

1 **REFERENCE:**

2
3 **PREAMBLE:** Does Elenchus understand why Manitoba Hydro projects that DSM energy and demand
4 effects will grow more slowly over time, even before Manitoba Hydro projects that its DSM programs
5 will end (e.g., in Appendix 4.2, pp. 120–123)?
6

7 **a) QUESTION:**

8 If so, please explain Elenchus's understanding of Manitoba Hydro's rationale.
9

10 **RESPONSE:**

11 As discussed in the Power Smart plan, the projected DSM contribution over time varies according to the
12 technical savings from the various measures, the uptake of the measures and saturation effects. The
13 technical savings may also be subject to a marginal diminution effect over time. Elenchus understands
14 that the combination of these factors, in MH's judgment, leads to a slowing down of DSM impacts.
15

16 **b) QUESTION:**

17 Please provide any workpapers Elenchus obtained from Manitoba Hydro through informal discussions
18 that lay out the derivation of the DSM effects on the load forecast.
19

20 **RESPONSE:**

21 Elenchus has not obtained any working papers from Manitoba Hydro through informal discussions that
22 lay out the derivation of the DSM effects on the load forecast.

1 **REFERENCE:**

2
3 **PREAMBLE:** Please state whether Elenchus has reviewed Manitoba Hydro's projection of declining
4 incremental DSM savings, such as in Appendix 4.2, p. 122 (from 108 GWh in 2013/14 to 68 GWh in
5 2018/19, 29 GWh in 2023/24 and -18 GWh in 2028/29).
6

7 **a) QUESTION:**

8 Does Elenchus believe Manitoba Hydro's projections of incremental GWh savings reasonably represent
9 the effects of continuing the current DSM Plan throughout the forecast period?
10

11 **RESPONSE:**

12 From the load forecast perspective Elenchus understands that Manitoba Hydro expects that "savings
13 due to DSM programs to date are embedded in the historical data that is the basis for this forecast", as
14 noted on page 57 of the 2013 Load Forecast. Elenchus understands that any quantification of future
15 program savings are not included in load forecast.
16

17 **b) QUESTION:**

18 Does Elenchus believe Manitoba Hydro's projections of incremental GWh savings reasonably represent
19 the effects of a least-cost DSM plan throughout the forecast period?
20

21 **RESPONSE:**

22 Assuming that a least-cost DSM plan would result in greater savings than currently projected by
23 Manitoba Hydro, the current projections do not reflect the effects of a least-cost plan. In the absence of
24 the development of a least-cost plan through a full IRP process, there is no evidence to demonstrate
25 that there would be increased savings.

REFERENCE:

PREAMBLE:

QUESTION:

Please provide all informal discovery responses from Manitoba Hydro to Elenchus regarding the derivation and load effects of Manitoba Hydro's projections of customer fuel choice.

RESPONSE:

Below are all informal discovery responses from Manitoba Hydro to Elenchus regarding the derivation and load effects of Manitoba Hydro's projections of customer fuel choice:

Question:

Please prepare a table for the years from 1992/93 to 2012/13 which displays annually for Residential Basic the % Electric Space Heat and the % Electric Water Heat similar to the presentation in Table 14.

Response:

The Residential End Use model was only calibrated from 2009, the year of the last Residential Survey, so no estimates of prior years were done as part of the forecast.

Estimates of space heat and water heat saturations for the years after 2009 were based on growth rates from the 2005 to 2009 period applied to the 2009 counts of space heat and water heat by area, dwelling type and appliance type. These counts were added each year and overall saturations were determined.

The 2003 and 2009 survey values are provided, along with our model estimates since the 2009 survey. Surveys prior to 2003 are not directly comparable as they did not include the Winnipeg Hydro service area.

	%Elec Space Heat	%Elec Water Heat
2003 Survey	29.8%	40.8%
2009 Survey	35.3%	45.8%
2010/11	35.6%	46.5%
2011/12	35.9%	47.8%
2012/13	36.3%	49.0%

Question:

Response indicated that the "Residential End Use model was only calibrated from 2009, the year of the last Residential Survey, so no estimates of prior years were done as part of the forecast."

I have a couple of additional questions to try to clarify our understanding around this issue:

(i) Table 14 of the 2013 Load Forecast identifies 165,576 “Electric Heat Billed” customers using 4255 GWh in 2012/13. Is this a measured actual figure, or is this simply “calculated” from the % Electric Space Heat of 36.3%?

Response:

This number is not measured. It is estimated starting with the 2009 Residential Energy Use Survey numbers and brought forward year by year as explained in the response to part (ii).

It is not calculated from the % Electric Space Heat, but the %Electric Space Heat of 36.3% is calculated from the estimated number of electric heat customers divided by the total number of customers.

(ii) How exactly was the 36.3% arrived at? Please show what equations/calculations were used if the response in part (a) is that the customers and energy were “calculated” rather than “measured”

Response:

The method of calculating energy is very involved because the model used is a detailed end use model that forecasts the saturation of each end use and the usage per appliance and then combines these together to get the total energy. The approach for this is described in the Residential Basic Methodology section of the 2013 Electric Load Forecast starting on page 59.

The method of calculating customers was detailed in response to GAC/MH I-052, see attached.

(iii) Please show how the “% Elec Space Heat” was projected to 2032/33 (show calculations).

Response:

The customers are forecast in 5 groups: Single Detached Winnipeg, Single Detached Gas Available, Single Detached No Gas Available, Multi-Attached and Apartments.

Please see the attached response to GAC/MH I-052.

(iv) In previous electric load forecast documents, historical data on “all-electric” customers and usage and “% All Electric” dating back prior to 2003 (the date of the survey previous to 2009) were provided. For example, in Table 6 of the 2010/11 Electric Load Forecast provides this to 1999/00. How were these figures determined? Why can’t these be provided now?

Response:

Forecasts up to the 2010/11 Electric Load Forecast used billing data as its basis to divide Residential customers into “All-Electric” and “Standard”.

The 2009 Residential Energy Use Survey’s classification of customers as Electric Heat versus non-Electric Heat was compared to the Billing system’s classification of All-Electric versus Standard. The survey estimated that there were more electric heat customers than what the Billing system indicated.

Upon examination of the differences, survey customers who indicated that they used electric heat were verified to have annual usage patterns reflective of an electric heat customer. In addition, the survey data provided detailed data about the type and age of heating system.

So starting with the 2011 forecast, survey data was used. The labeling in the Load Forecast document was changed from “All-Electric” and “Standard” to “Electric Heat Billed” and “Other Heat” to indicate that survey data was now being used.

Estimated values are available for the survey years of 2003 and 2009, as well as estimates since 2009 from the Residential End Use model, as follows:

	Electric Heat Billed	Other Heat	Total Residential	% Electric Heat Billed
2003 Survey	120,286	283,590	403,876	29.8%
2009 Survey	154,943	284,153	439,096	35.3%
2010/11	158,586	287,296	445,882	35.6%
2011/12	161,892	288,866	450,748	35.9%
2012/13	165,576	290,554	456,130	36.3%

(v) The 2007/08 Electric Load Forecast document (filed for the 2008-09 GRA) contains a “dynamic logit model” that “predicts the proportion of customers that will install electric heat in each of the forecast areas. This proportion is called the market share of electricity (MSE). It is calculated by dividing the number of All-Electric Basic customers by the number of total (Standard and All-Electric) Basic customers”.

(v-i) Where do the historical MSEs come from? Are they previous calculated estimates or does Manitoba Hydro know how many customers have electric heat?

Response:

The historical MSEs were from the number of All-Electric and Standard customers on the Billing system.

(v-ii) The logit model for 2007-08 contains a lagged market share for electricity and the relative price of gas compared to electricity. The logit model presented for 2006-07 also contains percentage of housing stock additions. Why was this explanatory variable subsequently removed?

Response:

In the 2006/07 and earlier forecasts, the model included historic data for 611 Town and Residential rate zone combinations. The rate zones identified customers who were in cities, who were in small towns and who were in rural areas. You will notice that the 2006/07 results showed a degrees of freedom (DF) of 4606 indicating that a lot of data was used in the regression.

Prior to Uniform Rate Legislation, Manitoba Hydro rates differed based upon location defined by three zones (city, town/village, or rural). With the legislation, zone differentiation was no longer required and residential rates were the same in all three zones across the Province. In 2006, Manitoba Hydro changed its billing system and the rate zones were eliminated and therefore was no longer available to be used. A simple province-only regression was performed. You’ll see that the 2007/08 results showed a degrees of freedom of only 13. Using this simpler model, the housing stock additions did not come in as a significant variable, so it was removed from the equation.

1 The 2007/08 analysis could have been done by town, but it was seen that the simple model gave a very
2 similar MSE forecast to the 2006/07 analysis. So the simple model was left as is.

3
4 (v-iii) What time series was used to estimate these models (in 2006-07 and 2007-08)?

5
6 Response:

7 The 2006/07 Forecast used customer data from 1989/90 to 2005/06. The 2007/08 forecast used
8 customer data from 1993/94 to 2006/07.

9 (v-iv) Does Manitoba Hydro use a similar logit model for the 2013 load forecast? If so, please
10 present results.

11 Response:

12 No.

13 (v-v) If the answer to part (iv) is no, please develop a logit model similar to what was used in 2007-
14 08 and develop the MSE based on this and contrast with what is presented in the 2013 load
15 forecast. Using the revised MSE, can you develop a revised residential basic forecast?

16 Response:

17 A forecast using the logit model from the 2007/08 forecast was developed using data up to 2012/13,
18 both with and without using the housing stock (mhsk) as an independent variable. This type of model
19 can produce quite different forecasts depending on the number of historical years of data used, so the
20 model results for different numbers of years are shown. These are compared to the 2013 MSE forecast.

Start Year N (Years)	1996 18	1998 16	2000 14	2002 12	1996 18	1998 16	2000 14	2002 12	All Elec As in 2013 Load Forecast
W/ Mhsk?	No	No	No	No	Yes	Yes	Yes	Yes	
2013/14	37.1%	37.1%	37.0%	36.6%	37.0%	37.0%	36.9%	36.4%	36.7%
2014/15	37.7%	37.7%	37.6%	36.8%	37.6%	37.6%	37.4%	36.5%	37.0%
2015/16	38.5%	38.5%	38.2%	37.0%	38.2%	38.2%	37.9%	36.5%	37.4%
2016/17	39.4%	39.4%	38.8%	37.1%	38.9%	38.8%	38.4%	36.5%	37.7%
2017/18	40.3%	40.3%	39.5%	37.2%	39.6%	39.5%	38.9%	36.5%	37.9%
2018/19	41.4%	41.4%	40.2%	37.3%	40.3%	40.3%	39.4%	36.6%	38.1%
2019/20	42.6%	42.6%	41.0%	37.4%	41.1%	41.0%	39.9%	36.6%	38.3%
2020/21	44.0%	44.0%	41.8%	37.5%	41.9%	41.9%	40.4%	36.7%	38.4%
2021/22	45.5%	45.5%	42.6%	37.6%	42.8%	42.7%	40.9%	36.7%	38.5%
2022/23	47.2%	47.2%	43.5%	37.6%	43.8%	43.6%	41.4%	36.7%	38.6%
2023/24	49.2%	49.0%	44.4%	37.7%	44.8%	44.6%	41.9%	36.8%	38.7%
2024/25	51.3%	51.1%	45.4%	37.8%	45.8%	45.6%	42.4%	36.8%	38.8%
2025/26	53.7%	53.5%	46.4%	37.8%	46.9%	46.6%	42.9%	36.8%	38.9%
2026/27	56.3%	56.1%	47.5%	37.9%	48.0%	47.7%	43.4%	36.8%	39.0%
2027/28	59.2%	58.9%	48.6%	38.0%	49.3%	48.9%	43.9%	36.8%	39.0%
2028/29	62.3%	62.0%	49.8%	38.0%	50.5%	50.1%	44.3%	36.8%	39.1%
2029/30	65.7%	65.3%	51.1%	38.1%	51.9%	51.4%	44.8%	36.8%	39.1%
2030/31	69.4%	68.9%	52.3%	38.1%	53.3%	52.7%	45.3%	36.8%	39.2%
2031/32	73.1%	72.6%	53.7%	38.2%	54.7%	54.1%	45.7%	36.8%	39.2%
2032/33	77.0%	76.5%	55.1%	38.2%	56.2%	55.5%	46.2%	36.8%	39.3%
R-Square	0.9104	0.894	0.8777	0.8894	0.9053	0.8868	0.8668	0.8948	
Intercept	0.11043	0.10983	0.07376	0.09933	0.05397	0.05164	0.01976	-0.30656	
logit1	1.10748	1.1059	1.03834	0.73831	1.04788	1.04441	0.9834	0.50621	
pgeff	0.01892	0.01982	0.04332	0.12834	-0.02033	-0.02133	-0.04333	-0.14299	
mhsk					0.00000254	0.00000262	0.00000258	0.00000848	
t-inter	1.54	1.37	0.79	-0.88	0.36	0.32	0.10	-1.51	
t-logit1	13.22	11.02	8.08	4.25	6.48	5.78	4.49	1.98	
t-pgeff	-0.78	-0.64	-1.05	-2.49	-0.81	-0.66	-1.00	-2.76	
t-mhsk					0.44	0.42	0.32	1.21	

1 (v-vi) What do the reported R-squared for these logit models represent?

2 Response:

3 The adjusted R-squared values are provided in the table above.

Question:

In response to the question on previous “% All Electric”, the response was that previous to 2011, “billing data” was used to divide Residential customers into “All Electric” and “Standard”. This begs the question of how billing data was used to do this? Is there an identifier on the billing account identifying the primary heat source? Or is there a separate Residential rate class for electrically heated residences? If so, then my question is why would a survey with 4500 responses be more accurate than the population of billing data? I’m just asking the question outright rather than trying to make assumptions.

Response:

Manitoba Hydro has the same rate class for all Residential Basic customers, whether they heat with electricity or another fuel. So the heating fuel was never needed to distinguish different rate codes.

However, Manitoba Hydro does have an indicator on the billing system to identify electric space heat. It is one of five fields that are used together to identify customers who would receive Provincial and City tax reductions on their electricity bill. The electric heat indicator is used to identify and count the “All Electric” customers versus the “Standard” customers.

The 2009 Residential Energy Use Survey asked customers about their heating system and the heating fuel they used. The survey results gave estimates of the number of Electric Heat Billed and Other Heat customers there were on the system. It was expected that these numbers would be close to the All Electric / Standard counts on the billing system.

Upon comparing the numbers between the Survey and the billing system, it was found that the All-Electric indicator on the billing system was about 15,000 less than the number of estimated Electric Heat Billed customers from the Survey. The customers from the Survey with differences were analyzed by looking at their monthly usage from the billing system. This analysis was usually able to confirm electric heat customers by their high usage per degree day heating. It was determined that in the majority of cases, the answer given in the survey was the better indicator of the customer’s heating fuel.

The difference between the Residential Survey and the billing system had several causes:

1. The billing field was used for the tax classification and certain customers, although they did heat with electricity, did not have the electric heat indicator as there may have been other reasons why the customer did not qualify for the tax reduction.
2. In 2006, Manitoba Hydro changed billing systems and certain customers who were heating with electricity but not qualifying for the tax reduction for other reasons, were not coded with the electric heat indicator on their accounts in the new billing system.
3. Unreported Customer fuel switches where Manitoba Hydro is not made aware of such change in space heating fuel.

The Residential Forecast is based on the information provided by the Residential End Use Model. The billing totals of All Electric customers would not allow proper calibration of the total energy use in the end use model. So the end use model was changed in 2011 to use the Electric Heat Billed / Other Heat estimates from the Residential Survey as the starting estimates for 2009. The end use model then forecasted these values forward from there. These Electric Heat Billed / Other Heat customer estimates are now what is included in the Electric Load Forecasts since 2011.

1 Question:

2 In the response that was sent, the last section (part vi) deals with the counterintuitive result that even
3 though the ratio of price of gas to price of electricity (PG/PE) is decreasing in 2012, the number the %
4 electric continues to go up. The table shows new electric and new other.

5 (i) Could you tell me where this data comes from?

6
7 Response:

8 The year each residential dwelling is built is maintained on the billing system. This data was from a
9 special run done from the billing system, by building type (coded as physical structure index), by
10 Winnipeg / South Gas / No Gas areas, by year built, using the All-Electric indicator.

11
12 (ii) How do you know electric vs. other, since it was previously answered that this is calculated, not
13 measured?

14
15 Response:

16 The All-Electric indicator on the billing system was used for this. This indicator is now known to
17 underestimate the number of Electric Heat billed customers. But for this study, this is what was available
18 and what was used.

19
20 (iii) Do you record every new residence by heating type? If so, where does this come from? The data is
21 shown back to 1990.

22
23 Response:

24 The year of construction is recorded on the billing system, and this was used in conjunction with the All-
25 Electric indicator.

1 **REFERENCE:**

2
3 **PREAMBLE:**

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5 **QUESTION:**

6 Please provide any data available to Elenchus regarding the amount of electric load (in MW and GWh) in
7 Manitoba Hydro's forecast due to non-residential space heating in areas with gas availability.

8
9 **RESPONSE:**

10 Elenchus is not in possession of any data regarding the amount of electric load (in MW and GWh) in
11 Manitoba Hydro's forecast due to non-residential space heating in areas with gas availability.

1 **REFERENCE:**

3 **PREAMBLE:**

4 Please provide Elenchus' estimate of the reduction in Manitoba Hydro's peak load and energy
5 requirements under each of the following conditions:

7 **a) QUESTION:**

8 No net increase in saturation of residential electric space heating in areas with gas availability (e.g.,
9 either installation of electric space heating in areas with gas availability is zero, or electric-to-gas
10 conversions offset new electric heating installations).

12 **RESPONSE:**

13 Elenchus does not have access to data necessary to calculate the requested information.

15 **b) QUESTION:**

16 10% of existing residential electric space heating in areas with gas availability is converted to gas
17 heating.

19 **RESPONSE:**

20 Elenchus does not have access to data necessary to calculate the requested information.

22 **c) QUESTION:**

23 10% of existing residential electric water heating in areas with gas availability is converted to gas water
24 heating.

26 **RESPONSE:**

27 Elenchus does not have access to data necessary to calculate the requested information.

1 **REFERENCE:**

2
3 **PREAMBLE:**

4
5 **QUESTION:**

6 Please describe the ways in which Manitoba Hydro and its affiliate Centra Gas could discourage the
7 choice of electricity for space and water heating where gas is available.
8

9 **RESPONSE:**

10 Elenchus would note that it is not so much discouraging customers from using electricity for space
11 heating as it would be encouraging consumers to convert to gas.
12

13 Elenchus has observed that in the USA various states have legislatively promoted fuel conversion to
14 natural gas. The drivers for change are centered on benefits derived from increasing consumer
15 disposable income, movement away from high carbon fossil fuel emission (coal generation of electricity,
16 use of heating oil, etc.). In some states it was also due to state revenue interest in natural gas fracking
17 operations.
18

19 A disincentive to conversion can be the upfront cost to convert heating systems. There is a
20 concentration of efforts directed towards assisting customers in converting heating systems by allowing
21 on-bill financing and financial assistance. It is recognized that consumers would be able to afford
22 conversions by using future savings to pay for system conversion.
23

24 Some states recognized that the high cost of accessing gas service can be a disincentive to conversion to
25 gas. These states encouraged gas utilities to expand services to economically infeasible customers by
26 delaying collection of customer contributions to future years, rather than upfront collection currently
27 mandated by tariffs. This approach ensured that existing customers were not subsidizing new
28 customers. In other cases, the cost of conversion has been subsidized by the natural gas distributor with
29 the cost being recovered through distribution rates, with the assistance being factored into the
30 economic test for system expansion.
31

32 The most common approach used by natural gas utilities to promote conversion is marketing the
33 financial and other benefits of natural gas to promote natural gas to both potential customers and
34 developers.