Sufficient evidence is not available on the record to evaluate whether cancellation costs of this magnitude are plausible.

The textbox below provides three examples in which a courageous decision was made to cancel or mothball a large capital project in the interest of protecting ratepayers.

V.C. Summer Nuclear Expansion Project

On July 31 2017, the South Carolina Public Service Authority decided to suspend the construction of the V.C. Summer nuclear expansion project. The expansion project started construction in 2009 with a $6.3 billion construction budget. The project was suspended in 2017 with a sunk cost of $14 billion and another $11 billion projected for completion.

Bellefonte Nuclear Plant

Tennessee Valley Authority mothballed the decades-old Bellefonte nuclear plant in 2013. The estimated construction cost of the plant was $4.9 billion in 2011 but has since grown to $8.7 billion in 2013. With an existing sunk cost of $8.1 million, TVA has entered into contract with Nuclear Development LLC to sell the unfinished plant for $111 million. Nuclear Development LLC estimated an additional $13 billion capital to finish the construction of the plant.

Tazi Twe Hydroelectric Plant

SaskPower announced that it was deferring the development of Tazi Twe hydroelectric plant due to a decline in the projected demand for power in norther Saskatchewan. SaskPower officials stated that this approach is inline with capital spending plans while providing power at low rates. The project to date has already cost $34 million, with construction beginning in 2012.

Source: SCANA Press Release, Merger Press Release, Journal of Commerce

4.3 Analysis presented is out of date and does not assess full range of options

To support its decision to continue work on Keeyask plant, Manitoba Hydro hired Boston Consulting Group ("BCG") to perform a review of Keeyask and Bipole III projects answering the following questions:

- how sound was the original rationale for the projects?
- can the projects be stopped without undue risks or "breakage" costs?
- what is the downside risk if the existing project scope is run to completion?

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- what viable alternatives exist to maximize value?[89]

BCG's review was conducted based on information available as of the end of May 2016. Since the review was completed, a number of conditions have changed materially:

- peak demand growth has fallen to 0.9% (in MH16 Update) over the prior projection of 1.5%;[90]
- additional cost overrun projections increased the budget from $7.2 billion to $8.7 billion;[91]
- US Environmental Protection Agency announced plans to repeal the Clean Power Plan lowering the potential demand for zero-emissions power;[92]
- Minnesota Power, one of Manitoba Hydro's export customers, is expected reach a peak demand of 2,070 MW in 2028, later than the 2026 forecasted its 2013 integrated resource plan;[93,94] and
- the Midcontinent Independent System Operator's ("MISO") current projected peak demand for 2025 fell in all of its local resource zones ("LRZ"), compared to its forecast in 2015.[95,96] In LRZ 1, where Manitoba Hydro's capacity is currently deliverable, 2025 peak demand fell by 1,548 MW.[97]

Simply holding all other assumptions unchanged and applying the unspent cost overruns to BCG's calculations suggests the project cancellation may be a more viable option. In Figure 39 of BCG's September 19th, 2016 presentation, benefits in the sensitivity case, which uses a more appropriate discount rate, range from $0.5 billion to $1.0 billion in the low and reference cases.[98] Subtracting the increase in project budget announced in February 2017 of $1.5 billion from these Net Present Value ("NPV") estimates shows that the project has a negative value of $0.5 billion

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89 Manitoba Hydro-Electric Board. *Boston Consulting Group (BCG) Engagement Details.* November 3, 2016.

90 GSS-GSM/MH I-5a

91 Manitoba Hydro. *Manitoba Hydro 2017/18 & 2018/19 GRA: Tab 2 – Key Messages & Compelling Reasons for a Rate Increase.* May 12, 2017.

92 EPA. *Proposed Rule: Repeal of Carbon Pollution Emission Guideline for Existing Stationary Sources: Electric Utility Generating Units.* October 16, 2017.

93 Minnesota Power. 2013 *Integrated Resource Plan.*

94 Minnesota Power. 2015 *Integrated Resource Plan.*

95 State Utility Forecasting Group. *2015 MISO Independent Load Forecast.* November 2015.

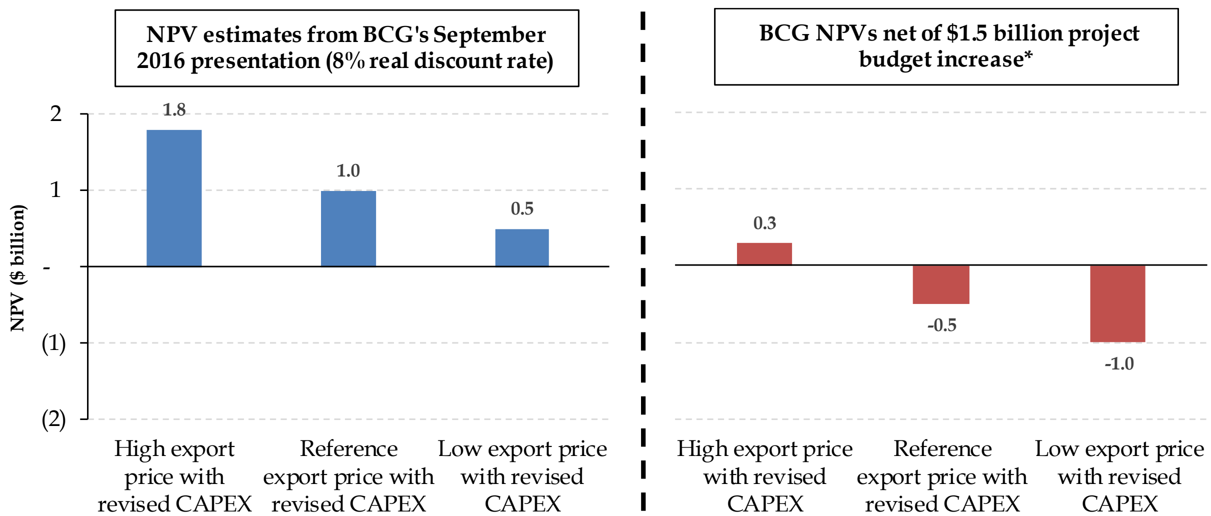
96 State Utility Forecasting Group. *2016 MISO Independent Load Forecast.* November 2016.

97 Manitoba Hydro. 2015 Cost of Service Methodology Review - COALITION/MH-I-54b

98 BCG. *Bipole III, Keeyask and Tie-Line review.* September 19, 2016.

to $1 billion. The value of the project is negligible even if the potentially implausible high export case is used. These numbers are illustrated in Figure 26.

Figure 26. Indicative BCG NPV estimates after accounting for project budget increases and additional sunk costs



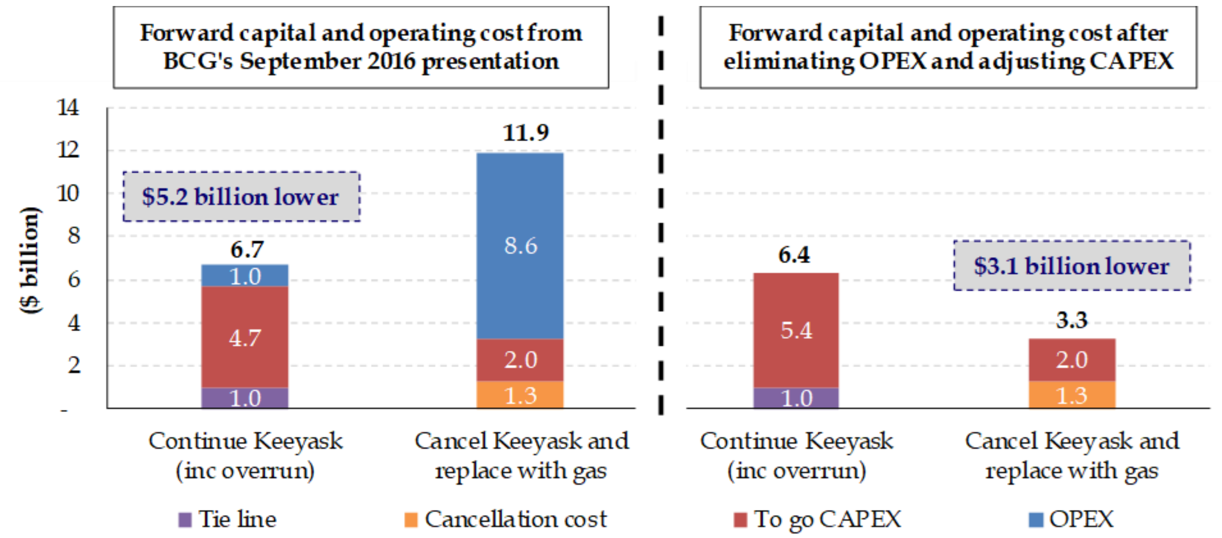
Source: BCG. Bipole III, Keeyask and Tie-Line review. September 19, 2016; LEI analysis.

Even if the more favorable discount rate is used, the range of benefits diminishes significantly, even before taking into account the fact that reduced demand has further delayed the need for the project to 2040.

Furthermore, the discussion of forward capital and operating costs on the same BCG slide is misleading. The slide shows the potential for forward capital and operating costs of gas versus Keeyask to be approximately $5 billion higher, with Keeyask costing $6.7 billion and the gas alternative costing $11.9 billion. Even before critiquing this methodology and excluding sunk costs, the additional projected cost overruns would reduce the alleged $5 billion advantage to $3.5 billion. However, by failing to acknowledge differences in the timing and nature of the expenses, the bar charts present a distorted view. Additional gas construction costs can be delayed and staged more easily than those for Keeyask. Furthermore, assuming that a large portion of opex in this graphic is related to fuel, these costs are avoidable if demand does not materialize. This optionality has significant benefits which the BCG study does not capture. The ability to delay a portion of the gas capex, and to avoid a large portion of capex entirely if demand does not materialize, suggests that the replace with gas alternative would be the clear favorite.[99]

[99] In the case where the facilities are not needed at all, as appears to be the case with Keeyask until at least 2040, incremental costs of the gas project would be $3.3 billion versus $5.7 billion for Keeyask. In fact, given the current market understanding, the "to go" capex for the gas alternative could be deferred potentially for over a decade, meaning that only the $1.3 billion cancellation costs would need to be considered in the near term.

Figure 27. Indicative capital and operating cost comparison after making adjustments to BCG[100]



4.4 Proper analysis requires a different approach

Using current information and applying it to the BCG presentation already demonstrates that continuing with Keeyask is a questionable choice. However, to reinforce that conclusion, Manitoba Hydro should be required to perform additional analysis. Such additional analysis should include both engineering and economic analysis. Among the questions to consider are:

- Would the estimates of termination costs change if the project were to be mothballed rather than cancelled?
- Can the project be brought online in phases, or particular aspects, such as purchase and installation of the turbines, delayed or spread out?
- Could Keeyask be separated from Manitoba Hydro into a private or public-private partnership, potentially with Manitoba Hydro purchasing a portion of the power under a power purchase agreement ("PPA")?
- Does a revised cost benefit analysis suggest that, when cancellation costs are taken into account, it remains viable to continue with the project?

The above analysis would need to be subjected to a range of sensitivity analysis on variables ranging from the timing of domestic need to the value of potential export revenues. Manitoba Hydro advisors have noted that the utility has yet to articulate "its long term vision for how it sees the energy industry changing over the next 10, 20, and 40 years, nor for the role that [it] will play in the industry."[101] Any analysis of Keeyask must include a reference to such a vision in

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[100] Source: *BCG. Bipole III, Keeyask and Tie-Line review. September 19, 2016; LEI analysis.*

[101] Manitoba Hydro. *Asset Management Gap Assessment: Report of Findings to Manitoba Hydro*. December 15, 2016, pg.14.

order to be credible. While analysis of this depth is beyond the scope of this submission, the illustrative results are of a magnitude to strongly suggest that the Province would benefit from taking the time and devoting the resource to performing it properly and independently.

4.5 Pace of increase in equity thickness needs to be moderated to slow pace of rate increases

The impact on rates of the massive and partially unnecessary capital expenditures is exacerbated by Manitoba Hydro's desire to increase its equity thickness to 25% within ten years. The utility claims that "a financial plan that returns the Corporation to a 25% equity level over almost 20 years is not credible as a commitment to being a self-supporting entity."[102] However, a financial plan that has the potential to drive away customers and reduce load is also not credible. The rate of increase in rates may have the opposite of the desired effect if it further suppresses load growth, resulting in lower than expected revenues and further pressure for rate increases.

Manitoba Hydro has not demonstrated that its ability to raise funds is significantly hampered by a slower rate of increase in its equity thickness, nor has it presented a case for how customers benefit. It is not currently in the position of "near zero" retained earnings that would impact views on whether it is self-sustaining.[103] Indeed, the desire to increase equity thickness to 25% is only one of three metrics targeted by Manitoba Hydro. The others are the target EBITDA Interest Coverage Ratio and the Consolidated Capital Coverage Ratio. Both reach their target levels quite rapidly under the proposed rate increases – in the case of the EBITDA measure, by 2019, while the Capital Coverage metric is met in 2018. Both are then substantially exceeded in subsequent years (see Figures 16-2 and 16-3 in the April 2017 IFF document). This suggests that there is some leeway in potentially reducing the pace of rate increases while moving towards the established targets.

Although "Manitoba Hydro acknowledges past applications and testimony" tolerating relaxation of the capital structure below 15% equity and a 15 year timeframe for recovery, it now claims that "the MHEB tolerance for risk has changed considerably and therefore a path back to 25% equity of longer than 10 years is, in the view of Manitoba Hydro, too risky."[104] But just because Manitoba Hydro's board and management changed does not mean the regulator or customers should be forced to change their views to accommodate it. If it is indeed a "strategic imperative to restore financial sustainability" then taking another look at alternatives to completing Keeyask makes sense.

4.6 Implications for rate setting

Strikingly, Manitoba Hydro's most recent load forecast reduced peak load by approximately 185 MW on average. These revised forecasts do not appear to account for the potential success of

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[102] Manitoba Hydro. *2017/18 and 2018/19 General Rate Application*. May 12, 2017, p. 28.

[103] KPMG. *Manitoba Hydro: Financial Targets Review*. May 2015, pg. 7.

[104] Ibid., p.37.

Efficiency Manitoba in further reducing demand, or the full impact of projected rate increases on demand.

Without proper forecasting and scenario analysis, ratepayers can have little confidence that Manitoba Hydro's aggressive rate increase trajectory will not be further modified in the future to extend or increase the rate increases further. Indeed, Manitoba Hydro's statement that "assuming 7.9% rate increases each year for 5 years, there is only a 50% chance that [it] will achieve its minimum equity target"[105] are troubling, as they clearly set the foundation for such future requests. If demand forecasts do not account for projected rate increases, they may be overstated, further undermining the rationale for Manitoba Hydro's capital plans. Likewise, even higher rate increases may be requested if export revenues fall still further; the IFF (p.15) shows the possibility that increases of 8.7% could be required under a low export price case. Based on Manitoba Hydro's own estimated elasticity of demand this would result in yet further declines in load. This begs the question – why continue with a large capital expenditure that faces a potentially outsize risk of losses even higher than projected?

[105] Ibid., p. 32.

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5 Operating efficiencies and service quality

Manitoba Hydro claims that the rate increases are "coupled with significant cost enhancement measures."[106] It is unclear, however, whether these measures are of sufficient magnitude to assure that Manitoba Hydro is operating at levels of productivity consistent with its peers. Currently, operating and administrative costs contribute approximately 27.12% to the total revenue requirement included in PCOSS. While operating costs contribute a smaller amount to the rate increase trajectory, it is nonetheless important to assure that the expenses incurred are consistent with efficient provision of electricity at the desired service quality levels. To explore this issue, LEI examined Manitoba Hydro's performance under a series of partial measures of efficiency, as well as based on standard measures of service quality.

5.1 Little evidence has been presented to prove that operating costs are at efficient levels

While Manitoba Hydro has announced steps to reduce its operating costs, further evidence is necessary to determine whether these steps are sufficient. As per the IFF in Appendix 3.0 of the GRA, Manitoba Hydro committed to a cost reduction plan in February 2017 which aimed to reduce its total workforce by 15%, or 900 positions.[107] The process began with the reduction of the executive leadership team by 30% and of the number of direct reports to the Vice-Presidents by 40%. The Voluntary Departure Program was launched at the same time to achieve the reduction of the remaining positions. Other cost reduction efforts included wage freezes, slower escalation, and procurement savings obtained via the Supply Chain Management initiative. The cost reduction efforts signify a $900 million reduction over the 10-year forecast period to 2026/27, of which $700 million are assumed to be operational savings, and the remaining $200 million to be capital.[108] LEI notes that Manitoba Hydro, as a part of their cost reduction strategy, includes the reduction of single-sourced contracts through competitive bidding tenders, yet it retained BCG on a sole source contract to perform a review of Keeyask and Bipole III at a cost of $3.8 million.[109]

Manitoba Hydro also provides Operating & Administrative Expense Benchmarking in Appendix 10.12; however, LEI notes that Manitoba does not describe the basis for selecting the utilities, the number of utilities, and whether those selected as comparators are vertically integrated. Other elements of submitted evidence are troubling. For example, UMS highlights that "some of the key elements of an Asset Management System are missing… these include audits, controls, and

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[106] Manitoba Hydro. *2017/18 and 2018/19 General Rate Application*. May 12, 2017, p.3.

[107] Manitoba Hydro. *Appendix 3.0 Key Messages and Reasons for a Rate Increase*. May 12, 2017, p.6.

[108] Ibid.

[109] Manitoba Hydro-Electric Board. *Boston Consulting Group (BCG) Engagement Details*. November 3, 2016.

performance metrics…" UMS also highlights that Manitoba Hydro has not focused on "driving improvement" in asset management.[110]

5.2 Measures of partial efficiency suggest that additional efficiencies can be gained

The operational, maintenance, and administrative performance of Manitoba Hydro can be assessed through partial measures of the utility's labor efficiency in managing different areas of its business. To explore Manitoba Hydro's performance on an illustrative basis against a selection of peer utilities, LEI identified several Key Performance Indicators ("KPIs"). LEI examined selected utilities in USA and Canada with at least 20% hydroelectric generation in their operating fleet, as follows:

- British Columbia Hydro and Power Authority ("BC Hydro");
- Hydro-Québec;
- Nova Scotia Power;
- Saskatchewan Power Corporation ("SaskPower");
- New Brunswick Power Corporation ("NB Power");
- Avista Utilities; and
- Idaho Power Company ("IDACORP").

Figure 28 shows the shares of hydroelectricity, the total MW of installed capacity, and the total MW of hydroelectric capacity for each utility selected. LEI notes that utilities that had at least 20% hydroelectric generation, but were not vertically integrated and/or had significantly smaller service areas (i.e. less than 50,000 square kilometres) were excluded from the list of comparators. Note that for the number of full-time employees for Manitoba Hydro, LEI accounted for the 15% reduction (i.e. 900 positions) in their total work force mentioned in Section 5.1.

Figure 28. Selected utilities' percentage shares of hydroelectricity, total MW of installed capacity, and total MW of hydro capacity

Holding company	% Hydro of total capacity	Total MW of installed capacity	Total MW of hydro capacity
BC Hydro	98.2%	12,383	12,163
Hydro-Québec	95.4%	36,441	34,751
Manitoba Hydro	91.8%	5,679	5,213
Avista Utilities	50.7%	1,953	990
IDACORP	47.8%	3,626	1,734
NB Power	24.4%	3,639	888
Emera (Nova Scotia Power)	22.2%	4,441	987
Crown Investments Corporation (SaskPower)	21.4%	3,958	849

Source: Manitoba Hydro-Electric Board 66th Annual Report and third-party commercial database.

LEI focused on four KPIs:

- the total megawatt hour ("MWh") of throughput per employee;
- the installed megawatt ("MW") of capacity per employee;

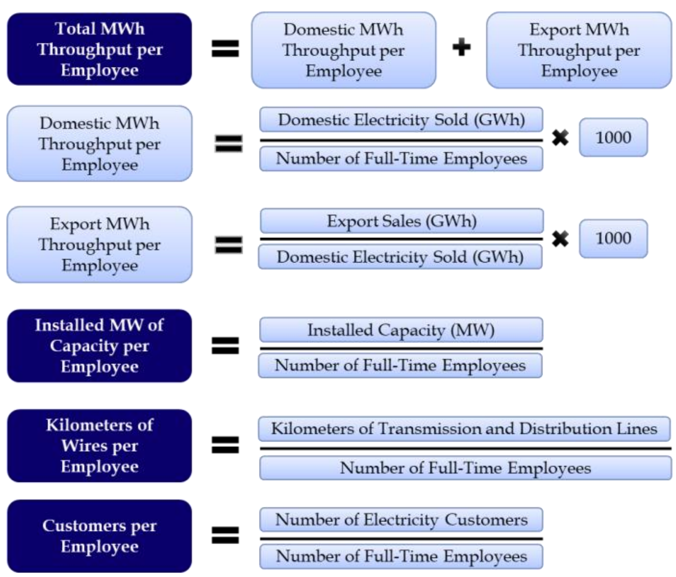
[110] Manitoba Hydro. *Asset Management Gap Assessment: Report of Findings to Manitoba Hydro.* December 15, 2016, pg.8.

- the kilometres of wires per employee; and
- the number of customers per employee.

All four metrics allow for the determination of relative efficiency against the average utility in the sample. This was achieved by first compiling all parameters relevant to the KPIs from Manitoba Hydro and the selected utilities' annual reports from 2016. Corresponding indicators include the number of electricity customers, the installed MW of capacity, the gigawatt hours ("GWh") of domestic electricity sold, the GWh of export sales, the number of full-time employees, the kilometres of wires per employee, and the service area in square kilometres. Each parameter was then averaged for the seven comparators.

Figure 29 shows how the parameters collected were used in calculating the four KPIs. Results are discussed in the following sections. This exercise is intended to be illustrative, consistent with the scope of intervenor budgets and timescales; the purpose of the presentation is to demonstrate that further analysis is necessary rather than to suggest that the results are exhaustive and conclusive.

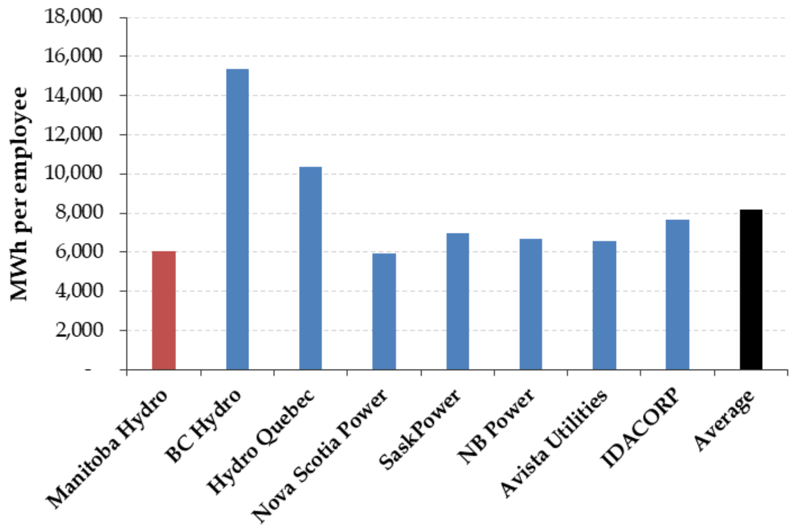
Figure 29. Determination of KPIs using compiled utility parameters



5.2.1 Total MWh of throughput per employee

The total MWh of throughput per employee serves as a partial measure of the utility's efficiency in generating and transporting its output. Figure 30**Error! Reference source not found.** shows that the total MWh of throughput per employee for Manitoba Hydro remains the lowest of that of all utilities. At 6,030 MWh per employee, Manitoba Hydro's throughput per employee also remains below the average throughput per employee (i.e. 8,194 MWh per employee) by approximately 26%. The highest total throughput per employee is found in BC Hydro (i.e. 15,376 MWh per employee).

Figure 30. Total MWh of throughput per employee

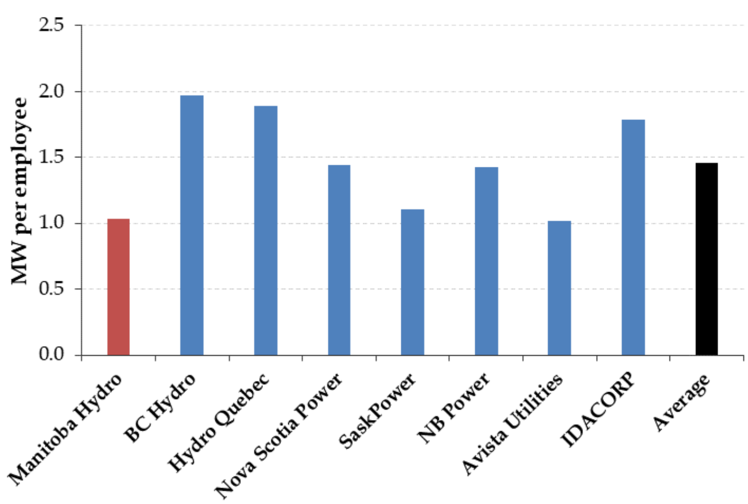


Source: Various utilities' (i.e. *Manitoba Hydro, BC Hydro, Hydro-Québec, Nova Scotia Power, SaskPower, NB Power, Avista Utilities, and IDACORP*) annual reports.

5.2.2 Installed MW of capacity per employee

The installed MW of capacity per employee acts as a partial measure of the utility's efficiency in deploying, operating, and maintaining its integrated generation, transmission, and distribution system. Figure 31 shows that Manitoba Hydro's installed MW of capacity per employee, too, remains the lowest of that of all sampled utilities. At 1.03 MW per employee, the capacity per employee also remains below the average capacity per employee (i.e. 1.46 MW per employee) by approximately 29%. The highest installed MW of capacity per employee is found in BC Hydro at 1.97 MW per employee.

Figure 31. Installed MW of capacity per employee



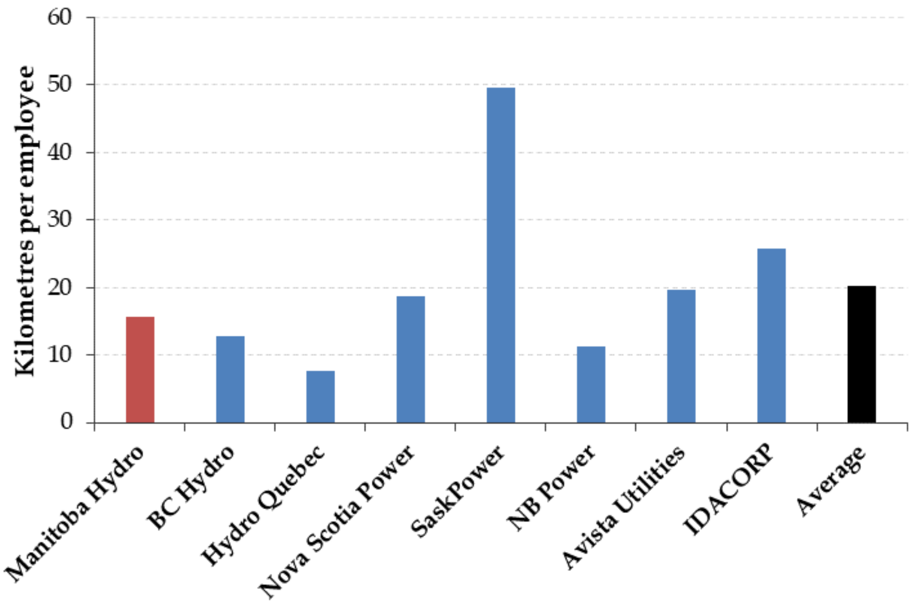
Source: Various utilities' (i.e. *Manitoba Hydro, BC Hydro, Hydro-Québec, Nova Scotia Power, SaskPower, NB Power, Avista Utilities, and IDACORP*) annual reports.

5.2.3 Kilometres of wires per employee

The kilometres of wires per employee parameter acts as a partial measure of the utility's efficiency in maintaining and operating the integrated network.

Figure 32 shows that this metric for Manitoba Hydro remains below that of the average value. More specifically, Manitoba Hydro has 15.71 kilometres per employee, approximately 22% below the average kilometres of wire per employee (i.e. 20.20 kilometres per employee). As per the results, SaskPower leads in maintaining and operating the wires network with 49.69 kilometres per employee.

Figure 32. Kilometres of wires per employee

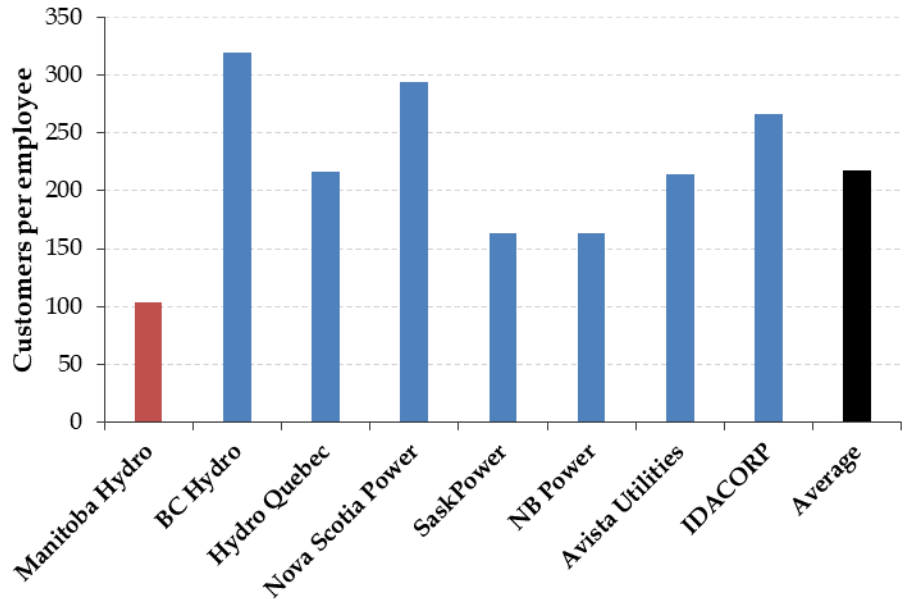


Source: Various utilities' (i.e. *Manitoba Hydro, BC Hydro, Hydro-Québec, Nova Scotia Power, SaskPower, NB Power, Avista Utilities, and IDACORP*) annual reports.

5.2.4 Number of customers per employee

The number of customers per employee parameter acts as a partial measure of the utility's efficiency in serving its customer base. As can be seen in Figure 33, the number of customers per employee for Manitoba Hydro is significantly lower than that of the comparators. At 104 customers per employee, Manitoba Hydro's measure is also 52% less than the average of 218 customers per employee. Meanwhile, BC Hydro has the highest number of customers per employee with approximately 320 customers per employee.

Figure 33. Customers per employee



Source: Various utilities' (i.e. *Manitoba Hydro, BC Hydro, Hydro-Québec, Nova Scotia Power, SaskPower, NB Power, Avista Utilities, and IDACORP*) annual reports.

5.3 Illustrative analysis suggests that other utilities have maintained service quality with fewer resources

The reliability of a power distribution system depends on its ability to provide uninterrupted service to its customers. The North American Electric Reliability Corporation ("NERC"), the international regulatory body that assures the security and reliability of power systems in North America, developed reliability standards to define the requirements for the planning and operations of power systems.[111] These standards aim to track and ensure the quality of the service levels of utilities. Four commonly used indices to assess power system reliability are as follows:

- the System Average Interruption Duration Index ("SAIDI") measures the total duration of an interruption for the average customer in a given period, typically in hours or minutes per year;
- the System Average Interruption Frequency Index ("SAIFI") measures the average number of times that a system customer experiences an outage in a given period. It is usually calculated on an annual basis; and
- the Customer Average Interruption Duration Index ("CAIDI") measures the total duration of an interruption for the average customer and can be calculated as a ratio of SAIDI and SAIFI, provided they are calculated over the same period.

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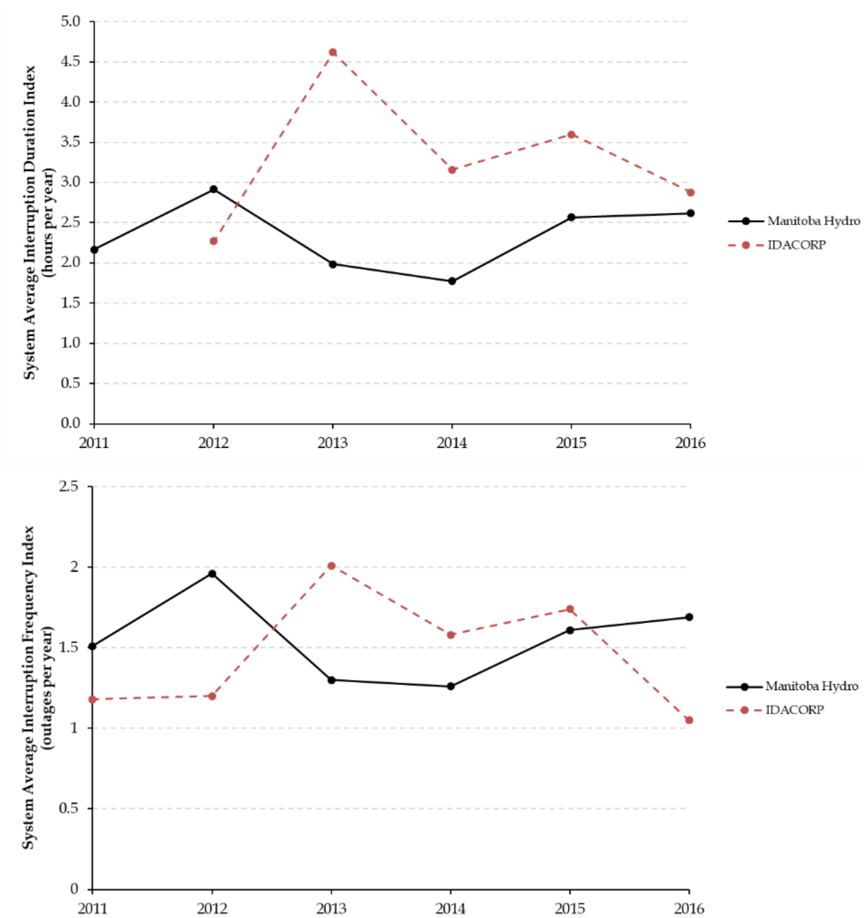
[111] "Standards." *North American Electric Reliability Corporation (NERC).* 2016. Web. October 26, 2017. <http://www.nerc.com/pa/Stand/Pages/default.aspx>

While Manitoba Hydro has achieved performance consistent with other utilities with regards to reliability indices (i.e. SAIDI, SAIFI, and CAIDI), other utilities have maintained similar levels of service quality with fewer resources. One such comparator is IDACORP; with a similar-sized electricity customer base of 535,000 (Manitoba Hydro has 573,438 electricity customers), IDACORP resembles Manitoba Hydro's performance with respect to service reliability while achieving higher levels of partial efficiency metrics. Specifically, like Manitoba Hydro, IDACORP has above average performance in terms of SAIDI and SAIFI. Figure 34 shows historical SAIDI and SAIFI performances of Manitoba Hydro and IDACORP over a five-year timeframe from 2011 to 2016.

Figure 34. Historical SAIDI and SAIFI values (2011-2016)



Note: A SAIDI score was unavailable for IDACORP in 2011.

Source: Manitoba Hydro-Electric Board 66th Annual Report and *IDACORP Electric Service Reliability Annual Report for 2016.*

With regards to SAIDI, both Manitoba Hydro and IDACORP have above average service reliability performance (i.e. below average values).[112] In general, lower SAIDI values reflect higher levels of service reliability. In 2016, Manitoba Hydro and IDACORP scored SAIDI values of 2.62 and 2.88 hours per year, while the average was approximately 3.98 hours per year.[113] These two utilities also had the lowest SAIDI scores across all eight utilities.

Manitoba Hydro and IDACORP also have above average service reliability performance (i.e. below average scores) in terms of SAIFI.[114] Like SAIDI scores, lower SAIFI scores imply higher levels of service reliability. In 2016, Manitoba Hydro and IDACORP scored SAIFI values of 1.69 and 1.05 outages per year, while the average was approximately 2.35 outages per year.[115] Once again, the two utilities had the lowest SAIFI scores across all eight utilities.

However, IDACORP demonstrates higher levels of the following partial efficiency measures when compared to those of Manitoba Hydro:

- total MWh of throughput per employee;
- installed MW of capacity per employee;
- kilometres of wire per employee;
- number of customers per employee; and
- density (i.e. lower number of square kilometres of service area per customer, or higher levels of sparsity).

According to its annual report, Manitoba Hydro is currently not meeting its own service quality metrics in several areas. In the *Manitoba Hydro-Electric Board 66th Annual Report* from 2016/17, Manitoba Hydro lists SAIDI and SAIFI targets of less than 1.93 hours per year and less than 1.4 outages per year, respectively.[116] In terms of actual performance in 2016, however, Manitoba Hydro had SAIDI and SAIFI scores higher than targeted. Customer satisfaction is another measure for which Manitoba Hydro didn't meet their own target; with a target of greater than 8.2 out of 10, Manitoba Hydro achieved a score of 8.08 in 2016.[117]

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[112] SAIDI is calculated as follows: SAIDI = sum of all customer hours of interruption / total number of customers served. *Source: Lee Layton. Electric System Reliability Indices. 2004.*

[113] The average was calculated using the SAIDI scores of Manitoba Hydro, BC Hydro, Hydro-Québec, SaskPower, NB Power, and IDACORP from 2016; SAIDI scores for 2016 were unavailable for Nova Scotia Power and Avista Utilities.

[114] SAIFI is calculated as follows: SAIFI = total number of customers interrupted / total number of customers served. *Source: Lee Layton. Electric System Reliability Indices. 2004.*

[115] The average was calculated using the SAIFI scores of Manitoba Hydro, BC Hydro, SaskPower, NB Power, and IDACORP from 2016; SAIFI scores for 2016 were unavailable for Hydro-Québec, Nova Scotia Power, and Avista Utilities.

[116] Manitoba Hydro. *Manitoba Hydro-Electric Board 66th Annual Report for the Year Ended March 31, 2017*. p. 20. 2017.

[117] Ibid.

In addition, there are important service quality metrics that Manitoba Hydro appears not to report prominently, including the amount of time it takes to connect customers in general and specific customer types in particular. KAP has raised concerns regarding the speed with which its members are connected and the sufficiency of power when they are connected. Farms have been consolidating and growing at rapid rates by optimizing operations with, for instance, grain storage aeration fans and automated milking equipment in dairy farms; however, insufficient levels of power hinder them from doing so.

6 Recommendations

On April 18, 2017, Manitoba government passed an OIC granting the PUB special authority to access information on Manitoba Hydro's financial health and capital expenditure plans.[118] In view of the authority provided to the PUB in this proceeding, and Manitoba Hydro's capital plan being a primary driver for the proposed rate increases, LEI considers the following recommendations compliant with the PUB's mandate.

LEI believes that Manitoba Hydro's request for a rate increase should be held in abeyance until the following analysis is performed and submitted to the Board for its review:

- Properly conducted macroeconomic analysis which appropriately addresses full impacts of all of the projected rate increases on the Manitoba economy in an integrated fashion, including the impact on employment, economic growth, and per capita incomes;
- An independent analysis of whether Keeyask should be postponed, modified, or cancelled, taking into account revised demand forecasts, scenario analysis of key assumptions, including export revenues, consideration of alternative sources of supply available on a more granular, as needed basis, and bearing in mind the potential for yet further cost overruns; and
- An independent review of Manitoba Hydro costs, staffing, and operating procedures consistent with desired levels of service to determine whether existing proposed staffing cuts are sufficient to assure that Manitoba Hydro is operating consistent with reasonable, achievable levels of productivity.

Manitoba Hydro acknowledges that OIC 92/17 requires the PUB to perform a "careful examination of capital expenditures in the context of its rate approval function."[119] It cannot do this without a more fulsome and current discussion of alternatives for addressing Keeyask. Because performing a review of the economics of Keeyask while spending is ongoing provides a temptation to contractors to create "facts on the ground" that would increase the costs of changing direction, the Province should consider ordering a temporary halt to construction while the review is being performed. The review should be time-limited; a three-month period should be sufficient to prepare a thoughtful review of appropriate depth to allow for informed decision-making.

The cumulative magnitude of the proposed rate increases will have a significant impact on Manitoba's comparative advantage in the North American marketplace. The increases do not meet Manitoba Hydro's own stated objective in its financial planning process to avoid "undue shocks to ratepayers." Pushing through rate increases without sufficient reflection on the available alternatives could doom the Province to elevated rates for decades. Leaving aside the immediate need for an unbiased assessment of the economics of completing the Keeyask project, the province should also consider how to put in place appropriate mechanisms, such as an

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[118] Government of Manitoba. *Manitoba gives public utilities board authority to review hydro's capital program when setting rates.* April 18, 2017.

[119] Manitoba Hydro 2017/18 and 2018/19 General Rate Application – Letter of Application, page 3.

enhancement of the Board's powers, to assure that such imprudent investment decisions are not undertaken in the future.

7 Appendix A: List of works consulted

"Agribusiness." Economic Development Winnipeg. Web. 2017. <http://www.economicdevelopmentwinnipeg.com/key-industries/agribusiness>

"Agricultural and Food Processing – Commodities: Special Crops." *Government of Manitoba*. Web. October 24, 2017. <https://www.gov.mb.ca/trade/globaltrade/agrifood/commodity/potatoes.html>

Agricultural Marketing Resource Center. *Commodities & Products: Wheat*. 2016.

BCG. *Bipole III, Keeyask and Tie-Line review.* September 19, 2016.

BINE Information Service. *Producing Animal Feed with Less Electricity and Heat*. ProjektInfo. Bonn, Germany. July 2014.

"Canadian Feed Stats." *Animal Nutrition Association of Canada (ANAC).* 2012. Web. October 23, 2017. <http://www.anacan.org/en/resources-links/canadian-feed-industry/canadian-feed-stats>

CSI Market. *Hotels & Leisure Industry Profitability.* 2017.

"Economy: Manitoba GDP by Industry (Basic Prices)." Government of Manitoba. October 2016. Web. October 13, 2017. <https://www.gov.mb.ca/jec/invest/busfacts/economy/gdp_all.html>

"Economy: Manitoba's Exports by Industry." *Government of Manitoba.* October 2016. Web. October 13, 2017. <https://www.gov.mb.ca/jec/invest/busfacts/economy/exp_by_ind.html>

Energy Information Administration. *Appendix C – Technical Notes*. September 2017.

EPA. *Proposed Rule: Repeal of Carbon Pollution Emission Guideline for Existing Stationary Sources: Electric Utility Generating Units.* October 16, 2017.

"Farm Cash Receipts, by Province (Quarterly) (Manitoba)." *Statistics Canada*. May 24, 2017. Web. October 13, 2017. <https://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/agri04h-eng.htm>

"Farm Operating Expenses and Depreciation Charges." *Statistics Canada.* Web. October 22, 2017. <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=20005#F>

Government of Manitoba. *Agricultural Statistics – Manitoba Crop Highlights – 2011 Census of Agriculture.* Agriculture Statistics Index. September 20, 2013.

Government of Manitoba. *Guidelines for Estimating Crop Production Costs – 2016.* January 2016.

Government of Manitoba. *Guidelines for Estimating Potato Production Costs – 2016*. January 2016.

Government of Manitoba. *Guidelines for Estimating Swine Farrow-Finish Costs 2016.* November 2015.

Government of Manitoba. Manitoba Agriculture. *Agriculture Statistics: State of Agriculture in Manitoba.* 2017.

Government of Manitoba. *Manitoba gives public utilities board authority to review hydro's capital program when setting rates*. April 18, 2017.

Government of Manitoba. *The Public Utilities Board Act*. October 27, 2017.

"Irrigation – Potatoes." *Agriculture Victoria.* Web. October 24, 2017. <http://agriculture.vic.gov.au/agriculture/horticulture/vegetables/vegetables-a-z/potatoes/irrigation-potatoes>

Jacobson, L.D. *Energy Use in Swine Buildings*. University of Minnesota. St. Paul, MN, United States. March 13-14, 2014. Speaker

KAP. *About KAP*. 2016 <http://www.kap.mb.ca/>

Keystone Agricultural Producers of Manitoba (KAP). *2016 Annual Report*. 2016.

Khakbazan, M. *A Comparative Study of Energy Use in Hog Barns on the Prairies*. September 1999.

Khakbazan, M. *A Descriptive Analysis of On-Farm Energy Use in Canada.* Natural Resources Canada (NRCan). February 2000.

KPMG. *Manitoba Hydro: Financial Targets Review*. May 2015, pg. 7.

"Our Position on Dairy Farm Energy Consumption." *DeLaval Corporation*. June 13, 2016. Web. October 13, 2017. <http://www.delavalcorporate.com/sustainability/our-position/our-position-on-energy-consumption/>

"Manitoba Agriculture – Crops." *Government of Manitoba*. Web. October 13, 2017. <https://www.gov.mb.ca/agriculture/crops/index.html>

"Manitoba Agriculture - Environmental Farm Plan." *Government of Manitoba*. Web. October 17, 2017.<https://www.gov.mb.ca/agriculture/environment/environmental-farm-plan/index.html>

"Manitoba Agriculture – Livestock Production." *Government of Manitoba*. Web. October 13, 2017. < https://www.gov.mb.ca/agriculture/livestock/production/index.html>

Manitoba Hydro. *2015 Cost of Service Methodology Review - COALITION/MH-I-54b*.

Manitoba Hydro. *Asset Management Gap Assessment: Report of Findings to Manitoba Hydro*. December 15, 2016, pg.14.

Manitoba Hydro-Electric Board. *Boston Consulting Group (BCG) Engagement Details.* November 3, 2016.

Manitoba Hydro. *Manitoba Hydro-Electric Board 66th Annual Report for the Year Ended March 31, 2017.* p. 20. 2017.

Manitoba Hydro. *Manitoba Hydro 2017/18 & 2018/19 GRA: Appendix 8.2 PCOSS18 Allocation Program.* May 26, 2017. P.9.

Manitoba Hydro. 2017*/18 and 2018/19 General Rate Application – Letter of Applicatio*n. p. 3.

Manitoba Hydro. *Manitoba Hydro 2017/18 & 2018/19 GRA: Tab 8 - Cost of Service and Load Research.* May 26, 2017. p.26

Manitoba Hydro. *Manitoba Hydro GRA: PUB MFR 12*. May 26, 2017

Manitoba Hydro. *Manitoba Hydro 2017/18 & 2018/19 GRA: Tab 2 – Appendix 3.2.* May 12, 2017.

Manitoba Hydro. *Appendix 3.0 Key Messages and Reasons for a Rate Increase*. May 12, 2017, p.6.

Manitoba Public Utilities Board. *Order 59/16.* April 28, 2016.

Manitoba Public Utilities Board. *Order 70/17.* June 30, 2017.

Manitoba Public Utilities Board. *Order 80/17.* July 31, 2017.

Manitoba Public Utilities Board. *Order 164/16.* December 20. 2016.

Manitoba Public Utilities Board. *Re: Manitoba Hydro 2017/18 & 2018/19 General Rate Application – GSS/GSM and KAP Request to Intervene and Intervener Budgets.* September 15, 2017.

Manitoba Public Utilities Board. *Manitoba Hydro 2017/18 and 2018/19 General Rate Application Pre-Hearing Conference.* Transcript. June 12, 2017.

Minnesota Power. 2013 *Integrated Resource Plan.*

Minnesota Power. 2015 *Integrated Resource Plan.*

NACS. *NACS State of Industry Summit 2015.* 2016.

"New Framework – The New Canadian Agricultural Partnership. Government of Manitoba. Web. October 13, 2017. <https://www.gov.mb.ca/agriculture/growing-forward-2/next-policy-framework.html>

"Policy Development." Keystone Agricultural Producers of Manitoba. Web. October 17, 2017. <http://www.kap.mb.ca/policy.cfm>

Smith Travel Research. *HOST Almanac 2017.*

"Some Irrigation Methods." The United States Geological Survey Water Science School. December 02, 2016. Web. October 13, 2017. < <https://water.usgs.gov/edu/irquicklook.html>

"Standards." *North American Electric Reliability Corporation (NERC).* 2016. Web. October 26, 2017. <http://www.nerc.com/pa/Stand/Pages/default.aspx>

Statistics Canada. *Service Bulletin – Canadian Potato Production 2012*. Vol. 10, no. 2, Catalogue no. 22-008-X. 2012.

"Statistics on Revenues and Expenses of Farms – Average Operating Revenues and Expenses by Province (or Region) for Selected Farm Types – Dairy Cattle and Milk." *Statistics Canada*. Web. October 23, 2017. <http://www.statcan.gc.ca/pub/21-208-x/2012002/t069-eng.pdf>

"Statistics on Revenues and Expenses of Farms – Average Operating Revenues and Expenses by Province (or Region) for Selected Farm Types – Hog and Pig Farming." *Statistics Canada*. Web. October 23, 2017. <http://www.statcan.gc.ca/pub/21-208-x/2012002/t070-eng.pdf>

"Statistics on Revenues and Expenses of Farms – Average Operating Revenues and Expenses by Province (or Region) for Selected Farm Types – Dairy Cattle and Milk." *Statistics Canada*. Web. October 23, 2017. <http://www.statcan.gc.ca/pub/21-208-x/2012002/t069-eng.pdf>

Statistics Canada. *Table 2.1-1: Total Private Employment by Province and Establishment Size.* 2015.

Statistics Canada. *Table 384-0040 - Current accounts - Households, provincial and territorial.*

Statistics Canada. *Average household food expenditure, by province (Canada)*. 2015.

Statistics Canada. *Retail trade, operating statistics, by province and territory (Manitoba)*. 2014.

Statistics Canada. *Average hourly wages of employees by selected characteristics and occupation unadjusted data, by province (Manitoba).* October 6, 2017.

Statistics Canada. *Production of principal field crops*. 2017.

Statistics Canada. *Individuals by total income level, by province and territory (Manitoba)*. 2017.

State Utility Forecasting Group. *2015 MISO Independent Load Forecast.* November 2015.

State Utility Forecasting Group. *2016 MISO Independent Load Forecast.* November 2016.

"Table 003-0103 Hog statistics, number of farms reporting and average number of hogs per farm, semi-annual (number)." *Statistics Canada*. 2016. Web. October 26, 2017. <http://www5.statcan.gc.ca/cansim/a01?lang=eng>"Table 004-0213 Census of

Agriculture, hay and field crops." *Statistics Canada*. 2016. Web. October 26, 2017. < http://www5.statcan.gc.ca/cansim/a01?lang=eng>

Teagasc Agricultural and Food Development Authority. *Energy Use on Pig Farms*. August 2016.

United States Department of Agriculture. *Guidelines for Economic Impact Analysis with IMPLAN.* December 5, 2014.

8 Appendix B: Details of IMPLAN model results

Figure 35. Direct, indirect and induced impacts of household spending change by scenario

0% savings usage

Impact Type	Employment	Labor Income ($)	Value Added ($)	Output ($)
Direct Effect	(237.55)	(11,001,183)	(24,239,026)	(41,973,481)
Indirect Effect	(94.73)	(5,663,510)	(9,269,022)	(19,208,950)
Induced Effect	(86.43)	(4,414,999)	(8,976,956)	(16,379,060)
Total Effect	**(418.71)**	**(21,079,692)**	**(42,485,004)**	**(77,561,490)**

10% savings usage

Impact Type	Employment	Labor Income ($)	Value Added ($)	Output ($)
Direct Effect	(124.46)	(5,764,202)	(12,700,329)	(21,992,510)
Indirect Effect	(49.64)	(2,967,464)	(4,856,616)	(10,064,760)
Induced Effect	(45.29)	(2,313,292)	(4,703,584)	(8,582,005)
Total Effect	**(219.39)**	**(11,044,958)**	**(22,260,529)**	**(40,639,276)**

20% savings usage

Impact Type	Employment	Labor Income ($)	Value Added ($)	Output ($)
Direct Effect	(52.84)	(2,446,968)	(5,391,432)	(9,336,066)
Indirect Effect	(21.07)	(1,259,722)	(2,061,688)	(4,272,603)
Induced Effect	(19.22)	(982,018)	(1,996,724)	(3,643,157)
Total Effect	**(93.13)**	**(4,688,708)**	**(9,449,843)**	**(17,251,826)**

9 Appendix C: LEI credentials

London Economics International LLC ("LEI") is a global economic, financial, and strategic advisory professional services firm specializing in energy and infrastructure. The firm combines a detailed understanding of specific network and commodity industries, such as electricity generation and distribution, with sophisticated analysis and a suite of proprietary quantitative models to produce reliable and comprehensible results. The firm's roots stem from the initial round of privatization of electricity, gas, and water companies in the UK. Since then, LEI has advised private sector clients, market institutions, and government on policy initiatives, market and tariff design, asset valuation, market power, and strategy in virtually all deregulated markets worldwide.

9.1 Selected relevant experience

LEI has conducted rate design and COS studies for numerous clients along with counseling governments and regulators to design tariffs that allocate costs in an economically efficient manner.

9.1.1 Cost allocation experience

Distribution cost allocation and customer class definition: LEI, in consortium with an engineering firm, analyzed the customer density and distribution service costs for one of Ontario's largest utility. This engagement had three specific objectives: (i) evaluate the relationship between customer density and distribution service costs; (ii) assess whether utility's existing density-based rate classes and density weighting factors appropriately reflect this relationship; and (iii) consider, qualitatively, the appropriateness and feasibility of establishing alternative customer class definitions.

Transmission cost causation study: LEI was engaged to prepare a transmission cost causation study for the AESO. The study will be incorporated into, and filed with, the AESO's 2014 tariff application, which is expected to be submitted to the Alberta Utilities Commission ("AUC" or "Commission") on June 30th, 2013. LEI performed functionalization of transmission costs into bulk, regional, and point-of-delivery ("POD") functions using three methods: by voltage, by economics, and by megawatt-kilometer ("MW-km"). Classification into demand and energy related costs has been performed using the minimum system approach.

Self-funding tariff for ISO New England including cost causation study: LEI provided support for ISO New England throughout the design and submission to FERC of ISO New England's self-funding tariff. LEI first defined the basic underlying economic principles for specifying the tariff, then undertook to show how the tariff should be applied to various system users. The engagement involved an intensive financial modeling effort, frequent interaction with stakeholders, and written testimony before FERC.

Economic advice on cost causation and tariff regime: LEI provided Australia's former power market regulator, NEMMCO, economic advice on the appropriate regime for charging market participants for the costs incurred by the client in providing its services, in accordance with the National Electricity Code. In making its recommendation on participant fees, LEI considered the criteria specified by the National Electricity Code. LEI also considered the issues and arguments raised in submissions provided by participants in response to the issues paper released in December 1999.

Tariff design for Kingdom of Saudi Arabia: Led multiple engagements with international team assessing tariff design, modeling, and electricity market evolution in Saudi Arabia; engagement resulted in a revised tariff system, including performance based rates, tolling agreements for generation, and an open access tariff. Included holding workshops for regulator in explaining cost of capital, tariff design, and other regulatory issues.

9.1.2 Rate design experience

Performance-based ratemaking ("PBR") testimony for multiple electric utilities in Alberta: LEI provided supporting testimony for an electricity utility in its filing for a PBR plan. The testimony provided detailed data analysis (including inflation and total factor productivity ("TFP") trends), underpinning PBR economic theory, and reviewed best practices in various North American and international jurisdictions. The testimony offered back-up elements for each of the various components of the PBR plan that was being proposed by the utility. LEI also responded to the information requests by interveners and advised the client on issues raised by these interveners.

Second generation PBR in Ontario: LEI President A.J. Goulding led a $1.5 million engagement focusing on design of second generation PBR in Ontario. Key components include estimating TFP, determining appropriateness of yardstick competition, analyzing demand-side management programs in the context of PBR, and examining service quality indicators.

Review of gas distribution PBR regimes across North American jurisdictions: LEI was engaged by Union Gas to review Union's proposed 2014 to 2018 incentive-based ratemaking ("IBR") plan as presented to stakeholders on April 29th, 2013 and to examine case studies of approaches to IR applied to other North American gas distribution utilities. In the case study analysis, Union particularly requested LEI to examine approaches to a set list of ratemaking parameters: productivity and X-factor trends, alternative approaches to designing an I-X framework, approaches to establishing inflation factors, approaches in other jurisdictions to applying an Earnings Sharing Mechanism ("ESM"), use of capital trackers for unknown costs, appropriateness of deferral accounts for unaccounted-for gas ("UFG"), and service quality indicators ("SQIs") and how they are measured. LEI was subsequently requested by Union to provide comments on Union's draft Settlement Agreement.

IBR in Malaysia: For a large Malaysian utility, LEI has been retained to provide advice on incentive-based ratemaking in preparation for its submission to the regulator. As part of the assignment, LEI has been tasked with performing a cross-jurisdictional review of regulator instructions to utilities with regards to rate submissions. LEI will examine the Australian, UK and Philippines markets to understand the regulatory submission cycle, instructions and requirements from utilities for IBR submissions.