Winnipeg Chapter of Council of Canadians Submission to the PUB on the Efficiency Manitoba Plan
by
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1. Introduction

We focus on the natural gas aspects of Efficiency Manitoba and make recommendations to the PUB.

According the Efficiency of Manitoba Act, the mandate is to,

"*Implement and support demand-side management initiatives to meet the savings targets and achieve any resulting reductions in greenhouse gas emissions in Manitoba*."
https://web2.gov.mb.ca/bills/41-2/b019e.php

The target savings for natural gas according to Section 7 of the Act are:

"*Subject to the regulations, the annual savings targets that Efficiency Manitoba is responsible for meeting in the 15-year period following the commencement date are as follows:*
In the initial year following the commencement date, net savings that are at least equal to 0.75% of the consumption of natural gas in the preceding year.
In each of the following years, incremental net savings that are at least equal to 0.75% of the consumption of natural gas in the immediately preceding year."
https://web2.gov.mb.ca/bills/41-2/b019e.php

We comment on the following PUB responsibilities according to the Section 39(h) of the Act:

"(h*) prescribing factors which the PUB must consider when it reviews an efficiency plan, including the value or weight to be given to*
(i*) reductions in greenhouse gas emissions in Manitoba, and*
(ii) *the societal benefits to be achieved by all or a portion of Efficiency Manitoba's initiatives*"
https://web2.gov.mb.ca/bills/41-2/b019e.php

There are no regulations specified in the Act that give specific greenhouse gas (GHG) emission targets relating to EM. Recognized climate targets such as the Paris agreement and Net Zero by 2050 are not considered. We provide information to support recommendations for regulations that should be prescribed.
http://web2.gov.mb.ca/laws/regs/annual/2019/119.pdf

Section 11 of the regulations of the Act states,

"*The PUB must consider the following when reviewing an efficiency plan: (a) the appropriateness of the methodologies used by Efficiency Manitoba to select or reject demand-side management initiatives*;

(j) *whether the efficiency plan adequately considers new and emerging technologies that may be included in a future efficiency plan*"
http://web2.gov.mb.ca/laws/regs/annual/2019/119.pdf

We provide evidence that emerging technological improvements to heat pumps will yield superior efficiency and lower GHG emissions more than improvements to natural gas combustion.

We provide evidence that the Manitoba Efficiency Plan has fallen into the Efficiency Trap,

"*More efficiency leads to more consumption, faster depletion of resources, and ultimately more stress on the planet*"
https://www.amazon.com/Efficiency-Trap-Finding-Achieve-Sustainable/dp/1616147253

Growth in consumption always outweighs savings from efficiency. This is also called Jevons Paradox. https://www.researchgate.net/publication/282736016_Capitalism_and_the_Curse_of_Energy_Efficiency_The_Return_of_the_Jevons_Paradox. The Made in Manitoba Green Plan clearly states this phenomenon,

"*Despite fuel-efficiency gains and stricter emissions standards for vehicles, more cars and trucks on the road have resulted in higher carbon emissions from transportation in the province*."
https://www.gov.mb.ca/asset_library/en/climatechange/climategreenplandiscussionpaper.pdf

We provide evidence that the small historic decrease in the volume of natural gas consumption in the province is caused primarily by increasing temperatures due to climate change not by increased efficiency. As predicted by Jevons Paradox, growth outweighs savings from increased efficiency in natural gas combustion. Any future decrease in natural gas use will be caused mainly by the continued temperature increase caused by climate change. We provide evidence that the natural gas savings targets mandated by the EM green plan are not likely to be met by improvements in efficiency. We provide evidence that GHG emissions targets of the Paris Accord and Net Zero by 2050 cannot be met through the Efficiency Manitoba Plan. Only transition away from fossil fuels can meet climate change targets. We provide evidence that heat pumps are more efficient and cost effective than natural gas heating. We recognize that the primary mandate of Efficiency Manitoba is cost savings through increased efficiency. Heat pumps will maximize both cost savings and GHG reductions. We recommend that the PUB ensure regulations to transition away from natural gas are prescribed in order to meet climate change targets and to maximize cost savings. These regulations should prescribe a target schedule and incentives for replacement of all sources of natural gas heating with electrical heating primarily from heat pumps.

2. Manitoba GHG Emissions

The history of Manitoba GHG emissions and future projections of EM savings target and climate change targets are illustrated in Figure 1.

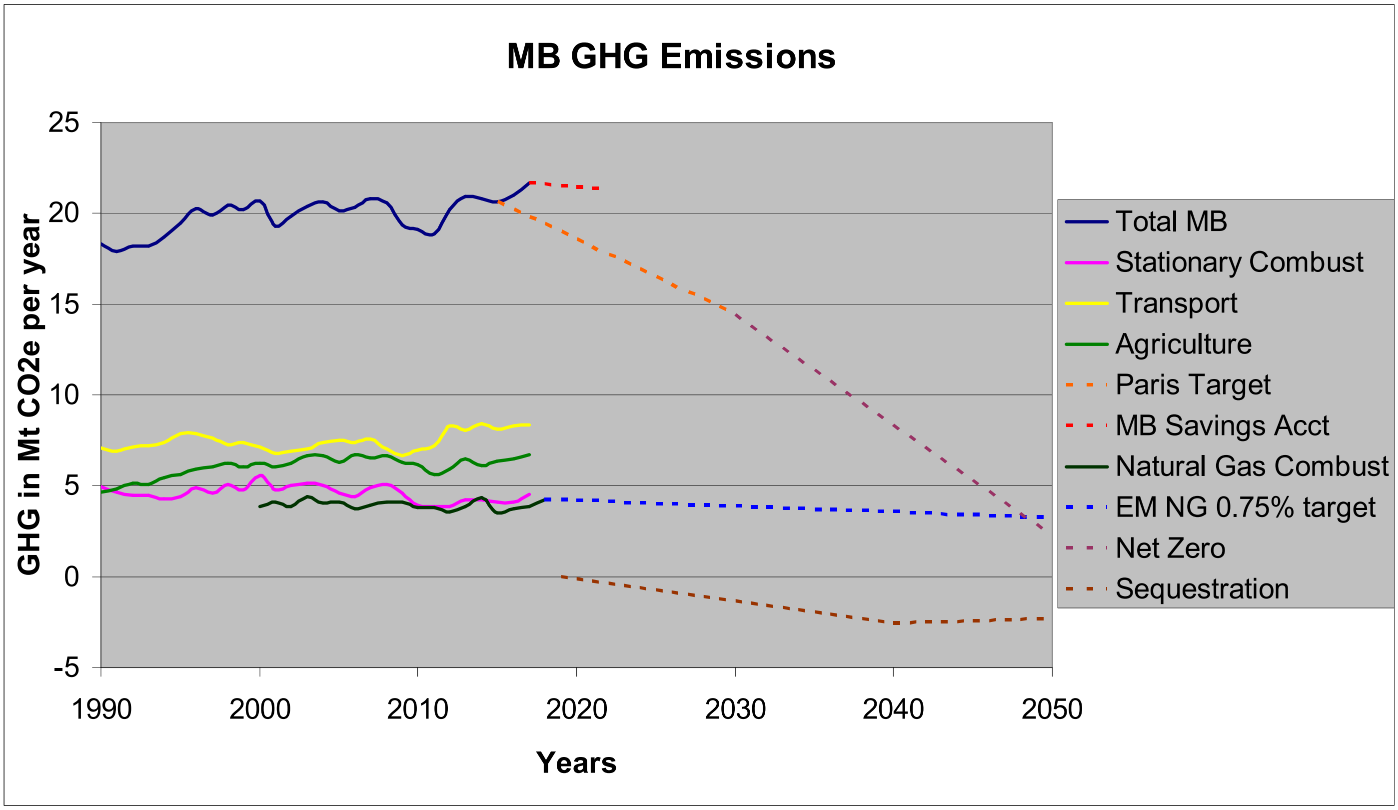

Figure 1. Manitoba GHG emissions history and future emissions targets

The three largest contributors to GHG emissions in Manitoba are agriculture, transportation and stationary combustion. Stationary combustion emissions are comprised mainly of natural gas combustion shown by the dark green line. Combustion of propane mostly accounts for the small difference between emissions from natural gas combustion and stationary combustion.

Figure 1 shows the emissions from transportation have gradually increased from 1990 to the present despite improvements in vehicular efficiency. Growth outweighs efficiency in conformance with the Jevons Paradox and the efficiency trap. The made in Manitoba Green Plan promotes improvement in vehicular efficiency. https://www.gov.mb.ca/asset_library/en/climatechange/climategreenplandiscussionpaper.pdf

This is counter productive. It will lock in fossil fuel emissions for the lifetime of a new vehicle. Growth will continue to outweigh efficiency and vehicular emissions will continue to rise. The only effective means to reduce transportation emissions is by switching to electric vehicles. This is an illustration of the futility of relying solely on efficiency to reduce GHG emissions. The same principle applies to the combustion of natural gas which currently accounts for about 20% of the provincial emissions.

The Paris climate change targets and the Net Zero target for 2050 are shown by the dotted orange and plum coloured lines. Net Zero does not necessarily have to reach zero emissions. Potential sequestration of carbon through agricultural practices and afforestation can counteract small continued emissions. The potential for sequestration in Manitoba is shown by dotted negative emissions brown line. https://www.iisd.org/sites/default/files/publications/carbon-dioxide-equivalent-sequestration-agro-manitoba.pdf . Deforestation due to forest fires driven by climate change are likely to result in emissions that outweigh sequestration. https://climatechangeconnection.org/impacts/ecosystems-impacts/forest-impacts/ https://www.sciencedaily.com/releases/2019/08/190821135257.htm. Thus Net Zero for Manitoba likely would require zero overall emissions.

To reduce emissions in Manitoba an expert advisory council has proposed a carbon savings account. The planned savings account requires that Manitoba should set a GHG reduction goal of no less than one Mt of CO_2e cumulative emissions reductions over five years from 2018- 2022.
https://manitoba.ca/asset_library/en/eac/eac_carbon_savings_report2019.pdf

The bending of the emissions curve from the carbon savings account show in red in Figure 1 is insufficient to meet climate change targets. In 2018, 4.24 Mt of annual CO_2e were emitted from natural gas combustion. The EM target savings of 0.75% per year would contribute only 0.16 Mt CO_2e of the planned carbon budget savings of 1 Mt over the five years from 2018 to 2022. The EM target savings shown by the blue line are not enough to meet the Paris target for 2030 or Net Zero by 2050. Neither the planned carbon budget nor the EM target are sufficient to meet climate change targets. Climate change targets are currently outside the scope of EM mandate. However, we feel that the PUB should consider climate change targets as part of its obligations under Section 39(h) of the Act. We recommend regulations pertaining to climate change targets be prescribed.

The past history of DSM savings indicates that the EM target of 0.75% savings per year is unlikely to be met. This is within the scope of the PUB hearings for EM. We provide further evidence of this below.

3. History of Growth and DSM Savings

The emissions from combustion of natural gas as shown in Figure 1 trend slightly downward from 2000 to the present. This seems to contradict the efficiency trap and Jevons Paradox. Just as with transportation we would expect that growth in natural gas use would outweigh efficiency.

According to the MB Hydro 2012 Natural Gas Volume Forecast, the residential Heating Value Weather (HVW) Adjusted Volume for small general service (SGS) residential customer has decreased from 650 million cubic metres in 2003 to 590 million cubic metres in 2012. The commercial SGS and LGS (large general service) HVW combined decreased from 620 million cubic metres in 2003 to 605 million cubic metres in 2012.

This decrease in natural gas use is inconsistent with growth. The decrease in natural gas use is documented in the 2012 Hydro Natural Gas Volume Forecast,

"*During 2011/12 there was an average of 241,845 SGS Residential customers. Over the last 9 years, this class has grown an average of 1,826 customers or 0.8% per year. They are forecast to grow at an average of 2,736 customers or 1.1% per year between 2011/12 and 2021/22. The total number of customers in the combined SGS Commercial and LGS classes is continuing to grow slowly. Over the past 9 years, customers increased by about 98 customers or 0.4% per year. Over the next 10 years, they are forecast to grow by about 81 customers or 0.3% per year.*"
http://www.pubmanitoba.ca/v1/centra_2013_14_gra/pdf/appendix_8_1.pdf

The average population growth rate for Manitoba from 2009 to 2018 was 1.2%
https://www.gov.mb.ca/mbs/reports/pubs/501_pop/mbs501_pop_2018_a01.pdf
A medium scenario prediction is 1.3% growth to 2038.
https://www.gov.mb.ca/mbs/reports/pubs/601_pop_projections/oview_fall2014_prov-er_free.pdf

The volume weighted average of customer growth of both residential and commercial from 2003 to 2012 is about (590x0.8% + 605x0.4%)/(590+605) or 0.6%. Using the same weighting the average customer increase to 2022 will be about 0.7% based on the projections from the 2012 Hydro volume forecast.

The DSM savings history from 2012 to 2018 is shown in Table 1 reproduced from the 2019 PUB rate application information requests
https://www.hydro.mb.ca/docs/regulatory_affairs/pdf/natural_gas/general_rate_application_2019/information_requests/pub_irs_1-99.pdf

Table 1. DSM savings 2012 to 2018

Actual and Forecast Natural Gas Savings

(millions m^3)

	2012/13		2013/14		2014/15		2015/16		2016/17		2017/18		2018/19	
	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast
RESIDENTIAL														
Affordable Energy														
Furnaces	*0.5*	*0.3*	*0.5*	*0.5*	*0.7*	*0.6*	*0.5*	*0.6*	*0.4*	*0.6*	*0.5*	*0.5*	-	*0.4*
Other technologies	*0.7*	*0.5*	*0.7*	*0.7*	*0.7*	*0.8*	*0.7*	*0.8*	*0.6*	*0.7*	*0.7*	*0.5*	-	*0.5*
Total	*1.1*	*0.8*	*1.1*	*1.2*	*1.4*	*1.3*	*1.2*	*1.4*	*1.0*	*1.3*	*1.1*	*0.9*	-	*0.9*
Home Insulation	1.1	1.0	0.7	1.0	0.7	0.8	0.6	0.7	0.5	0.7	0.6	0.6	-	0.5
New Homes Program (Redesign)	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.1	-	0.1
Residential Appliances	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	-	0.0
Residential HRV	-	-	-	-	-	-	-	-	0.0	0.2	0.0	0.0	-	-
Smart Thermostats	-	-	-	-	-	-	-	-	0.2	0.1	0.3	0.1	-	0.3
Water & Energy Saver	1.0	0.8	0.6	0.8	0.5	0.8	0.6	0.8	1.1	0.7	0.4	0.8	-	0.7
Discontinued/Completed	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	3.3	2.6	2.5	3.0	2.6	2.9	2.3	2.8	2.9	3.0	2.5	2.5	-	2.5
CUSTOMER SERVICE INITIATIVES														
Power Smart Residential Loan	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.4	0.3	0.4	-	0.3
Residential Earth Power Loan	0.3	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.1	0.0	-	0.0
Power Smart PAYS Financing	(0.0)	0.0	(0.0)	0.1	(0.0)	0.0	-	0.0	(0.0)	(0.0)	(0.0)	(0.0)	-	(0.0)
RESIDENTIAL TOTAL	0.6	0.4	0.5	0.5	0.3	0.5	0.3	0.4	0.4	0.4	0.4	0.4	-	0.3
COMMERCIAL														
CBOP	0.1	0.3	0.2	0.2	0.0	0.1	-	0.1	0.1	0.0	-	0.2	-	0.2
Commercial Building Envelope	1.2	1.4	1.7	1.3	2.3	1.3	1.7	1.1	1.4	1.4	1.1	1.3	-	1.7
Commercial Custom Measures	1.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.5	0.1	0.0	0.3	-	0.3
Commercial New Buildings	2.4	0.5	0.1	0.8	0.1	0.3	0.7	0.4	0.1	0.1	0.6	0.2	-	0.1
Commercial Kitchen Appliances	0.0	0.0	0.0	0.2	0.3	0.2	0.6	0.3	0.0	0.3	0.0	0.0	-	0.0
Internal Retrofit Program	-	0.0		0.0	0.0	0.0	-	-	-	-	0.0	0.0	-	0.1
Power Smart Shops		0.0		-		-	0.0	0.0	0.0	0.0	(0.0)	0.0	-	0.0
HVAC	1.3	1.0	1.2	0.4	1.5	1.2	0.9	1.1	0.8	1.3	0.7	1.0	-	0.7
Race to Reduce		-		-		-		-		0.3	(0.2)	0.3	-	0.1
Discontinued/Completed	-	0.0	-	0.0	-	-	-	-	-	-	-	-	-	-
Total	6.1	3.4	3.3	3.0	4.4	3.2	4.3	3.2	2.9	3.5	2.2	3.4		3.1
CUSTOMER SERVICE INITIATIVES														
Power Smart for Business PAYS Financing	0.0	0.0	0.0	0.0	0.0	0.0	-		0.0	0.0	0.0	0.0	-	0.0
COMMERCIAL TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	0.0
INDUSTRIAL														
Natural Gas Optimization	1.9	1.6	0.9	1.6	1.5	1.2	0.5	1.0	1.0	1.0	1.6	2.5	-	2.0
Industrial Discontinued/Completed	0	-	-	-	-	-	-	-	-	-	-	-	-	-
INDUSTRIAL TOTAL	1.9	1.6	0.9	1.6	1.5	1.2	0.5	1.0	1.0	1.0	1.6	2.5		2.0
EFFICIENCY PROGRAMS SUBTOTAL	11.9	7.9	7.1	8.1	8.9	7.9	7.4	7.3	7.3	8.0	6.7	8.8	-	8.0
CUSTOMER SELF-GENERATION														
Bioenergy Optimization	-	0.0	-	0.3	-	0.0	-	-	-	-	-	-	-	-
Total	-	0.0	-	0.3	-	0.0	-	-	-	-	-	-	-	-
INTERACTIVE EFFECTS	-0.7	-1.1	-0.9	-1.1	(1.7)	-1.0	-1.3	-1.9	-5.0	-3.5	-4.0	-3.0	-	(3.1)
PROGRAMS SUBTOTAL	11.2	6.8	6.3	7.3	7.2	6.9	6.1	5.4	2.3	4.5	2.7	5.8	-	4.8
CODES, STANDARDS & REGULATIONS	3.4	1.9	2.8	2.7	2.9	3.3	2.8	3.4	3.0	4.3	2.1	3.6	-	3.7
DSM TOTAL	**14.6**	**8.8**	**9.1**	**10.0**	**10.1**	**10.2**	**8.9**	**8.9**	**5.3**	**8.8**	**4.9**	**9.4**	**-**	**8.5**

Note: small values that round to zero are denoted as 0.0.

The total natural gas volumes consumed in million of m^3 and percent D SM savings from 2012 to 2018 are given ion Table 2

Table 2 DSM saving % from 2012 to 2018 in millions of cubic metres

year	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
DSM Total	14.6	9.1	10.1	8.9	5.3	4.9
NG	1866	2049	2280	1846	1986	2048
DSM% of volume	0.782	0.444	0.443	0.482	0.267	0.239

The average DSM saving from 2012 to 2018 was 0.443% annually.

The history and projected DSM savings from 1989 to 2029 are illustrated in Figure 2

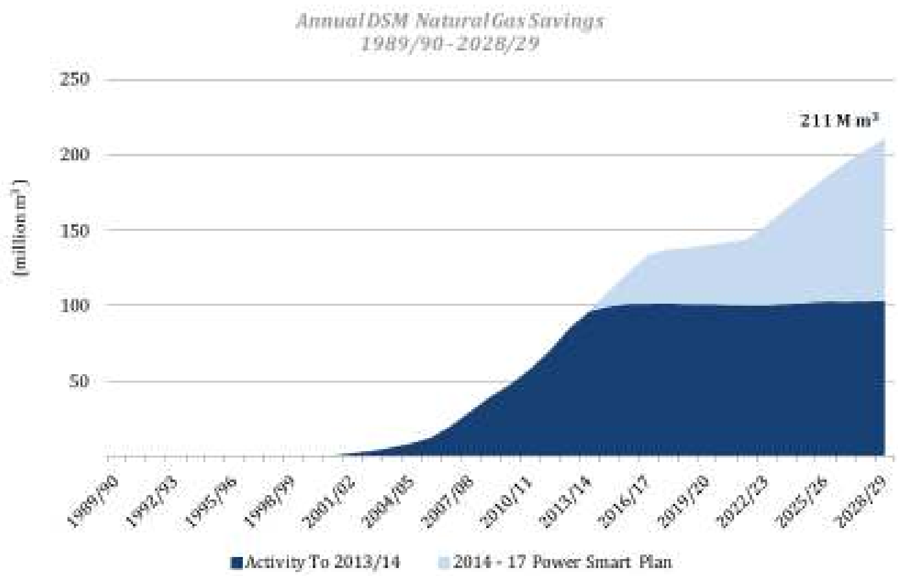

Figure 2. History of DSM savings and projection from 1989 to 2029
Figure 2 is reproduced from
https://www.hydro.mb.ca/regulatory_affairs/electric/gra_2014_2015/pdf/appendix_8_1.pdf

From 1989 to 2001 the DSM savings were insignificant. From 2001 to 2014 the cumulative savings according to the graph were almost 100 million cubic metres. From MB Hydro annual reports, the total natural gas volume from 2001 to 2014 was 31,428 million cubic metres. The average DSM savings per year from 2001 to 2014 based on these numbers were 0.318%. Including the average DSM savings from 2015 to 2018 of 0.329%, the overall average annual DSM savings from 2001 to 2018 were 0.32%. Population growth was 0.9% and residential customer growth was about 0.8%. Commercial customer growth was averaging about 0.4% per year. The volume average annual customer growth was about 0.6%. Clearly growth has been exceeding efficiency savings historically. This is consistent with the efficiency trap. The question is why has not overall natural gas consumption from the year 2000 to the present trended upwards rather than slightly downwards. The DSM savings have not accounted for the decline. We return to this question after consideration of projected future DSM savings.

The projected DSM savings to 2031 are illustrated in Figure 3 taken from PUB 2019 general rate application document appendix 7.3.
https://www.hydro.mb.ca/docs/regulatory_affairs/pdf/natural_gas/general_rate_application_2019/07-3_appendix_7-3_2018_dsm_plan_and_2016-17-15_year_supplement.pdf

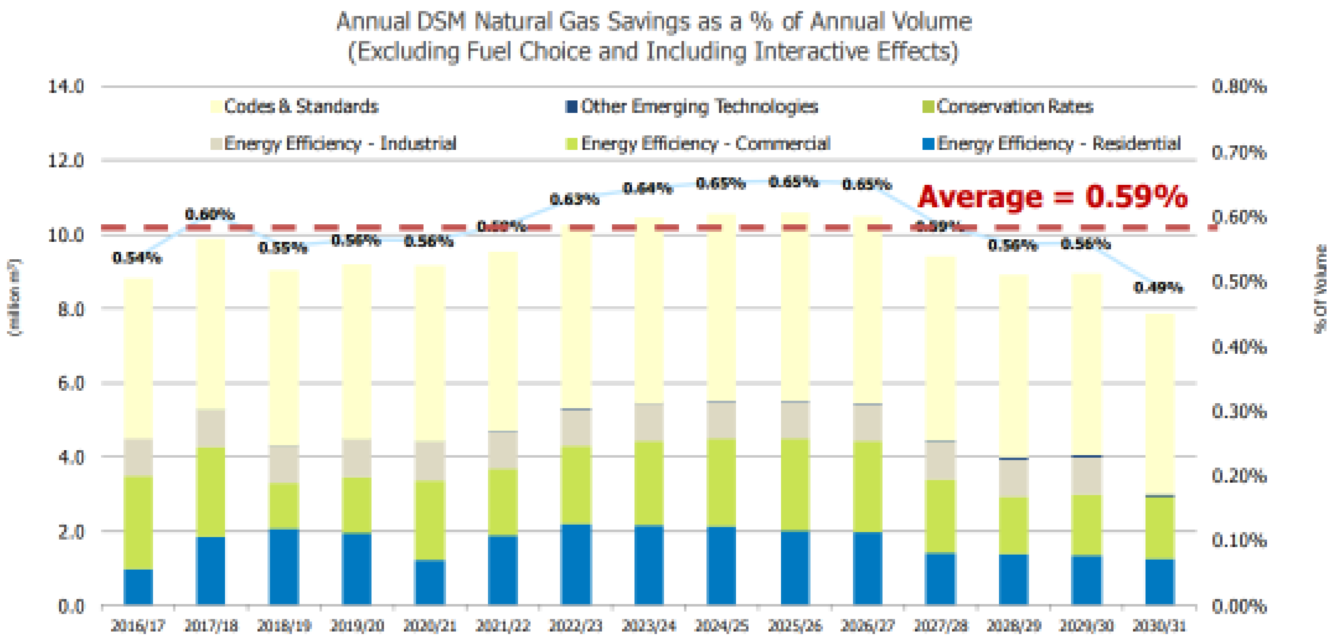

Figure 3. Predicted DSM Natural Gas Fuel Savings from 2016 to 2031

These predictions appear to optimistic since that actual DSM savings in 2016/17 and 2017/18 of 5.3 and 4.9 million m^3 respectively are about one half of predicted. The overly optimistic average predicted DSM annual savings of 0.59% shown in Figure 3 are below the EM target of 0.75%. DSM annual growth has averaged about 3.2% from 2001 to 2018. Based on this evidence we expect that the EM target of 0.75% annual savings is optimistic and will not be achieved.

Growth has exceeded DSM savings historically. Historically the volume weighted annual customer growth was about 0.6%. The future annual growth is expected to be about 0.7% as predicted by the MB Hydro 2012 Natural Gas Volume Forecast. We would expect that growth would continue to be greater than DSM savings.

It is interesting that interactive effects considered in Figure 3 such as switching to LED lights increases natural gas use and reduces DSM savings. The effects of fuel choice are not included in the analysis for Figure 3. MB hydro regarding fuel choice states,

"*Fuel Choice Initiative – Risk Level: Medium to High Achieving the energy savings associated with the Fuel Choice initiative presents a medium to high level of risk to the Corporation. This initiative involves encouraging customers to switch from using electricity to natural gas for space heating purposes where natural gas is available. This initiative would result in participating customers having lower heating bills however it would result in higher regional emissions and lower global emissions. Given the dynamics associated with this initiative, Manitoba Hydro has mixed support for pursuing this initiative by its various stakeholders. For example, the provincial government is not supportive of Manitoba Hydro pursuing this opportunity while some interveners are strong advocates of Manitoba Hydro pursuing the opportunity. Manitoba Hydro is managing this risk by continuing to have discussions with its key stakeholders to assess whether the opportunity will or should be pursed.*"

The assumption of lower global emissions associated with fuel choice is predicated on the idea that Hydro exports result in lower emissions than in Manitoba. It is assumed that exports will displace fossil fuels that have higher emissions factors than natural gas consumed in Manitoba. Manitoba uses an emissions factor associated with burning of natural gas that ignores the contribution from fugitive emissions associated with natural gas leaks at the well head, in processing and in the supply chain. Fugitive emissions of methane have a 20 year global warming potential of about 87. https://www.epa.gov/ghgemissions/understanding-global-warming-potentials The fugitive emissions of natural gas occur mostly outside the province but should be taken into account since emissions contribute to warming globally. https://www.canadasnaturalgas.ca/en/environmental-action/air/reducing-menthane-emissions Once fugitive emissions are considered, exporting of Hydro electrical power elsewhere produces about the same emissions savings globally wherever the Hydro is used. Consideration of fugitive emissions could increase the emissions rate of natural gas by 50%. https://earthworks.org/cms/assets/uploads/2018/02/NY-Pipelines-PSE-TECHNICAL-REPORT.pdf

We feel that switching from electric heat to natural gas must be disallowed because of associated the increase in GHG emissions. We recommend, the PUB should exercise its responsibility under Section 11 of the regulations of the Act to ensure that such fuel switching from electricity to natural gas does not occur.

We return to the question of why is it that total volumes of natural gas consumed trends downward rather than upward. An upward trend would be expected consistent with the efficiency trap and the historic average natural gas customer growth of 0.6% per year that exceeds the DSM saving of 0.32% per year. To answer this question we examine the Heating Degree Days for Winnipeg that drives natural gas consumption.

4. Natural Gas Consumption and Heating Degree Days (HDD)

A Heating Degree Day (HDD) is measured by subtracting the average daily temperature from the base of 18 ^{o}C. The total Heating Degree days are added for a year. HDD is a measure of the heating requirements for buildings and residences. The Heating Degree Day history for Winnipeg is shown in Figure 4 together with volume of gas consumed and CO_2e emissions from the gas combustion. https://climateatlas.ca/map/canada/hdd_2060_85#city=465&lat=54.98&lng=-95.01

Linear fits to the data for the heating degree day history and the natural gas emissions illustrate the historic downward trend. The EM target reduction for natural gas emissions to 2035 is shown in Figure 4. Extrapolation of the heating degree day data to 2035 is shown in Figure 4.

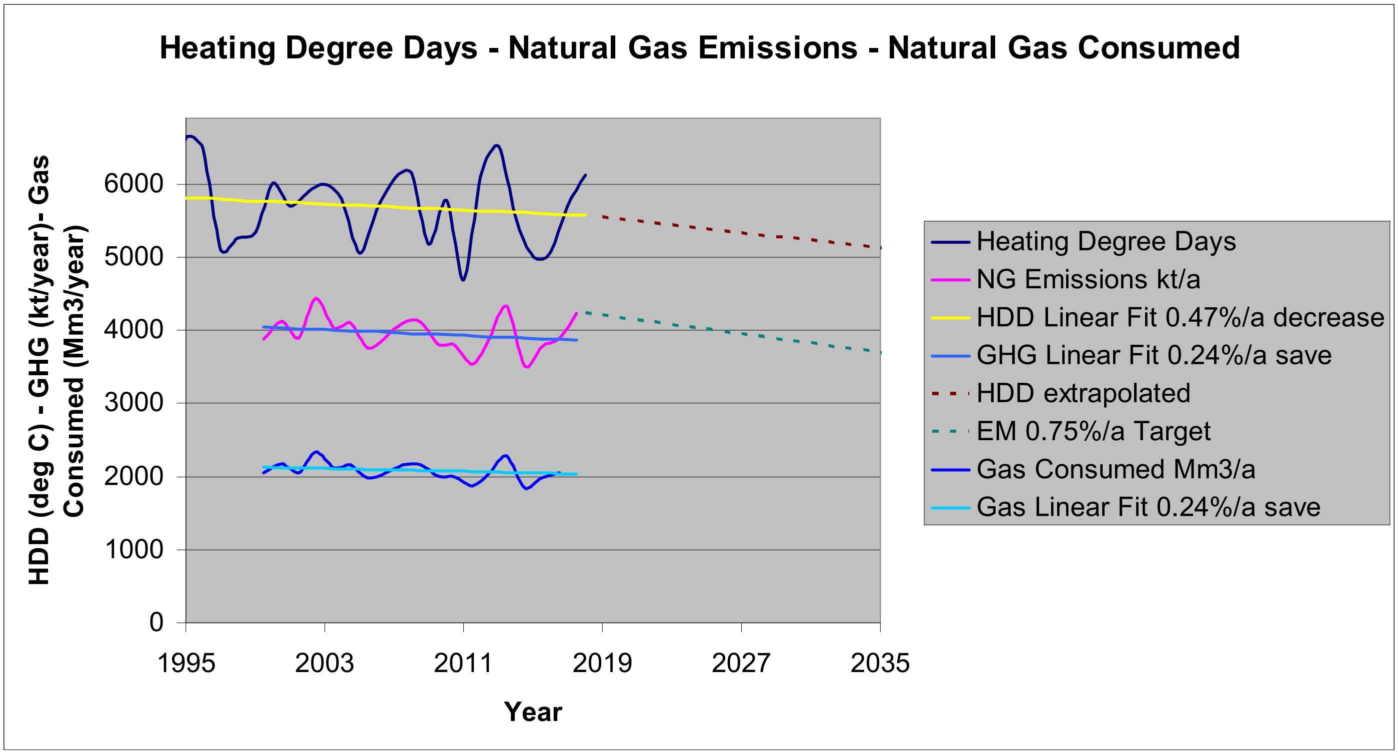

Figure 4. Heating Degree days and Natural Gas Emissions

The yearly fluctuations in history of natural gas volume and emissions closely match fluctuations for the Heating Degree Days. Yearly fluctuations depend on the severity of the winter. The projected target for EM savings has the same downward trend as the projected HDD. The HDD are trending downward due to climate change. The natural gas consumption and resultant emissions follow this trend. This is a casual effect not a correlation. Natural gas consumption and emissions must decrease with increasing temperature.

A linear fit to the volume of gas consumed and the resulting emissions shows an average decrease for 2001 to 2018 of 0.24%. This is lower than the average DSM savings over this period of 0.32%. Customer growth over this period is about 0.6%. The percent decrease in HDD from a linear fit is about 0.47%. Assuming the percent decrease in HDD will result in the same percent decrease in natural gas consumption, all the factors of DSM, growth and HDD would result in an average of 0.6% - 0.33% - 0.47% or -0.2% change in natural gas consumption per year. The actual average decrease in natural gas consumption is about 0.24% per year consistent with the combination of growth, DSM and HDD. The annual decrease in HDD of 0.47% is larger than average annual DSM savings of 0.32%. DSM savings in themselves do not outweigh growth.

Future DSM savings may well be less than in the past subject to the law of returns for continued efficiency gains. https://www.eia.gov/todayinenergy/detail.php?id=17071 Eventually all furnaces, water heaters, boilers and poorly insulated houses will be upgraded. Growth is predicted to be somewhat higher in the future than in the past.

In summary, the EM target of 0.75% annual decrease, according to past DSM savings, appears to the optimistic. DSM savings and EM targets will not bend the future emissions curve downward as claimed. The HDD days are predicted to decrease more in the future according to climate models. Any lower future emissions from natural gas are likely to be caused primarily by decreasing HDD. The decrease will not be enough to meet climate change targets as shown in Figure 1 and Figure 4. It is very ironic that the emissions that are driving climate change also drive natural gas consumption and resultant emissions lower. In accordance with the Jevons Paradox growth outweighs efficiency for natural gas consumption. It would appear that the entire rational for the paramount focus on efficiency by EM is intrinsically flawed.

If efficiency gains are ineffectual and do not outweigh growth for natural gas as predicted by Jevons Paradox, what can be done? The answer is obvious. Just as in the transportation sector we must transition away from fossil fuels. Natural gas use must be phased out and electric heat pumps used for heating. Heat pumps produce no emissions. We shall see, considering future carbon taxes, electrification of heating results in larger cost savings than from more efficient combustion of natural gas.

5. Heat Pump and Natural Gas Heating Cost Comparison

The heating cost for a recent 1200 square foot home for heat pumps, natural gas and electric heat are compared in Figure 5. Data for heating cost were obtained from Hydro online heating cost calculator. Data for the carbon tax and projected increase in electricity rates were also obtained from MB Hydro sources.
https://www.hydro.mb.ca/your_home/heating_and_cooling/calculator/
https://www.hydro.mb.ca/accounts_and_services/carbon_charge/

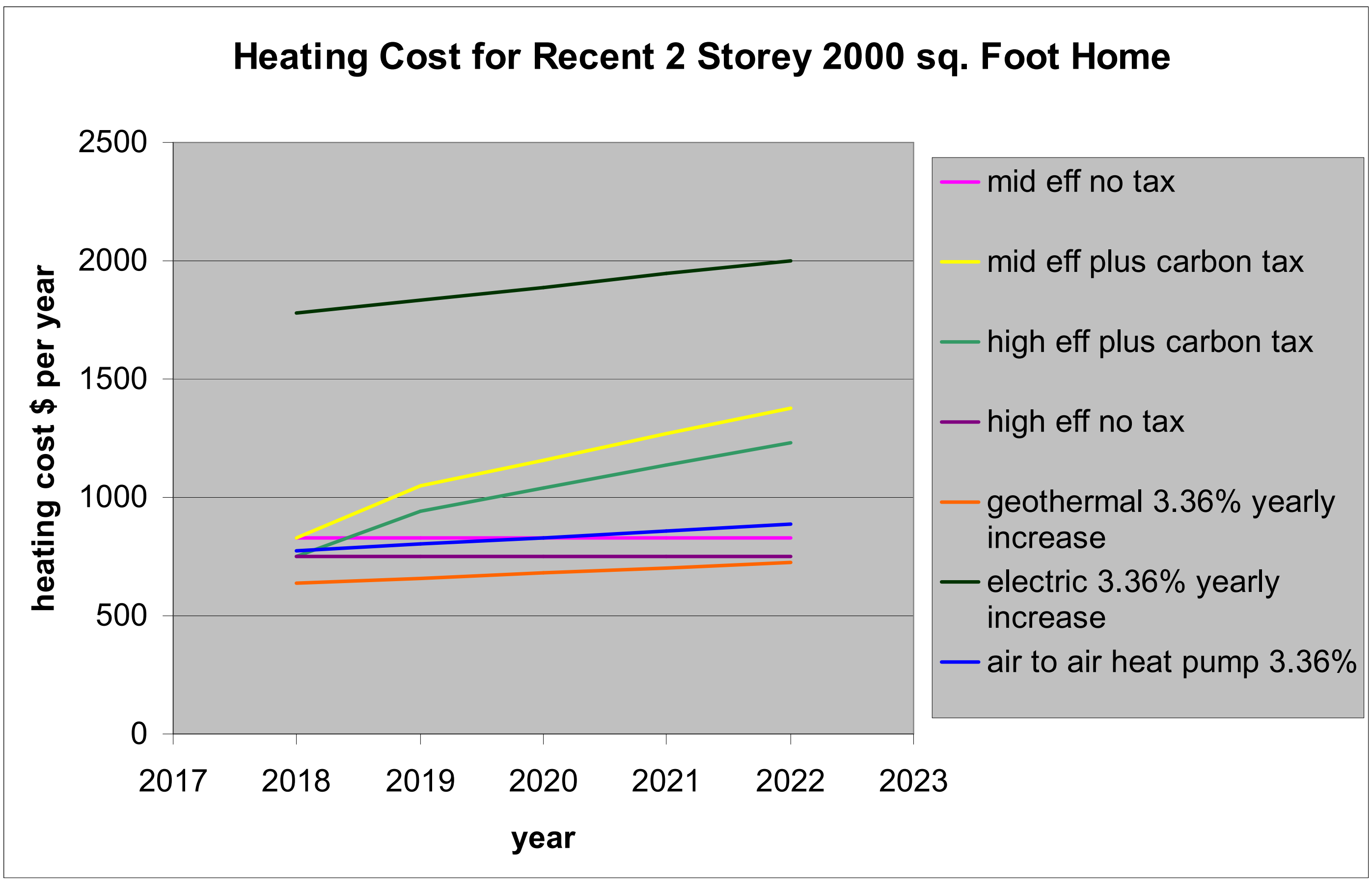

Figure 5. Home Heating Cost Comparison

A linear fit to available data shown in Figure 6 was used to obtain the efficiency of air to air heat pumps for the HDD for Winnipeg. The heat pump efficiency for Winnipeg of 250% was used to estimate the heating cost of heat pumps shown in Figure 5. https://sustainabletechnologies.ca/app/uploads/2015/12/ASHP-GSHP_TechBrief_Final.pdf
https://winnipeg.weatherstats.ca/charts/hdd-yearly.html

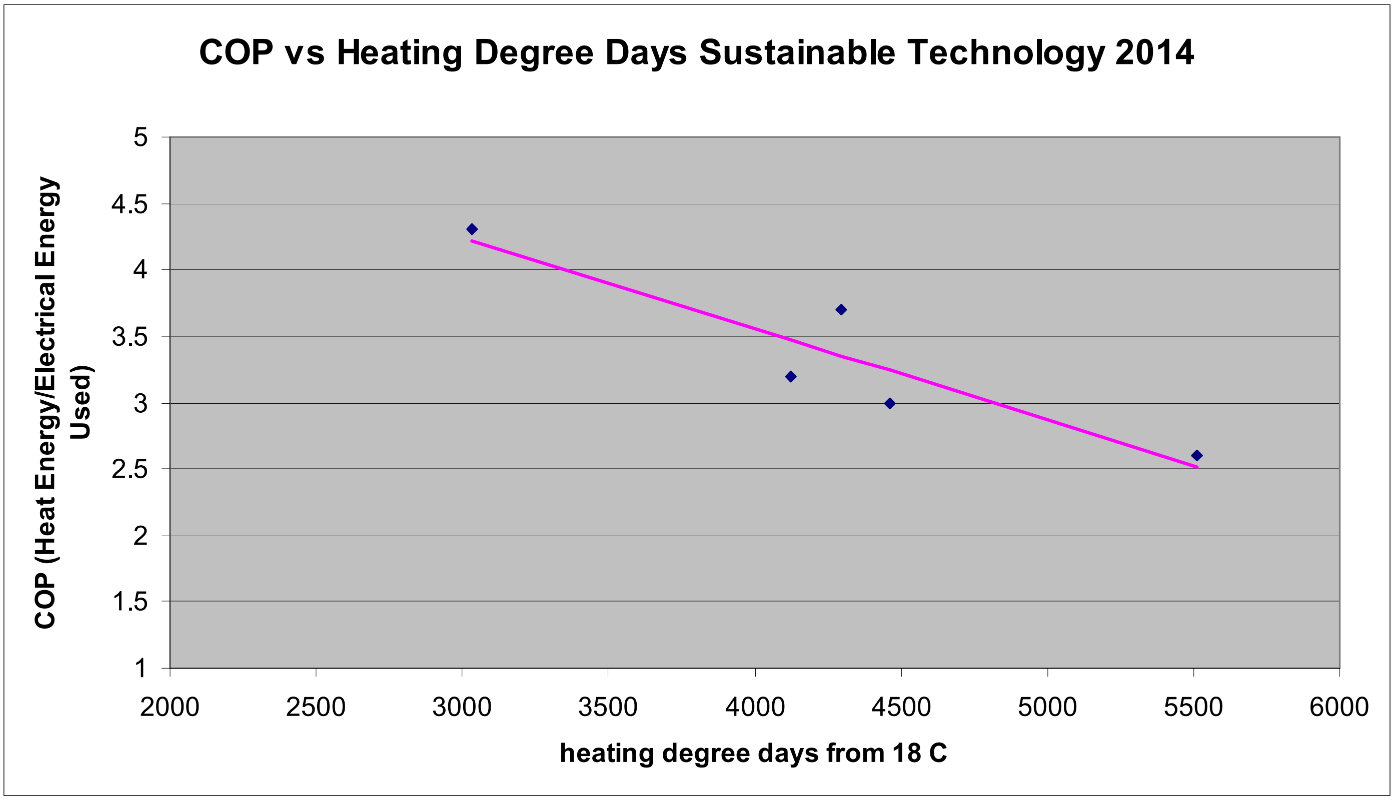

Figure 6. Air to Air Heat Pump Efficiency

Figure 5 illustrates electric resistance heating costs are higher than other methods. When planned carbon taxes are included a high efficiency natural gas furnace has a higher operating cost than both geothermal and air to air heat pumps. An assumed yearly increase of 3.36% was used for heat pumps and electrical furnace.

Geothermal heat pumps have a much higher installation cost than high efficiency gas furnaces. The higher geothermal installation cost can be recovered over time due to the lower yearly heating costs.

Air to air heat pumps have comparable installation costs to high efficiency natural gas furnaces and do not require extensive land use required by geothermal. Air to air heat pumps could require a costly upgrade to the electrical service. The cost of the electrical service upgrade can be recovered over time through the lower operating cost.

Incentives to cover the installation costs of heat pumps could be covered by revenue from future carbon taxes. Air to air heat pumps are improving rapidly for use in cold climates. We feel the PUB is obliged by Section 11 of the Act Regulations to consider air to air heat pumps
"whether the efficiency plan adequately considers new and emerging technologies that may be included in a future efficiency plan"

At this stage supplemental electric resistance heating for air to air heat pumps would be required on the coldest days. This could be provided by baseboard heating or an electric furnace. The efficiency used for air to air heat pumps from Figure 6 includes supplemental electric resistance heat for cold days.

6. Furnace Replacement

Section 15 (2) of the Act requires,

"*Effective April 1, 2020, (a) no further money is to be allocated to the FRP account; and (b) the residual amount in the FRP account as of April 1, 2020 is to be used to offset the cost of the natural gas demand-side management initiatives set out in an approved efficiency plan*."
Section 15(4) states

"*If the Furnace Replacement Program is continued under an approved efficiency plan, it is to be continued under the administration of Efficiency Manitoba*"

The history of furnace replacement is given in the PUB 2019 general rate application document appendix 7.1

"*To date, an estimated 22,369 homes have completed energy efficiency retrofits. Of the total retrofits, approximately 11,464 insulation projects have been completed, and 5,730 furnace replacements have been completed. The program is forecast to reach 6% (898) of the remaining targeted homes with poor or fair insulation levels within the total LICO 125% market in 2018/19. The program is forecast to reach 16% (510) of the remaining standard furnaces in the LICO 125% market in 2018/19*"

https://www.hydro.mb.ca/docs/regulatory_affairs/pdf/natural_gas/general_rate_application_2019/07-3_appendix_7-3_2018_dsm_plan_and_2016-17-15_year_supplement.pdf

As of 2018/19, the program projects that there are approximately 15,500 insulation customers and 3,250 standard furnace customers remaining in the market.
https://www.hydro.mb.ca/docs/regulatory_affairs/pdf/natural_gas/general_rate_application_2019/07-3_appendix_7-3_2018_dsm_plan_and_2016-17-15_year_supplement.pdf

Data on the he history of furnace and boiler replacement in Manitoba is given in Table 3.

Table 3 Furnace and Boiler Replacement

	2007/08 to 2017/18*	2018/19	Total to 2018/19
Total Participation	22,369	3,428	**25,797**
No. of Insulation Projects	11,464	898	**12,362**
No. of Furnaces Installed	5,730	510	**6,240**
No. of Boilers Installed	130	10	**140**
Capacity Savings (MW)	15.2	1.3	**16.5**
Energy Savings (GW.h)	32.3	3.9	**36.2**
Natural Gas Savings (million m^3)	10.4	0.9	**11.4**
Utility Investment (Millions, $)	$63.0	$6.5	**$69.5**
Customer Investment (Millions, $)	$4.5	$0.2	**$4.6**
Total DSM Investment (Millions, $)	$67.5	$6.7	**$74.2**

Table 3 is reproduced from
https://www.hydro.mb.ca/docs/regulatory_affairs/pdf/natural_gas/general_rate_application_2019/07-3_appendix_7-3_2018_dsm_plan_and_2016-17-15_year_supplement.pdf .

A standard furnace is 60% efficient. A high efficiency furnace is up to 92% efficient. The savings in upgrading from standard to high efficiency will be about 32%.
https://www.hydro.mb.ca/your_home/affordable_energy/
https://www.hydro.mb.ca/your_home/heating_and_cooling/heating_systems/.

To achieve the Paris target of 30% emission rate reduction by 2030 over the 2015 rate, all existing furnaces would have to be standard and be replaced with high efficiency. Most standard efficiency furnaces have already been replaced. There are only 3,250 remaining. It is impossible to reach the Paris Target by furnace replacement alone.

From Table 3, in 2018/19, the installation of 510 high efficiency furnaces and 10 boilers saved 0.9 million cubic metres. This amounts to 1.73 thousand cubic metres per installation per year.

At emission rate used by MB Hydro of 0.0019 tonnes of CO_2e per cubic metre of natural gas, the yearly emissions saving of one installation is 3.287 tonnes of CO_2e. http://www.pubmanitoba.ca/v1/proceedings-decisions/appl-current/pubs/2020-em-3-yr-plan/em-3-yr-plan-application.pdf . Assuming a linear decrease in emissions the total savings required to reach the Paris target is 46.395 Mt CO_2e. Since natural gas accounts for about 19% of total emissions the share of the Paris target for natural gas would be 8.8 MtCO_2e. There are only 3,250 standard furnaces left on the market. Complete replacement of all the remaining standard efficiency furnaces with high efficiency would save 0.01 Mt of CO_2e, an insignificant portion of the Paris climate target.

Switching from standard efficiency to high efficiency furnace saves about 32%. Switching to heat pumps saves 100%. The Net Zero climate target can only be achieved by complete replacement of natural gas heating with electrical heating preferably with efficient heat pumps. DSM saving methods other than more efficient combustion such as insulation improvements could contribute to meeting the Paris target but cannot meet Net Zero. DSM savings other than combustion efficiency can reduce the load required for electric heat and should therefore be encouraged.

In 2017 Centra Gas had a total of 280,509 customers.
https://www.hydro.mb.ca/docs/regulatory_affairs/pdf/natural_gas/general_rate_application_2019/07-2_appendix_7-2_2011-12_to_2019-20_customer_and_volulme_summary_schedules.pdf

Assuming at least one combustion unit per customer there would have to be a minimum of 84,152 heat pumps installed to achieve a 30% natural gas emission reduction by heat pumps alone. Other continued DSM savings would reduce this number. From Table 1 furnace replacement historically has resulted in about 6% of DSM savings. Applying this factor to heat pump replacement, about 5,000 heat pumps would be required to meet the Paris Target. This cannot be achieved immediately. Heat pumps installed later will achieve fewer savings to 2030. If the heat pumps are installed gradually over the next ten years about 10,000 heat pumps or 1,000 per year would be required to meet the 2030 Paris Target. Considering that 898 furnace replacements were done in 2017/18, one thousand heat pumps per year would be possible if the furnace program were replaced with a heat pump program.

The furnace replacement savings are reaching the law of diminishing returns associated with efficiency measures. Eventually there will be no more furnaces to upgrade and homes to insulate. At a rate of about 900 replacements per year the remaining 3,250 standard efficiency furnaces would be replaced in less than four years. The marginal cost of other efficiency measures such as insulation will outweigh the marginal benefit eventually. As a result, in the future efficiency measures are even less likely to meet targets than in the past.

A rapid conversion of all 280,509 natural gas customers to heat pumps to meet Net Zero by 2050 might seem impractical. As the carbon tax increases, heat pumps will become progressively more financially attractive as shown in Figure 5. In Winnipeg the transition from heating oil to natural gas was relatively rapid once the TransCanada gas line was installed in 1960. This demonstrates that large transition away from natural gas can be rapid. We recommend EM should plan to phase out the natural gas use in the province.

7. Responsibilities of the PUB

The EM mandate is narrowly focussed on demand-side savings targets. Reductions in GHG emissions are considered only as an associated benefit of savings targets and not as a requirement to meet climate change targets. We have shown that the targeted EM savings will be ineffective in mitigating GHG emissions and counter productive with respect to climate change targets. Initiatives to install more efficient natural gas furnaces, boilers and natural gas combustion equipment will lock in fossil fuel use for decades and actually increase aggregate emissions compared to switching to fuel pumps. The only viable method to achieve climate targets is by fuel switching from fossil fuels to electricity. For natural gas, transition to heat pumps is required. Despite the urgency of the climate crisis, climate targets may be considered out of scope in the PUB hearing. We have shown that heat pumps are more cost efficient than natural gas furnaces and will achieve far more emissions savings. Transition to heat pumps for heating will achieve both greater efficiency savings and greater emissions reductions that can potentially meet climate targets.

Switching to heat pumps and electric vehicles will increase electrical load for the province. This is a concern for EM. This concern must be addressed with all stakeholders including MB Hydro. The new CEO of Hydro Jay Grewal in a presentation to the MB Chamber of Commerce in September 2019 stated,

"In this vision of the future, energy consumers are also energy producers – "prosumers" as it were. The prosumer generates with solar panels and stores electricity locally in their car and house batteries. They buy and sell energy transactionally from the grid, using their batteries to bridge between when the energy is generated and when it is consumed. Batteries allow the prosumer to effectively trade electricity - buying low and selling high - according to price signals from the grid. Having charged their car from the solar panel during the day and knowing that they only need their car for a short trip in the morning, the prosumer may elect to sell some of the energy stored in their car battery onto the grid at night when prices climb in response to a lack of solar generation and demand for electric heating. As you may have already guessed, the grid of tomorrow is not the grid of today – it is a SmartGrid backed with sensors and analytics to optimize supply and demand. Electricity pricing is set dynamically in real time, providing incentives to prosumers to manage their consumption.

We may not be ready to power all of our cars with renewable hydroelectricity in three years, or have the latest behind the meter technology ready to deploy in 12 months, you can rest assured that we are thinking about those issues, and charting a path forward to ensure that as the energy value chain evolves"
https://www.hydro.mb.ca/corporate/news_media/pdf/2019_09_25_mb_chamber_presentation.pdf

MB Hydro embraces the transition away from fossil fuels and is actively planning to meet the increased electrical demand. Why is it that EM Manitoba is promoting and investing in perpetuating the use of natural gas through more efficient combustion? Is this not contrary to the MB Hydro vision and harmful to society as a whole in terms of known future detriment from climate change? The U.N. Secretary-General António

Guterres warns that the point of no return on climate change is upon us.
https://www.nbcnews.com/news/world/u-n-chief-warns-point-no-return-climate-change-n1093956

We feel the responsibilities of the PUB under the Section 39(h) of the Act, "*the societal benefits to be achieved by all or a portion of Efficiency Manitoba's initiatives,"* requires the PUB to consider climate change to be within scope. We see that no other body is in a position to integrate across the different government departments of MB Hydro, Centra Gas and EM to ensure societal benefits associated with climate change mitigation will be considered.

We feel that the PUB should draft regulations in the Act in conformance with Section 39(h) of the Act:

"(h*) prescribing factors which the PUB must consider when it reviews an efficiency plan, including the value or weight to be given to*
(i*) reductions in greenhouse gas emissions in Manitoba, and*
(ii) *the societal benefits to be achieved by all or a portion of Efficiency Manitoba's initiatives*"
https://web2.gov.mb.ca/bills/41-2/b019e.php

7. Conclusion and Recommendations

We have provided evidence that the EM target of 0.75% savings per year is unrealistic and will not be met by demand-side initiatives. Climate change is primarily driving the decrease in natural gas consumption not savings from combustion efficiency. Consistent with the efficiency trap and Jevons Paradox, growth will continue to outweigh efficiency. More efficient natural gas combustion through furnace replacement and other structural measures will lock in GHG emissions for decades and prevent effective emissions reduction. The only effective method to reduce GHG emissions and maximize cost savings is through transition way from fossil fuels.

We recommend that the PUB make regulations and schedules for EM to implement the following,

1) transition away from fossil fuels,
2) phase out the use of natural gas,
3) replace the programs and incentives for more efficient natural gas heating with heat pump installation programs and incentives,
4) disallow fuel switching from electric to fossil fuel heating,
5) continue insulation and other DSM efficiency programs that do not involve fossil fuel consumption, and
6) design and monitor heat pump replacement programs to meet climate change targets.