Section:	Tab 1	Page No.:	3
Topic:	Letter of Application		
Subtopic:	Bill Impacts		
Issue:	Customer Sensitivity		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-3 (a) & (b).

QUESTION:

a) How has Manitoba established that rate stability and predictability are important considerations in determining a customer's sensitivity to rate increases. For example, has it conducted focus groups or surveys to determine customers' views/attitudes regarding rate increases? If so, please provide the results.

b) Is the magnitude of rate increases also an important consideration? If so, what information does Manitoba Hydro have regarding the "customer sensitivity" to different levels of rate increase?

RATIONALE FOR QUESTION:

The initial question asked "how has Manitoba Hydro identified/determined 'customer sensitivity to rate increases'. The response states that "Manitoba Hydro believes rate stability and predictability to be important considerations in determining a customer's sensitivity to rate increases". However, the response does not indicate how Manitoba Hydro arrived at this conclusion as initially requested nor does the response specifically discuss customers' sensitivity to the level of rate increases.

RESPONSE:

<u>Response to part a):</u>
It is Manitoba Hydro's understanding that the principles of rate stability and predictability have historically been key attributes of sound rate making policy for public utilities in

general. For instance, Bonbright noted on page 383 of "Principles of Public Utility Rates" that one of the attributes of a sound rate structure is as follows:

> Stability and predictability of the rates themselves, with a minimum of unexpected changes seriously adverse to rate-payers with a sense of historical continuity. (Bonbright, 1988, p. 383)

Manitoba Hydro has historically applied the principles of gradualism and rate-smoothing as part of its cost of service approach to making rate proposals. For instance, as noted in Tab 6, Section 6.1, one of Manitoba Hydro's general rate making objectives is "In conformity with the principles of gradualism and sensitivity to customer impacts, annual adjustments to revenues by customer class are less than two percentage points greater than the overall proposed increase."

In addition, the legislative underpinnings to Manitoba Hydro's policy of gradualism and rate-smoothing are articulated in following excerpts from *The Manitoba Hydro Act*, which clearly contemplates the establishment of reserves by the Manitoba Hydro-Electric Board for the purposes of stabilizing rates to customers:

SALE OF POWER

Price of power sold by corporation

> **39(1)** The prices payable for power supplied by the corporation shall be such as to return to it in full the cost to the corporation, of supplying the power, including
>
> …..
>
> **(c)** the sum that, in the opinion of the board, should be provided in each year for the reserves or funds to be established and maintained pursuant to subsection 40(1).

DEPRECIATION AND STABILIZATION RESERVES

Establishment of reserves

> **40(1)** The board shall establish and maintain, and may adjust as required, such reserves or funds of the corporation as are sufficient, in the opinion of the board, to provide
>
> ….

> **(c)** for the stabilization by the board of rates or prices for power sold by the corporation, the meeting of extraordinary contingencies, and such other requirements or purposes as in the opinion of the board are proper.

Use of reserves

> **40(2)** The reserves created pursuant to subsection (1) may be used or employed by the board
>
> ….
>
> **(d)** in such manner towards the stabilization of rates or prices for power, the meeting of extraordinary contingencies, and for such other requirements or purposes, as the board in its discretion deems proper; and
>
> …

Interveners to Manitoba Hydro's previous GRAs have often cited the need for rate stability and predictability on behalf of their constituents. For instance, the pre-filed evidence of Patrick Bowman, on behalf of MIPUG, at the 2012/13 & 2013/14 GRA, noted at page 2-2 that:

> In previous interventions, MIPUG members, as major power users, have consistently expressed concern about the long-term interests of Hydro's domestic customers with respect to the following items:
>
> - the need for stability and predictability of domestic rates over the long as well as short-term
>
>   ……

In addition, the Green Action Centre, in its written submission filed in response to Manitoba Hydro's Interim Electric Rate Application for April 1, 2014 noted the following, at page 3:

> In contrast, customers of Manitoba Hydro expect and require rate stability. This would appear to be especially true in reference to commercial entities, including the MIPUG members. Residential customers would also appear to appreciate rate stability in contrast to rate shock.
>
> In order to reconcile the variability of the Manitoba Hydro revenue stream with the stability desired by many of Manitoba Hydro's customers, the Board ought to

> look at setting rates on the basis of longer term trends as opposed to the actual results of last year's revenues or the short-term conditions, be they favourable or unfavourable. GAC is of the view that the current longer term trends point strongly in the direction of requiring more revenue for Manitoba Hydro.

As a final observation, Manitoba Hydro believes that consumers of goods and services generally prefer pricing changes that are more gradual in nature, rather than volatile. As well, Manitoba Hydro believes that it is beneficial for customers to be able to budget with a degree of certainty for future rate increases. For these reasons, Manitoba Hydro has proposed regular and moderate rate increases of 3.95% for 2015/16 & 2016/17 and has projected indicative rate increases of 3.95% into the future.

<u>Response to part b):</u>
Manitoba Hydro is of the view that the magnitude of a proposed rate increase is also an important consideration in terms of customer sensitivity. This is why Manitoba Hydro's approach to rate setting has been to take a longer term view in proposing rate increases in order to reduce the risk of rate shock to customers in the future.

As noted in the response to COALITION/MH-I-3a, there is financial justification for requesting rate increases in the order of 5.5% to 6.0% for the next four years in order to reduce the losses that are projected in the next 10 year period and maintain financial reserves at current levels. However, Manitoba Hydro recognizes that requesting rate increases that maintain its financial ratios at or above targets in the near to medium term, would be financially challenging for its customers.

In Tab 2, Manitoba Hydro has also outlined the projected impact on future rate increases if near-term rate increases lower than 3.95% are implemented in the next four years. As demonstrated in Figure 2.26 in Tab 2, with 2% rate increases for the next 4 years, Manitoba Hydro would require 8% rate increases for the following five years, and with 2.95% rate increases for the next four years, Manitoba Hydro would require 6% rate increases in the five years that follow.

With consideration of customer sensitivity to rate increases, Manitoba Hydro has maintained the minimum proposed rate increases at 3.95%. Manitoba Hydro believes that gradually raising rates by the minimum 3.95% rate increases is in the customers' best interest as this maintains rate stability and predictability during a period where rate increases are necessary to maintain the Corporation's financial strength and avoid the need for sudden or larger rate increases in the near future.

Section:	Tab 2: Appendix 2.1 NFAT Hearing: Appendix H	**Page No.:**	18
Topic:	Application Overview		
Subtopic:	Corporate Strategic Plan		
Issue:	CSP Targets		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-4 a)-f) and COALITION/MH I-10 a)-b).

QUESTION:

a) Please confirm for what years the CSP included in Appendix 2.1 is applicable.

b) Please confirm for what years the 2011 CSP filed in the last GRA was applicable.

c) Did the measures and targets in the Corporate Dashboard for 2011-12 differ from the measures and targets set out in the 2011-12 CSP? If yes, please provide the measures and targets in the 2011-12 Corporate Dashboard.

d) Please provide the actual 2011-12 results for:
   i. the measures set out in the 2011-12 CSP and
   ii. the 2011-12 Corporate Dashboard (if different).

e) Please confirm for what years the 2012-13 CSP filed in the recent NFAT proceeding (Appendix H) was applicable.

f) Did the measures and targets in the Corporate Dashboard for 2012-13 differ from the measures and targets set out in the 2012-13 CSP? If yes, please provide the measures, targets and actual results for 2012-13 Corporate Dashboard.

g) Please provide copies of any other CSPs issued after the 2011 CSP.

RATIONALE FOR QUESTION:

The response states that "Manitoba Hydro updates and re-publishes the CSP every three years unless changes to the strategic direction prompt a need for an earlier revision". The response also states that the Corporate Dashboard is a separate document with a different review cycle which confirmed on an annual basis. The purpose of the questions is to clarify the period of applicability of past/current CSPs and to clarify the recent Corporate Dashboard measures, targets and actual results.

RESPONSE:

a) In 2013/14 Manitoba Hydro developed its current Corporate Strategic Plan (CSP) which is intended to be reviewed and updated every 3 years, unless changes to the Corporation's strategic direction prompt a need for an earlier revision. Prior to 2013/14 Manitoba Hydro developed and published an annual CSP applicable to the fiscal year dated on the document.

The CSP included in Appendix 2.1 is applicable to fiscal years: 2013/14, 2014/15, and 2015/16. The 2013/14 CSP also included a new Corporate Dashboard that highlighted performance targets and actual results. The Dashboard, which is attached at the end of the 3 year CSP (pg.19 of Appendix 2.1), is a standalone document which is updated at the beginning of every fiscal year.

b) The 2011 CSP filed in the last GRA (2012/13 & 2013/14) was applicable to Manitoba Hydro's 2011/12 fiscal year.

c) Manitoba Hydro did not produce a separate Corporate Dashboard document in fiscal year 2011/12. Measures and targets were reflected within the 2011/12 CSP document itself.

d) i. Actual results for 2011/12 for the measures set out in the 2011/12 CSP are provided in the attachment to Coalition/MH I-9a.
ii. No Corporate Dashboard document was prepared in 2011/12 as the measures and targets were reflected within the 2011/12 CSP document itself.

e) The 2012/13 CSP filed in the recent NFAT (appendix H) was applicable to Manitoba Hydro's 2012/13 fiscal year.

f) Manitoba Hydro did not produce a separate Corporate Dashboard document in fiscal year 2012/13. Measures and targets were reflected within the 2012/13 CSP document itself.

g) There were no CSP documents other than those referenced in parts a) through e) above.

Section:	Tab 2: Appendix 2.1	**Page No.:**	18
Topic:	Application Overview		
Subtopic:	Corporate Strategic Plan		
Issue:	CSP Targets		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-5 (a).

QUESTION:

a) Figure 10.1 referenced in the response provides the budget and actual results for 2013/14. However, the Corporate Dashboard referred to in the original question is for 2014/15. Please respond to the original question by providing the 2014/15 budget values for each financial strength target and indicating/providing the relevant source document.

RATIONALE FOR QUESTION:

The response does not provide the requested information.

RESPONSE:

The budget values for each financial strength measure for 2014/15 with the relevant source are provided in the table below:

	Measure	Annual Budget	Source
Financial Strength (per IFF14) *2014/15*	Net income (Loss) (consolidated) ($ thousands)	114 814	Appendix 3.3, IFF14, p.26
	OM&A costs (consolidated) ($ thousands)	562 404	Appendix 3.3, IFF14, p.26
	Capital expenditures - electric operations - ***Major New Generation & Transmission*** ($ thousands)	1 451 710	Appendix 3.3, IFF14, p.32
	Capital expenditures - electric & gas operations - ***Major & Base Capital*** ($ thousands)	618 883	Appendix 3.3, IFF14, p.33

Section:	Tab 2: Appendix 2.1	**Page No.:**	18
Topic:	Application Overview		
Subtopic:	Corporate Strategic Plan		
Issue:	CSP Targets		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I- 6c) & g).

QUESTION:

a) Throughout the reported Customer Satisfaction survey results comparisons are made as between Manitoba Hydro's performance and the CEA Canadian Utility Average. Please explain why such comparisons are appropriate when the CEA results Manitoba Hydro is comparing itself to are the result of a totally different survey vehicle.

b) Please compare what the CEA determined Manitoba Hydro's customer satisfaction index to be in the CEA's most recent survey with the CEA Canadian Utility Average.

RATIONALE FOR QUESTION:

Clarify whether comparisons between Manitoba Hydro's survey results and the CEA's survey results are appropriate.

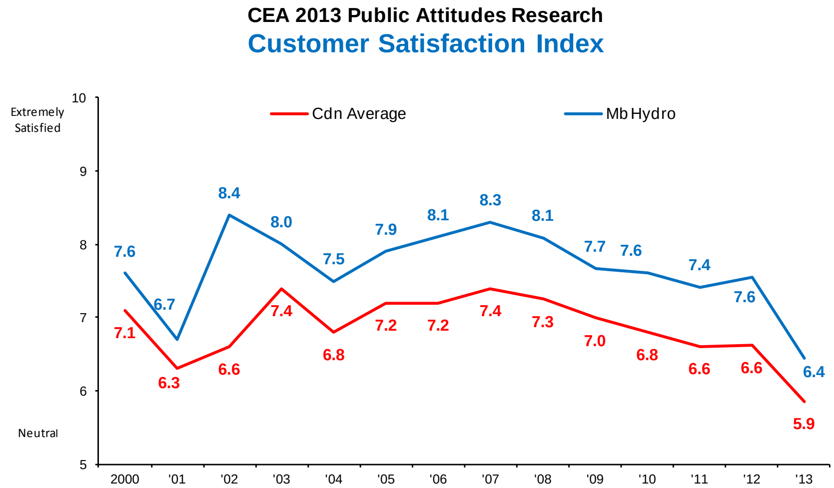
RESPONSE:

a) Manitoba Hydro recognizes that its Customer Satisfaction Tracking Study (CSTS) and the CEA study are different survey vehicles.

Both surveys provide valuable insight and complement each other. The survey results provide an indication of customer satisfaction (as measured by each survey), trending information, a benchmark for customer satisfaction for Canadian Electric Utilities and a relative ranking of Manitoba Hydro's customer satisfaction among Canadian electric utilities.

b) The Customer Satisfaction Index (CSI) reflects an electric utility's performance on the top drivers of customer satisfaction related to the provision of electricity service based on a regression analysis of over twenty-five attributes of electric service. Results of the CEA's CSI are reported on a provincial basis, not on a utility basis.

As outlined in the following graph, Manitoba's annual performance in the CEA Public Attitudes Research CSI over the past decade has exceeded the national average by a significant lead and has been among the leading utilities on a province-to-province basis.



The 2013 CEA CSI national average for Canadian Electric Utilities was 5.9 and Manitoba's 2013 CEA CSI was 6.4. For the 2013 CEA CSI, Manitoba was tied with another province for the second highest score across Canada.

Section:	NFAT Hearing: Attachment H (2012/13 CSP)	**Page No.:**	
Topic:	Application Overview		
Subtopic:	Corporate Strategic Plan		
Issue:	CSP Targets and Strategies		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-10 b).

QUESTION:

a) Please explain the variance between the 2012/13 OM&A/customer (electric) target ($814) and the actual 2012/13 result ($844).

b) Please provide the actual OM&A and customer count values used to calculate the OM&A/customer results reported.

RATIONALE FOR QUESTION:

The information is required to clarify the basis for the actual results reported.

RESPONSE:

a) The increase in the actual cost per customer of $844 for 2012/13 compared to the target of $814 is primarily due to storm restoration activities and changes in the discount rate impacting pension and other benefits.

b) Please see the following table for the OM&A and customer count values:

	Actual 2012/13	IFF11-2 2012/13
OM&A expense 'electric only' (in millions of $)	463	447
# of Customers	548 774	549 150
OM&A (electric only) per customer (in dollars)	844	814

Section:	Tab 3 2012/13&2013/14 GRA, MIPUG/MH I-2	**Page No.:**	11
Topic:	Integrated Financial Forecast and Economic Outlook		
Subtopic:	Financial Targets		
Issue:	Review of Financial Targets		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-16 (a).

QUESTION:

a) Please respond to the original question as posed and provide a copy of the review of financial targets referenced in MIPUG/MH I-2 from the last GRA.

RATIONALE FOR QUESTION:

The response did not provide a copy of the 2012 Review as was requested.

RESPONSE:

Manitoba Hydro is unable to provide a copy of the review of financial targets referenced in MIPUG/MH-I-2 from the 2012 GRA as the review was deferred until the completion of the NFAT, as indicated in response to COALITION/MH-I-16a. This review is currently underway and once completed, Manitoba Hydro will provide a copy for consideration at a future rate proceeding.

Section:	Tab 3: Appendix 3.3, Figure 5.1 Tab 11: Appendix 11.19	**Page No.:**	7 3-4
Topic:	Integrated Financial Forecast and Economic Outlook		
Subtopic:	Extra-Provincial Revenue		
Issue:	Changes in Extra-Provincial Revenues		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-24 (b).

QUESTION:

a) Please confirm whether the Preferred Development Plan scenario in NFAT, Appendix 11.3 is consistent with IFF12.

RATIONALE FOR QUESTION:

The response provided does not address the specific question posed in the original interrogatory.

RESPONSE:

Not confirmed. The NFAT Preferred Development Plan scenarios and associated Average Unit Revenue/Cost schedules in NFAT Appendix 11.3 were based on the 2012 planning assumptions used in IFF12 except for the following updates:

- The long-term outlook for electricity prices, which were adjusted downwards to reflect the information that was available at the end of December 2012 (please see section **1.5.1.3 Adjusted 2012/13 Electricity Price Forecast,** Appendix 9.3 – Economic Evaluation Documentation of the NFAT Business Case for more information); and
- Addition of the Great Northern Transmission Line assumptions based on negotiations since the preparation of IFF12.

Section:	Tab 3 – Appendix 3.3 Tab 4 Appendix 4.1	Page No.:	14-15 4 & 13-15 3-8
Topic:	Integrated Financial Forecast and Economic Outlook		
Subtopic:	Capital Expenditure Forecast		
Issue:	Changes in Capital Expenditure Forecast		

PREAMBLE TO IR (IF ANY):

This is a follow-up to COALITION/MH I-28e) and COALITION/MH I-32 b).

QUESTION:

a) What is the impact on the total year over year change in capital spending between 2014/15 and 2015/16 due to IFRS-related changes in the capitalization of overheads?

b) What accounts for the significantly higher level of Sustaining Capital spending in 2016/17 relative to the other years in the forecast?

RATIONALE FOR QUESTION:

To better understand the forecasted increases in capital spending.

RESPONSE:

a) As illustrated in the table in the response to PUB/MH-I-73a, the IFRS impacts as a result of overhead costs no longer eligible for capitalization will result in a $55 million decrease in capital spending between 2014/15 and 2015/16 with a corresponding increase in OM&A costs.

b) The increase in 2016/17 relative to the other years is primarily due to the impacts of capacity constraints and customer demand as well as aging infrastructure associated with distribution plant. The following provides a description of some of the key items to be addressed:

- Replacement of the existing 24kV distribution at St. Vital station due to equipment rating concerns and customer-driven demand;
- Construction of the new Adelaide station to meet capacity requirements and to allow for the decommissioning of the King station;
- Increased capital investment for urban and rural station development to address overloaded substations and feeder development; and,
- Increased capital investment for aging plant including poles, underground cables, streetlights and manholes.

Section:	Tab 5 Appendix 5.7	**Page No.:**	4
Topic:	Financial Results & Forecasts		
Subtopic:	Summary of Financial Results and Forecasts		
Issue:	Year over Year Variances		

PREAMBLE TO IR (IF ANY):

This is a follow-up to COALITION/MH I-40 c) and COALITION/MH I-51.

QUESTION:

Does Manitoba Hydro consider all of the changes listed in Appendix 5.7, Schedule A (with the exception of the Average Service Life Changes) to be required as a result of the move to IFRS? The response to COALITION/MH I-51 suggests the answer is yes. However, the response to COALITION/MH I-40 (c) does not list all of these items when discussing IFRS changes nor does the impact it attributes to IFRS ($24 M) equal the total impact on revenue requirement of all changes except service life changes ($25 M) from Appendix 5.7.

RATIONALE FOR QUESTION:

The information is required in order to clarify the impact of IFRS driven changes from other accounting changes.

RESPONSE:

Manitoba Hydro considers all of the changes listed in Appendix 5.7 (with the exception of the Average Service Life Changes) to be required as a result of the adoption of IFRS. The response to COALITION/MH-I-40c inadvertently did not mention the Meter Compliance, Exchange and Sampling IFRS change.

The difference between the $24 million referenced in COALITION/MH-I-40c and $25 million from manually adding Appendix 5.7 is due to rounding.

Section:	Tab 5, Appendix 5.5, Figures 5.5.13 and 5.5.16 Tab 11: Appendix 11.30	Page No.:	
Topic:	Financial Results & Forecasts		
Subtopic:	Operating, Maintenance and Administrative		
Issue:	Detailed Forecast versus Actual Comparisons		

PREAMBLE TO IR (IF ANY):

This is a follow-up to COALITION/MH I-46 b).

QUESTION:

Please provide a copy of MIPUG Pre-Ask 12 from the previous GRA.

RATIONALE FOR QUESTION:

The Coalition has been unable to locate a copy of the referenced document on either the PUB's or Manitoba Hydro's web-sites.

RESPONSE:

Please see the attachment to this response for a copy of MIPUG Pre-Ask 12 from the 2012/13 & 2013/14 GRA.

MANITOBA HYDRO

2012/13 & 2013/14 ELECTRIC GENERAL RATE APPLICATION

MANITOBA INDUSTRIAL POWER USERS GROUP ("MIPUG") PRE-ASK QUESTIONS OF MANITOBA HYDRO

MIPUG/MH/PRE-ASK-12

Question:

Please update the table in Appendix 5.6 at page 7 to 2014/15.

Response:

The following table provides a summary of Manitoba Hydro's actual and forecast costs over a 6 year period.

MANITOBA HYDRO
OPERATING, MAINTENANCE AND ADMINISTRATIVE COSTS BY COST ELEMENT

(In thousands of $)	2009/10 Actual	2010/11 Actual	2011/12 Actual	2012/13 Forecast	2013/14 Forecast	2014/15 Forecast	Average Annual % Inc/(Dec)
Wages, Salaries	$ 407,988	$ 425,158	$451 925	$476 570	$486 101	$ 495,823	4.0%
Overtime	50,307	50,704	54,987	56,005	57,126	58,268	3.0%
Employee Benefits	83,013	95,376	104,444	125,549	130,535	139,206	11.0%
Employee Safety & Training	4,284	3,863	3,909	4,914	5,013	5,113	4.2%
Travel	32,435	32,594	31,266	32,405	33,053	33,714	0.8%
Motor Vehicle	24,281	24,436	28,676	27,452	28,001	28,561	3.5%
Materials & Tools	26,897	28,105	26,663	27,173	27,716	28,271	1.1%
Consulting & Professional Fees	14,814	11,157	10,250	11,639	11,872	12,109	-3.1%
Construction & Maintenance Services	20,109	22,657	21,228	18,706	19,080	19,461	-0.3%
Building & Property Services	22,931	21,944	21,386	22,399	22,847	23,304	0.4%
Equipment Maintenance & Rentals	14,379	14,165	13,388	14,476	14,766	15,061	1.0%
Consumer Services	5,798	5,086	5,365	5,284	5,389	5,497	-0.9%
Collection Costs	4,599	4,497	4,034	4,347	4,434	4,523	-0.2%
Customer & Public Relations	8,155	7,905	8,093	6,849	6,986	7,126	-2.4%
Sponsored Memberships	1,325	1,917	1,608	1,081	1,103	1,125	-0.1%
Office & Administration	15,320	14,316	14,277	15,263	15,569	15,880	0.8%
Computer Services	983	1,003	861	909	927	946	-0.5%
Communication Systems	1,772	1,678	1,683	1,683	1,717	1,751	-0.2%
Research & Development Costs	3,952	3,651	2,796	3,509	3,579	3,651	-0.3%
Miscellaneous Expense	1,190	1,264	2,032	1,213	1,237	1,262	6.1%
Contingency Planning	-	-	-	(883)	(1,019)	1,783	
Operating Expense Recovery	(21,580)	(23,004)	(21,716)	(9,787)	(9,983)	(10,183)	-10.0%
Total Costs	722,951	748,471	787,155	846,758	866,049	892,253	4.3%
Capital Order Activities	(224,298)	(243,545)	(268,651)	(245,865)	(250,782)	(255,798)	2.9%
Capitalized Overhead	(60,151)	(47,336)	(53,084)	(78,284)	(81,021)	(84,535)	9.2%
Operating and Administration Charged to Centra	(60,951)	(60,644)	(62,117)	(67,300)	(68,800)	(70,176)	2.9%
Subsidiaries	2,146	6,121	7,414	6,491	6,946	7,388	
IFRS Changes					-	61,437	
Change in Wuskwatim	-	-	-	-	5,208	369	
OM&A Attributable to Electric Operations per Annual Report	**$ 379,697**	**$ 403,067**	**$ 410,717**	**$ 461,800**	**$ 477,600**	**$ 550,938**	
Less:							
Subsidiaries	2,146	6,121	7,414	6,491	6,946	7,388	
Accounting Changes	11,240	30,910	34,973	75,411	78,318	143,211	
Wuskwatim				5,589	10,797	11,166	
OM&A Attributable to Electric Operations after adjusting for subsidiaries, accounting changes and Wuskwatim	**$ 366,311**	**$ 366,036**	**$ 368,330**	**$ 374,309**	**$ 381,539**	**$ 389,173**	

Section:	Tab 5 Tab 5: Appendix 5.6 Tab 11 Tab 11: Appendix 11.43	Page No.:	26 2 & 7 14 2
Topic:	Financial Results & Forecasts		
Subtopic:	Depreciation and Amortization		
Issue:	Changes in Calculation of Depreciation		

PREAMBLE TO IR (IF ANY):

This is a follow-up to COALITION/MH I-49 d).

QUESTION:

Please provide the amortization periods for DSM used by other Canadian utilities reviewed by Manitoba Hydro.

RATIONALE FOR QUESTION:

The initial question asked for the results of Manitoba Hydro's review of the amortization period for DSM.

RESPONSE:

The amortization periods for DSM/Energy Efficiency programs used by other Canadian utilities readily available to Manitoba Hydro are as follows:

Utility	Amortization Period (Years)
Hydro Quebec	10
Gaz Metro	10
Fortis BC	10
BC Hydro	15
Nova Scotia Power	8
Yukon Energy	5
Average	**9.7**

Section:	Tab 6 Tab 6: Appendix 6.13	**Page No.:**	6 3 and Attachment 2
Topic:	Proposed Rates and Customer Impacts		
Subtopic:	Area & Roadway Lighting		
Issue:	New LED Rates		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-53 c) and d)

QUESTION:

a) Please provide a revised version of Appendix 6.13, Attachment 2 where the 2014 LED rates are calculated using the approved 2014 HPS rates for standard ARL lighting and the $0.0505 / kWh value from PCOSS14 escalated by the interim May 1st, 2014 increase of 2.75%.

b) If Manitoba Hydro owns, installs and maintains the lighting billed under ARL, is it Manitoba Hydro or the cities and municipalities that dictate the type of lighting that will be installed?

RATIONALE FOR QUESTION:

Clarify the roles of Manitoba Hydro versus the cities/municipalities in the choice of ARL lighting options and determine what the differences would be if the 2014 ARL LED rates were determined using the results for PCOSS14.

RESPONSE:

a) The table on the following page has been revised to show the impact on LED rates by using the $0.0505 / kWh value from PCOSS14 escalated by the interim May 1, 2014 increase of 2.75%.

b) Under Area & Roadway Lighting, Manitoba Hydro offers a selection of standard materials which are provided as options to developers or municipalities for new installations of municipal area and roadway lighting, including options for decorative lighting. The wattage and fixture installed is dictated by the roadway type and light levels required, as specified in the Illuminating Engineers Society (IES) / American National Standards Institute (ANSI) Recommended Practice #8 (RP-8) for roadway lighting which specifies the minimum acceptable level of lighting. The developer or municipality may choose to install the standard roadway luminaire or a decorative option.

In some special circumstances, non-standard decorative luminaires have in the past been installed by the City of Winnipeg, or by organizations operating in cooperation with the City of Winnipeg. For these installations, estimated to represent less than 2% of all Area and Roadway lighting fixtures, the City of Winnipeg and Manitoba Hydro have special maintenance arrangements in place whereby the City of Winnipeg retains the inventory of the non-standard replacement materials which Manitoba Hydro uses to maintain the lighting.

NEW RATE NAME		HPS Category	HPS Wattage	LED Wattage	Wattage Savings	kW Savings	Annual Hours	Annual kWh Savings	Energy Rate	Annual Energy Savings	Per Month Savings	May 2014 HPS Rate	Revised Monthly LED Rate
10 LED (20w CF Equivalent)	Exclusive	20 W CF	20	12.5	7.5	0.008	4252	31.9	$0.05189	$1.65	$0.14	$2.13	$1.99
60 LED (70w HPS Equivalent)	Shared	70	97	58.2	38.8	0.039	4252	165.0	$0.05189	$8.56	$0.71	$7.60	$6.89
60 LED (70w HPS Equivalent)	Exclusive	70	97	58.2	38.8	0.039	4252	165.0	$0.05189	$8.56	$0.71	$12.48	$11.77
60 24 hrs LED (70w 24 hrs HPS Equivalent)	Exclusive	70	97	58.2	38.8	0.039	4252	165.0	$0.05189	$8.56	$0.71	$14.03	$13.32
80 LED (100w HPS Equivalent)	Shared	100	135	81	54.0	0.054	4252	229.6	$0.05189	$11.91	$0.99	$7.89	$6.90
80 LED (100w HPS Equivalent)	Exclusive	100	135	81	54.0	0.054	4252	229.6	$0.05189	$11.91	$0.99	$13.16	$12.17
110 LED (150w HPS Equivalent)	Shared	150	190	114	76.0	0.076	4252	323.2	$0.05189	$16.77	$1.40	$9.67	$8.27
110 LED (150w HPS Equivalent)	Exclusive	150	190	114	76.0	0.076	4252	323.2	$0.05189	$16.77	$1.40	$14.86	$13.46
180 LED (250w HPS Equivalent)	Shared	250	300	180	120.0	0.120	4252	510.2	$0.05189	$26.48	$2.21	$12.32	$10.11
180 LED (250w HPS Equivalent)	Exclusive	250	300	180	120.0	0.120	4252	510.2	$0.05189	$26.48	$2.21	$17.13	$14.92
280 LED (400w HPS Equivalent)	Shared	400	470	282	188.0	0.188	4252	799.4	$0.05189	$41.48	$3.46	$14.14	$10.68
280 LED (400w HPS Equivalent)	Exclusive	400	470	282	188.0	0.188	4252	799.4	$0.05189	$41.48	$3.46	$23.77	$20.31
280 2/100' LED (400w 2/100' Equiv)	Exclusive	400	470	282	188.0	0.188	4252	799.4	$0.05189	$41.48	$3.46	$36.75	$33.29
280 4/100' LED (400w 4/100' Equiv)	Exclusive	400	470	282	188.0	0.188	4252	799.4	$0.05189	$41.48	$3.46	$26.99	$23.53

PCOSS14	0.0505
May 1, 2014 Rate Inc	2.75%
Revised Energy Rate	0.05189

Section:	Tab 7: Appendix 7.1	Page No.:	63-64
Topic:	Electric Load Forecast		
Subtopic:	General Service Sector – Mass Market		
Issue:	Load Forecast Methodology		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-64 b).

QUESTION:

Please explain how the total load forecast and total customer forecast for the Small Non Demand, Small Demand and Medium customers combined is broken down by customer class. As part of the explanation, please provide the calculations for 2015/16.

RATIONALE FOR QUESTION:

To better understand how the aggregate load forecast for the Small Non Demand, Small Demand and Medium customers is broken down into the separate customer classes.

RESPONSE:

Manitoba Hydro utilizes econometric models to forecast the overall number of customers and the overall average use per customer for the General Service Small Non-Demand, Small Demand and Medium classes combined as described in the 2014 Electric Load Forecast methodology section (Appendix 7.1 page 62-64).

Total Combined Forecast for 2015/16

Average Number of Customers	Average Use per Customer (kW.h)	Total Forecast Usage (GW.h)
67,327	102,514	6,902

The classes are forecast together because of the inherit truncation of the rate classes where customers move from one class to another based on their energy consumption. As energy consumption of a customer increases (or decreases) sufficiently they will be re-assigned to the appropriate rate class. These shifts over time have resulted in relatively stable average uses within each rate class over the past eight years.

To determine the growth in the Year End Number of Customers within each rate class, the year end growth of the combined customer forecast (553 in the 2015/16 forecast year) is multiplied by the percentage of new customers in each rate class. The percentage of new customers in each rate class is based on the allocation of new customers within the rate classes that equalize the growth rates across the three rate classes.

Forecast Year End Number of Customers

	Total Combined Forecast	Small Non Demand	Small Demand	Medium
2014/15	67,028	52,950	12,028	2,050
forecast Growth of new customers	553			
% of new customers		80.2%	17.0%	2.8%
2015/16	67,581	53,394	12,122	2,065

To calculate the average number of customers for each forecast year, the number of customers in each month is assigned from the year end number of customers by means of applying equal growth of new customers across every month. The average annual number of customers is calculated by averaging the monthly customers over the fiscal year.

Forecast Average Number of Customers for 2015/16 (before customer class transfer)

Total Combined Forecast	Small Non Demand	Small Demand	Medium
67,327	53,191	12,079	2,058

For forecasting purposes, the average use of each rate class is defined to remain constant in each year of the forecast as the average of the last three years.

Three Year Historical Average Use per Customer (kW.h)

Small Non Demand	Small Demand	Medium
31,167	170,224	1,561,264

The total combined forecast usage is calculated by multiplying the average number of customers for each year by the overall average use per customer. The forecast usage within each class is produced by multiplying the average number of customers within each rate class for each year by the average use for that class. With each rate class using a fixed average use, the total usage forecast of the three rate classes does not equal the total combined forecast as illustrated below for 2015/16, where there is a 25 GW.h difference between the total combined forecast and the sum of the three rate classes.

Forecast Total Usage for 2015/16 (before customer class transfer)

Total Combined Forecast GW.h	Small Non Demand GW.h	Small Demand GW.h	Medium GW.h	Sum of Rate Classes GW.h
6,902	1,658	2,056	3,213	6,927

The class forecasts are reconciled to the total combined usage by transferring customers from the General Service Medium class to the General Service Small Non-Demand class until the sum of the three rate classes equals the Total Combined Forecast GW.h. For the 2015/16 fiscal year, 16 customers are moved from General Service Medium to General Service Small Non Demand, reducing the sum of the rate classes by 25 GW.h to equal the Total Combined Forecast for 2015/16.

Forecast Average Number of Customers for 2015/16
(after customer class transfer)

Total Combined Forecast	Small Non Demand	Small Demand	Medium
67,327	53,207	12,079	2,042

Forecast Total GW.h Usage for 2015/16 (After customer class transfer)

Total Combined Forecast GW.h	Small Non Demand GW.h	Small Demand GW.h	Medium GW.h	Sum of Rate Classes GW.h
6,902	1,658	2,056	3,188	6,902

Section:	Tab 10	**Page No.:**	10
Topic:	PUB Directives and Interim Orders		
Subtopic:	Directives from Order 150/08		
Issue:	Independent Benchmarking Study - Status		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-73 a).

QUESTION:

Please indicate when the "assessment" will be completed and direction sought from the PUB.

RATIONALE FOR QUESTION:

A commitment is sought from Manitoba Hydro regarding the timing of its response to the 2008 PUB directive.

RESPONSE:

As indicated in the response to COALITION/MH-I-73a, Manitoba Hydro will assess the value of carrying out an independent benchmarking study subsequent to the implementation of IFRS. The implementation of IFRS will not be completed until Manitoba Hydro's initial IFRS financial statements are issued in August 2016.

Section:	4	Page No.:	7 of 26
Topic:	Capital Expenditure Forecast		
Subtopic:	Major New Generation& Transmission Capital Expenditure Forecast		
Issue:	Information related to figure 4.6		

PREAMBLE TO IR (IF ANY):

This is a follow-up to COALITION/MH I-84 (b).

QUESTION:

a) If 10% of the forecast capital spending is assumed to be rolled over into the next fiscal year, won't this also affect the in-service dates for some of the capital projects?

b) Has there been any adjustment in the in-service dates for the major new G&T projects consistent with this assumption? If not, why not?

c) Similarly, wouldn't the assumed 10% roll over in capital spending on major new G&T each year affect the timing and magnitude of Manitoba Hydro's new debt issues?

d) Has there been any adjustment to the assumption regarding the timing and/or size of new debt issue to account for this assumption? If not, why not?

RATIONALE FOR QUESTION:

To clarify if the assumption on roll over of capital expenditures into the next fiscal year is also reflected in the in-service dates for the projects.

RESPONSE:

a) The 10% adjustment to current year capital expenditures rolled from year to year only affects the total annual spending for Major New Generation and Transmission and does not impact the planned in-service cost of individual projects.

b) With the size and duration of Major New Generation and Transmission projects, it is not unusual for timing differences to occur in the annual cash flows of a project.

Typically, the under-expenditure is resolved over the construction duration without impacting the planned in-service date or total cost of a project.

If delays in a project result in material changes to the planned in-service date or projected cost, a revision is submitted for approval via a CPJ addendum and the CEF is adjusted accordingly in the next forecast period.

c-d) IFF14 forecasts of revenues, expenses and cash flows determine the amount and timing of the Corporation's new borrowings. By its inclusion in the CEF14 and IFF14, the 10% adjustment to current year capital expenditures rolled from year to year is factored into the amount and timing of new borrowing. The adjustment assists the Corporation by obtaining new borrowing closer to when it is actually needed and to manage its cash flow in the most efficient and cost effective way.

Note that new debt is not issued specifically for individual projects, but rather, is managed from a consolidated corporate perspective.

Section:	Appendix 11.23	Page No.:	1
Topic:	OM&A		
Subtopic:	Equivalent Full Time (ETF) and Vacancy Rate		
Issue:			

PREAMBLE TO IR (IF ANY):

This is a follow-up to MIPUG/MH I-6 a) & c).

QUESTION:

a) Was this same definition of an ETF (i.e., 73.7 hours biweekly) used for all the historical and forecast values reported in the Application and Interrogatory responses? If not, please indicate where the previous definition of (72.7 hours biweekly) was used.

b) Given that the historical vacancy rate in recent years has been 7.4% or greater, why is Manitoba Hydro using a vacancy rate of 4.5% for its 2014/15 to 2016/17 forecast?

RATIONALE FOR QUESTION:

The response indicates that Manitoba Hydro has changed its definition of an ETF. The response also reports higher vacancy rates historically than what have been used in the forecast.

RESPONSE:

a) Please see Manitoba Hydro's response to MIPUG/MH-II-2a-c.

b) The vacancy rate is defined as the number of vacant positions as a percentage of total positions required to support both capital and operational activities. Vacant positions are attributable to a number of factors including employee retirements, turnover of staff both internally and externally and cost containment initiatives.

As provided in the response to MIPUG/MH-I-6b, the average vacancy rate forecasted for the years 2014/15 to 2016/17 for the Corporation is approximately 4.5%. Manitoba Hydro has forecasted a lower vacancy rate than experienced historically as a result of the need to fill vacant capital positions to support major new generation and transmission development, replace aging utility assets and address increased capacity requirements.

Section:	Tab 9 Tab 5	**Page No.:**	9 3
Topic:	Total Hydraulic Resources and Net Revenues		
Subtopic:			
Issue:			

PREAMBLE TO IR (IF ANY):

This is a follow-up question to MIPUG/MH I-9.

QUESTION:

Please explain why the average 2016/17 net revenues shown over all the flow conditions ($151.43 M) does not equal the net revenues for 2016/17 calculated from Tab 5, Schedule 5.1.0 (i.e., $449.738 - $112.167 - $190.933 = $146.638 M)

RATIONALE FOR QUESTION:

To reconcile the 2016/17 reported values for net revenues.

RESPONSE:

The following table provides a reconciliation of 2016/17 net revenue from MIPUG/MH-I-9 and Tab 5, Schedule 5.1.0.

Reconciliation between MH14 Net Export Revenues and "Average Net Export Revenues over all Flow Years"

	2016/17	NOTES
MH14 Net Export Revenues	146.637	
Variable OM&A Costs	(3.114)	1
Diesel Fuel Costs	6.898	2
Water Chemical & Treatment Costs	1.098	2
Other	(0.089)	3
Total Average Net Export Revenues over all Flow Years	**151.430**	

NOTES:

1. The forecasted variable operating and administrative expenses associated with operating thermal facilities are classified as thermal costs under Average Net Export Revenues over all Flow Years for resource planning purposes but are reclassified as Operating and Administrative expenses for income statement presentation.
2. Diesel Fuel and Water Chemical Treatment and Supply Costs are non-flow related costs that are not included in Net Export Revenues over all Flow Years for resource planning purposes but are classified as Fuel & Power Purchased for income statement presentation.
3. “Other” includes other minor reclassifications as well as rounding differences.

Section:	Tab 4	Page No.:	25-26
Topic:	Transmission		
Subtopic:	Capital Expenditures		
Issue:			

PREAMBLE TO IR (IF ANY):

This question is a follow-up to MIPUG/MH I-44 (b).

QUESTION:

a) Please indicate which of the capital projects in CEF14 specifically address the transmission deficiencies noted in the response to MIPUG/MH I-44 b.

b) Please indicate which of these projects were not in CEF11 and/or have had their completion date advanced vis-a-vis what was in CEF-11.

RATIONALE FOR QUESTION:

To identify the degree to which the noted Transmission deficiencies are driving the proposed increase in capital spending.

RESPONSE:

The following table lists the Major or Base Capital projects from CEF14 that address capacity-related issues within the transmission system. Ongoing risk based capital prioritization (as per COALITION/MH-I-11a) has resulted in the deferral of some projects in order to accommodate higher priority projects within budget constraints.

Capital Project	CEF14 Budget	In CEF11?	ISD changed since CEF11?
1) Rockwood East 230-115kV Station	$53.3M	No	n/a
2) Lake Winnipeg East System Improvements	$64.6M	Yes	CEF11: Nov 2015 CEF14: Oct 2016[a]
3) Letellier - St. Vital 230kV Transmission Line	$59.0M	No	n/a

Capital Project	CEF14 Budget	In CEF11?	ISD changed since CEF11?
4) Transmission Line Upgrades for NERC Alert	$151.3M	No	n/a
5) Winnipeg - Brandon Transmission System Improvements	$43.1M	Yes	CEF11: Oct 2014 CEF14: Apr 2017[b]
6) Brandon Area Transmission Improvements	$11.5M	Yes	CEF11: May 2013 CEF14: Dec 2013[c]
7) Whiteshell Bank 1 Replacement	$3.0M	No	n/a
8) Neepawa New 230-66kV Station	$33.3M	Yes	CEF11: Dec 2013 CEF14: Mar 2015[d]
9) St Vital-Steinbach 230kV Transmission	$32.2M	Yes	No change
10) Laverendrye-St. Vital New 230kV Transmission Line & Breakers Replacement	$32.8M	No	n/a
11) Southwest Winnipeg 115kV Transmission Improvements	$40.2M	No	n/a
12) Brandon Victoria Ave Breaker Replacements	$4.2M	No	n/a
13) Southern AC System Breaker Replacements	$14.7M	No	n/a
14) Stanley Station 230-66kV Transformer Addition	$19.4M	Yes	CEF11: Oct 2015 CEF14: Oct 2016[e]
15) Ashern Station Bank Addition	$10.0M	Yes	CEF11: Nov 2014 CEF14: Feb 2017[f]
16) Souris East Capacity Enhancements	$11.3M	No	n/a

[a] ISD for Lake Winnipeg East System Improvements has been deferred due to ongoing delays to obtaining an environmental license.

[b] ISD for Winnipeg - Brandon Transmission Improvements (specifically, the Dorsey-Portage South 230kV Transmission Line D83P) was deferred due to risk based capital prioritization.

[c] ISD for Brandon Area Transmission Improvements was delayed as a result of a delay in the completion of a design package.

[d] ISD for Neepawa 230-66kV Station was deferred due to risk based capital prioritization.

[e] ISD for Stanley Station 230-66kV Transformer Addition was deferred due to risk based capital prioritization.

[f] ISD for Ashern Station Bank Addition was deferred due to risk based capital prioritization.

Section:	Tab 2	Page No.:	8
Topic:	Application Overview		
Subtopic:	MH Corporate Profile		
Issue:	Customer Satisfaction		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to MMF/MH I-5 (a) – (e).

QUESTION:

a) How many utilities are included in the CEA's calculation of the national average customer satisfaction index?

b) Is Manitoba Hydro one of the utilities included in the CEA's Public Attitudes Research Customer Satisfaction Index?

c) If the response to part (b) is affirmative, for the 2013 survey how many utilities had reported customer satisfaction indexes higher than Manitoba Hydro's?

d) Please provide copies of the studies referred to in response to MMF/MH I-5 (e).

RATIONALE FOR QUESTION:

To further clarify Manitoba Hydro's ranking in terms of customer satisfaction as compared to other Canadian utilities.

RESPONSE:

a) Approximately 100 different electric utilities are included in the CEA's calculation of the national average customer satisfaction index.

b) Yes.

c) Results of the CEA's Customer Satisfaction Index are reported on a province basis, not on a utility basis. In the 2013 Public Attitudes Study, Manitoba's Customer

Satisfaction Index is tied with another province for the second highest score across Canada.

d) Manitoba Hydro does not have copies of these studies. The following links to the press releases for each study summarize the study findings.

- Harris/Decima EquiTrend® Brands of the Year for 2012 http://www.newswire.ca/en/story/1045319/harris-decima-s-equitrend-brands-of-the-year-for-2012
- J.D. Power and Associates' Canadian Electric Utility Residential Customer Satisfaction 2010 Study http://www.newswire.ca/en/story/593017/j-d-power-and-associates-reports-large-electric-utility-providers-outperform-midsize-providers-in-residential-customer-satisfaction-in-canada

Section:	Tab 3, Appl 3.1	**Page No.:**	11
Topic:	Integrated Financial Forecast & Economic Outlook		
Subtopic:	2014 Economic Outlook		
Issue:	Labour Rates		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to MMF/MH I-7 (a) – (f).

QUESTION:

a) The responses suggest that wage rates in Manitoba are not affected by economic conditions elsewhere in Canada. Please confirm whether or not this is Manitoba Hydro’s position.

b) If yes, please indicate the basis for this.

c) If not, please indicate whether the 2014 Economic Outlook fully accounts for the recent significant reduction in oil prices and capital spending in the related Canadian sectors.

RATIONALE FOR QUESTION:

To clarify Manitoba Hydro’s position, as set out in the original IR response, and determine whether the 2014 Economic Outlook is still appropriate.

RESPONSE:

To date there has been no noticeable impact on Manitoban construction labour due to the recent drop in oil prices. Current forecasts indicate continued strong demand for construction labour for both private and public sector construction.

Section:	Tab 3, App. 3.3	**Page No.:**	iii
Topic:	Integrated Financial Forecast & Economic Outlook		
Subtopic:	IFF14		
Issue:	Rate affordability		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to MMF/MH I-8 (a).

QUESTION:

a) The response suggests that Manitoba Hydro judges the "affordability" of Manitoba Hydro's rates by comparing them to the rates of other Canadian utilities. Please confirm whether or not this is the case.

b) If yes, why is this an appropriate measure for "affordability"?

c) Does Manitoba Hydro consider there to be a distinction between "rate affordability" and "rate competitiveness"?

d) Please confirm that, in principle, the fact that one utility's rates are lower than another's (i.e. the first utility's rates competitive with those of the second utility) does not necessarily mean that the rates offered by the first utility are "affordable". If not confirmed, explain why.

e) Please comment on the appropriateness of rate increases at or below the rate of inflation as a measure of affordability.

f) Are there any other measures of affordability that Manitoba Hydro would consider to be appropriate?

RATIONALE FOR QUESTION:

To clarify Manitoba Hydro's definition and measure for "rate affordability".

RESPONSE:

Response to parts a) through f):

Overall, affordability is a social issue and the responsibility of government. Manitoba Hydro refers to the aspect of "affordability" in this Application in the context of the value that it provides to customers at rates that are amongst the lowest in Canadian jurisdictions. The comparison of annual bills of Manitoba Hydro customers with those found in other jurisdictions provides the degree to which customers generally pay less for electricity in Manitoba. Notwithstanding that there are differences in income levels and the overall cost of living between jurisdictions, the relative ranking of the level of electricity costs can be a meaningful indication of the relative value of Manitoba Hydro's service.

Manitoba Hydro also refers to the "competitiveness" of its rates and resulting customer bills in comparison to those experienced in other jurisdictions. This term is relevant to the comparison of rates for commercial and industrial customers. For Manitoba-based customers that are selling their products into national or international markets, the cost of electricity as an input is a consideration in their own relative competitiveness.

Manitoba Hydro believes that affordability is supported by the approach of seeking reasonable revenue increases on a predictable and routine basis. In this way, customers have the visibility as to the expected change in rates for each year, and are not exposed to unwarranted negative impacts of rate shock. Customers may be able to plan and adjust budgets with sufficient lead time to accommodate rate increases on an annual basis, but significant rate increases above those proposed by Manitoba Hydro in this Application may be problematic.

As discussed on Pages 19 to 21 in Tab 6 of this Application, electric utilities in general will need to refurbish, expand and replace infrastructure which will put pressure on electricity rates to increase faster than the overall rate of inflation. Major levels of infrastructure investment can produce large rate increases as plant is put into service. Manitoba Hydro utilizes a rate-smoothing cost of service approach that enables it to place large investments into service without the accompanying short term rate shock that can occur in jurisdictions where rates are regulated on a rate-base/rate-of-return approach.

Section:	Tab 3: Appendix 3.3, Figure 5.1 Tab 11: Appendix 11.19	Page No.:	7 3-4
Topic:	Integrated Financial Forecast & Economic Outlook		
Subtopic:	Export Revenue		
Issue:	Changes in Export Revenue		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITIO/MH I-24 (d).

QUESTION:

Please explain the reasons for the variances between MH14 and the other MHs during the first 10 years (i.e., prior to the once planned in-service of Conawapa).

RATIONALE FOR QUESTION:

The information is required to understand the changes as between the extra-provincial revenue forecasts filed in previous PUB proceedings for the period prior to the once planned in-service date for Conawapa.

RESPONSE:

Please see the attached schedule of net extra-provincial price and volume variance between MH14 and MH13, MH12, MH11-2, and MH10-2 for the 10 years in question.

Lower forecast electricity export prices result in a reduction to net extra-provincial revenues in MH14 compared to previous forecasts due to lower forecast natural gas prices, reduced forecast US demand for energy and capacity, as well as deferral and reductions in carbon pricing.

Net export volumes are higher in MH14 when compared to each of the MH10-2, MH11-2, MH12, and MH13 forecasts mainly due to higher volumes of energy available for export as a result of a reduction in the Manitoba domestic load forecast through increased DSM programs. Volumes forecast in MH14 for 2014/15 and 2015/16 are higher compared to previous forecasts due to the change in forecast assumptions from average extraprovincial revenues and costs under all flow conditions to revenues and costs based upon actual reservoir levels and expected or median flow conditions. Current water conditions for 2014/15, and to a lesser extent 2015/16, are favourable compared to average revenues. Consequently, the results, as shown in the attached table, for these two flow years are higher compared to the average revenues in previous forecasts. In addition, there have been minor changes to the assumed characteristics of the new US tieline (namely, capacity and in-service date) over the pertinent forecasts.

Changes in the USD/CAD exchange rates will not have a significant impact on Manitoba Hydro's forecasted net income due to the hedges between US dollar revenues and US dollar cash flows.

(Millions of Dollars)

	MH14 compared to MH13				MH14 compared to MH12				MH14 compared to MH11-2				MH14 compared to MH10-2			
Fiscal Year	**Price**	**Volume**	**US Exchange & Other**	**Total**	**Price**	**Volume**	**US Exchange & Other**	**Total**	**Price**	**Volume**	**US Exchange & Other**	**Total**	**Price**	**Volume**	**US Exchange & Other**	**Total**
2014/15	(4)	11	25	32	(43)	104	37	98	(95)	122	29	56	(174)	111	13	(51)
2015/16	(58)	107	56	104	(56)	109	50	103	(147)	123	42	18	(234)	120	21	(92)
2016/17	14	5	38	57	4	23	32	58	(97)	39	21	(38)	(159)	34	2	(123)
2017/18	(1)	(17)	33	15	1	9	31	40	(118)	43	20	(56)	(167)	26	1	(140)
2018/19	(11)	13	34	36	(25)	54	32	60	(132)	66	21	(46)	(172)	52	1	(118)
2019/20	(8)	17	32	40	(38)	83	29	74	(154)	84	17	(52)	(229)	53	(4)	(180)
2020/21	(22)	36	58	72	(43)	138	28	123	(166)	173	10	17	(254)	184	(24)	(94)
2021/22	(18)	53	49	83	(46)	133	19	106	(173)	198	(1)	24	(198)	133	(41)	(105)
2022/23	(26)	58	58	89	(49)	121	29	101	(182)	209	9	36	(202)	127	(32)	(106)
2023/24	(22)	82	57	117	(60)	175	30	145	(154)	215	10	71	(157)	(42)	(32)	(231)
Total	**(157)**	**365**	**439**	**647**	**(356)**	**948**	**316**	**908**	**(1 418)**	**1 271**	**177**	**30**	**(1 947)**	**800**	**(93)**	**(1 240)**

Section:	Tab 3: Figure 3.3	**Page No.:**	8
Topic:	Integrated Financial Forecast & Economic Outlook		
Subtopic:	Operating Results		
Issue:	Operating Result Shortfall		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to PUB/MH I-8 (e).

QUESTION:

With respect to PUB/MH I-8 e), please provide equivalent chart and table comparing IFF14 to IFF11-2. As part of the response please also provide the annual net export revenues from each IFF used to determine the total variance.

RATIONALE FOR QUESTION:

To further understand the changed forecast for Net Export Revenues in IFF14.

RESPONSE:

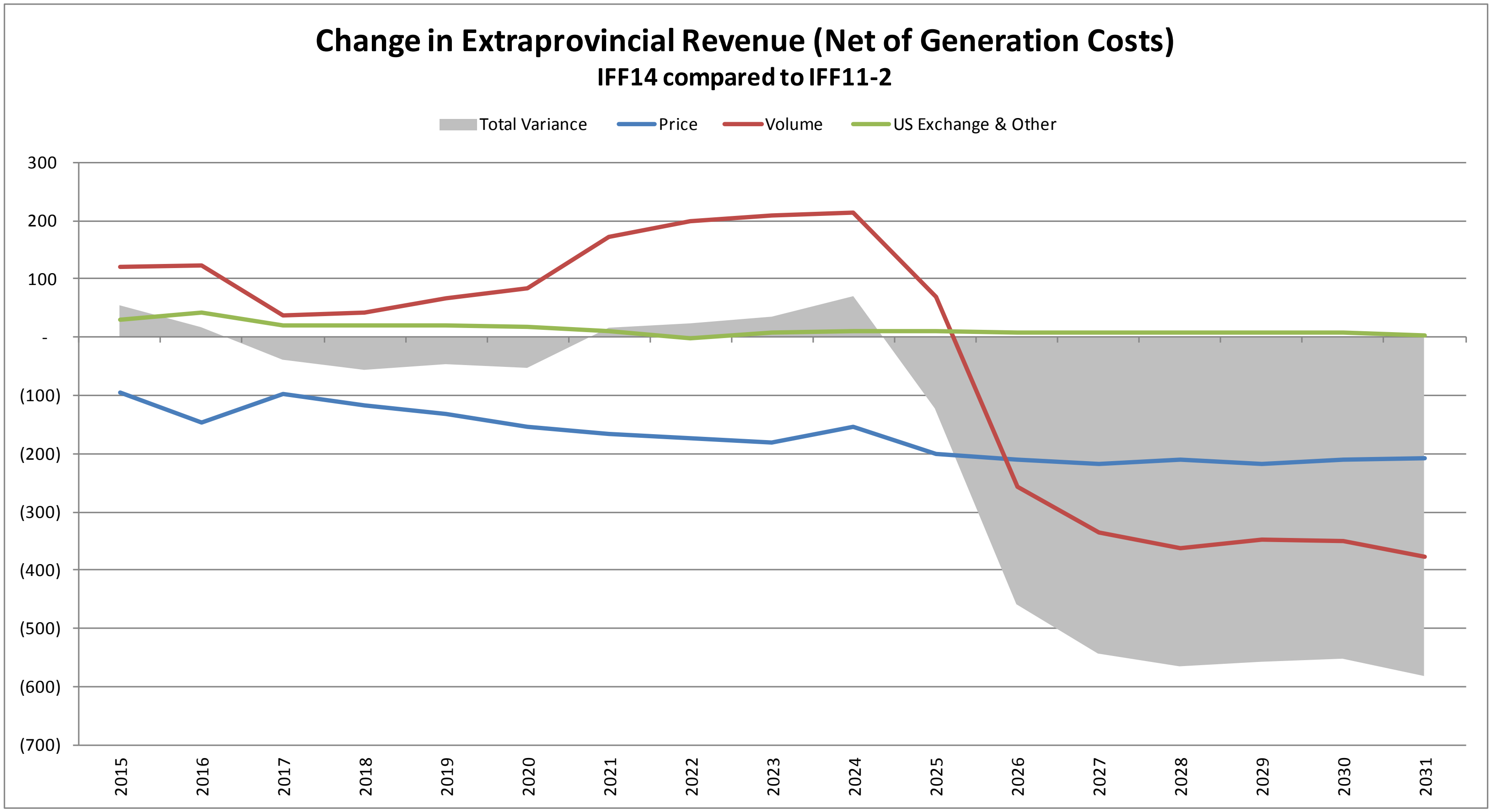
The following schedule and figure provide the change in net extraprovincial revenues (net of water rentals and fuel and power purchases) from IFF11-2 to IFF14 due to changes in price, volume and US exchange and other.

Annual Forecasted Net Export Revenues

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
IFF14	150	181	147	142	160	195	459	554	569	588	586	521	528	505	496	491	469	6 739
IFF11-2	95	163	185	198	205	247	442	529	533	517	708	980	1 071	1 070	1 053	1 044	1 051	10 092
Total Variance	56	18	(38)	(56)	(46)	(52)	17	24	36	71	(122)	(459)	(544)	(566)	(558)	(553)	(582)	(3 353)

Relative Impacts of Changes in Price, Volume, and US Exchange on IFF14 Extraprovincial Revenues Compared to IFF11-2

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
Price	(95)	(147)	(97)	(118)	(132)	(154)	(166)	(173)	(182)	(154)	(202)	(210)	(218)	(211)	(217)	(210)	(208)	(2 893)
Volume	122	123	39	43	66	84	173	198	209	215	70	(257)	(334)	(363)	(349)	(350)	(377)	(689)
US Exchange & Other	29	42	21	20	21	17	10	(1)	9	10	10	8	8	8	8	8	3	229
Total	56	18	(38)	(56)	(46)	(52)	17	24	36	71	(122)	(459)	(544)	(566)	(558)	(553)	(582)	(3 353)


Change in Extraprovincial Revenue (Net of Generation Costs)
IFF14 compared to IFF11-2
Total Variance
Price
Volume
US Exchange & Other
300
200
100
-
(100)
(200)
(300)
(400)
(500)
(600)
(700)
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031

Section:	Tab 4, Appl 4.1	**Page No.:**	CEF14, p. 3
Topic:	Capital Expenditures		
Subtopic:	Bipole III Project Cost		
Issue:	Current Cost Projection and Cost Risk		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to PUB/MH I-20 (a).

QUESTION:

Please provide schedules for the cost of Bipole III (similar in format to that provided for Keeyask in the NFAT, Chapter 2, page 36) based on CEF12 and CEF14, so as to illustrate the impact on the projected cost of the change in the P50 estimate and the management reserve fund.

RATIONALE FOR QUESTION:

To clarify the impact on the cost of Bipole III of the revised P50 contingency and Management Reserve fund.

RESPONSE:

The following table (on the next page) outlines the cost estimate breakdown for the Bipole III budget included in CEF 12 and CEF 14:

	CEF 12 *(in millions $)*	**CEF 14** *(in millions $)*
Point Estimate:		
HVDC Converter Stations *(including Riel Expansion)*	**$1 301**	**$2 138**
Transmission Line	**$953**	**$1 191**
AC Collector Lines	**$120**	**$198**
Community Development Initiative	**$-**	**$62**
Total Point Estimate	**$2 374**	**$3 589**
P50 Contingency & Management Reserves	**$220**	**$348**
Total Base Estimate	**$2 594**	**$3 937**
Escalation (at CPI)	**$158**	**$148**
Capitalized Interest	**$528**	**$568**
In-Service Cost	**$3 280**	**$4 653**

Section:	Tab 6: Appendix 6.11	**Page No.:**	9-10
Topic:	Proposed Rates and Customer Impacts		
Subtopic:	Curtailable Rates		
Issue:	Increase in Capital Expenditures		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to COALITION/MH I-60 (b).

QUESTION:

Are there any reasons why the planned review of the value of CRP could not be completed in time to be considered by the PUB in conjunction with the PUB's consideration of TOU rates? If yes, what are they?

RATIONALE FOR QUESTION:

The information is required in order to understand the timing of the planned review of the value of CRP.

RESPONSE:

Manitoba Hydro's resources that are required to undertake this review are committed to the current GRA and other tasks, and as such any review of the CRP Reference Discount level would not begin until the completion of the GRA.

The scheduling of a number of future regulatory processes have not yet been confirmed, therefore, it is not known whether the review of reference discount levels would coincide with any such future public hearing process.

Section:	6	Page No.:	5
Topic:	Bill Impacts		
Subtopic:	Diesel Rates		
Issue:	Rates Paid by Diesel Community Customers		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to PUB/MH I-47 (f).

QUESTION:

a) The response to PUB/MH I-47 (f) states “all obligations under the Settlement Agreement have been satisfied”. Does this include just the obligations on the signatories to the agreement or all governments and their agencies, including the Province of Manitoba, obligation to pay a portion of the diesel zone’s undepreciated capital?

b) The response to PUB/MH I-47 (f) states “all obligations under the Settlement Agreement have been satisfied”. Please reconcile this statement with the fact that Manitoba Hydro has yet to request for an allocation of net export revenues to

i. retire diesel zone accumulated deficit and, then,
ii. reduce the costs allocated to the diesel zone.

RATIONALE FOR QUESTION:

To clarify the statements by Manitoba Hydro regarding the status of the Settlement Agreement.

RESPONSE:

In Order 33/15, the PUB ruled that as noted in Order 18/15, MKO has still not filed the executed Settlement Agreement with respect to the diesel communities. The PUB found that the issues raised in the IRs related to the diesel settlement agreement should be examined after the Settlement Agreement has been filed.

However, in order to assist in the understanding of Manitoba Hydro's comments, the Settlement Agreement is a contractual agreement between Manitoba Hydro, Manitoba Keewatinowi Okimakinak ("MKO"), Indian and Northern Affairs Canada ("INAC"), Barrens Land First Nation, Northlands Denesuline First Nation, Sayissi Dene First Nation and Shamattawa First Nation. No other agencies or the Province of Manitoba are signatories to the Settlement Agreement.

The PUB's rulings regarding the allocation of net export revenues in Orders 117/06 and 134/10 were sufficient to enable Manitoba Hydro to meet its obligations under the Settlement Agreement and there are no further applications required.

Section:	Appendix 6.3	**Page No.:**	21
Topic:	Area and Roadway Lighting		
Subtopic:	Bill Impacts		
Issue:	Outdoor Lighting Rates – Tariff 2015-80		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COW/MH I-2 and PUB/MH I-49 (a).

QUESTION:

How would applying the updated approach set out in response to PUB/MH I-49 (a) change the calculation of the rates as set out in Manitoba Hydro's June 23, 2014 Application to the Board (Attachment 2)? Please provide a similar schedule showing the recalculation of each LED rate that was approved for August 1, 2014 (Order 79/14) by omitting the April 1, 2015 3.95% increase in the calculation of the "energy rate".

RATIONALE FOR QUESTION:

Manitoba Hydro has revised its approach to LED replacement and its LED rate descriptions.

RESPONSE:

Table 1 on the following page shows the recalculation of each LED rate that was approved for August 1, 2014 using the new rate descriptions and wattage levels (as described in PUB/MH-I-49a) and omitting the April 1, 2015 proposed rate increase of 3.95%.

Table 2 provides a comparison of the LED rates that were approved for implementation August 1, 2014 to those recalculated as per above, as well as the proposed April 1, 2015 LED rates. The recalculated August 1, 2014 rates are slightly lower than those approved by the PUB. This is due to the lower wattage levels assigned to each LED category.

TABLE 1:

HPS Category	HPS Wattage	LED Wattage	LED Wattage Range	Wattage Savings	kW Savings	Annual Hours	Annual kWh Savings	Energy Rate	Annual Energy Savings	Per Month Savings	May 2014 HPS Rates	Proposed Monthly LED Rate
20 W CF	20	10	1 - 30	10.0	0.010	4252	42.5	$0.05287	$2.25	$0.19	$2.13	$1.94
70	97	40	>30 - 50	57.0	0.057	4252	242.4	$0.05287	$12.81	$1.07	$7.60	$6.53
70	97	40	>30 - 50	57.0	0.057	4252	242.4	$0.05287	$12.81	$1.07	$12.48	$11.41
70	97	40	>30 - 50	57.0	0.057	4252	242.4	$0.05287	$12.81	$1.07	$14.03	$12.96
100	135	70	>50 - 80	65.0	0.065	4252	276.4	$0.05287	$14.61	$1.22	$7.89	$6.67
100	135	70	>50 - 80	65.0	0.065	4252	276.4	$0.05287	$14.61	$1.22	$13.16	$11.94
150	190	100	>80 - 120	90.0	0.090	4252	382.7	$0.05287	$20.23	$1.69	$9.67	$7.98
150	190	100	>80 - 120	90.0	0.090	4252	382.7	$0.05287	$20.23	$1.69	$14.86	$13.17
250	300	150	>120 - 180	150.0	0.150	4252	637.8	$0.05287	$33.72	$2.81	$12.32	$9.51
250	300	150	>120 - 180	150.0	0.150	4252	637.8	$0.05287	$33.72	$2.81	$17.13	$14.32
400	470	230	>180 - 280	240.0	0.240	4252	1,020.5	$0.05287	$53.95	$4.50	$14.14	$9.64
400	470	230	>180 - 280	240.0	0.240	4252	1,020.5	$0.05287	$53.95	$4.50	$23.77	$19.27
400	470	230	>180 - 280	240.0	0.240	4252	1,020.5	$0.05287	$53.95	$4.50	$36.75	$32.25
400	470	230	>180 - 280	240.0	0.240	4252	1,020.5	$0.05287	$53.95	$4.50	$26.99	$22.49

	¢/kWh
2.5% Sept 1, 2012 ARL Increase	2.50%
3.5% May 1, 2013 ARL Increase	3.50%
2.75% May 1, 2014 ARL Increase - Approved	2.75%
3.95% April 1, 2015 ARL Proposed	**0.00%**
Projected Cumulative Rate Increases	9.00%
2012/13 ARL Energy Cost (PCOSS13) at April 1, 2012 Rates	4.850
Projected PCOSS Energy Rate	5.287

TABLE 2:

	PREVIOUS DESCRIPTIONS / WATTAGES APPROVED AUG 1, 2014 RATES			NEW DESCRIPTIONS / WATTAGES RECALCULATED AUG 1, 2014 RATES			NEW DESCRIPTIONS / WATTAGES PROPOSED APRIL 1, 2015 RATES		
HPS DESCRIPTION	LED DESCRIPTION	LED WATTAGE	APPROVED RATE	LED DESCRIPTION	LED WATTAGE	RATE	LED DESCRIPTION	LED WATTAGE	PROPOSED RATE
20 W CF	10 W LED - S	12.5	$1.99	10 W LED - S	10	$1.94	10 W LED - S	10	$2.02
70 W HPS - S	60 W LED - S	58.2	$6.87	40 W LED - S	40	$6.53	40 W LED - S	40	$6.79
70 W HPS - E	60 W LED - E	58.2	$11.75	40 W LED - E	40	$11.41	40 W LED - E	40	$11.86
70 W 24 HR - E	60 W 24 HR - E	58.2	$13.30	40 W 24 HR - E	40	$12.96	40 W 24 HR - E	40	$13.47
100 W HPS - S	80 W LED - S	81	$6.88	60 W LED - S	70	$6.67	60 W LED - S	70	$6.93
100 W HPS - E	80 W LED - E	81	$12.15	60 W LED - E	70	$11.94	60 W LED - E	70	$12.41
150 W HPS - S	110 W LED - S	114	$8.25	90 W LED - S	100	$7.98	90 W LED - S	100	$8.30
150 W HPS -E	110 W LED - E	114	$13.44	90 W LED - E	100	$13.17	90 W LED - E	100	$13.70
250 W HPS - S	180 W LED - S	180	$10.07	150 W LED - S	150	$9.51	150 W LED - S	150	$9.89
250 W HPS - E	180 W LED - E	180	$14.88	150 W LED - E	150	$14.32	150 W LED - E	150	$14.89
400 W HPS - S	280 W LED -S	282	$10.62	250 W LED -S	230	$9.64	250 W LED -S	230	$10.03
400 W HPS - E	280 W LED - E	282	$20.25	250 W LED - E	230	$19.27	250 W LED - E	230	$20.04
400 W HPS 2/100	280 W LED 2/100	282	$33.23	250 W LED 2/100	230	$32.25	250 W LED 2/100	230	$33.53
400 W HPS 4/100	280 W LED 4/100	282	$23.47	250 W LED 4/100	230	$22.49	250 W LED 4/100	230	$23.39

S = SHARED
E = EXCLUSIVE

Section:	App. 4.1 App. 11.37	**Page No.:**	3 2
Topic:	Capital Expenditure Forecast		
Subtopic:	Sustaining (Base) Capital Expenditures		
Issue:	Proposed Spending Levels		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to PUB/MH I-67 (c).

QUESTION:

a) Please provide a schedule with the numerical values used to create the chart in PUB/MH I-67 c).

b) Please extend the schedule provided in part (a) back to 2011/12 and where applicable for a particular IFF include actual values.

RATIONALE FOR QUESTION:

To better understand the forecast changes in Sustaining (Base) Capital Expenditures.

RESPONSE:

Please see the response to PUB/MH-II-39 for the data points used to create the chart in the response to PUB/MH-I-67c, including data points back to 2008.

Section:	Tab 11: Appendix 11.10, Quarterly Report – Ended December 31, 2014 Tab 5: Appendix 5.5	**Page No.:**	1 15
Topic:	Financial Statements		
Subtopic:	Electricity Operations OM&A Expenses		
Issue:	Year to Date Spending		

PREAMBLE TO IR (IF ANY):

The Quarterly Report for the nine months ended December 31, 2014 states that year to date electric operations operating and administrative expenses are $9 M less than in the prior year. In contrast, the 2014/2015 OM&A forecast in the Application shows an increase of $5 M over the previous year.

QUESTION:

a) Is there a need to revise the 2014/15 OM&A forecast in the Application? If not, why not? If yes, what is the revised forecast for 2014/15?

b) Will the 2014/15 reductions in OM&A (to levels below those forecast) carry through to future years? If not, why not? If yes, what adjustments are required to the forecast OM&A levels for the years beyond 2014/15?

RATIONALE FOR QUESTION:

Recently reported financial results indicate 2014/15 OM&A will be less than forecast.

RESPONSE:

a) The Quarterly Report for the nine-months ended December 31, 2014 is an interim report, and as such, OM&A results for 2014/15 have not yet been finalized. Manitoba Hydro does not restate approved forecasts based upon either favorable or unfavorable interim results.

b) As indicated in a) above, OM&A results for 2014/15 have not yet been finalized. IFF14 incorporates aggressive cost containment measures in the OM&A forecast for future years to ensure that costs remain below inflationary levels, excluding accounting changes. No further adjustments are required at this time for the years beyond 2014/15.

Section:	Tab 3	**Page No.:**	3
Topic:	Integrated Financial Forecast and Economic Outlook		
Subtopic:	Economic Outlook		
Issue:	Economic Outlook Update		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to COALITION/MH I-12 (b).

QUESTION:

Please confirm that the source forecasts used by Manitoba Hydro do not suggest any need to update the outlook for any economic parameters apart from interest rates and CA/US exchange rates.

RATIONALE FOR QUESTION:

Confirm the extent to which changes in the 3rd party economic forecasts used by Manitoba Hydro necessitate a change in Manitoba Hydro's Economic Outlook.

RESPONSE:

There was no indication that any other economic indicators required an update.

For further discussion on the implications of constant updates to Manitoba Hydro's integrated financial forecast see response to COALITION/MH-II-44a-e.

Section:	Tab 3: Appendix 3.3	**Page No.:**	22-25
Topic:	Integrated Financial Forecast and Economic Outlook		
Subtopic:	Sensitivity Analysis		
Issue:	Changes in Load Growth		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to COALITION/MH I-29 (c)

QUESTION:

The response does not address the question originally asked which was "are unit revenues from new dependable exports expected to be greater or less than domestic unit revenues over the first 10 years". Please respond to the original question as posed.

RATIONALE FOR QUESTION:

Based on the clarification provided in response to COALITION/MH I-29 (b), the Information Request explores the impact of changes in load growth on Manitoba Hydro's financial results.

RESPONSE:

The question requires disclosure of commercially sensitive information. Disclosure of new dependable export unit revenues relative to the average domestic unit revenue provides valuable pricing information to third parties with whom Manitoba Hydro negotiates, either currently or in the future. Information which may be disclosed publicly includes the combined dependable and opportunity export average unit revenues, as was discussed in the response to COALITION/MH-I-29c.

Section:	Tab 7: Appendix 8.1	**Page No.:**	Executive Summary
Topic:	Demand Side Management		
Subtopic:	DSM Metrics		
Issue:	Applicable Period		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-68 (a) and (b).

QUESTION:

a) Part a) of the original question was not asking the period of time over which the savings and costs were evaluated but rather what programs were evaluated:

i. those programs initiated years the 2014-2029 (the period covered by the Supplemental Report) or

ii. those programs initiated in 2014-2017 (the period covered by the 2014-2017 Power Smart Plan). Please revise the response to COALITION/MH I-68 a) to address the original question.

b) Based on the understanding provided in and the response to part (a), please respond to COALITION/MH I-68 (b) as posed.

RATIONALE FOR QUESTION:

To clarify the basis for the DSM metrics quoted and establish the DSM metrics for the DSM programs being implemented during the test period for Application.

RESPONSE:

a) The original question posed in Coalition/MH I-68a requested whether the values in the Executive Summary of Appendix 8.1 (an overall electric Power Smart portfolio TRC of 2.2, a RIM of 1.0 and a levelized cost of 1.8 cents per kilowatt hour) were based on the entire 2014 to 2029 period or just 2014-2017. The metrics reported in Appendix 8.1 are based on the energy savings and costs associated with all programs offered during the timeframe of 2014-2029, regardless of when programs were initiated.

b) There are four programs included in Appendix 8.1 that were planned to be initiated during the period of 2014-17; Residential LED Lighting Program, LED Roadway Lighting Conversion Program, Power Smart Shops and Customer Sited Load Displacement. All other programs offered during the 2014-17 time period are ongoing programs which were initiated prior to this period. The metrics for individual programs, including the four programs/initiatives initiated in the 2014-17 time period, are provided in Appendix 8.1 on pages 38, 42, and 44. These individual program metrics are included in the overall electric metrics of:

a. TRC – 2.2;
b. RIM – 1.0; and
c. Levelized Utility Cost – 1.8¢/kW.h.

There are four programs/initiatives included in Appendix 8.1 that were scheduled to be initiated (launched) after the period of 2014-2017; the New Homes Program, Conservation Rates – Residential, Conservation Rates – Commercial and Fuel Choice. Placeholders were used for these programs based on high level and internally unapproved program designs. The metrics for these four programs/initiatives are based on high level designs and are provided in Appendix 8.1 on pages 38, 42, and 44. The overall electric portfolio metrics excluding these four programs/initiatives (using a 30-year stream of savings and costs) are:

a. TRC – 1.8;
b. RIM – 1.0; and
c. Levelized Utility Cost – 2.2¢/kW.h.

Section:	Tab 3: Appendix 3.3	Page No.:	14-15
Topic:	Integrated Financial Forecast and Economic Outlook		
Subtopic:	Capital Expenditure Forecast		
Issue:	Changes in Capital Expenditure Forecast		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH I-28 (a) and PUB/MH I-18 (f).

QUESTION:

a) The MH11-2 capital expenditures shown in response to COALITION/MH I-28 a) differ from those in shown in IFF11-2 (page 29). Please reconcile the differences.

b) Please explain the footnote to the tables in COALITION/MH I-28 a) and PUB/MH I-18 f). Didn't the capital expenditures forecast in CEF11-2 and CEF12 already include the removal of overheads consistent with the implementation of IFRS?

RATIONALE FOR QUESTION:

Information is required in order to understand the reported change in capital expenditures forecasts.

RESPONSE:

a) The attached schedule provides the reconciliation of total electric capital expenditures in the response to COALITION/MH-I-28a to CEF11-2.

b) The adjustments for ineligible overheads were made at an aggregate Corporate level to Property, Plant and Equipment for MH11-2 and MH12 and were not captured and reported at the project and business unit level until subsequent CEFs.

Capital Expenditures (in millions of dollars)	**MH14**	**MH11-2***	*CEF11-2 Electric Capital Sub-total before Adjustments Page 29*	*Portion of CEF11-2 Target Adjustment Page 29 applicable to electric*	*MH11-2 CGAAP/ IFRS OH Adjustment*	**MH14 minus MH11-2**
2013	1 033	1 174	*1 201*	*-*	*(27)*	(141)
2014	1 454	1 454	*1 518*	*-*	*(64)*	(1)
2015	2 023	1 611	*1 676*	*-*	*(65)*	412
2016	2 491	1 931	*1 966*	*31*	*(66)*	560
2017	3 073	1 983	*1 963*	*88*	*(68)*	1 090
2018	3 125	2 333	*2 269*	*134*	*(69)*	792
2019	2 078	1 565	*1 480*	*155*	*(71)*	514
2020	1 432	1 808	*1 704*	*177*	*(72)*	(377)
2021	999	1 806	*1 832*	*47*	*(74)*	(807)
2022	751	1 692	*1 767*	*-*	*(75)*	(941)
2023	679	1 502	*1 579*	*-*	*(77)*	(823)
2024	681	1 396	*1 474*	*-*	*(78)*	(715)
2025	729	1 573	*1 653*	*-*	*(80)*	(844)
2026	735	884	*966*	*-*	*(82)*	(149)
2027	735	739	*822*	*-*	*(83)*	(4)
2028	730	827	*912*	*-*	*(85)*	(97)
2029	745	996	*1 083*	*-*	*(87)*	(251)
2030	726	942	*1 031*	*-*	*(89)*	(217)
2031	770	869	*960*	*-*	*(91)*	(99)
2032	782	809	*902*	*-*	*(93)*	(27)

Section:	4	**Page No.:**	11 & 12
Topic:	Capital Expenditure Forecast		
Subtopic:	Sustaining Capital		
Issue:	Historic Spending		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to COALITION/MH I-35 and COALITION/MH I-85 (e)

QUESTION:

Manitoba Hydro's Asset Condition Assessment Study (Appendix 4.2) identifies and classifies the condition of its various types of assets. The current CEF14 forecasts a significant increase in sustaining capital expenditures relative to historic levels and relative to forecasts in previous CEFs. Please provide whatever information Manitoba Hydro can that demonstrates the extent to which this increased spending is actually targeted to those assets and asset categories showing the greatest degree of degradation.

RATIONALE FOR QUESTION:

This information is required in order to better understand those areas where expenditures on Sustaining Capital are increasing.

RESPONSE:

The increase in sustaining capital investment as reflected in CEF14 relative to historic spending levels and previous forecasts was provided to alleviate both capacity constraints due to customer growth and to address aging infrastructure concerns. The allocation of funds between asset types is continually reassessed taking into account changes in asset condition, capacity limitations, new customer requirements and other factors.

Please see Manitoba Hydro's response to COALITION/MH-I-11a, for a discussion on the overall framework for the evaluation and prioritization of the Corporation's capital expenditures.

Section:	Tab 5: Appendix 5.5, Figures 5.5.13 & 5.5.16	Page No.:	15 and 21
Topic:	Financial Results and Forecasts		
Subtopic:	Operating, Maintenance and Administrative		
Issue:	OM&A Reconciliation		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to COALITION/MH I-45 b).

QUESTION:

Schedule 5.5.13 indicates that Electric OM&A expenses (exclusive of accounting changes) are increasing at 1% per annum between 2013/14 and 2-16/17. COALITION/MH I-45 b) sought to establish the Electric OM&A expenses by business unit over the same period (excluding accounting changes) so as to be able to determine the comparable annual increase by business unit. Please provide whatever information Manitoba Hydro can to demonstrate that OM&A expense increases (excluding accounting changes) in each of its business units are being contained and reasonably close to the aggregate 1% per annum increase.

RATIONALE FOR QUESTION:

The information is required in order to better understand the extent of Manitoba Hydro's cost containment initiatives.

RESPONSE:

Please see Manitoba Hydro's response to PUB/MH-II-42 which provides a summary by business unit of the actual position reductions achieved to December 31, 2014. These reductions enable the Corporation to limit OM&A expenditures to a 1% average annual increase.

Section:	Tab 6: Section 6.2	Page No.:	
Topic:	Residential Low-Income Needs and Responses		
Subtopic:	Payment Troubles: Company Response		
Issue:	Reasonableness of rates, bills and collections for low-income customers		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to GAC/MH I-6 (a)-(b) and GAC/MH I-23 (a)-(f)

QUESTION:

a) If there are no tariff sheets and (as suggested by GAC/MH I-6 (a)-(b)) no PUB approval or connection to the provision of power, what is Manitoba Hydro's authorization for charging customers the various fees set out in GAC/MH I-23 (a)-(f)?

b) What limits (if any) are there on the scope of Manitoba Hydro's ability to charge customers fees/rates that are not for the provision of power?

RATIONALE FOR QUESTION:

This information is required to clarify the basis for the "Other Revenue" offset included in Manitoba Hydro's revenue requirement.

RESPONSE:

Manitoba Hydro's response to GAC/MH I-6a and GAC/MH I-6b indicates that late payment fees are not rates for the provision of power.

Section 16(2) of the Electric Power Terms and Conditions of Supply Regulation, C.C.S.M. c. H190 (the "Regulation") provides that "All overdue and unpaid accounts are subject to a service charge."

Section:	6	Page No.:	5
Topic:	Bill Impacts		
Subtopic:	Diesel Rates		
Issue:	Rates Paid by Diesel Community Customers		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to PUB/MH I-47 (c)

QUESTION:

a) Please clarify what types of costs/expenditures are included in the values provided for "variable non-fuel costs"

b) The response states that "customer contributions received have been insufficient to support ongoing capital activity". Please explain more fully why this is the case and what the extent of the shortfall is.

RATIONALE FOR QUESTION:

This information is required in order to complete and fully understand the response to the original question.

RESPONSE:

a) Variable non-fuel costs include consumer support, customer service, distribution facility maintenance, distribution plant maintenance, generation maintenance, major / minor overhauls, soil remediation, standby maintenance and technical support.

b) The funding of capital expenditures for diesel communities is addressed in the tentative settlement agreement. In Order 33/15, the PUB accepted Manitoba Hydro's submission, in response to its objection to other Intervenor requests, and found that issues raised in Information Requests related to the Diesel Settlement Agreement should be examined after the Agreement has been filed.

Section:	Tab 5: Appendix 5.7	Page No.:	2
Topic:	Financial Results and Forecasts		
Subtopic:	Accounting Policy & Estimate Changes		
Issue:	Reclassification of Unamortized Experience Gains and Losses on Pension Balances		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to COALITION/MH I-50

QUESTION:

a) What is the impact of the reclassification to AOCI on the forecast debt/equity ratio for 2015/16 and 2023/24? Please provide the supporting calculations.

b) Please explain why AOCI is considered a component of equity for the calculation of the debt/equity ratio.

c) How do the various rate agencies treat AOCI in their determination of Manitoba Hydro's debt/equity ratio?

RATIONALE FOR QUESTION:

This information is required in order to fully understand the implications of the reclassification of unamortized experience gains and losses on pension balances.

RESPONSE:

<u>Response to part a)</u>

The IFRS reclassification of unamortized experience gains and losses on pension balances to Accumulated Other Comprehensive Income (AOCI) results in a two percentage point reduction to the equity ratio in 2015/16 and a one percentage point reduction to the equity ratio in 2023/24. The supporting calculations are provided in the following table:

ELECTRIC OPERATIONS (MH14)
PROJECTED DEBT TO EQUITY RATIO

For the year ended March 31	2016	2024
Long-Term Debt	14,142	23,843
Sinking Fund Assets	(308)	(467)
Short-Term Debt	214	200
Short-Term Investments	-	-
Debt for Gas Operations	(310)	(370)
Total Debt	**13,739**	**23,205**
Retained Earnings	2,778	2,001
AOCI	(399)	(305)
Unamortized Customer Contributions	446	727
BPIII Reserve Account	81	-
Non-controlling Interest	132	45
Total Equity	**3,039**	**2,468**
Total Debt and Equity	**16,777**	**25,673**
Equity Ratio	**18.11%**	**9.61%**

ELECTRIC OPERATIONS (MH14)
PROJECTED DEBT TO EQUITY RATIO (Excluding Pension AOCI)

For the year ended March 31	2016	2024
Long-Term Debt	14,142	23,843
Sinking Fund Assets	(308)	(467)
Short-Term Debt	214	200
Short-Term Investments	-	-
Debt for Gas Operations	(310)	(370)
Total Debt	**13,739**	**23,205**
Retained Earnings	2,778	2,001
AOCI	46	(1)
Unamortized Customer Contributions	446	727
BPIII Reserve Account	81	-
Non-controlling Interest	132	45
Total Equity	**3,484**	**2,772**
Total Debt and Equity	**17,223**	**25,977**
Equity Ratio	**20.23%**	**10.67%**
Difference in Equity Ratio:	**2.12%**	**1.06%**

Response to parts b&c)

The objective of AOCI is to provide a transparent manner in which to report unrealized gains and losses on the balance sheet, and reflects the IFRS move towards fair value measurement at the balance sheet date. The inclusion of AOCI in the debt:equity ratio is reflective of this objective.

Moody's and S&P generally accept Manitoba Hydro's inclusion of AOCI within the debt:equity ratio and may make some minor additional pension adjustments for their analytical purposes. DBRS calculates a total debt in capital structure ratio, both including and excluding AOCI, in order to see the impact of unrealized gains or losses on the capital structure.

Section:	Tab 9: Section 9.1 & 9.2	**Page No.:**	1-7
Topic:	Energy Supply		
Subtopic:	Power Resource Plan		
Issue:	Relative DSM Achievement		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to PUB/MH I-58

QUESTION:

Please provide revised versions of Figures 1, 2, 3 and 4 from the 2014/15 Power Resource Plan that also include the values for the 2011/12 and 2012/13 Power Resource Plans.

RATIONALE FOR QUESTION:

This information is required in order to more fully understand the change in Manitoba Hydro's load forecast since the last GRA.

RESPONSE:

The following figures have been updated to include the values for the 2011/12 and 2012/13 Power Resource Plans. Note that Figures 1 & 2 are the base loads forecasts before DSM is deducted.

Figure 1: Comparison of Manitoba Load Energy Forecasts:

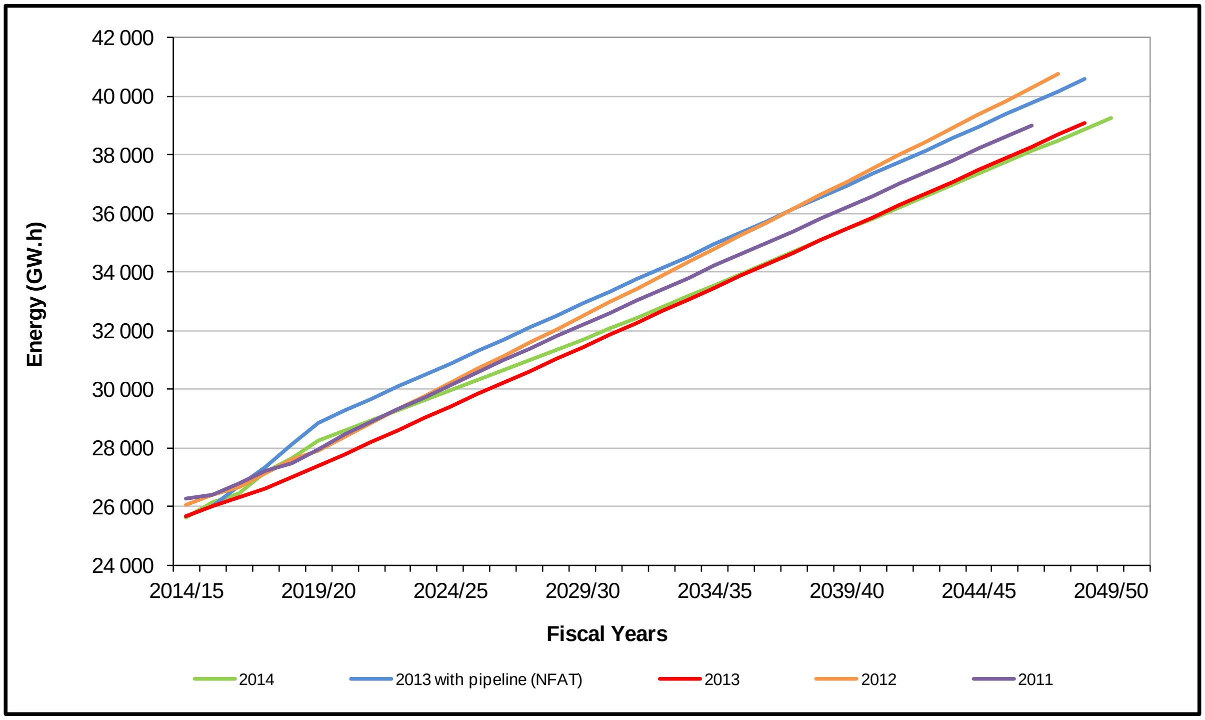


Figure 2: Comparison of Manitoba Load Winter Peak Capacity Forecasts:

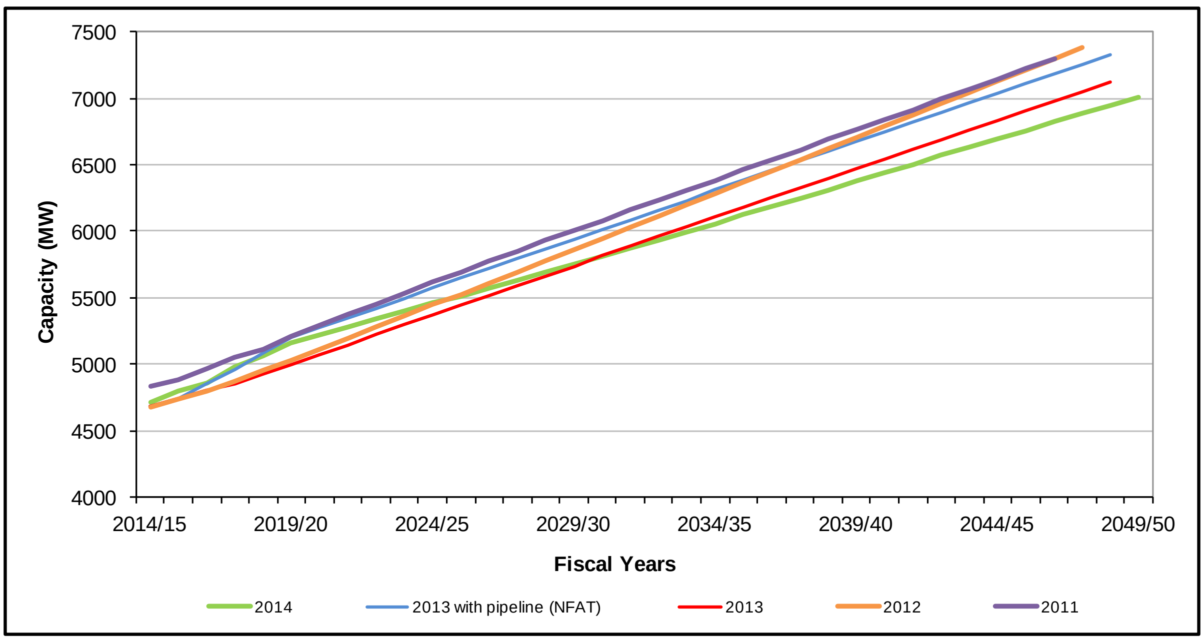


Figure 3: Comparison of DSM Energy Forecasts:

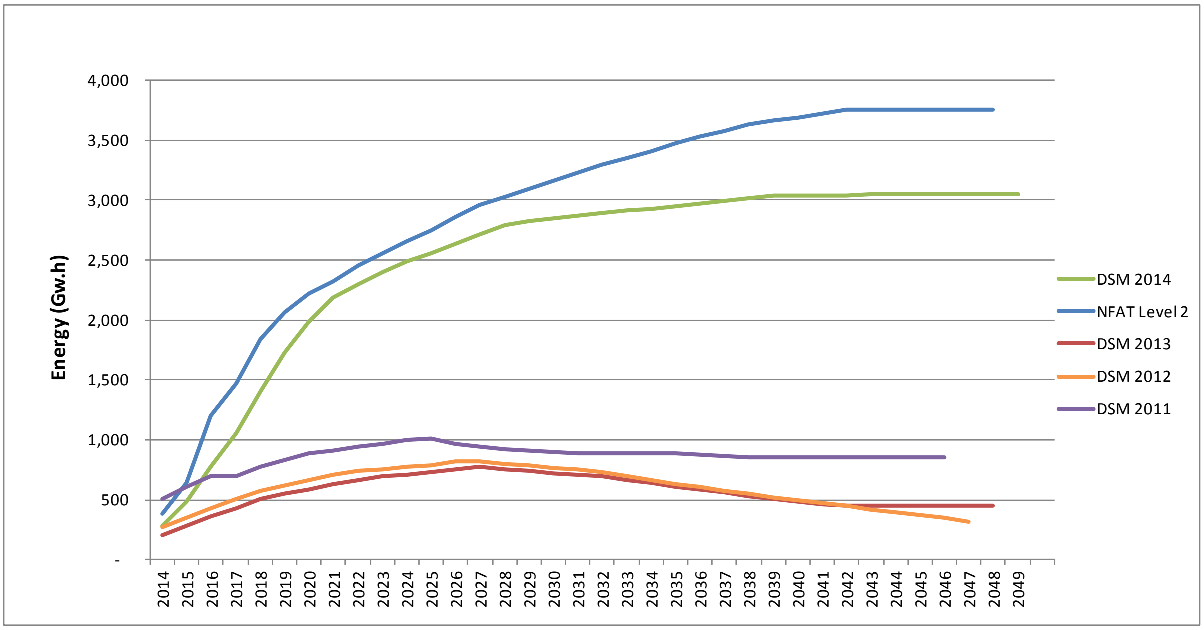
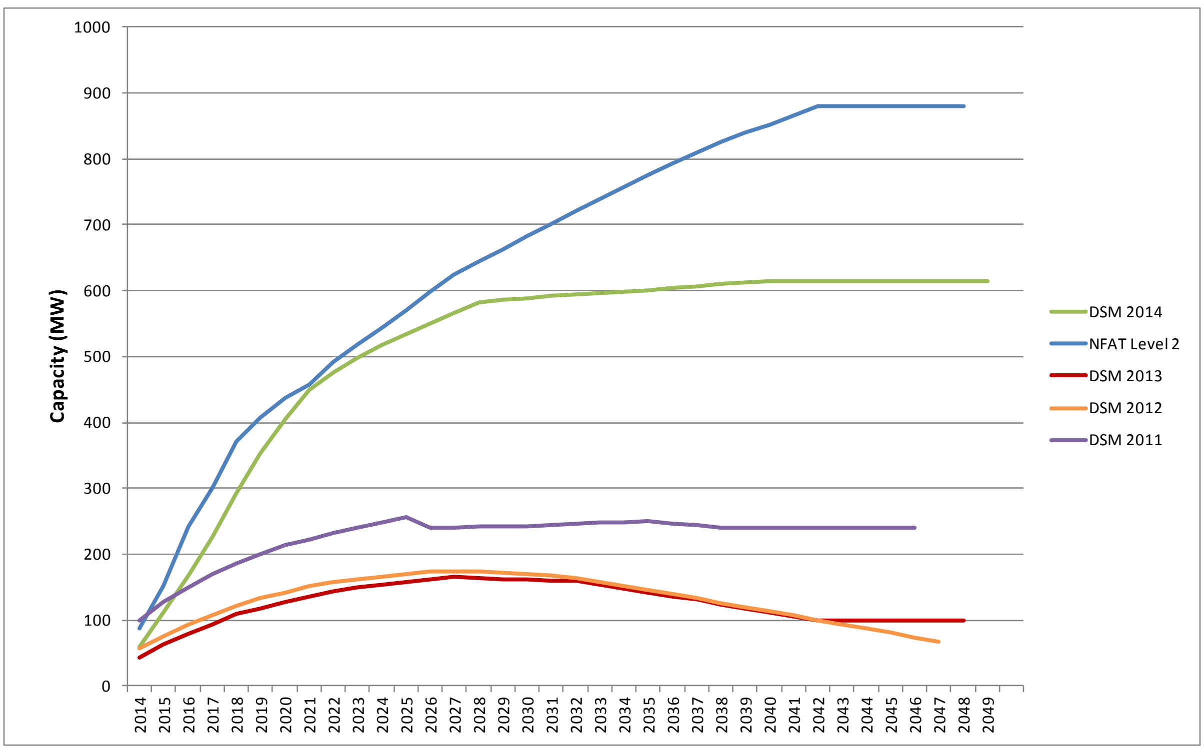


Figure 4: Comparison of DSM Capacity Forecasts:



Section:	2012/13 & 2013/14 GRA Appendix 3.1	**Page No.:**	
Topic:	Application Overview		
Subtopic:	Corporate Strategic Plan		
Issue:	CSP Strategies		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to COALITION/MH I-11 a) – c)

QUESTION:

a) The response to COALITION I-11 a) indicates (2nd paragraph, page 2) that sustaining projects within an asset group are evaluated against a common set of risk criteria. However, it is not clear from the 2nd paragraph on page 1 of the response whether for sustaining capital the same project versus project assessment is done across asset categories/business units. Please further clarify how the targets for sustaining capital are established for major asset categories and, specifically, whether this is done by evaluating all the projects for all asset categories against a common set of criteria.

b) The response (2nd paragraph, page 1) appears to suggest that spending on new generation and transmission facilities is established separately and independently from the requirement for sustaining capital spending and from the corporate-wide capital prioritization process. Please clarify whether or not spending on new major generation and transmission is included in the corporate-wide capital prioritization process such that individual major G&T projects are assessed against individual sustaining capital projects using a common set of criteria.

c) The response to COALITION I-11 b) does not address the question posed which was –"If so, for which IFF/budget year was it first applied?" Please provide a response to the original question as posed.

RATIONALE FOR QUESTION:

The information is required in order to understand Manitoba Hydro's capital prioritization process.

RESPONSE:

a) The annual target for Sustaining Capital is apportioned to the major asset categories (i.e. generation, transmission, distribution and corporate infrastructure) by members of the Executive Committee following discussions regarding the operational and business risks associated with a higher or lower level of capital investment in each category. The allocation of target to the major asset categories is not based on a project by project assessment, but rather a review of the overall system priorities to ensure continued safe and reliable supply of energy.

As discussed in COALITION/MH-I-11a, on a regular basis targets are reviewed to assess whether a reallocation of funds is required in order to balance operational priorities and optimize overall corporate value. This integrated planning approach ensures that overall capital spending delivers optimal value to the ratepayers of Manitoba. Each Vice-President is then responsible for the management of the portfolio of projects within their respective target. Projects within each major asset category are evaluated against a common set of risk criteria such as public and employee safety, reliability and capacity impacts on system operations, customer requirements and environmental and financial impacts.

b) The evaluation of overall funding levels for Major New Generation & Transmission (MNG&T) and Sustaining Capital is not done independently but involves a process considering a number of inputs and risk factors. The allocation of overall funding for MNG&T is supported by the Power Resource Plan which identifies the key assumptions for the recommended development plan and supports the Integrated Financial Forecast (IFF). Resource planning is based upon capacity and resource planning criteria ensuring –

i. A minimum reserve that Manitoba Hydro will carry in order to manage the risks associated with the breakdown of plant and an increase in demand above the Manitoba forecast peak demand and reserves required by export contracts; and,

ii. The Corporation will have adequate energy resources to supply the firm energy demand in the event that the lowest recorded coincident water supply conditions are repeated.

These criteria provide the basis for determining when new resources are required to ensure an adequate supply of capacity and energy for Manitoba. Overall capital funding levels consider the requirements for MNG&T infrastructure along with operational risk factors, impacts on overall financial targets and debt levels as well as the need to provide rate stability to customers.

All projects (MNG&T and Sustaining Capital) are evaluated and approved using the Capital Project Justification process which confirms the need for the project based on a number of criteria including system reliability, safety, customer service, environmental impacts and corporate profitability.

c) While a capital approval prioritization process has been in place for many years, modifications have been incorporated when necessary to ensure established expenditure levels reflect the Corporation's overall goals and objectives.

Section:	Tab 4	**Page No.:**	10-12
Topic:	Capital Expenditure Forecast		
Subtopic:	Sustaining Capital Expenditures		
Issue:	Spending for System Extensions		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to COALITION/MH I-34 (a) – (b)

QUESTION:

a) Is the projected new pipeline load all associated with existing customer sites?

b) If not, why won't the projected new pipeline load trigger the need for extending the current transmission system?

c) Does the new pipeline load given rise to the need for additional spending on the existing transmission system in order to accommodate the load? If so, what is the additional spending included in CEF14 and how much of this is covered by capital contributions?

RATIONALE FOR QUESTION:

This information is required in order to better understand the basis for Manitoba Hydro's sustaining capital expenditures related to new customers/new load.

RESPONSE:

a) The projected pipeline growth is anticipated to arise from a combination of expansion at existing customer sites and additional new customer sites required to service the anticipated pumping load.

b) The projected pipeline growth will likely require Manitoba Hydro to increase capacity of the transmission and sub-transmission infrastructure currently serving the existing customer sites. In addition, facilities will be required for the transmission and/or sub-transmission extensions to new customer sites that are proposed for the pipeline projects.

c) The requirement for enhancements and extensions to Manitoba Hydro's transmission and sub-transmission system is presently being examined. The outcomes of this review are in-progress and were not available for inclusion in CEF14.

It is expected that the majority of the infrastructure required to serve these loads will be dedicated facilities and therefore, will be funded by the customers through contributions in aid of construction.

Section:	Tab 4	Page No.:	19 of 26
Topic:	Capital Expenditure Forecast		
Subtopic:	Manitoba Hydro Current and 20 year outlook Asset Health Index		
Issue:	Update figure 4.17 for short term horizon		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to COALITION/MH I-86 (a) and COALITION/MH I-89 (a).

QUESTION:

a) Please explain why the response provided to COALITION/MH I-86 a) assumed "funding levels reflective of CEF13" as opposed to CEF14.

b) What impact would the using CEF14 funding levels have on the response provided?

c) Are the replacement quantities shown in response to COALITION/MH I-89 (a) based on CEF13 or CEF14 spending levels?

d) If the response to part (c) is CEF13, what would be the impact of using CEF14 spending levels?

RATIONALE FOR QUESTION:

The information is required in order to relate the response to the spending levels proposed in the current Application.

RESPONSE:

a) The response to COALITION/MH-I-86a references funding levels reflective of CEF13 as Manitoba Hydro's Electric Infrastructure Condition Assessment Summary (Appendix 4.2) report was drafted prior to approval of CEF14.

b) CEF14 funding would have a minimum impact on the condition of the Corporation's assets during the 2014/15 to 2017/18 period, given that the increased forecast base capital spending in CEF14 is primarily in the last 10 years of the 20 year forecast, as illustrated in the response to PUB/MH-II-39.

c) The response to COALITION/MH-I-89a was based on CEF13 spending levels.

d) The response to COALITION/MH-I-89a provided an estimation of the forecast replacement quantities out to 2034. Manitoba Hydro is not in a position at this time to estimate the replacement quantities based upon CEF14 forecast spending. The impact of using CEF14 spending levels would directionally result in an increase in the replacement of assets over the 20 year forecast as increased capital funding is made available to replace assets in poorer condition.

Section:	Tab 4 Appendix 4.1	Page No.:	4 & 13-15 3-8
Topic:	Capital Expenditure Forecast		
Subtopic:	Capital In-Service		
Issue:	Continuity Schedule		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to COALITION/MH I-32 a) and PUB/MH I-75 b). COALITION/MH I-32 a) confirms that capitalized interest is included in the capital expenditure values set out in Tab 4 and CEF14. PUB/MH 75 b) indicates that a lower interest rate environment will reduce the interest capitalization rate and the amount of interest capitalized. IFF14 indicates (Appendix 3.3, page 3) that the forecast interest rates used are lower than those in IFF13.

QUESTION:

a) Given these facts, why in CEF14 are there no projects where the capital cost revisions are attributed to a change in interest capitalization rate from CEF13?

b) Given these facts, why is it that the capital costs for some projects in CEF 14 remain unchanged from CEF13 (e.g., Pine Falls Unit 1-4 Major Overhauls; Manitoba-Minnesota New 500 kV Transmission Line; Slave Falls Overhauls; Point du Bois GS Rehabilitation; and most of the Major Capital Transmission Projects)?

RATIONALE FOR QUESTION:

The information is required in order to understand the basis for the capital expenditures included in the financial forecast.

RESPONSE:

a) Projected interest capitalized for all projects in CEF14 will be lower compared to CEF13, all things remaining equal. However, other factors unrelated to interest rates, such as changes in the timing of annual spending, may change the interest capitalized on a project. In addition, it is assumed that the total project costs are the same as

CEF13 unless a significant change due to scope, schedule or cost warrants revising a project CPJ resulting in a change to the total cost of project.

b) The projects that remain unchanged from CEF13 to CEF14 assume that the reduction in interest is offset by changes in other project costs and are managed within the existing project total. Over time, project contingencies will be adjusted accordingly.

Section:	Tab 3: Appendix 3.7	Page No.:	1
Topic:	Integrated Financial Forecast and Economic Outlook		
Subtopic:	Interest Rate Forecast		
Issue:	Weighted Average Interest Rate		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to PUB/MH I-10 (b) and COALITION/MHI-103 (c).

QUESTION:

a) Please indicate precisely what assumptions differ as between Appendix A and Appendix B to PUB/MH I-10(b) (i.e., is it just export prices?).

b) Do either of the financial forecasts provided in the response to PUB/MH I-10 (b) incorporate the updated CAD/US exchange rate forecast set out in COALITION/MH I-103 (c)?

c) If not, please provide a revised version of Appendix B that also incorporates the updated foreign exchange rate forecast.

d) PUB/MH 1-10(b) states that "[i]t is important to recognize that this scenario would not occur in isolation of other economic outcomes that may affect the Corporation's financial performance and therefore the scenario in Appendix A is not a representative update to the Corporation's revenue requirement."

   i. Can Manitoba Hydro confirm whether Appendix A is an accurate representation of its financials based upon the assumptions therein?
   ii. Is it Manitoba Hydro's position that each of the sensitivities that are available in this proceeding are also "not a representative update to the Corporation's revenue requirement" (as they incorporate one or two different assumptions rather than a wholesale re-balancing of the host of assumptions)?
   iii. As Appendix A is not a representative update to the Corporation's revenue requirement, please provide an update that is representative.

e) PUB/MH 1-10(b) states that "Manitoba Hydro operates in a complex economic environment that simultaneously affects many parts of its operations. The economy's impact upon Manitoba Hydro's revenue requirement is not exclusively seen through changing interest rates and the evolving views of Manitoba Hydro's external interest rate forecasters. There are numerous counterbalances."

i. Please provide a list of the factors which should be considered in the process of correctly counterbalancing a lower interest rate scenario in addition to export prices and volumes.

RATIONALE FOR QUESTION:

This information is required to in order to better understand the implications of recent economic updates on Manitoba Hydro's financial forecast.

RESPONSE:

Response to parts a-e)

The most balanced representation of the Corporation's financial projections and revenue requirement is the Corporation's Integrated Financial Forecast (IFF).

Manitoba Hydro operates in a complex operational and economic environment that simultaneously affects many parts of its financial performance. The IFF is the culmination of many months of entering, integrating and reviewing forecast inputs (such as hydrological, operational, capital, economic, and load). Care needs to be taken to avoid the oversimplification and disintegration that may occur when applying subsequent input updates. Off-the-run update scenarios that simply isolate the impacts of changes, beneficial or adverse, in any one input variable without considering potential counterbalances have the potential to create spurious forecasts and false conclusions if they are developed for the purpose of determining Manitoba Hydro's revenue requirement for rate setting purposes.

The forecast scenario that only updates for interest rate changes (Attachment A in PUB/MH-I-10b), is not a representative update to the Corporation's total revenue requirement. This is because the economy's impact upon Manitoba Hydro's revenue requirement is not exclusively seen through changing interest rates and the evolving views of Manitoba Hydro's external interest rate forecasters. There are numerous economic counterbalances that would affect the total revenue requirement for rate setting purposes.

The essential need to consider economic counterbalances was demonstrated in Attachment B to PUB/MH I-10b that showed the combined effects of updated interest rates along with estimated reductions in export revenue (see the response to PUB/MH-II-82a&b and 83a for details regarding the input variables). The results showed that the cumulative net income to 2016/17 was $6 million lower than the base case IFF14 when simultaneously updated with both interest rates and extra-provincial revenues. This revenue requirement stands in sharp contrast to the false conclusion that may arise if one only considered changes to interest rates.

Manitoba Hydro periodically updates its financial projections to reflect a wide range of updated information. However, these off-the-run scenarios need to be viewed with caution as they may also lead to a false sense of precision. While the scenario in Attachment B to PUB/MH I-10b is generally indicative of the effects of updated interest rates and export revenues, it will not be as rigorous as an IFF update that would consider the detailed impacts of changes in these variables; for example, a lower interest rate environment may lower the pension and benefit discount rate which may increase benefit expense, or changing economics may affect the domestic load forecast. All of these iterative, system-wide considerations typically require extensive time to appropriately update, integrate and review.

Sensitivities run on base case integrated forecasts need to be understood in their proper context. As stated in response to COALITION/MH-I-110d:

> “Sensitivities, such as the -1% interest rate scenario, are instructive in highlighting key risks that the Corporation faces and are not developed for the purpose of determining the Corporation’s revenue requirement.”

The scenarios in response to PUB/MH-I-10b did not include a run for changes in the USD/CAD exchange rate as the revenue requirement fluctuations associated with this economic variable have been largely eliminated due to the balanced combination of natural and accounting hedges (see Manitoba Hydro‘s response to COALITION/MH-II-103a). Therefore, for revenue requirement purposes, there is no relevant need to recalibrate the scenarios for this economic variable.

It is important to recognize that perpetually chasing real time updates, under the false assumption that the updated scenarios provide a more representative revenue requirement for rate setting purposes, also ignores the reality that Manitoba Hydro operates under a self-correcting cost of service rate setting methodology. Manitoba Hydro's retained earnings and net income of Manitoba Hydro are held for the benefit of ratepayers. To the extent that financial results are higher or lower than forecast, the difference, along with all other differences, flows to retained earnings. Retained earnings are not distributed as dividends to private shareholders (as may be the case in jurisdictions with a rate-base rate of return methodology) or used for any purpose other than managing the risks and revenue requirements on behalf of Manitoba Hydro's customers. To the extent that there are higher contributions to retained earnings as a result of this difference, there will be lower future rate increase requirements. Manitoba Hydro views this self-correcting mechanism at each GRA to be no different than the impact on earnings of weather or any other revenue or expense variable.

Manitoba Hydro periodically updates its financial projections to reflect a wide range of updated information. However, these updates need to be viewed in context and with caution. As discussed in Tab 2 of the Application, a large portion of the revenue requirements are associated with the magnitude of the capital assets being placed into service over the next forecast period. Manitoba Hydro's financial strength provides the means to smooth out short term volatility in costs and revenues to provide customers with rate stability. Isolating the impacts of changes, beneficial or adverse, in any one input variable has the potential to create a spurious forecast, and add undue rate variability and/or to alter the longer term progress towards the achievement of Manitoba Hydro's financial targets. For revenue requirement and rate setting purposes, the most balanced representation of the Corporation's financial projections is the Corporation's Integrated Financial Forecast (IFF) that was filed as a part of this rate application.

Section:	Tab 3: Appendix 3.7	Page No.:	1
Topic:	Integrated Financial Forecast & Economic Outlook		
Subtopic:	Interest Rate Forecast		
Issue:	Weighted Average Interest Rate		

PREAMBLE TO IR (IF ANY):

This question is in follow-up to PUB/MH I-10 b), COALITION/MH I-32 a) and PUB/MH I-75 b). COALITION/MH I-32 a) confirms that capitalized interest is included in the capital expenditure values set out in Tab 4 and CEF14. PUB/MH 75 b) indicates that lower interest rate environment will reduce the interest capitalization rate and the amount of interest capitalized.

QUESTION:

a) Was the capital expenditure forecast used to produce the financial forecast provided in PUB/MH I-10 b) reduced to account for the lower interest capitalization rate that would result from a lower interest rate environment?

b) If not, please revise the response accordingly.

c) If yes, please explain why there is no change in the value reported for Plant in Service as between the Balance Sheet provided in response to PUB/MH I-10 b) (Attachment A) and that for MH14 until after 2018/19.

d) Please provide the average unit revenue and cost calculation (similar to Appendix 11.19, page 3) for the financial forecast provided in Attachment B to PUB/MH I-10 b).

RATIONALE FOR QUESTION:

This information is required in order to better understand the financial forecasts that Manitoba Hydro has provided in response to PUB/MH I-10 (b).

RESPONSE:

a) The scenarios provided in PUB/MH-I-10b assume that interest capitalized during construction is lower for all projects in CEF14. However, project total expenditures remain unchanged from CEF14 assuming that the reduction in interest is offset by changes in other project costs and are managed within the existing project total. Over time, project contingencies will be adjusted accordingly. This is consistent with project budget management in practice. As indicated in the response to COALITION/MH-II-43, projects are managed within the existing project total unless there is a substantive change in scope, schedule or cost which warrants a CPJ revision resulting in an approved change to the total project cost.

b) No revision is required.

c) Please see the response to part a) above.

d) Please see the response to PUB/MH-II-89 for the Average Unit Revenue and Cost table associated with Attachment B to PUB/MH I-10b.

Section:	Tab 3: Figure 3.3	**Page No.:**	8
Topic:	Integrated Financial Forecast & Economic Outlook		
Subtopic:	Operating Results		
Issue:	Operating Result Shortfall		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to PUB/MH 1-8(c)

QUESTION:

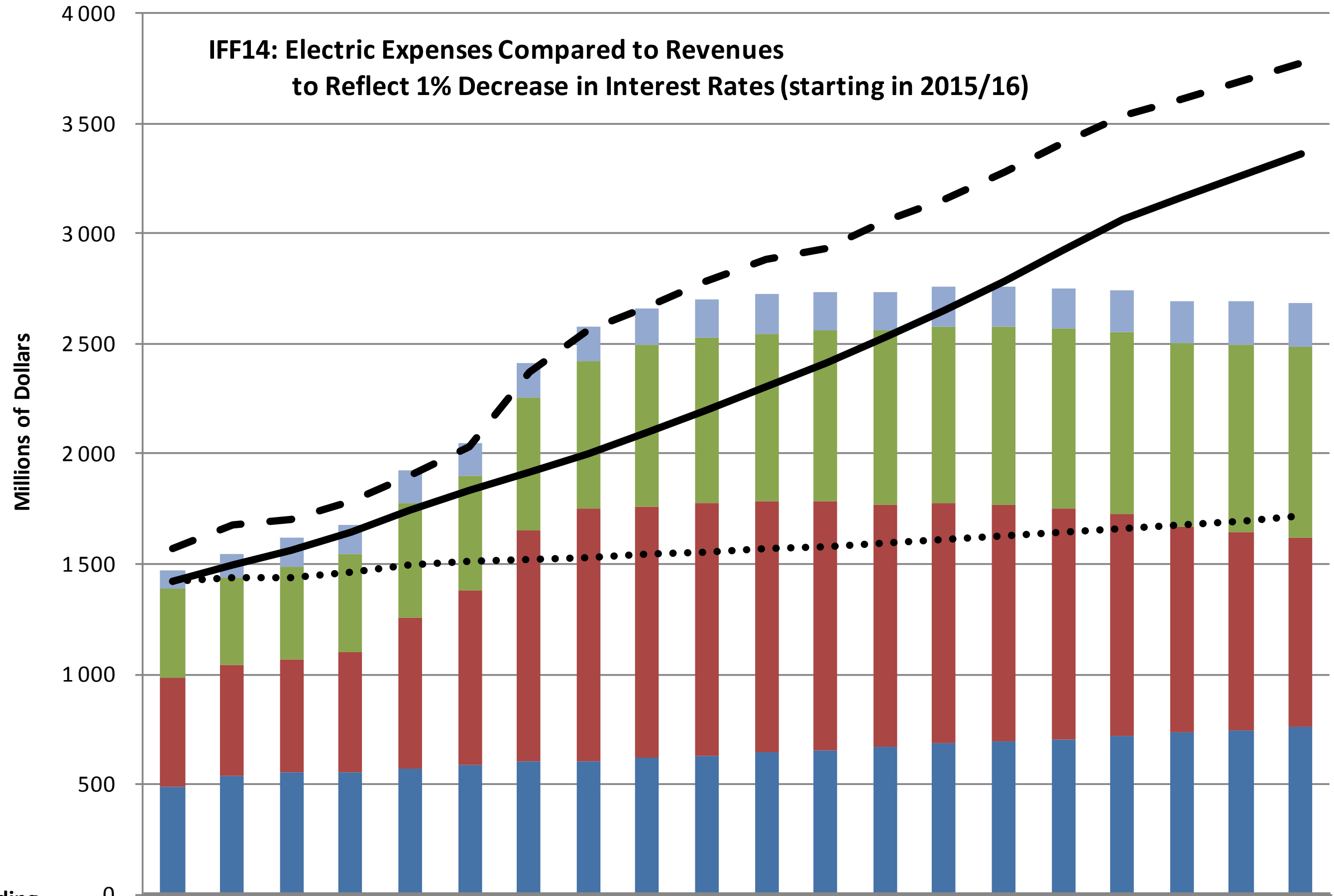
Please revise the chart in PUB/MH 1-8(c) to reflect a 1% decrease in rates over the assumed values commencing in 2017/18.

RATIONALE FOR QUESTION:

In order to fully consider the effects of variances from the forecasts one must consider both scenarios of both rate increases and rate decreases.

RESPONSE:

IFF14 includes an interest rate sensitivity to reflect a 1% decrease in interest rates on short-term, long-term, floating rate debt, and as well as sinking funds. This analysis commences in 2015/16. Please see the following figure and table of data points for results of the 1% decrease in interest rate sensitivity.



Fiscal Year Ending	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Taxes and Other	85	106	124	139	149	152	151	162	165	175	179	175	178	181	184	186	189	193	197	201
Depreciation and Amortization	405	401	422	445	520	523	610	663	733	748	764	776	787	800	807	816	827	838	852	868
Finance Expense	495	497	518	541	683	792	1 049	1 148	1 141	1 148	1 140	1 126	1 102	1 093	1 072	1 045	1 006	932	897	853
Operating and Administrative	486	542	552	557	571	585	601	607	619	631	644	657	669	683	697	706	719	733	748	763
GCR incl Additional	1 422	1 493	1 558	1 644	1 744	1 837	1 915	2 000	2 096	2 195	2 302	2 414	2 531	2 654	2 782	2 922	3 069	3 164	3 262	3 365
GCR incl Additional + Net Extraprov	1 572	1 674	1 705	1 786	1 903	2 032	2 374	2 560	2 665	2 783	2 887	2 935	3 059	3 158	3 278	3 413	3 538	3 612	3 689	3 778
GCR at PUB approved rates	1 422	1 436	1 440	1 461	1 494	1 516	1 521	1 529	1 541	1 554	1 568	1 582	1 597	1 611	1 625	1 642	1 660	1 678	1 696	1 716

Section:	Tab 3: Appendix 3.7	Page No.:	1
Topic:	Integrated Financial Forecast & Economic Outlook		
Subtopic:	Interest Rate Forecast		
Issue:	Weighted Average Interest Rate		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to PUB/MH 1-10(b)

QUESTION:

a) PUB/MH 1-10(b) states “[f]or example, the low interest rate environment has provided an opportunity for Manitoba Hydro, on behalf of its ratepayers, to beneficially reduce its weighted average interest rate on its debt portfolio (please see PUB/MH-I-10a). However, at the same time that Manitoba Hydro experiences lower interest rates, the Corporation is also experiencing factors that are contributing to lower energy prices. One of the factors cited by the Bank of Canada for its January 21, 2015 action to lower the target overnight interest rate was the “unambiguously negative impact on the Canadian economy” of lower oil prices. ”The Coalition notes that the charts presented in this application suggest that interest rates have generally been in a downward trend since 1995. http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D provides a chart of WTI oil prices which show oil prices trading in a narrow band width from 1995 to 2004, followed by a spike and crash in approximately 2008 and 2009, and again relatively constant prices from 2011 to early 2014.

i. Please provide the correlation of Manitoba Hydro's choice of the most applicable oil price index and Manitoba Hydro's export prices since 2005.

ii. Please describe the Corporation’s experience with low oil prices in the 2008-2009 period, with particular emphasis on the export market effects.

b) PUB/MH 1-10(b) states that “[n]atural gas prices are a significant factor driving electricity prices in the export market. There are numerous factors that underlie natural gas prices, such as oil and natural gas production growth, electricity demand growth and political events (related to OPEC). These factors are currently resulting in a continued commodity oversupply relative to demand, driving down natural gas prices which is then having a downward impact on the electricity export market." The Coalition notes that the charts presented in this application suggest that interest rates have generally been in a downward trend since 1995. http://www.eia.gov/dnav/ng/hist/rngwhhdd.htm provides a chart and underlying data points on the Henry Hub Natural Gas Spot Price. The Coalition observes that the current gas prices of $2.72 are exactly equal to those that prevailed on various dates in March 2000, November 2001, September 2009, and July and August 2012. Prices as low as the $1.80 range were available in 1998 and 1999, September through November 2001, and April 2012.

i. Please provide the correlation of the Corporation's choice of the most applicable gas price index and the Corporation's export prices since 2005.
ii. Please describe the Corporation's experience with low gas prices since 2009, with particular emphasis on the export market effects

RATIONALE FOR QUESTION:

To gain an understanding of the financial exposure of the planned capital spending and to further clarify Manitoba Hydro's response to PUB/MH 1-10(b).

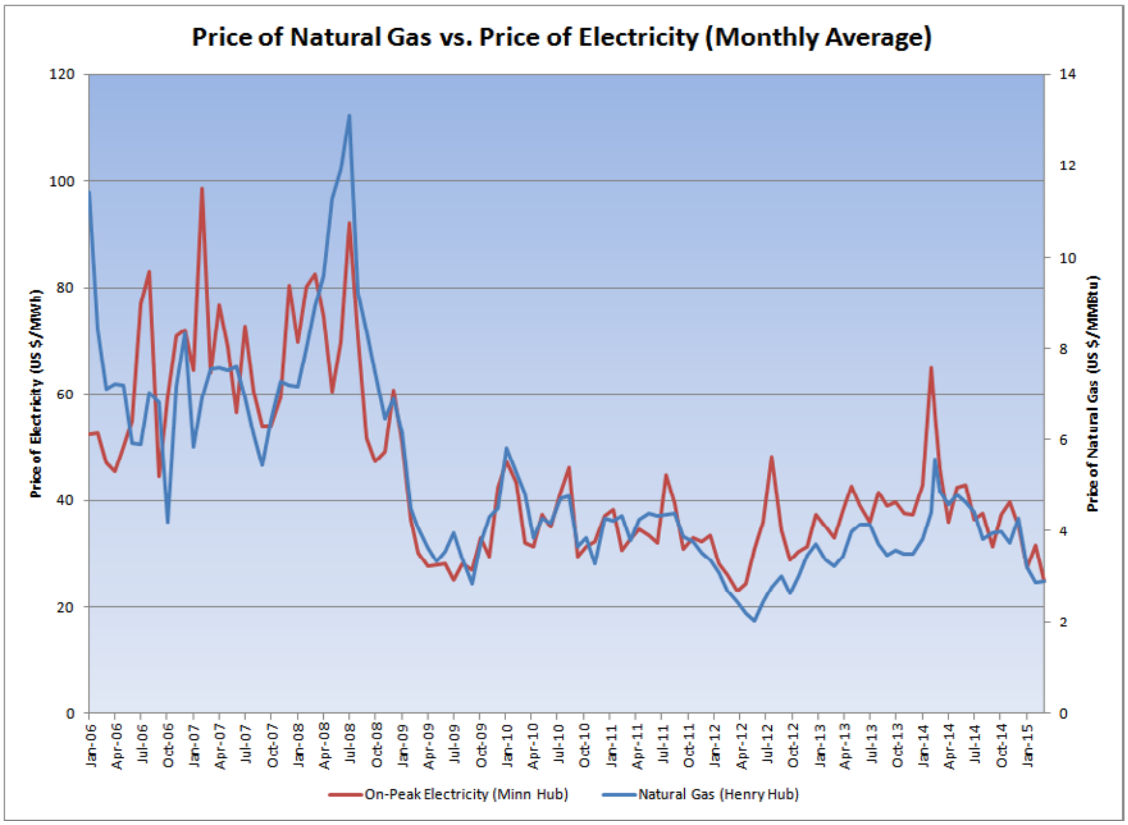
RESPONSE:

Response to parts a and b)

As described in response to PUB/MH-I-10b, "Manitoba Hydro operates in a complex environment that simultaneously affects many parts of its operations. … at the same time that Manitoba Hydro experiences lower interest rates, the Corporation is also experiencing factors that are contributing to lower energy prices."

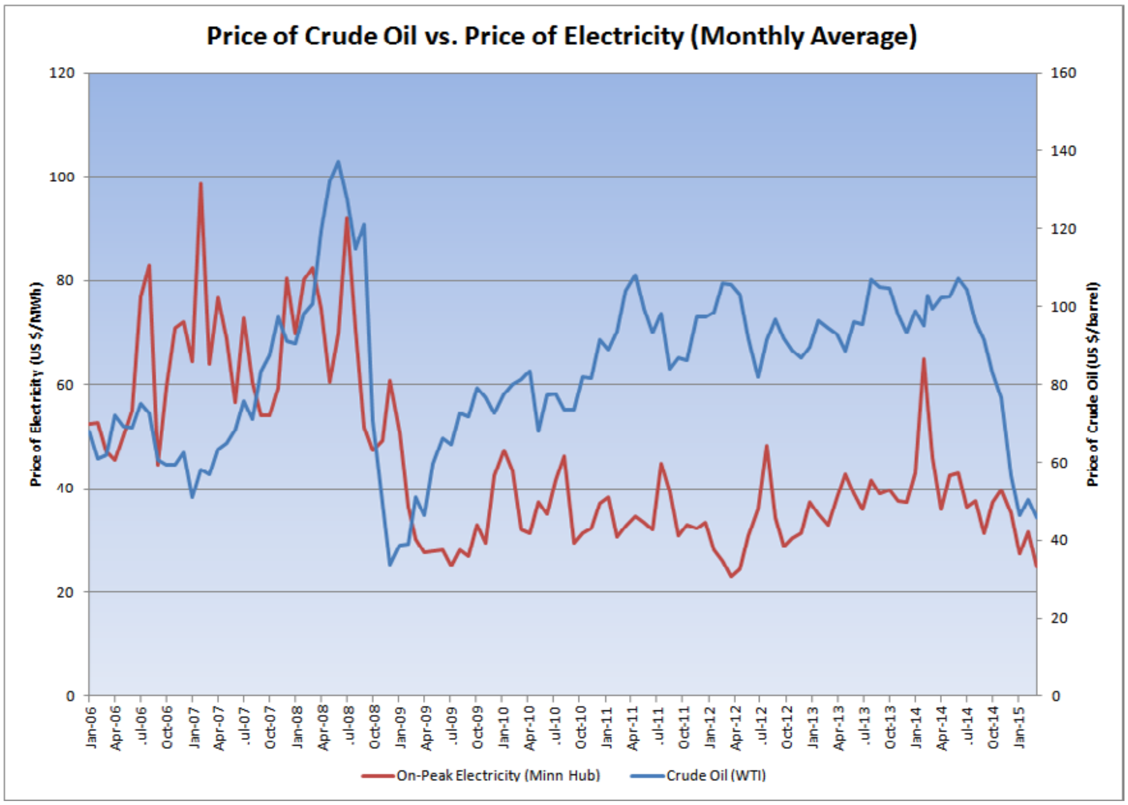
As noted in the question, natural gas prices are a significant factor driving electricity prices in the export market. There are numerous factors that underlie natural gas prices, such as oil and natural gas production growth, electricity demand growth and political events (related to OPEC). These factors are currently resulting in a continued commodity oversupply relative to demand, driving down natural gas prices which is then having a downward impact on the electricity export market. As a result, Manitoba Hydro expects that export revenue projections will be reduced from those provided for IFF14 largely offsetting the impact of lower interest rates on Manitoba Hydro's overall revenue requirement.

The following chart depicts the spot price of natural gas (Henry Hub) versus the on peak price for electricity (MISO Minnesota Hub) using the monthly average over the period from January 1, 2006 to March 31, 2015. The chart shows the relationship between natural gas and electricity prices. This relationship is not surprising as natural gas units typically set the marginal clearing price during many on-peak hours in the MISO market.



Over this timeframe, the coefficient of determination (r^2) between natural gas and on-peak electricity prices is 0.61. A coefficient of determination can range from 0 to 1; with 0 indicating no relationship and a coefficient of 1 indicating a relationship where 100% of the change in one variable can be explained by a change in another. The statistical results would suggest that electricity price is strongly linked to changes in natural gas price and that 61% of the change in monthly average electricity prices can be explained by the natural gas price index. It should be noted that correlations may change through time and care must be taken when interpreting statistical analysis as correlation does not mean causation and there may be numerous variables (such as weather) that may affect the relationship between these prices.

The following chart depicts the relationship between the spot price of crude oil (WTI) and the on peak price for electricity (MISO Minnesota Hub) using the monthly average over the period from January 1, 2006 to March 31, 2015.



The statistical correlation over this timeframe does not show a relationship between the price of oil and the price of electricity ($r^2 = 0.006$). However macro-economic shocks do have the ability to influence both commodities as seen in the global economic downturn of 2008-09.

Manitoba Hydro operates in a complex environment that simultaneously affects many parts of its operations. The economy's impact upon Manitoba Hydro's revenue requirement is not exclusively seen through changing interest rates and the evolving views of Manitoba Hydro's external interest rate forecasters. There are numerous counterbalances, including the complex relationships between the economy and energy prices.

Section:	Tab 3 App. 3.3 IFF14 Tab 11.4	**Page No.:**	Sect. 10.0, p.13 App. 11.4 (WPLP), p.1, App. 11.6, p.2 of 13
Topic:	Integrated Financial Forecast & Economic Outlook		
Subtopic:	Wuskwatim Power Limited Partnership (WPLP)		
Issue:	Cost impacts to MH Ratepayers of the Amended WPLP Agreement		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to PUB/MH 1-11(b).

QUESTION:

As a follow up to PUB/MH 1-11(b), please provide the amounts of interest capitalized for WPLP and Manitoba Hydro as a whole.

RATIONALE FOR QUESTION:

As the finance expenses do not fully reflect the interest capitalized, this question seeks further clarification on Manitoba Hydro's total interest capitalized.

RESPONSE:

The following table provides the total interest capitalized by WPLP and Manitoba Hydro for the project:

Generating Station	$175 million	WPLP Plant in Service (Manitoba Hydro Plant in Service on consolidation with Electric operations)
Manitoba Hydro Equity Contributions to WPLP	$42 million	Manitoba Hydro Plant in Service
Transmission	$63 million	WPLP Intangible Asset (Manitoba Hydro Plant in Service on consolidation with Electric operations)
Total	$280 million	

Section:	Appendix 3.1	Page No.:	
Topic:	Application Overview		
Subtopic:	Corporate Strategic Planning		
Issue:	CSP Strategies		

PREAMBLE TO IR (IF ANY):

Please refer to the response to Coalition/MH-I-11(a)

QUESTION:

a) Provide internal documentation that describes how targets for sustaining capital are allocated for every fiscal year.
b) Please confirm the complete set of the common risk criteria for each asset category is indicated on page 2 of 3 of the response.
c) For the risk criteria provided above, please provide the relative weights assigned to each criteria used by Manitoba Hydro when evaluating each asset's category risk profile.
d) Please provide a workflow illustrating when different processes take place from the capital investment requirements to the evaluation and prioritization stage.

RATIONALE FOR QUESTION:

Confirm evaluation of risk and capital expenditure prioritization process.

RESPONSE:

a) Please see the response to COALITION/MH-II-40(a) and (b) which discusses the process for the evaluation of overall capital funding levels and the apportionment of the annual targets for Sustaining Capital between major asset categories.

b) Manitoba Hydro utilizes a common set of risk criteria to prioritize its capital investments and manage its portfolio of projects as identified on Page 2 of COALITION/MH-I-11a. These consist of financial, employee and public safety, system reliability, capacity or transfer capability and environment. Depending on the asset category, risk criteria may be weighted in consideration of the operational and business requirements for that area. For example, where financial impact/consequence and system reliability are important for all asset categories, generation assets place greater risk emphasis on financial consequence where distribution assets place more risk emphasis on reliability performance.

c) The relative weights assigned to the risk criteria in each of Manitoba Hydro's asset categories are dependent on the operational priorities of each asset area and may be either quantitatively defined or qualitatively interpreted. For example, financial consequence is weighted more heavily for generation assets versus transmission and distribution asset categories, while reliability and capacity/transfer capability is weighted more heavily for distribution and transmission assets. Risks considered higher in consequence and with a greater probability of occurrence are associated with higher weights relative to other risks.

d) Manitoba Hydro follows a consistent risk-based workflow process for all asset categories when evaluating and prioritizing its capital investment requirements. This includes the completion of engineering planning studies and technical reviews, development of Capital Project Justifications (CPJs) to justify business value and securing appropriate approvals.

However, the evaluation process differs in methodology across generation, transmission and distribution asset categories in the use of applications and scoring frameworks as described below:

Generation asset based projects are evaluated and prioritized on the basis of current and future loss of generation capability and associated financial consequence. Using the Copperleaf C55 risk mapping application, it forecasts end of life of its major assets and establishes a portfolio of projects that mitigates overall risk to generation operations (see Generation Asset Risk Map).

Likelihood \ Consequence	None	Low	Medium	Medium High	High
High		19 Battery Banks 52 Breakers	9 Breakers 9 Exciters 16 Transformers	5 Exciters 4 Transformers	7 Governors
Medium High		2 Battery Banks 5 Breakers 2 Generators	19 Breakers 10 Exciters 10 Generators 5 Governors 13 Transformers	6 Exciters 18 Generators 9 Transformers 3 Turbines	4 Generators 2 Transformers 1 Turbines
Medium			14 Breakers 4 Exciters 15 Generators 6 Governors 10 Transformers	28 Exciters 30 Generators 8 Transformers 19 Turbines	7 Generators 5 Turbines
Low			5 Breakers 3 Generators 2 Transformers	3 Exciters 25 Generators 4 Governors 8 Turbines	3 Generators 3 Turbines
None		26 Battery Banks 102 Breakers	137 Breakers 10 Exciters 20 Generators 31 Governors 15 Transformers	32 Breakers 43 Exciters 65 Generators 56 Governors 65 Transformers 26 Turbines	12 Breakers 32 Generators 3 Governors 14 Transformers 47 Turbines

Transmission system asset based projects are evaluated and prioritized through a capital budget ranking method that scores proposed projects on criteria that is representative of its business objectives to reduce risk (see Transmission Capital Budget Ranking Tool illustration). Higher scoring projects undergo a further qualitative review by senior management to determine which projects becomes part of the transmission capital plan.

CAPITAL BUDGET RANKING TOOL for use on TRANSMISSION Projects
Matrix Scoring Sheet

See the CAPITAL BUDGET RANKING TOOL DOCUMENTATION for instructions and definitions.

I.M. #
WBS # (if Domestic)

NAME OF PROJECT:

Prepared by: name, department Date: yyyy/mm/dd

Scoring: (Weight) x (Probability points) x (Consequence points)

Weight	TRANSMISSION GOAL - Factor	Level 1 (=10 points)	Level 2 (=7 points)	Level 3 (=5 points)	Level 4 (=2 points)	Level 5 (=0 points)	GOAL SCORES	COMMENTS / RATIONALE (Required)
10	SAFETY							
	Probability of risk to public or employee safety	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
	Consequence of risk to public or employee safety	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
10	SERVICE & RELIABILITY							
	Probability of:							
	- event affecting service to a customer OR	CERTAIN	HIGH	MEDIUM	LOW	does not apply		
	- event affecting reliability of the transmission or distribution system	CERTAIN	HIGH	MEDIUM	LOW	does not apply		
	Consequence of:							
	- event affecting service to a customer, OR	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
	- event affecting reliability of the transmission or distribution system,	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
	- event affecting reliability of the communications system	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
5	FINANCIAL IMPACT							
	Probability of achieving financial impact	CERTAIN		LIKELY		does not apply		
	Consequence:							
	- Net Present Value, OR	> $1,000k	> $100k and ≤ $1,000k	> $0 and ≤ $100k		≤ $0		
	- Average avoided cost per year	> $250k	> $100k and ≤ $250k	> $30k and ≤ $100k	> $0 and ≤ $30k	does not apply		
5	TRANSFER CAPABILITY							
	Probability of impact to transfer capability			ALL PROJECTS		does not apply		
	Consequence of increase to or prevent loss of transfer capability	MW INCREASE > 50	MW INCREASE > 10 and ≤ 50	MW INCREASE > 0 and ≤ 10	PREVENT LOSS	does not apply		
5	ENVIRONMENT							
	Probability of negative or positive impact	HIGH		MEDIUM	LOW	does not apply		
	Consequence of negative or positive impact	HIGH		MEDIUM	LOW	does not apply		
	Tier 1 ≥ 1,200; Tier 2 = 850-1,199; Tier 3 = 550-849; Tier 4 = 200-549 & Tier 5< 200					MATRIX SCORE:	0	= TIER 5

Distribution capital projects and programs are evaluated and prioritized first by addressing the risks impacting operations, and establishing a capital portfolio that mitigates these risks as illustrated in the Customer Service & Distribution Risk Map. It then evaluates and approves proposed projects and programs that are representative of its capital portfolio segments. Project evaluations by senior management are qualitative in nature with plans to incorporate the Copperleaf C55 risk mapping application into its process to quantify its risk assessments.

Customer Service & Distribution - Risk Map

Risks

Electric Infrastructure:
1. Electric Distribution System Capacity
2. Electric Distribution Component Failure
3. Technological Advancements
4. Damages to Plant (Gas & Electric)

Gas Infrastructure:
5. Gas Distribution System Capacity
6. Gas Distribution Component Failure

Human Resources:
7. Labour Shortage
8. Knowledge Gap

Safety:
9. Employee Injury
10. Public Injury

Customer Service:
11. Inability to Meet Customer Expectations
12. Inadequate Emergency Management

Tolerance Rating

Green	**No additional action required at this time as the risk is under control and is not subject to significant change.**
Yellow	There are, or appears to be, some emerging issues that need to be closely monitored and addressed. Additional action is required to bring the risk back to the established tolerance. Management has time to respond in an orderly manner.
Red	The risk has become critical to business operations and requires day to day senior management attention. If not resolved quickly, it could have catastrophic impacts on the organization.

In general, CS&D shall work to mitigate the risks in the red and yellow categories into the green category by reducing the impact and/or likelihood of the risk occurrence. Priority and attention will be directed to the red categories before the yellow and green categories. CS&D recognizes that it may not be possible/realistic to move all risks in to the green category.

Section:	Tab 4	Page No.:	P 19 of 26
Topic:	Capital Expenditure Forecast		
Subtopic:	Manitoba Hydro Current and 20 year		
Issue:	Update figure 4.17 for short term horizon		

PREAMBLE TO IR (IF ANY):

Please refer Response to Coalition/MH-I-86a

QUESTION:

a) How does improvement in the asset categories affect future capital spending?

b) Please describe how MH incorporates updates to its system in the risk assessment model.

c) How did MH determine that governors, breakers and transformers are a higher risk assets than generator, turbine and exciters? Provide the calculations and or process that resulted in this assessment, and confirm whether the assessment is static?

d) Please provide the figures included in the response updated to show years 2019-2035 individually (i.e., 2019, 2020, 2021, etc.)

RATIONALE FOR QUESTION:

To assess how AHI develops in the short term and reasonableness of capital prioritization.

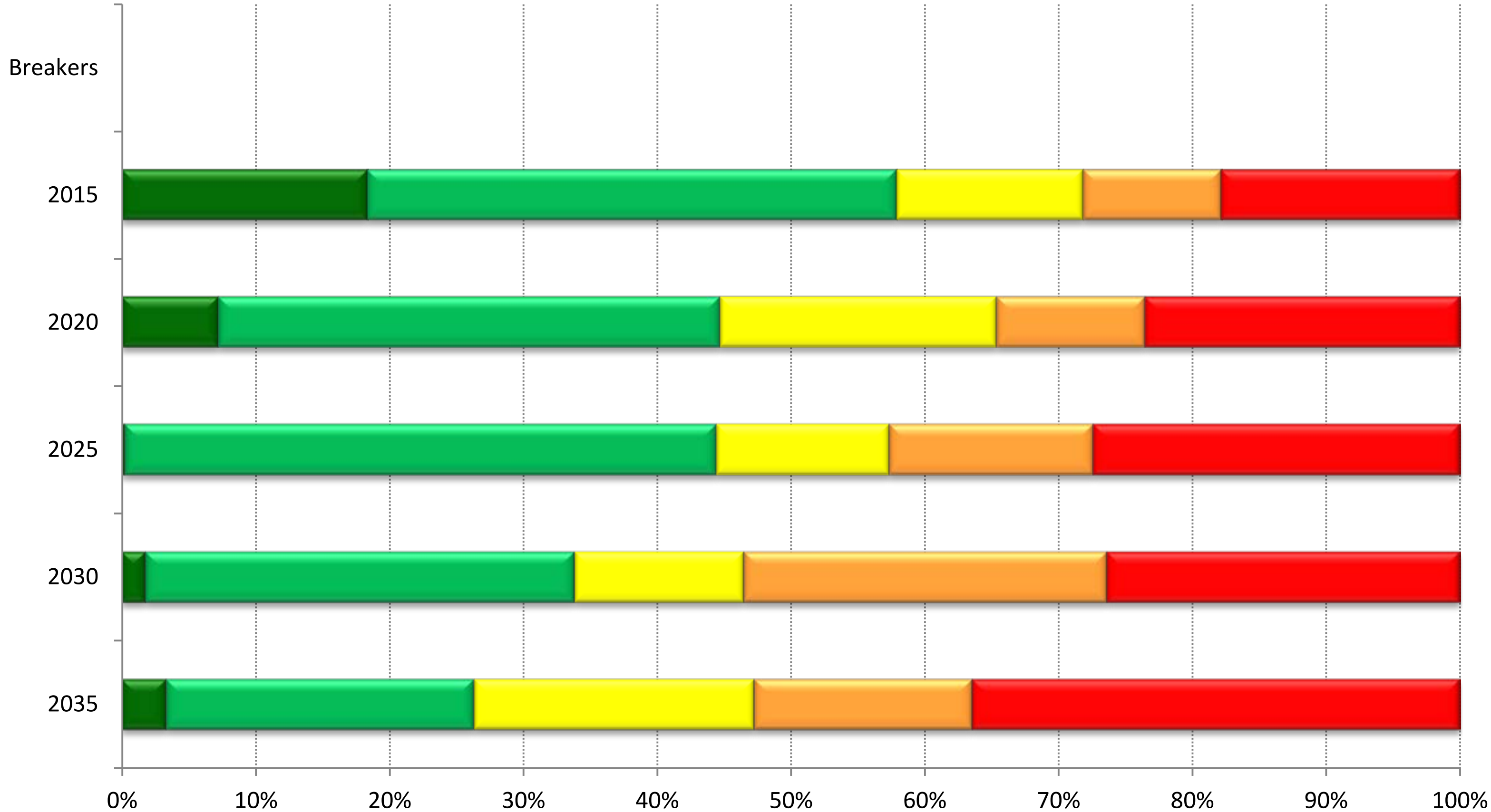
RESPONSE:

a) For the years 2014/15 to 2017/18, there are small improvements in asset health in some of the asset types based on the current priorities. However, overtime the assets on an overall population basis will continue to deteriorate without incremental capital funding.

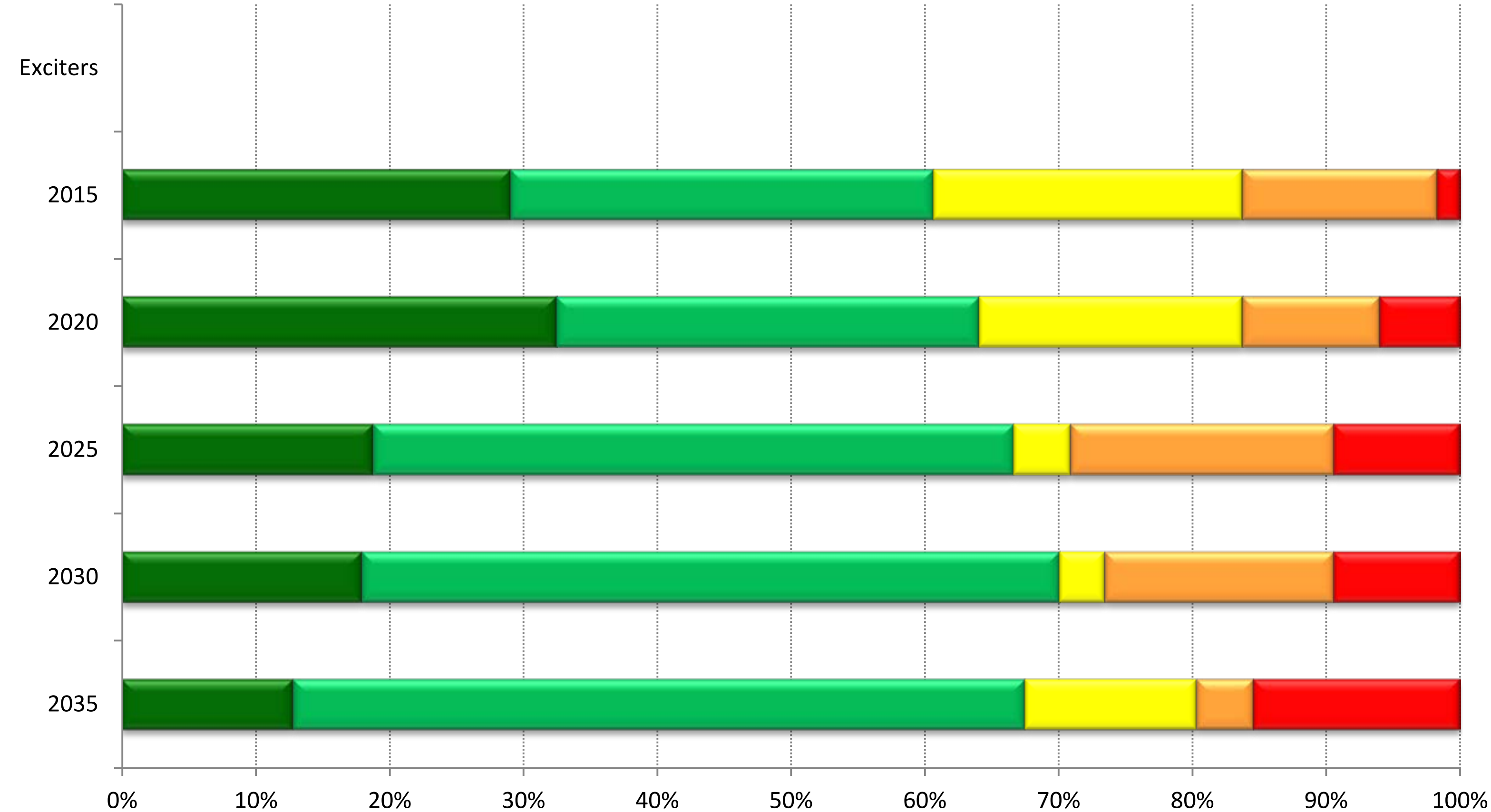
b) When an asset is replaced or refurbished resulting in a higher asset condition score, the model calculates a lower associated loss generation risk.

c) Generation asset based projects are evaluated and prioritized, at least annually, on the basis of current and future loss of generation capability and associated financial consequence. Using the Copperleaf C55 risk mapping application, it forecasts end of life of its major assets and establishes a portfolio of projects that mitigates overall risk to generation operations. Please see the Generation Asset Risk Map in the response to COALITION/MH-II-49d.

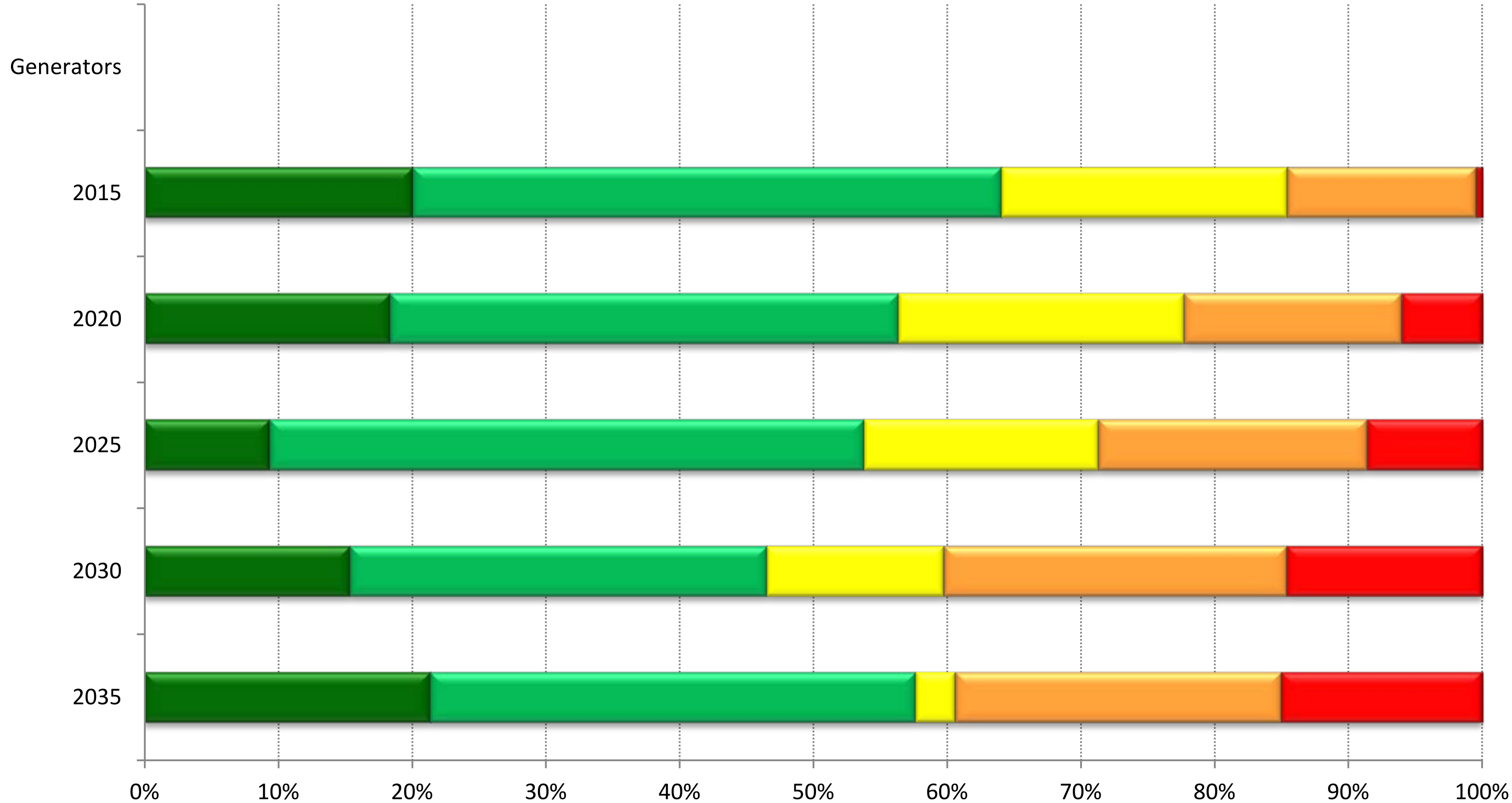
d) The following asset condition graphs by year are presented by generation asset type for 2020, 2025, 2030 and 2035. Manitoba Hydro has provided the information in five-year increments to present a representative picture of the change in the asset health index over the forecast period.



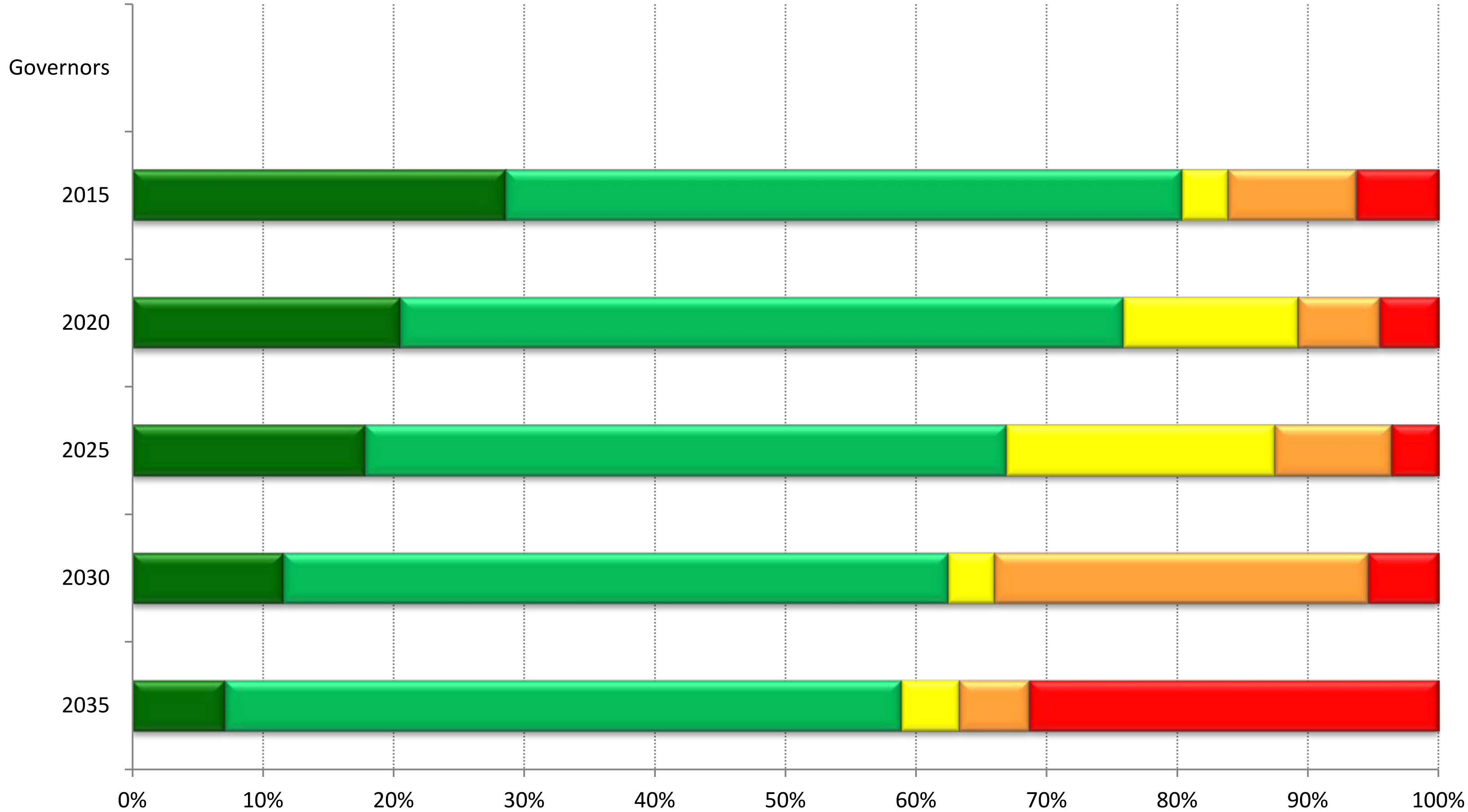
	2035	2030	2025	2020	2015	Breakers
Very Good	13	7	1	28	71	
Good	89	124	171	145	153	
Fair	81	49	50	80	54	
Poor	63	105	59	43	40	
Very Poor	141	102	106	91	69	



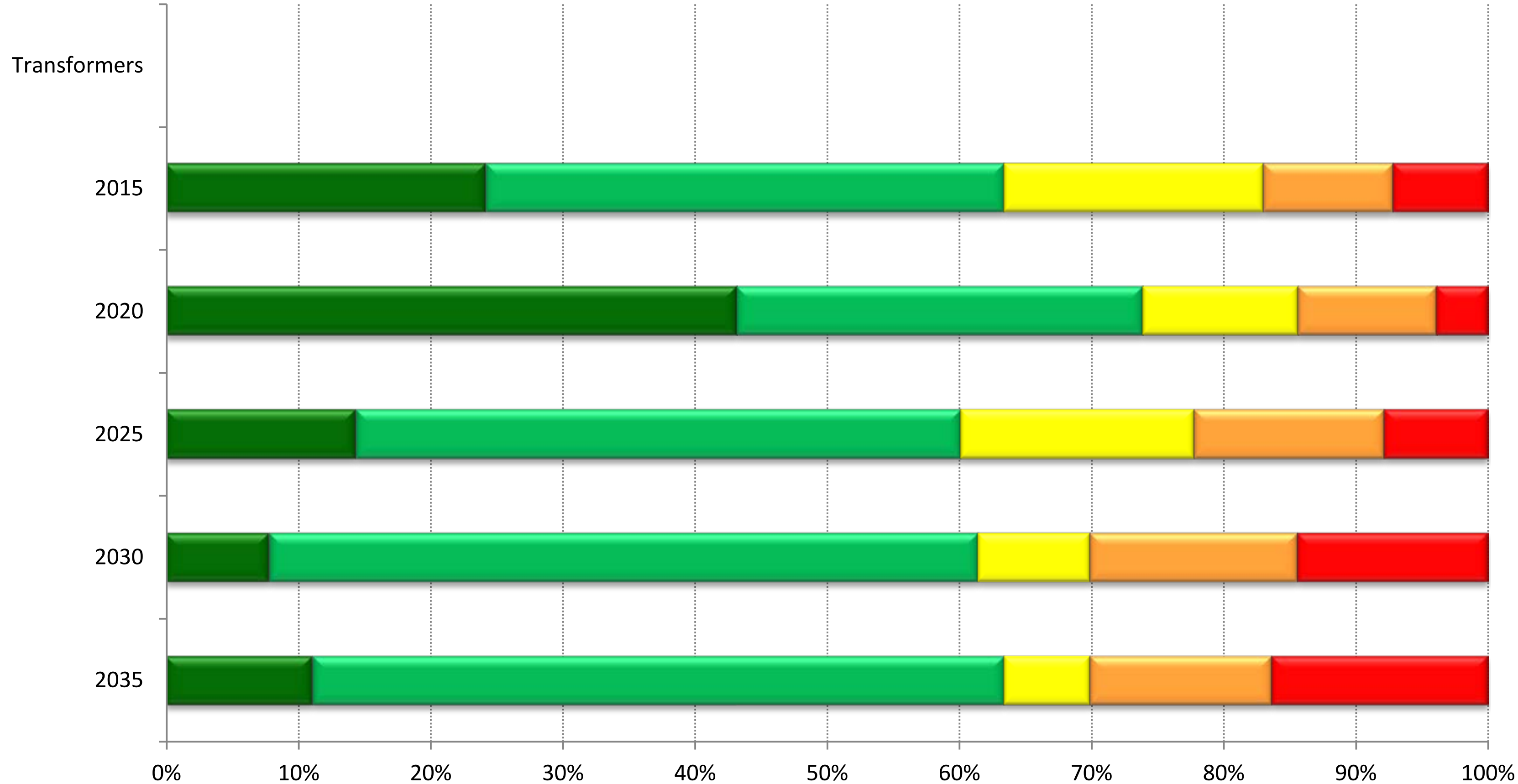
	2035	2030	2025	2020	2015	Exciters
Very Good	15	21	22	38	34	
Good	64	61	56	37	37	
Fair	15	4	5	23	27	
Poor	5	20	23	12	17	
Very Poor	18	11	11	7	2	



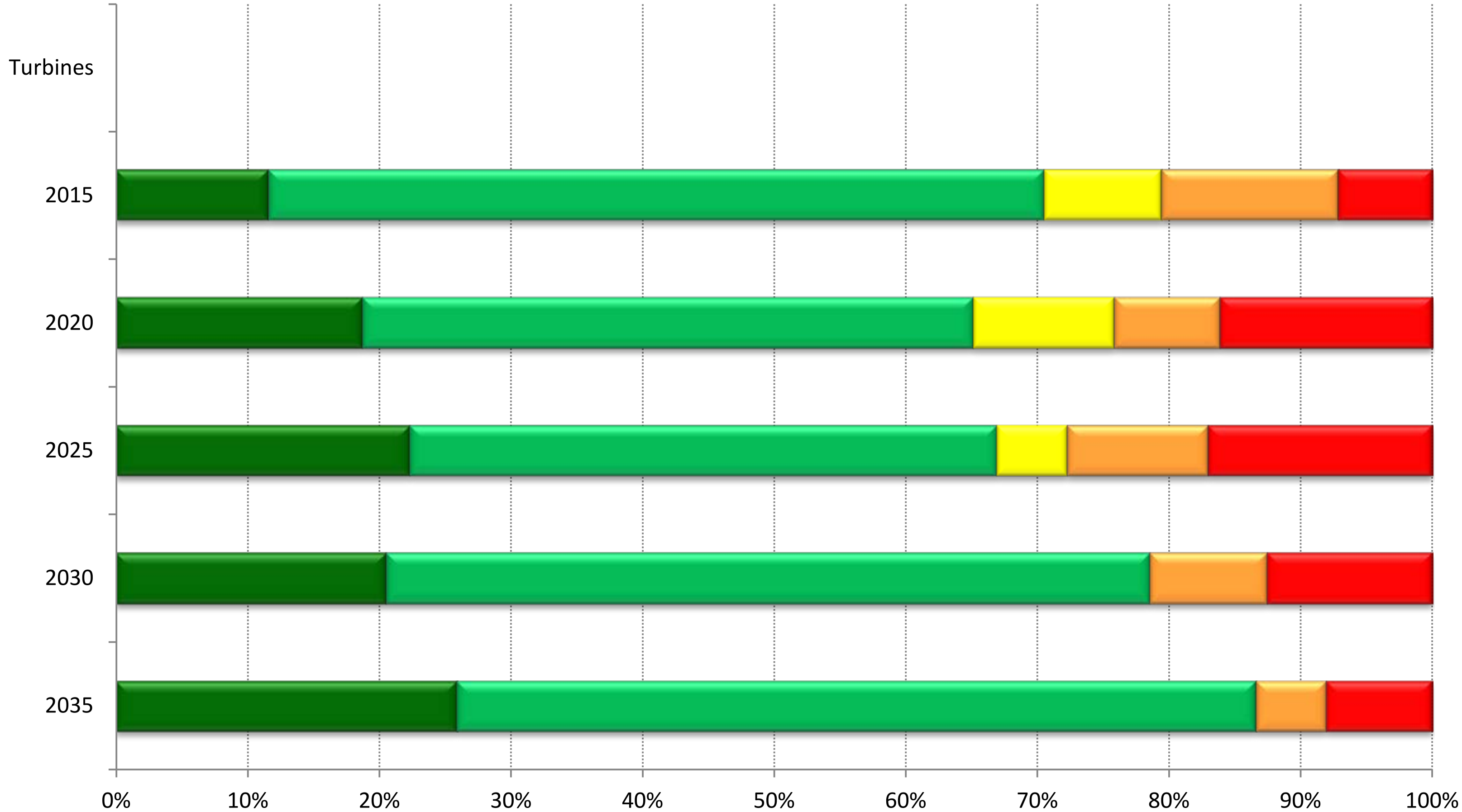
	2035	2030	2025	2020	2015	Generators
Very Good	25	18	11	22	24	
Good	43	37	52	45	52	
Fair	4	16	21	25	25	
Poor	29	30	24	19	17	
Very Poor	18	17	10	7	1	



	2035	2030	2025	2020	2015	Governors
Very Good	8	13	20	23	32	
Good	58	57	55	62	58	
Fair	5	4	23	15	4	
Poor	6	32	10	7	11	
Very Poor	35	6	4	5	7	



	2035	2030	2025	2020	2015	Transformers
Very Good	17	12	22	66	37	
Good	80	82	70	47	60	
Fair	10	13	27	18	30	
Poor	21	24	22	16	15	
Very Poor	25	22	12	6	11	



	2035	2030	2025	2020	2015	Turbines
Very Good	29	23	25	21	13	
Good	68	65	50	52	66	
Fair	0	-	6	12	10	
Poor	6	10	12	9	15	
Very Poor	9	14	19	18	8	

Section:	Tab 4 Appendix 4.2	**Page No.:**	p. 3
Topic:	Capital Expenditure Forecast		
Subtopic:	Electric Infrastructure Condition Assessment Summary		
Issue:	Assets' Consequence of failure		

PREAMBLE TO IR (IF ANY):

Response to COALITION/MH-I-92

QUESTION:

a) Provide documentation that shows how the weightings for the risk categories provided on page 2 of 2 are determined when the company evaluates risk for all categories included in the Capital Expenditure Forecast.

b) Please describe each category of risk provided on page 2 of 2.

c) Do you assume the same loss of plant risk for all assets within a category in the 20 year forecast?

d) How does the risk level change for an asset within a category after it is replaced? Do MH move the asset from high to low classification under that circumstance?

e) Please provide the documents/programs followed by the business units similar to the Corporate Risk Management Program.

f) Please provide the risk profiles, relative weights and criteria for each are of consideration as indicated on page 2 of 2 of the response.

RATIONALE FOR QUESTION:

Evaluate whether Manitoba Hydro capital expenditure methodology included the consequence of failure of an asset.

RESPONSE:

a) Manitoba Hydro's Corporate Risk Map (Page 20 of the redacted Corporate Risk Management Report filed as Appendix 11.7) illustrates the likelihood of occurrence and consequence for each of the risk categories identified on Page 2 of

COALITION/MH-I-92. The degree of severity and probability of occurrence combined serve to establish the relative importance or weightings of those risks. The severity of the identified risks in terms of consequence are empirically based using a set of qualitative and quantitative measured criteria including financial, system reliability, employee and public safety, environment and customer value. The likelihood of occurrence of each risk is also qualitatively rated as low (event not likely to occur within 10 years), medium (event likely within 5-10 years) and medium-high (event likely within 1-10 years). Risks considered a potentially higher impact to Manitoba Hydro may be elevated to a high level of consequence.

b) The following briefly describes the corporate risk categories identified in COALITION/MH-I-92:

D. Infrastructure

Catastrophic infrastructure failure is among the most significant risks facing Manitoba Hydro and its customers. Potential impacts include prolonged loss of system supply, inability to maintain minimum energy services, loss of life, severe environmental damage and significant costs to the Manitoba economy. Failure can be caused by an extreme weather event, sabotage, fire, human error or technical malfunction.

D1. Loss of Plant

Manitoba Hydro is subject to a variety of scenarios whereby physical plant is exposed to loss. The types of value exposed to loss include property, net income, liability and personnel. Loss from a property value perspective includes equipment breakdown, loss of facility, dam failure, and other property damage. Loss of plant can affect the Corporation's finances, reputation and impact on human life.

D1.1 Water Retaining Structure and Flow Control

Manitoba Hydro operates 17 major facilities for hydro power generation and water storage. The facilities were designed to meet established standards at the time of their construction and are systematically maintained and upgraded to ensure they meet current standards and operate safely. The facilities are the major source of system supply for Manitoba Hydro and the failure of water retaining structures could have impacts which range from insignificant to catastrophic, and could include loss of life, financial/economic costs, damage to the environment, and loss of system reliability, reputation, public confidence and heritage resources.

D3. Prolonged Loss of System Supply

Manitoba Hydro faces exposure to a catastrophic event that could result in prolonged loss of system supply and therefore an inability to meet its energy supply requirements.

This can be characterized as a system blackout due to the loss of key infrastructure such as the Dorsey Converter station or HVDC corridor and 500 kV line D602F. Reason for loss could be severe weather events such as tornado/downburst (Dorsey 1996, Elie 2007), wide front wind, combined wind and icing, lightning (Dorsey August 2007), sabotage, or fire.

D4. System Shutdown

The Corporation is exposed to an event(s) resulting in short term loss of system supply (electricity) and therefore not able to meet its energy supply requirements. It can be characterized as partial or total system blackout for 8 hours or as long as several days, resulting from weather events, sabotage, human error, equipment failure, or an inability to import energy from the market.

E1. Safety and Health

Manitoba Hydro identifies its risk to safety and health in direct relation to loss of a large number of employees that would result in a major disruption to business operations. Safety and health risk is also considered in the context of potential injury or loss of life to employees and the public.

H. NERC/MRO Reliability Standards

The Corporation could face negative consequences if it does not comply with mandatory NERC/MRO reliability standards as these standards identify specific reliability requirements for the planning, design, reliable operation, and maintenance and security of the North American bulk power system. NERC reliability standards are binding on the Corporation pursuant to the Reliability Standards Regulation under the Manitoba Hydro Act. The National Energy Board, which regulates international power lines, also requires Manitoba Hydro to comply with applicable Reliability Standards under its General Order on Mandatory Reliability Standards.

c) No. The magnitude of the risk related to loss of plant can vary between asset categories based on the consequence to the operations of the area. For example, the risk to Manitoba Hydro associated with a loss of plant due to a failed generator or hydraulic turbine generally poses a greater risk to the Corporation that the loss of plant due to a failed distribution overhead transformer.

d) Yes, the risk level changes as the probability of failure of that asset decreases. After an asset within its asset category is replaced, the health of that asset will improve to very good and the health of the overall asset type will also show improvement; the amount of improvement depends on the population of assets in the category.

e) Manitoba Hydro's approach to its risk management assessments for its asset categories are described in COALITION/MH-II-49d.

f) Manitoba Hydro's risks and relative weightings considered in its capital evaluations are described in COALITION/MH-II-49d.

Section:	Tab 4 Appendix 4.	Page No.:	p. 7
Topic:	Capital Expenditure Forecast		
Subtopic:	Objectives of the Electric Asset Health Index Summary Report		
Issue:	Describe Manitoba Hydro's risk management process		

PREAMBLE TO IR (IF ANY):

Please refer to response to Coalition/MH-I-93(c).

QUESTION:

a) Please describe how the weightings for each of several factors for each asset class are determined.

b) Provide copies of any analysis, if any, to support the specific quantification of the weighing factors uses for each criteria in the asset classes (distribution, transmission, generation).

c) Please provide the numerical value for the weightings of each AHI criteria for the transmission system circuit breakers on page 93 of Appendix 4.2 of the 2015/16 and 2016/17 GRA:

   i. Operating mechanism
   ii. Contact Performance
   iii. Arc Extinction
   iv. Insulation
   v. Service Record
   vi. Age (as a separate factor)

d) Please provide the numerical value for the weightings of each AHI criteria for the substation class transmission transformers noted on page 90 of Appendix 4.2 of the 2015/16 and 2016/17 GRA:

- Insulation
- Cooling

- Cooling system
- Sealing and connection
- Service record
- Age (as a separate factor)

e) For each of the 29 asset classes identified in the Electrical Infrastructure Condition Asset Summary, please identify the criteria and provide the value for the weighing assigned to each criteria in the AHI, and specifically provide the value for Age (where used) as a separate factor.

f) For each of the 29 asset classes identified in the Electrical Infrastructure Condition Asset Summary, please identify criteria and provide the value for the weighing assigned to each criteria for the consequence of failure of the asset.

RATIONALE FOR QUESTION:

To understand the risk management approach used by MH for capital assets.

RESPONSE:

a) Weighting for each factor used in deriving the AHI score is based on the relative importance of this factor in determining the overall condition of an asset, i.e. the more important a particular factor is in determining the asset's overall condition the higher its weighting and impact in the condition assessment formulation. The same weights were used in calculating AHI for all assets within the same asset class to ensure consistency.

Furthermore, the resultant AHI scores were validated by comparing calculated condition for some of the units with Manitoba Hydro's actual knowledge of and experience with these assets, i.e. was the unit found to be in "poor" condition using Health Indexing approach indeed known to be in "poor" condition by Manitoba Hydro technical and/or field staff.

b) Assigning weights is an exercise based on empirical results and experience of technical and field experts and is used as such by many utilities. Manitoba Hydro is not aware of any studies or analysis supporting specific weighting values. For some asset types, Manitoba Hydro has used weightings similar to other utilities.

c) – e) The weighting factors used in the condition assessment formulations are presented in the table below as either a percentage or as the weighting values used in the condition assessment formulations to achieve the appropriate level of impact for each factor.

Asset	Parameter/ Factor	Weight	Comments
Overhead Transformers	Age	100%	Visual and grounding inspections results were used to define age thresholds for assigning condition to individual transformers
Padmount Transformers	Age	100%	Visual and maintenance inspections results were used to define age thresholds for assigning condition to individual transformers
Overhead Primary Conductor	Age	100% for Aluminum Conductors	Copper conductor and steel conductor were assigned “very poor” and “poor” condition, respectively, regardless of age. Visual inspections were used as the basis for defining age thresholds for assigning condition to specific sections of aluminum conductor
Manholes	Visual inspections/expert opinion	100%	Results from the 2012 sample were extrapolated for the whole population.
Underground Cables	Age	100%	Cable type was used to define age thresholds for assigning condition to specific cable sections
Duct-lines	Visual inspections/expert opinion	100%	Results from the 2012 sample were extrapolated for the whole population
Street Lights	Age	100%	Visual inspections results and installation methods were used to define age thresholds for assigning condition to individual units

Asset	Parameter/ Factor	Weight	Comments
Wood Poles	Age	100%	Visual inspections and maintenance programs results were used to define age thresholds for assigning condition to individual poles
Transmission/ Distribution Breakers	Operating Mechanism	11 to 14	Depends on breaker type
	Contact Performance	7	
	Arc Extinction	5 to 9	Depends on breaker type
	Insulation	2	
	Service Record	5	Equal weighting is applied to Age and Operation Counter to determine Service Record score
Transmission/ Distribution Transformers	Insulation	6	
	Cooling	1	Cooling System is only parameter of Cooling
	Sealing & Connection	3	
	Service Record	3	Equal weighting is applied to Age and Loading to determine Service Record score
Transmission Battery Banks	Age	3 to 5	Varies with age to reflect increasing importance of age on battery condition.
	Functional Failure Count	5	
	Potential Failure Count	4	
Protection Relays	Age	2	
	Vendor Support	2	
	Spare Availability	4	
	Maintenance Performance	4	
Transmission Conductor	Age	1	Condition score based on age only
Transmission Steel Towers	Age	1	
	Inspection Records	4	

Asset	Parameter/ Factor	Weight	Comments
Transmission Wood Pole Structures	Pole Strength	5	
	Pole Physical Condition	4	
	Auxiliary Accessories	1	
	Service Record	3	A 2:1 weighting is applied to Age and Overall Condition Count to determine Service Record
HVDC Synchronous Condenser	Age	1	The weight for the excitation component of the synchronous condenser is 0.930
	Maintenance History	1	The weight for the excitation component is 0.710
	Operational Performance	1.5	The weight for the excitation components of the synchronous condenser for power circuitry, and control circuitry are 0.92 combined
	Physical Condition	1	The weight for the excitation component of the synchronous condenser for spare parts is 0.46
HVDC Valve Group	Age	1	
	Maintenance History	1	
	Operational Performance	1.5	
	Physical Condition	1	
HVDC Converter Transformer	Oil	1.135	
	Power Factor	0.666	
	Winding Resistance	0.666	
	O&M History	0.433	
	Age	0.433	
HVDC Transformer	Oil	1.135	
	Power Factor	0.666	
	Winding Resistance	0.666	
	O&M History	0.433	
	Age	0.433	
HVDC	Age	1	

Asset	Parameter/ Factor	Weight	Comments
Smoothing Reactors	Maintenance History	1	
	Operational Performance	1.5	
	Physical Condition	1	
HVDC Breakers	Dielectric	0.439	
	O&M History	1.316	
	Resistance	0.877	
	Number of Operations	0.702	
HVDC Shunt Reactors	Age	1	
	Maintenance History	1	
	Operational Performance	1.5	
	Physical Condition	1	
Generation, Transformers	Oil Analysis: a) Dissolved Gas Analysis-DGA b) Furan Levels	34%	
	Insulation tests: a) Capacitance b) Dissipation Factor c) Excitation current d) Insulation resistance	20%	Excitation current measurements are obtained during transformer turns ratio tests.
	DC winding resistance test	20%	
	Operations and Maintenance History	13%	for example historic failures, abnormal operating characteristics, issues with aux systems, failures or problems on equipment of similar design or manufacture, transformer turns ratio test
	Age	13%	As a function of in service date.

Asset	Parameter/ Factor	Weight	Comments
Governors	Age	0.17	
	Operations and Maintenance History	1.17	
	Spare parts	0.83	
	Performance	1.17	
Exciters	Age	1	Scoring varies between different models and manufacturers
	Operations and Maintenance History	1	Scoring varies between different models and manufacturers
	Spare parts	1	Scoring varies between different models and manufacturers
	Power Circuitry test	1	
	Control Circuitry test	1	
Generation, Breakers	Equipment performance	30%	
	Obsolescence Criteria: a) Equipment age b) Spare parts c) Technical support availability	70%	
Generators	Insulation Resistance and Polarization Index	0.1 - 0.25	Scoring depends on classification of the generator and there are currently 5 types – [11, 13.8kV] = 0.15 [6.6, 6.9, 7.2kV] = 0.25 [4.16kV – Jenpeg] = 0.25 [2.4kV] = 0.15 [thermal stations] = 0.1
	HVDC Ramp test	n/a – 0.75	Scoring depends on classification of the generator and there are currently 5 types – [11, 13.8kV] = 0.5 [6.6, 6.9, 7.2kV] = 0.75 [4.16kV – Jenpeg] = n/a [2.4kV] = 0.5 [thermal stations] = 0.45

Asset	Parameter/ Factor	Weight	Comments
	TVA probe	n/a – 0.35	Scoring depends on classification of the generator and there are currently 5 types – [11, 13.8kV] = 0.35 [6.6, 6.9, 7.2kV] = n/a [4.16kV – Jenpeg] = n/a [2.4kV] = n/a [thermal stations] = 0.2
	DF Tip-up (BDN, SLK)	n/a – 0.75	Scoring depends on classification of the generator and there are currently 5 types – [11, 13.8kV] = n/a [6.6, 6.9, 7.2kV] = n/a [4.16kV – Jenpeg] = 0.75 [2.4kV] = 0.35 [thermal stations] = 0.25
Turbines	The turbine is made up of many components, each of which the condition is assessed using the following parameters and methodology Some components, that have a significant impact on the operation of the unit, are considered "critical" The final Score is based on the lowest of any of the critical components, or the average of all components; whichever is lower.		
	Age	1	Scored first relative to a perfect score of 10 - for brand new with no recorded issues.
	Repaired to Original or Engineered Redesign implemented	1	Score impacted if applicable
	Operating restrictions in place due to component	1	Score further impacted if applicable
	Estimated longevity of repairs implemented	1	Score further impacted if applicable
	Asset maintainability	1	Score further impacted if applicable
	Severity of outstanding or non-repairable deficiencies	1	Score further impacted if applicable

f) None of the asset classes have criteria and weightings for the consequence of failure of the asset. Asset condition, consequence of failure and other factors such as deferring benefits are factored into the risk analysis for project justification and prioritization.

Section:	Tab 4 Appendix 4.2, Appendix C	**Page No.:**	8a
Topic:	Capital Expenditure Forecast		
Subtopic:	Asset condition Assessment methodology		
Issue:	Asset condition assessment methodology assessment		

PREAMBLE TO IR (IF ANY):

Please refer to the response to Coalition/MH-I-99(a) – Attachment 1

QUESTION:

a) Page 17 of 45 of the Agreement allows MH to provide input to Kinectrics on the proposed methodologies. Please describe the input and provide the documentation given to Kinectrics that included this input.

RATIONALE FOR QUESTION:

To understand the capital asset replacement decisions of MH.

RESPONSE:

Manitoba Hydro provided three main types of input to Kinectrics mostly verbally or during face-to-face meetings in Winnipeg:

i) Transmission staff answered questions about Manitoba Hydro's asset data regarding topics such as data sources, format, interpretation, collection frequency and attributes. This allowed Kinectrics to customize the condition assessment formulations to reflect Manitoba Hydro's data availability, terminology and application.

ii) Transmission staff provided input used by Kinectrics to construct Manitoba Hydro specific probability of failure curves used in calculating the age component of the condition assessment formulation and in identifying the long-term "flagged-for-action" strategy. This input included information regarding typical and extreme useful lives of various asset categories based on the historical information and field staff experience, some preliminary failure statistics for transformers and wood pole structures, and a qualitative assessment of default probability of failure assumptions presented by Kinectrics based on their experience with other utilities.

iii) Transmission staff reviewed preliminary condition assessment index results provided by Kinectrics to validate the overall results generated by the model. The models were further calibrated based on this input.

Section:	Tab 4 Appendix 4.2, Appendix C	Page No.:	8a
Topic:	Capital Expenditure Forecast		
Subtopic:	Asset condition Assessment methodology		
Issue:	Asset condition assessment methodology assessment		

PREAMBLE TO IR (IF ANY):

Please refer to the response to Coalition/MH-I-99(a) – Attachment 1

QUESTION:

b) Please describe the activities undertaken by Kinectrics under Stages 1 to 4 as describe on pages 15 to 18 of the Agreement.

RATIONALE FOR QUESTION:

To understand the capital asset replacement decisions of MH.

RESPONSE:

Stage 1

Kinectrics met and had a number of discussions with Manitoba Hydro technical, field and IT staff to describe Asset Condition Assessment and Risk Assessment methodologies and approaches; finalize the list of asset classes to be assessed; review the available data and information and discuss the format of their delivery to Kinectrics; obtain Manitoba Hydro's perspective on their maintenance and capital practices and philosophies; and review default condition assessment formulations. At the end of Stage 1 Manitoba Hydro and Kinectrics finalized the list of asset classes to be assessed and identified available information and data for each class. Kinectrics then developed Manitoba Hydro specific condition assessment formulation for each asset class.

Stage 2

Kinectrics used information and data provided by Manitoba Hydro in conjunction with AHI formulations developed in Stage 1 to derive Health Index score for each unit within each of the asset classes. Once this was done, Kinectrics consulted with Manitoba Hydro experts to validate the results by comparing condition calculated using AHI for some of the units with Manitoba Hydro's actual experience with these units. After the Asset Condition Assessment results were validated, Kinectrics performed a Risk Assessment to develop long-term condition-based "flagged-for-action" strategy for each of the asset classes. The Risk Assessment approach for station transformers and breakers involved evaluation of both probability of failure and specific criticality of each unit whereas for wood poles and spar arms all units were assumed to have the same criticality.

Stage 3

For the asset classes assessed Kinectrics provided conclusions and recommendations (see the response to COALITION/MH-II-53d for summary).

Stage 4

Kinectrics produced a comprehensive report that included a description of the methodologies and approaches used, a summary of the results, and conclusions and recommendations (see the response to COALITION/MH-II-53d). As well, for each of the asset classes assessed, the report provided the age distribution, the Health Index distribution, the data availability distribution, a risk based prioritized list of units requiring attention (for transformers and breakers only) and a long term "flagged-for-action" plan.

Section:	Tab 4 Appendix 4.2, Appendix C	Page No.:	8a
Topic:	Capital Expenditure Forecast		
Subtopic:	Asset condition Assessment methodology		
Issue:	Asset condition assessment methodology assessment		

PREAMBLE TO IR (IF ANY):

Please refer to the response to Coalition/MH-I-99(a) – Attachment 1

QUESTION:

c) Please provide copies of all progress reports and other written project feedback from Kinectrics for Stages 1 to 4.

d) Please provide the Final Report to MH described page 18 of the Agreement.

e) Please provide the assessment of whether MH should implement commercially available asset investment planning as described page 19, if not included in the Final Report.

f) Please provide the Microsoft Excel Spreadsheet and user's manual provided with the Final Report that includes all the finalized methodologies as described on page 19.

g) Please provide the presentation from Kinectrics describe on page 19.

RATIONALE FOR QUESTION:

To understand the capital asset replacement decisions of MH.

RESPONSE:

c) Kinectrics did not provide any formal written progress reports to Manitoba Hydro. Instead, Manitoba Hydro was informed of the project progress through the stages via verbal communication.

d) After consulting with Kinectrics, Manitoba Hydro is providing the Kinectrics report entitled "Manitoba Hydro 2012 Asset Condition Assessment". Please note that the location of specific electric assets has been redacted as it is considered sensitive information.

e) Please see Item 12 under the Conclusions & Recommendations section of the Executive Summary of the Report (page xvii).

f) After consultation with Kinectrics, Manitoba Hydro will not submit the spreadsheets provided by Kinectrics as these spreadsheets contain Kinectrics proprietary information and releasing them may cause Kinectrics a significant commercial harm.

g) After consultation with Kinectrics, Manitoba Hydro is providing the attached final presentation given by Kinectrics to Manitoba Hydro management. Please note that the location of specific electric assets has been redacted as it is considered sensitive information.

MANITOBA HYDRO
2012 ASSET CONDITION ASSESSMENT

December 17, 2012

Kinectrics Inc.
800 Kipling Avenue
Toronto, ON
M8Z 5G5 Canada
www.kinectrics.com

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MANITOBA HYDRO
2012 ASSET CONDITION ASSESSMENT

Kinectrics Report: K-418390-RA-0001-R00

December 17, 2012

Prepared by:

Fan Wang, Ph.D. P. Eng.
Senior Engineer/Scientist

Reviewed by:

Y. Tsim

Yury Tsimberg, M.Eng, P.Eng.
Director – Asset Management

Approved by:

D. Clh

Dave Clarke, P.Eng.
General Manager – Department of Transmission & Distribution Technologies

Dated: Dec 18, 2012

To: Manitoba Hydro
360 Portage Avenue
Winnipeg, MB R3C 0G8

Revision History

Revision Number	Date	Comments	Approved
R00	October 12, 2012	Initial Draft	N/A
R00	December 17, 2012	Final Report	

EXECUTIVE SUMMARY

Manitoba Hydro (MH) identified a need to have a third party perform a condition assessment of its key ageing transmission assets. Such an undertaking would result in a quantifiable evaluation of asset condition, aid in prioritizing and allocating sustainment resources, as well as facilitate the development of a long-term replacement strategy.

In late 2011, MH selected and engaged Kinectrics Inc (Kinectrics) as the successful third party to provide required consulting services as stipulated in the MH's RFP 035009 "Provision of Consulting Services for Ageing Asset Management and Investment Planning".

The scope of the project originally included the following transmission assets categories:

- Substation Transformers, together with on-Load Tap Changers (LTCs)
- Station Circuit Breakers
- Transmission Lines

Subsequently, MH and Kinectrics agreed that not enough of the required data were available for transmission line conductors do perform a credible condition assessment and only wood poles and SPAR arms ended up being included in the assessment, so the final list of asset categories became as follows:

1. Station transformers with 115 kV primary voltage
2. Station transformers with 138 kV primary voltage
3. Station transformers with 230 kV primary voltage
4. SF6 station circuit breakers
5. Air Blast station circuit breakers
6. Bulk oil station circuit breakers
7. Minimal oil station circuit breakers
8. Wood poles
9. SPAR arms

Furthermore, Kinectrics offered to include in the project scope 2 weeks of field testing on a limited sample of conductors selected by MH using Kinectrics proprietary technology, namely LineVue device: the second week of testing is schedule for later in 2012, and, thus, the test results will be included in the addendum to this report at a later date.

For each asset category, the ACA included the following tasks:

- Gathering relevant condition data
- Developing a Health Index Formula
- Calculating the Health Index for each asset

- Determining the Health Index distribution
- Developing a 10-year/20-year (depending on asset groups) condition-based replacement planIdentifying and prioritizing the data gaps for each group

This Asset Condition Assessment Report summarizes the methodology used, outlines specific approaches used in this project, and presents the resultant findings and recommendations.

Asset Condition Assessment Methodology

The Asset Condition Assessment Methodology involves the process of determining asset Health Index, as well as developing a Condition-Based "Flagged for Action" Plan for each asset group.

<u>Health Index</u>

Health Indexing is a composite index that quantifies equipment condition based on numerous condition parameters related to the long-term degradation factors cumulatively leading to an asset's end of life. The Health Index is an indicator of the asset's overall health, relative to a brand new asset, and is given in terms of percentage, with 100% representing an asset in brand new condition.

The condition data used in this study were obtained from MH and included the following:

- Asset Properties (e.g. age, location information)
- Test Results (e.g. Oil Quality, DGA) from StarLIMS, IPM databases
- Corrective Maintenance Records from RMS, TLine database
- Preventive Maintenance Records from IPM database

A Health Index was calculated for each asset with sufficient condition data. As well, in order to provide an effective overview of the condition of each asset group, the Health Index Distribution for each asset category was determined.

<u>Condition-Based "Flagged for Action" Plan</u>

Once the Health Indices were calculated, a "flagged for action" plan based on asset condition was developed. The Condition-Based "flagged for action" Plan outlines the number of units that require attention in the next 10 or 20 years (for reactively and proactively replaced asset groups, respectively). Based on the asset-specific field review, appropriate action could be replacement, or refurbishment, or modified spare parts strategy, or "do nothing".

The numbers of units were estimated using either a *reactive* or *proactive* approach. For assets with a relatively small consequence of failure, units are generally replaced <u>*reactively*</u> or on failure. The replacement plan for such an approach is based on the asset group's failure rate. This approach incorporates the possibility that assets may fail prematurely, prior to their expected typical end of lives. Wood pole and SPAR arms were treated as *reactively* replaced assets.

In the <u>*proactive*</u> approach, units are considered for replacement prior to failure. Station transformers and breakers were treated as *proactively* replaced assets. For these asset groups, a

Risk Assessment study was conducted to determine the units eligible for replacement. This process establishes a relationship between an assets's Health Index and the corresponding probability of failure first. Then the quantification of asset criticality is done using the assignment of weights and scores to criticality factors that impact the overall criticality. The combination of criticality and probability of failure determines risk and replacement timing as well as priority for that unit to be "flagged for action".

Health Index Results

The following figures show a summary of the Health Index evaluation results for all the asset groups addressed in this project.

For transformers Health Index distributions are shown for transformers only, LTCs only and combining transformers and LTC using 2 different approaches:

- 10% Approach

  In the so-called 10% approach, the combined Health Index is computed as a contribution from both transformer and LTC Health Index results, based on a combination of individual transformer and LTC Health Indeces when and only when the Health Index result discrepancy between transformer and LTC is within 10%. If the discrepancy is greater than 10%, then the combined Health Index is equal to transformer Health Index.

- 60% Approach

  In the so-called 60% approach, the combined Health Index is computed as a contribution from both transformer and LTC Health Index results, based on a combination of individual transformer and LTC Health Indeces when and only when both transformer and LTC have a Health Index not less than 60%. If either of them is less than 60%, then combined Health Index is equal to the lower value of these two, regardless of whether it is transformer or LTC.

For the breakers, Health Index distribution is presented for all types combined as well as for each of the 4 individual breaker types.

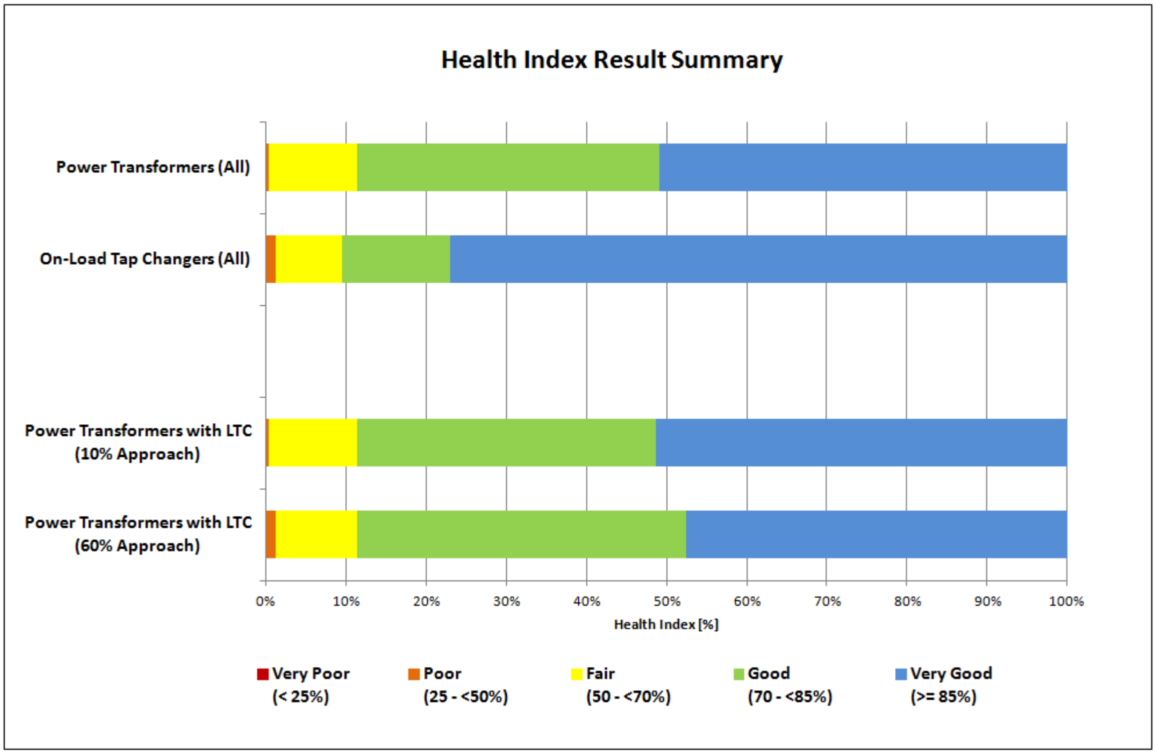

Figure 1 Transformers/LTCs Health Index Summary

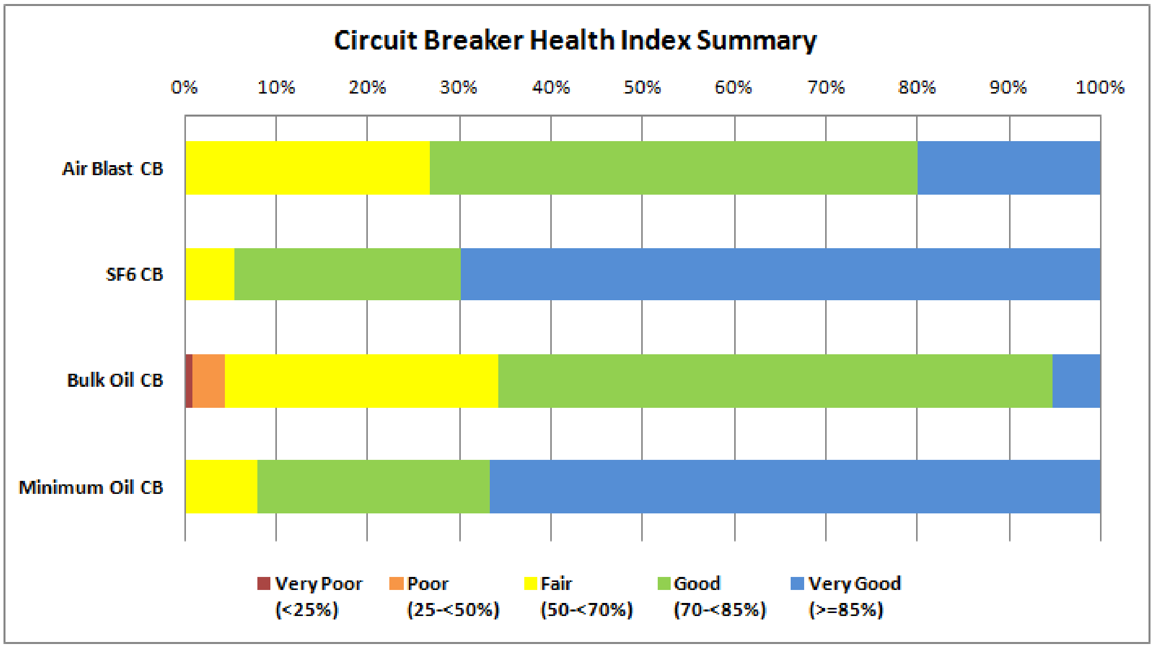

Figure 2 Circuit Breakers Health Index Summary

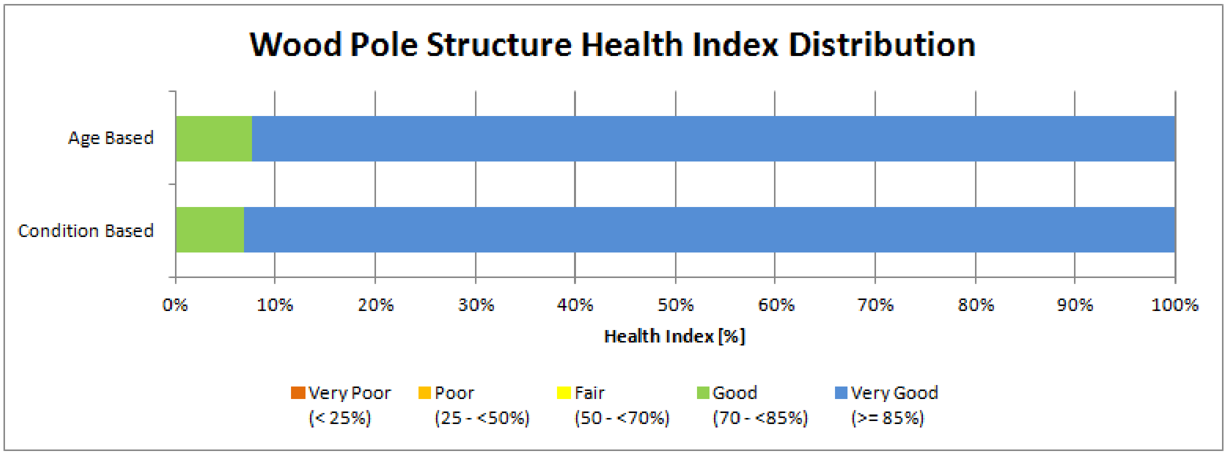

Figure 3 Wood Pole Structures Health Index Summary

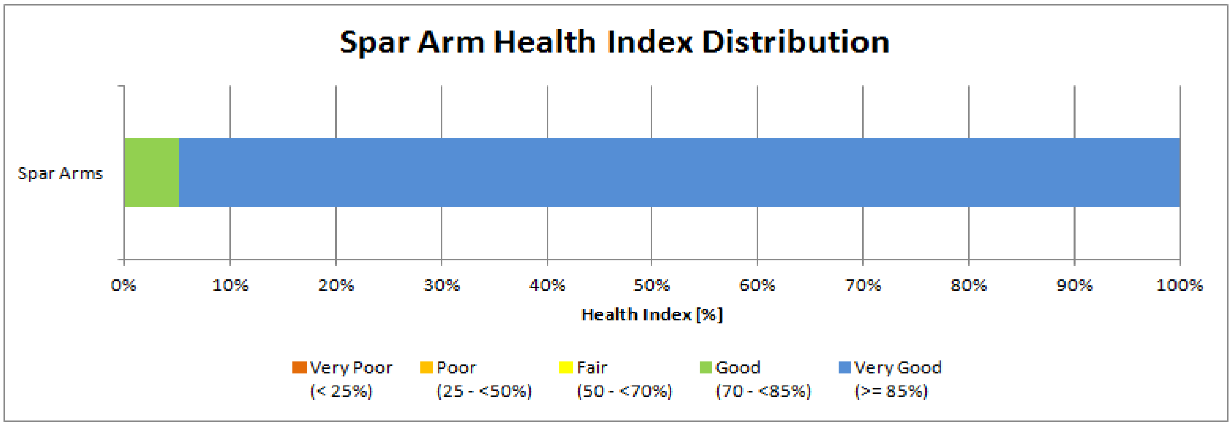

Figure 4 Spar Arms Health Index Summary

It can be observed from the results that in general, the overwhelming majority of both power transformers and LTCs are in good shape. There is a small portion of LTCs in poor condition and requires attention. The combined score for transformers and LTCs shows a Health Index distribution (both 10% and 60% approaches) that is quite close to the one for power transformers alone, indicating the LTC condition is either quite similar to the status of its associated transformer, or LTC population is too small to have substantial impact on the combined Health Index distribution.

The Health Index results for circuit breakers show that all the 4 types of breakers have the vast majority of their population in good or very good condition. Of the 4 types of breakers, bulk oil breakers are the only group that has poor or very poor units. On the other end, SF6 and minimum oil breakersare in a better condition, as more than 90% of the population is in good or very good condition.

Wood pole structures are all in good or very good condition as per Health Index results translated into “effective age”. Comparison of condition based results and age-only based results shows minor discrepancy. However, the difference is clearly seen in the “flagged for action” plans.

SPAR arm Health Index distribution is solely based on SPAR arm age information. The results show that almost all the SPAR arms are in good or very good condition. Although a SPAR arm's age is assumed to be the same as that for the associated wood pole structure, the Health Index distribution might be different because there might be more than 1 SPAR arm at each wood pole structure.

Condition Based Flagged for Action Plans

The following diagrams show the condition based "flagged for action" plans for all the asset groups.

MH's most significant expected flagged for action was found to be for Wood Pole Structures and SPAR Arms. 57 wood poles and 113 SPAR arms are flagged for action in the current year. Given the large population however, these values stand for less than 1% of the entire asset groups in both cases.

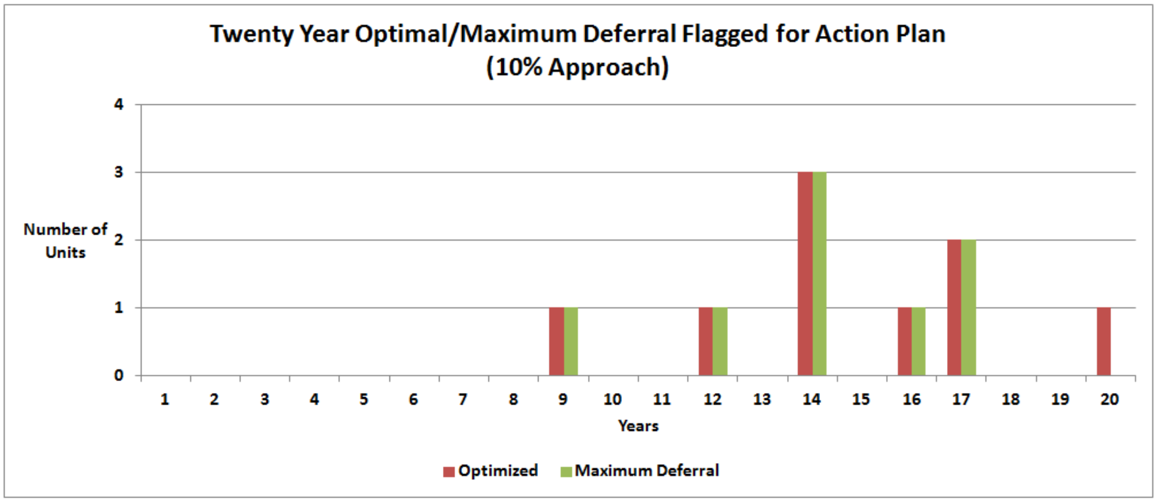

Figure 5 Transformers/LTCs Flagged for Action Plan (10% Approach)

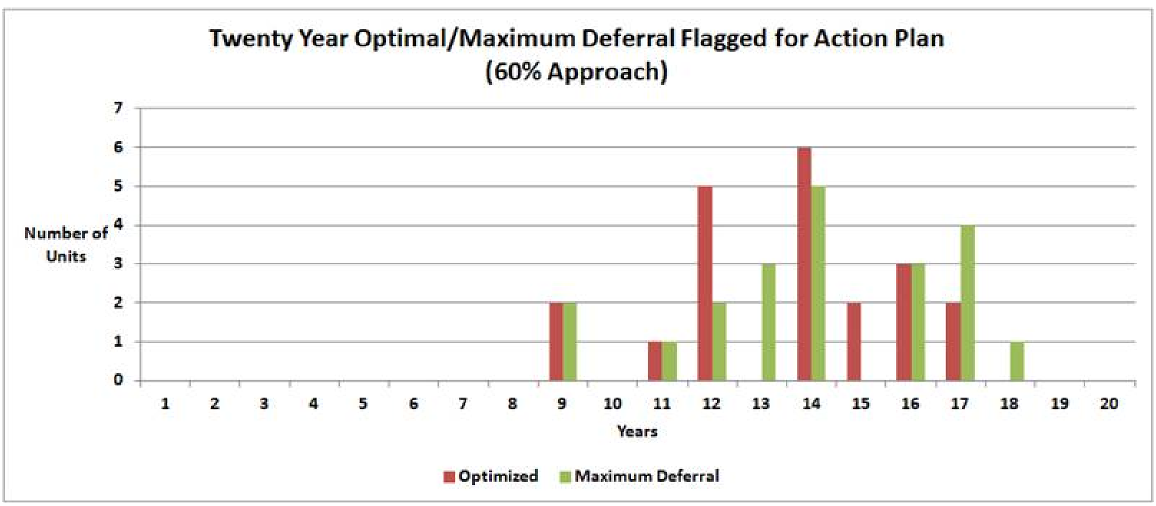

Figure 6 Transformers/LTCs Flagged for Action Plan (60% Approach)

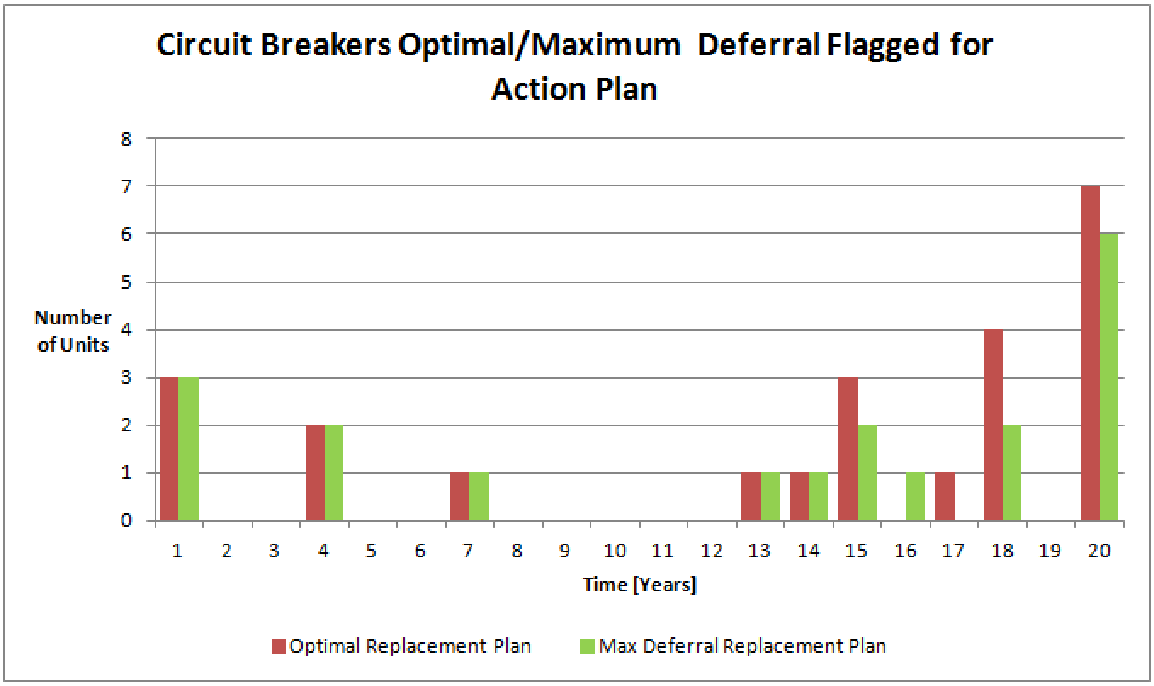

Figure 7 Circuit Breakers Flagged for Action Plan

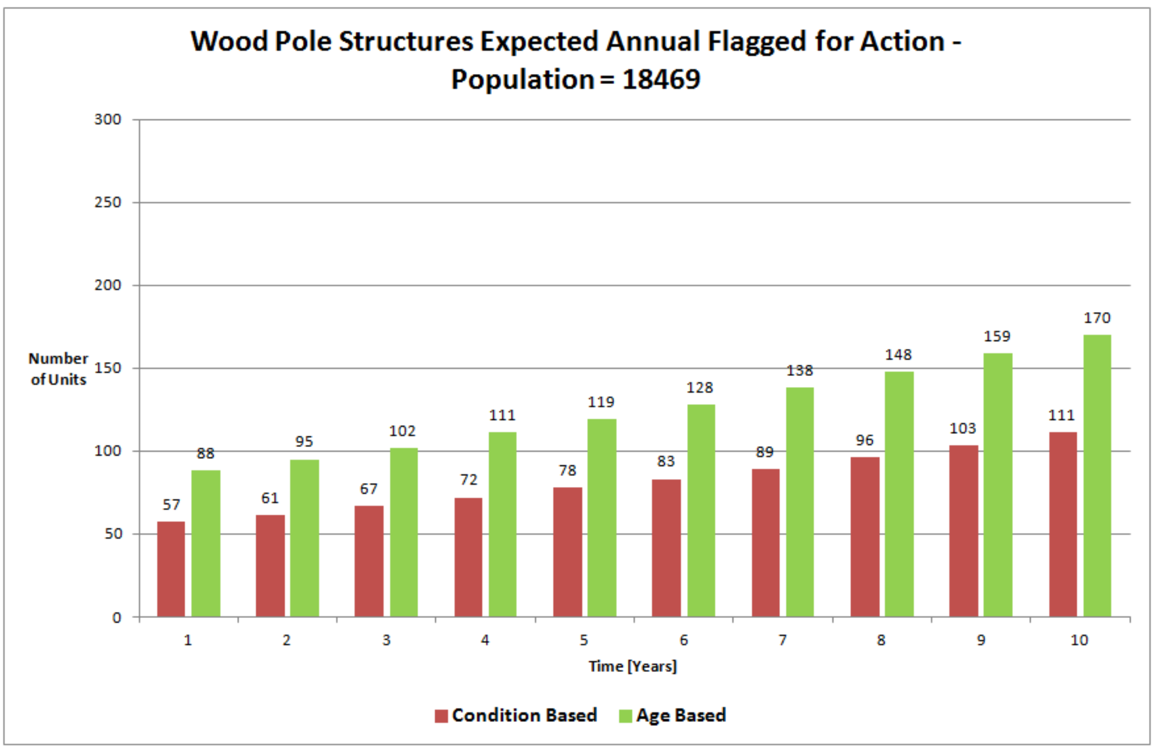

Figure 8 Wood Pole Structures Flagged for Action Plan

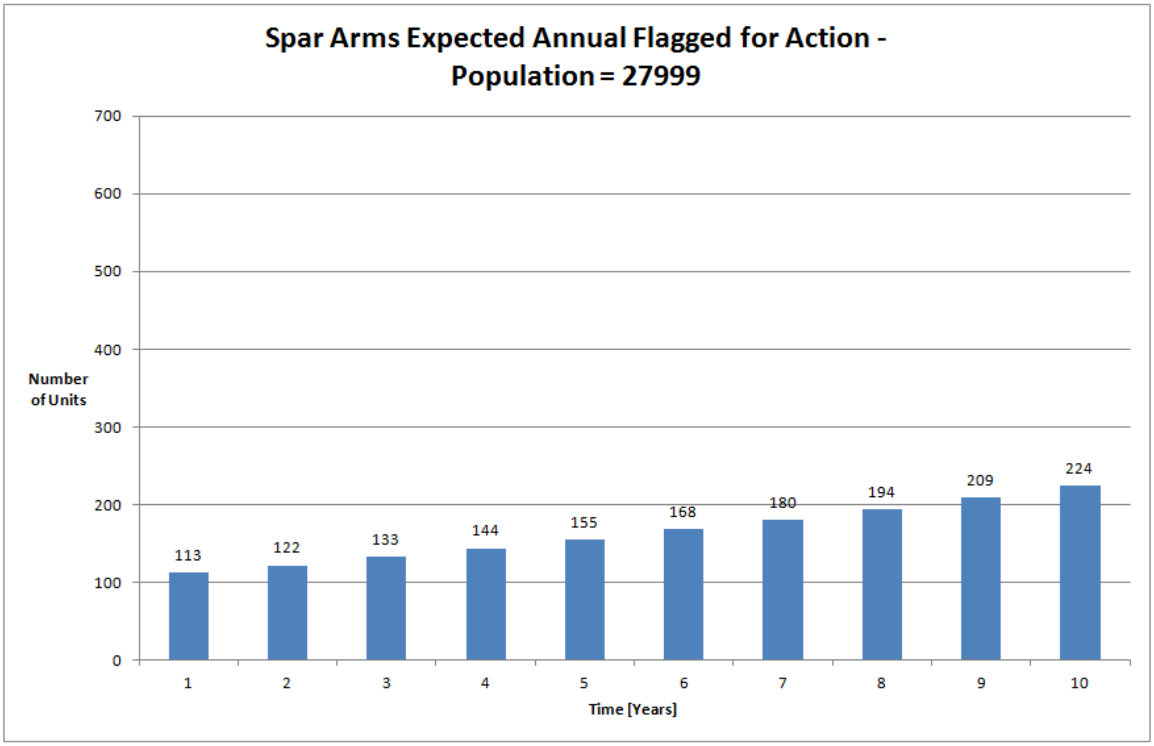

Figure 9 Spar Arms Flagged for Action Plan

For circuit breakers, 3 of them are "flagged for action" in the current year, counting for roughly 1% of the entire breaker population. There are no transformers or LTCs flagged for action in the current year.

For the reactively replaced asset groups such as wood pole structures and SPAR arms, the expected "flagged for action" numbers increase with time, based on the failure rate curve.

For the proactive replacement asset groups such as transformers/LTCs and circuit breakers, the study shows a peak in the expected "flagged for action" numbers after about 12 years.

Priority List

For the proactive replacement asset groups, priority lists presented in the following tables show the top 20 units that are "flagged for action". It takes into account not only the current condition of the unit, but also the potential impact when it fails. Such information is incorporated in determining the optimal and maximum deferral "flagged for action" plans, as shown in Figures 5, 6 and 7.

Table 1 Prioritized List of Transformers/LTCs – 10% Approach

Unique ID (NpHandle)	Location	Age	HI (Final)	Effective Age (HI Final)	POF at Effective Age	Criticality	Risk Factor (Criticality*POF) 10% Approach
[redacted]	[redacted]	8	47.84	59.3	0.38209	1.74	0.663
		35	51.96	56.6	0.27425	1.77	0.486
		40	53.75	55.1	0.22663	1.56	0.354
		10	53.51	55.1	0.22663	1.49	0.338
		45	54.65	54.4	0.19766	1.56	0.309
		36	57.34	51.9	0.14686	1.88	0.275
		38	56.41	52.8	0.15866	1.56	0.248
		12	57.40	51.9	0.14686	1.49	0.219
		40	61.60	48.4	0.08851	1.35	0.120
		49	63.63	46.5	0.06681	1.67	0.111
		36	65.74	44.4	0.04947	1.98	0.098
		38	64.09	45.5	0.05480	1.67	0.091
		27	64.18	45.5	0.05480	1.67	0.091
		18	64.44	45.5	0.05480	1.67	0.091
		11	63.94	46.5	0.06681	1.35	0.090
		44	64.13	45.5	0.05480	1.60	0.088
		34	66.08	43.4	0.04006	1.94	0.078
		13	66.15	43.4	0.04006	1.60	0.064
		21	66.15	43.4	0.04006	1.56	0.063
		44	66.35	43.4	0.04006	1.56	0.063

Table 2 Prioritized List of Transformers/LTCs – 60% Approach

Unique ID (NpHandle)	Location	Age	HI (Final)	Effective Age (HI Final)	POF at Effective Age	Criticality	Risk Factor (Criticality*POF) 60% Approach
[redacted]	[redacted]	8	47.84	59.3	0.38209	**1.74**	**0.663**
[redacted]	[redacted]	43	49.71	58.0	0.32636	**1.88**	**0.612**
[redacted]	[redacted]	43	47.61	59.3	0.38209	**1.60**	**0.610**
[redacted]	[redacted]	37	51.69	56.6	0.27425	**1.81**	**0.495**
[redacted]	[redacted]	35	51.96	56.6	0.27425	**1.77**	**0.486**
[redacted]	[redacted]	37	51.69	56.6	0.27425	**1.46**	**0.400**
[redacted]	[redacted]	19	51.71	56.6	0.27425	**1.46**	**0.400**
[redacted]	[redacted]	18	51.71	56.6	0.27425	**1.46**	**0.400**
[redacted]	[redacted]	34	54.77	54.4	0.19766	**1.94**	**0.384**
[redacted]	[redacted]	40	53.75	55.1	0.22663	**1.56**	**0.354**
[redacted]	[redacted]	10	53.51	55.1	0.22663	**1.49**	**0.338**
[redacted]	[redacted]	38	53.66	55.1	0.22663	**1.49**	**0.338**
[redacted]	[redacted]	41	52.38	55.9	0.24196	**1.35**	**0.328**
[redacted]	[redacted]	37	52.69	55.9	0.24196	**1.35**	**0.328**
[redacted]	[redacted]	45	54.65	54.4	0.19766	**1.56**	**0.309**
[redacted]	[redacted]	36	57.34	51.9	0.14686	**1.88**	**0.275**
[redacted]	[redacted]	37	54.77	54.4	0.19766	**1.35**	**0.268**
[redacted]	[redacted]	38	56.41	52.8	0.15866	**1.56**	**0.248**
[redacted]	[redacted]	30	56.30	52.8	0.15866	**1.49**	**0.237**
[redacted]	[redacted]	12	57.40	51.9	0.14686	**1.49**	**0.219**

Table 3 Prioritized List of Circuit Breakers

NpHandle	Location	Age	HI (Final)	Effective Age (HI Final)	POF at Effective Age	Criticality	Risk Factor (Criticality*POF)
[redacted]		63	20.8	86.0	0.98585	**1.47**	**1.448**
		50	32.2	84.2	0.97441	**1.47**	**1.431**
		63	33.7	83.6	0.96784	**1.47**	**1.422**
		47	49.9	73.0	0.69146	**1.91**	**1.318**
		47	49.9	73.0	0.69146	**1.91**	**1.318**
		31	52.0	70.5	0.59871	**1.66**	**0.992**
		51	60.4	62.7	0.32636	**1.91**	**0.622**
		41	58.2	64.8	0.40129	**1.47**	**0.589**
		51	60.2	62.7	0.32636	**1.78**	**0.581**
		19	59.4	63.8	0.36317	**1.47**	**0.533**
		63	60.3	62.7	0.32636	**1.47**	**0.479**
		38	62.1	60.3	0.27425	**1.47**	**0.403**
		43	63.8	59.1	0.24196	**1.66**	**0.401**
		38	64.7	57.9	0.21186	**1.84**	**0.391**
		53	66.6	55.2	0.17106	**2.03**	**0.347**
		40	64.7	57.9	0.21186	**1.63**	**0.344**
		49	66.5	55.2	0.17106	**1.91**	**0.326**
		41	64.1	57.9	0.21186	**1.53**	**0.324**
		55	65.8	56.6	0.19766	**1.63**	**0.321**

From Table 1 and Table 2, it can be observed that the risk for the top 20 transformers/LTCs is higher in 60% approach than in 10% approach. This indicates that, compared with 10% approach, applying 60% approach might drag down the Health Index for some of these transformers/LTCs entities, thus increasing the probability of failure and risk cost.

The priority list for circuit breakers shows that among the top 20 breakers with higher risk, the first 3 units are are "flagged for action" at the current year, as shown in Figure 7.

Data Assessment Results

For station transformers, tap changers, circuit breakers and wood poles most of the data required to develop a credible Health Index distribution were available. No condition data other than age were available for SPAR arms and for this asset category this is sufficient.

No condition data were available for transmission conductors and steel structures. Kinectrics will perform non-intrusive field testing on a small number of conductors at critical locations (added to the project scope at no additional cost) to assess some critical locations selected by MH.

Except for transformers, no information was available regarding MH-specific failure curves (more information for transformers still needs to be collected but what was already done represents a very good start). MH's technical expertise was used in constructing MH-specific failure curves that were quite different from the typical industry curves.

Criticality tables were modified to reflect MH's view on criticality and parameters required to calculate Criticality Multiples were provided by MH's technical experts.

Conclusions and Recommendations

1. An Asset Condition Assessment was conducted for 9 of MH's key transmission asset categories, namely Substation Transformers/Load Tap Changers (LTCs) (3 primary voltage levels), Circuit Breakers (4 types), Wood Pole Structures and SPAR Arms. For each asset category, the Health Index distribution was determined and a condition-based "flagged for action" replacement plan developed.

2. Transformers/LTCs and circuit breakers have the vast majority of their population generally in good to very good condition and their "effective age" was in most cases less tha the corresponding chronological age.

3. The approach to estimate the combined Health Index of Trransformers/LTCs depends on the maintenance and replacement strategy of MH. This means a decision on whether to replace both transformer and LTC or only LTC should be made on individual basis.

4. Almost all the wood poles and SPAR arms are generally in good or very good condition. The pole treatment appears to be effective as the MH-specific failure curves based on the information from MH technical experts indicated longer than typical lives. Moreover, using the "effective age" resulted in fewer expected replacements than when using chronological age.

5. It is important to note that the "flagged for action" plan presented in this study is based solely on asset condition and that there are numerous other considerations that may influence MH's Asset Management Plan.

6. MH has enough available data to determine a credible Health Index distribution for most of station transformers. For circuit breakers and wood poles however, only 50-60% of the population have sufficient data for yielding credible Health Index. For SPAR arms only age information is available. It is recommended that MH continues with the data collection effort and also start accumulating information required to develop failure curves by recoding age of assets when they are replaced, either due to failure or because they presented higher than acceptable risk.

7. MH needs to embark on a regular conductor testing program using a combination of conventional laboratory testing and non-intrusive LineVue field testing in order to increase the sample size with known data to a point that some projections on the overall population could be made.

8. It is recommended that MH start steel structure climbing inspections (a suggested climbing inspection form which also includes footing assesswement is shown in Appendix B) and start ultrasonic inspections of buried footings to determine the extent of their deterioration (the methodology description is also shown in Appendix B).

9. The “flagged for action” results should be used as a starting point in developing condition based long-term capital replacement plan and resourcing requirements. Actual replacement plan should also take into account factors like obsolescence, system growth, regulatory requirements, etc.

10. For the next 1-2 year specific units should be identified for replacement or refurbishment while total expected levels of capital expenditures for each asset category will suffice for subsequent years capital planning.

11. Assuming that replacement is the best course of action, EOL economic assessment should be used to identify the most economical replacement for each major unit, such as station transformers and breakers.

12. Multi-purpose software is required to store the data, annually update results, prioritize investments and analyze impact of “what if” capital replacement scenarios.

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I INTRODUCTION

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I Introduction

Manitoba Hydro Inc. (MH) is a Crown Corporation and the major energy utility of province of Manitoba. From the head office in downtown Winnipeg, Manitoba, MH serves 542,000 electric customers throughout Manitoba.

Kinectrics Inc. (Kinectrics) is an independent consulting engineering company with the advantage of almost 100 years of expertise gained as part of one of North America's largest integrated electric power companies. Kinectrics has a depth of experience in the area of transmission and distribution systems and has become a prime source of Asset Management and Asset Condition services to some of the largest power utilities in North America.

In late 2011, MH selected and engaged Kinectrics Inc (Kinectrics) to perform an Asset Condition Assessment (ACA) on MH's key distribution assets.

The Asset Condition Assessment Report summarizes the methodology, demonstrates specific approaches used in this project, and presents the resultant findings and recommendations.

I.1 Objective and Scope of Work

The assets in this study are categorized as follows:

- Substation Transformers, together with associated Load Tap Changers (3 categories based on the primary voltage)
- Circuit Breakers (4 categories based on the breaker type)
- Wood Pole Structures
- SPAR Arms

For each asset category, the ACA included the following tasks:

- Gathering relevant condition data
- Developing a Health Index Formula
- Calculating the Health Index for each asset
- Determining the Health Index distribution
- Developing a 10/20-year condition-based replacement plan
- Identifying and prioritizing the data gaps for each group

I.2 Deliverables

The deliverable in this study is a Report that includes the following information:

- Description of methodology for condition assessment of replacement plan (Section II)

- Description of the data assessment procedure (Section III)
- For each asset category the following are included (VI Appendix A: Results and Findings for Each Asset Category: Section 1 – Section 4):
  - Short description of the asset groups and a discussion of asset degradation and end-of-life issues
  - Age distribution
  - Health Index formulation
  - Health Index distribution
  - Condition-based Replacement Plan
  - Assessment of data availability by means of a Data Availability Indicator (DAI) and a Data Gap analysis

II ASSET CONDITION ASSESSMENT METHODOLOGY

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II Asset Condition Assessment Methodology

The Asset Condition Assessment (ACA) Methodology involves the process of determining asset Health Index, as well as developing a Condition-Based Replacement Plan for each asset group. The methods used are described in the subsequent sections.

II.1 Health Index

Health Indexing quantifies equipment condition based on numerous condition parameters that are related to the long-term degradation factors that cumulatively lead to an asset's end of life. The Health Index is an indicator of the asset's overall health and is typically given in terms of percentage, with 100% representing an asset in brand new condition. Health Indexing provides a measure of long-term degradation and thus differs from defect management, whose objective is finding defects and deficiencies that need correction or remediation in order to keep an asset operating prior to reaching its end of life.

Condition parameters are the asset characteristics or properties that are used to derive the Health Index. A condition parameter may be comprised of several sub-condition parameters. For example, a parameter called "Oil Quality" may be a composite of parameters such as "Moisture", "Acid", "Interfacial Tension", "Dielectric Strength" and "Colour".

In formulating a Health Index, condition parameters are ranked, through the assignment of *weights*, based on their contribution to asset degradation. The *condition parameter score* for a particular parameter is a numeric evaluation of an asset with respect to that parameter.

Health Index (HI), which is a function of scores and weightings, is therefore given by:

$$HI = \frac{\sum_{m=1}^{\forall m} \alpha_m (CPS_m \times WCP_m)}{\sum_{m=1}^{\forall m} \alpha_m (CPS_{m.\max} \times WCP_m)} \times \frac{1}{CPF_{\max}} \times DR$$

Equation 1

where

$$CPS = \frac{\sum_{n=1}^{\forall n} \beta_n (CPF_n \times WCPF_n)}{\sum_{n=1}^{\forall n} \beta_n (CPF_{\max} \times WCPF_n)}$$

Equation 2

CPS	Condition Parameter Score
WCP	Weight of Condition Parameter
α_m	Data availability coefficient for condition parameter
CPF	Sub-Condition Parameter Score
WCPF	Weight of Sub-Condition Parameter
β_n	Data availability coefficient for sub-condition parameter
DR	De-Rating Multiplier

The scale that is used to determine an asset's score for a particular parameter is called the *condition criteria*. For this project, a condition criteria scoring system of 0 through 4 is used. A score of 0 represents the worst score while 4 represents the best score. I.e. $CPF_{max} = 4$.

II.1.1 Health Index Example

Consider the asset class "Oil Circuit Breaker". The condition and sub-condition parameters, as well as their weights are shown on Table 4.

Table 4 Oil Circuit Breaker Condition and Sub-Condition Parameters

Health Index Formula for Oil Circuit Breakers			
Condition Parameters		**Sub-Condition Parameters**	
Name	**Weights (WCP)**	**Name**	**Weights (WCPF)**
Operating Mechanism	14	Lubrication	9
		Linkage	5
		Cabinet	2
Contact Performance	7	Closing Time	1
		Trip Time	3
		Contact Resistance	1
		Arcing Contact	1
Arc Extinction	9	Moisture	8
		Leakage	1
		Tank	2
		Oil Level	1
		Oil Quality	8
Insulation	2	Insulation	1
Service Record	5	Operating Counter	2
		Loading	2
		Age	1

Assume a parameter scoring system of 0 though 4, where 0 and 4 represent the "worst" and "best" scores respectively. The maximum score for any condition or sub-condition parameter (maximum CPS and CPF) is therefore "4".

Scores are determined using *condition criteria*. The criterion defines the score of a particular parameter. Consider, for example, the age criteria given on Table 5. An asset that is 35 years old will receive a score of "2" for "Age".

Table 5 Age Criteria

Parameter Score	Condition Description
4	0-19
3	20-29
2	30-39
1	40-44
0	45+

Table 6 shows a sample Health Index evaluation for a particular oil breaker. The sub-condition parameter scores (CPFs) shown are assumed values between 0 through 4.

The Condition Parameter Score (CPS) is evaluated as per Equation 2. The Health Index (HI) is calculated as per Equation 1. As no de-rating factors are defined, there is no multiplier for the final Health Index.

Table 6 Sample Health Index Calculation

Condition Parameters	**Operating Mechanism**			**Contact Performance**			**Arc Extinction**			**Insulation**			**Service Record**		
Sub-Condition Parameters	Sub-Condition Parameter	CPF	Weight (WCPF)	Sub-Condition Parameter	CPF	Weight (WCPF)	Sub-Condition Parameter	CPF	Weight (WCPF)	Sub-Condition Parameter	CPF	Weight (WCPF)	Sub-Condition Parameter	CPF	Weight (WCPF)
Scores (CPF) Weights (WCPF)	Lubrication	4	9	Closing Time	2	1	Moisture	4	8	Insulation	4	1	Operating Counter	3	2
	Linkage	2	5	Trip Time	3	3	Leakage	3	1				Loading	4	2
	Cabinet	3	2	Contact Resistance	2	1	Tank	3	2				Age	3	1
				Arcing Contact	3	1	Oil Level	2	1						
							Oil Quality	3	8						
Condition Parameter Score (CPS)	Operating Mechanism CPS (4*9 + 2*5 + 3*2) / (9+5+2) = 3.25			Contact Performance CPS (2*1 + 3*3 + 2*1 + 3*1) / (1+3+1+1) = 2.67			Arc Extinction CPS (4*8 + 3*1 + 3*2 + 2*1 + 3*8) / (8+1+2+1+8) = 3.35			Insulation CPS (4*1) / (1) = 4			Service Record CPS (3*2 + 4*2 + 3*1) / (2+2+1) = 3.4		
Weights (WCP)	*Weight = 14*			*Weight = 7*			*Weight =9*			*Weight = 2*			*Weight = 5*		
Health Index (HI)	HI = (3.25*14 + 2.67*7 + 3.35*9 + 4*2 + 3.4*5) / ((14 + 7 + 9 + 2 + 5)*4) = **80.6%**														

II.1.2 Health Index Results

As stated previously, an asset's Health Index is given as a percentage, with 100% representing "as new" condition. The Health Index is calculated only if there is sufficient condition data. The subset of the population with sufficient data is called the *sample size*. Results are generally presented in terms of number of units and as a percentage of the sample size. If the sample size is sufficiently large and the units within the sample size are sufficiently random, the results may be extrapolated for the entire population.

The Health Index distribution given for each asset group illustrates the overall condition of the asset group. Further, the results are aggregated into five categories and the categorized distribution for each asset group is given. The Health Index categories are as follows:

Very Poor	Health Index < 25%
Poor	25 ≤ Health Index < 50%
Fair	50 ≤ Health Index <70%
Good	70 ≤ Health Index <85%
Very Good	Health Index ≥ 85%

Note that for critical asset groups, such as Station Transformers, the Health Index of each individual unit is given.

II.2 **Condition-Based Replacement Methodology**

The Condition-Based Replacement plan outlines the number of units that are projected to be replaced in the next 20 years. The numbers of units are estimated using either a *proactive* or *reactive* approach. In the reactive approach, units are considered for replacement prior to failure, whereas the reactive approach is based on expected failures per year.

Both approaches consider asset failure rate and probability of failure. The failure rate is estimated using the method described in the subsequent section.

II.2.1 Failure Rate and Probability of Failure

Where failure rate data is not available, a frequency of failure that grows exponentially with age provides the best model. This is based on the Gompertz-Makeham law of mortality. The original form of the failure function is:

$$f = \gamma e^{\beta t}$$

Equation 3

f	= failure rate per unit time
t	= time
γ, β	= constant that control the shape of the curve

Depending on its application, there have been various forms derived from the original equation. Based on Kinectrics' expertise in failure rate study of multiple power system asset groups, the following variation of the failure rate formula is adopted:

$$f(t) = e^{\beta(t-\alpha)}$$

Equation 4

f = failure rate of an asset (percent of failure per unit time)
t = age (years)
α, β = constant parameters that control the rise of the curve

The corresponding probability of failure function is therefore:

$$P_f(t) = 1 - e^{-(f - e^{-\alpha\beta})/\beta}$$

Equation 5

P_f = cumulative probability of failure

Different asset groups experience different failure rates and therefore different probabilities of failure. As such, the shapes of the failure and probability curves are different. The parameters α and β are used to control the location and steepness of the exponential rise of these curves. For each asset group, the values of these constant parameters were selected to reflect typical useful lives for these assets.

Consider, for example, an asset class where at the ages of 25 and 65, the asset has cumulative probabilities of failure of 10% and 99% respectively. It follows that using Equation 5, α and β are calculated as 74 and 0.093 respectively. As such, for this asset class the cumulative probability of failure equation is:

$$P_f(t) = 1 - e^{-(e^{\beta(t-\alpha)} - e^{\alpha\beta})/\beta} = 1 - e^{-(e^{0.093(t-74)} - e^{-6.882})/0.093}$$

The failure rate and probability of failure graphs are as shown:

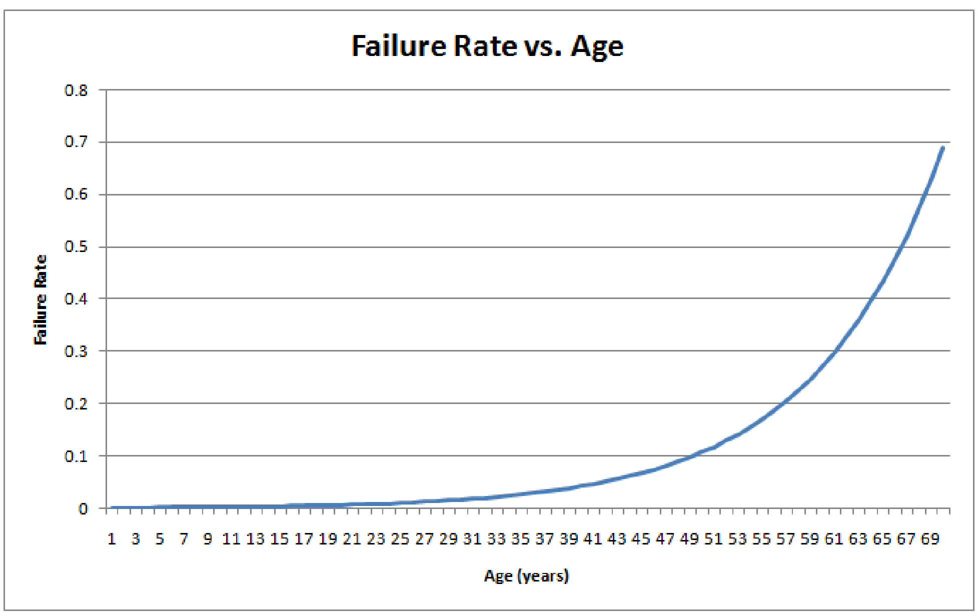

Figure 10 Failure Rate vs. Age

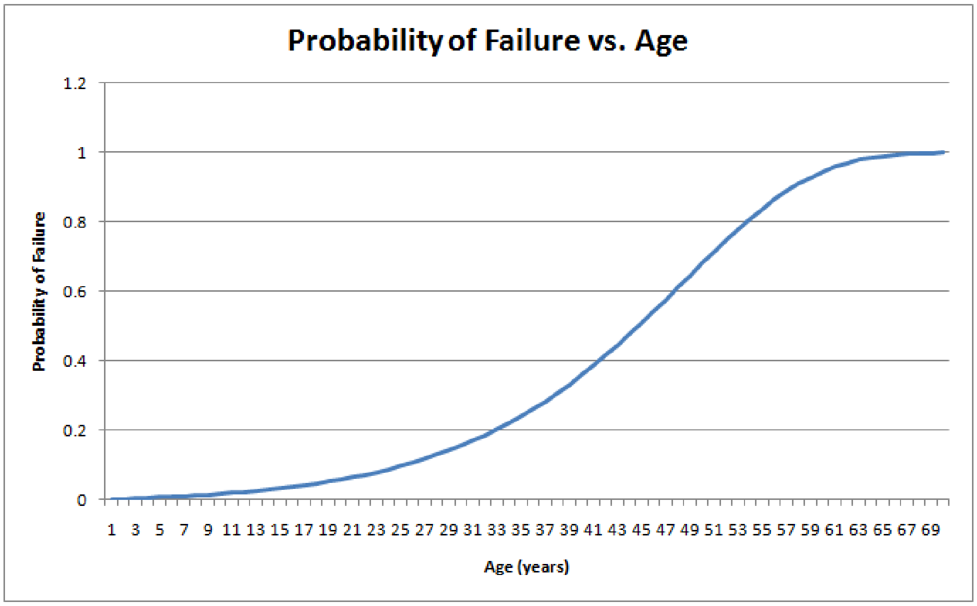

Figure 11 Probability of Failure vs. Age

II.2.2 Projected Replacement Plan Using a Reactive Approach

Because their consequences of failure are relatively small, many types of distribution assets are reactively replaced.

For such asset types, the number of units expected to be replaced in a given year are determined based on the asset's failure rates. The number of failures per year is given by Equation 4:

$$f(t) = e^{\beta(t-\alpha)}$$

with α and β determined from the probability of failure of each asset class.

An example of such replacement plan is as follows: Consider an asset distribution of 100 - 5 year old units, 20 – 10 year old units, and 50 - 20 year old units. Assume that the failure rates for 5, 10, and 20 year old units for this asset class are f_5 = 0.02, f_{10} = 0.05, f_{20} = 0.1 failures / year respectively. In the current year, the total number of replacements is 100(.02) + 20(0.05) + 50(0.1) = 2 + 1 + 5 = 8.

In the following year, the expected asset distribution is, as a result, as follows: 8 – 1 year old units, 98 – 6 year old units, 19 – 11 year old units, and 45 - 21 year old units. The number of replacements in year 2 is therefore 8(f_1) + 19(f_6) + 45(f_{11})+ 45(f_{21}).

Note that in this study the "age" used is in fact "effective age", or condition-based age as opposed to the chronological age of the asset.

II.2.3 Projected Replacement Plan Using a Proactive Approach

For certain asset classes, the consequence of asset failure is significant, and, as such, these assets are proactively replaced prior to failure. The proactive replacement methodology involves relating an asset's Health Index to its probability of failure by considering the stresses to which it is exposed.

Relating Health Index and Probability of Failure

Failure of an asset occurs when the stress to which an asset is exposed exceeds its strength. Assuming that stress is not constant, and that stress is normally distributed, the probability of stress exceeding asset strength leads to the probability of failure. This is illustrated in the figure below. A vertical line represents condition or strength (Health Index) and the area under the curve to the right of the Health Index line represents the probability of failure.

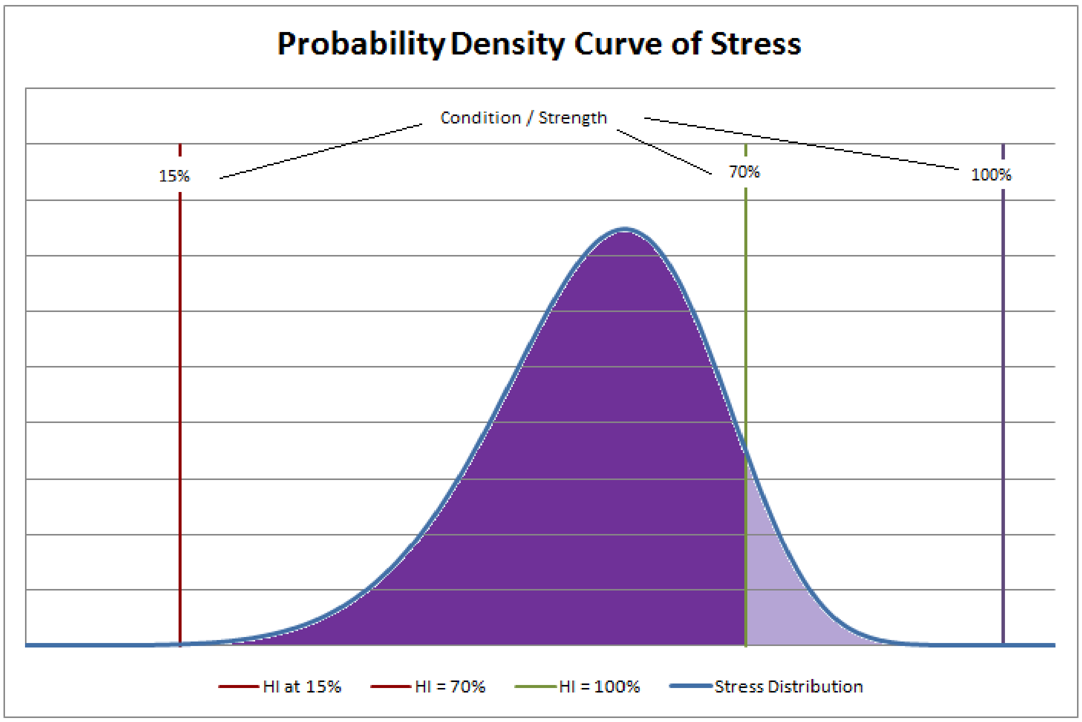

Figure 12 Stress Curve

Two points of Health Index and probability of failure are needed to generate the probability of failure at other Health Index values. A Health Index of 100% represents an asset that is in brand new condition and a Health Index of 15% represents the asset's end of life. The 100% and 15% conditions are plotted on the stress curve by finding the points at which the areas under the stress curve are equal to $P_{f\ 100\%}$(age at 100% Health Index) and $P_{f\ 15\%}$ = P_f(age at 15% Health Index). By moving the vertical line left from 100% to 15%, the probabilities of failure for other Health Indices can be found.

The probability of failure at a particular Health Index is found from plotting the Health Index on the X-axis and the area under the probability density curve to the right of the Health Index line on the Y-axis as shown on the graph of the figure below.

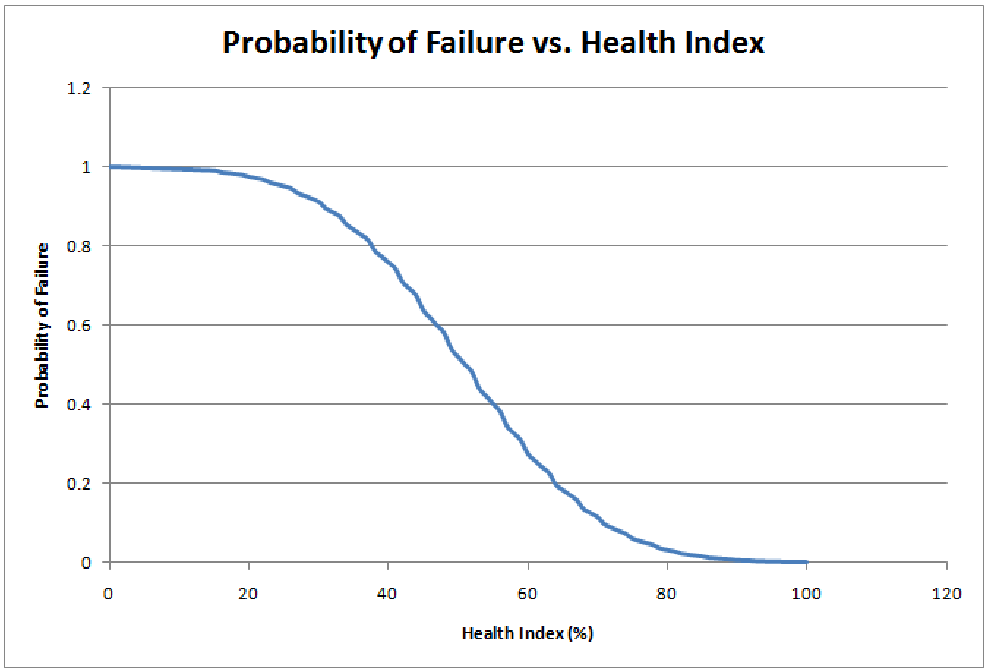

Figure 13 Probability of Failure vs. Health Index

Relating Health Index to Effective Age

Once the relationship between probability of failure and Health Index has been found, the "effective age" of an asset can be determined. The "effective age" is different from chronological age in that it is based on the asset's condition and the stresses that are applied to the asset.

The probability of failure associated with a specific Health Index can be found using the Probability of Failure vs. Health Index (Figure 13) and Probability of Failure vs. Age (Figure 11). The probability of failure at a particular Health Index can be found from Figure 13. The same probability of failure is located on Figure 11, and the effective age is on the horizontal axis of Figure 11. See example on the figure below where a Health Index of 60% corresponds to an effective age of 35 years.

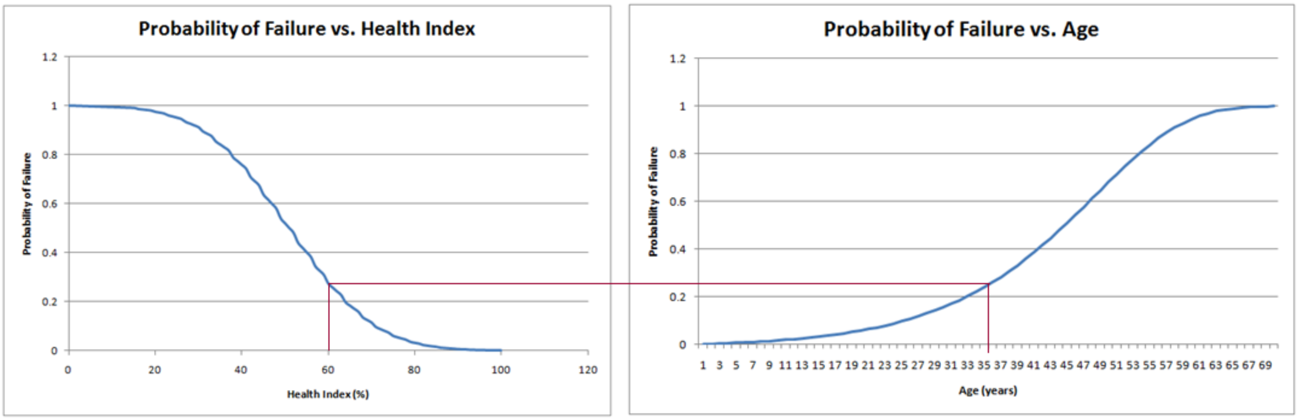

Figure 14 Effective Age

Condition-Based Replacement Plan

In order to develop a replacement plan, the risk of failure of each unit must be quantified. Risk is the product of a unit's probability of failure and its consequence of failure.

The probability of failure is determined by an asset's Health Index while the metric used to measure consequence of failure is referred to as *criticality*.

Criticality may be determined in numerous ways, with monetary consequence or degree of risk to corporate business values being examples. The higher the criticality value assigned to a unit, the higher is it's consequence of failure.

A unit becomes a candidate flagged for action when either its probability of failure (POF) reaches a pre-set limit, or its risk, product of its *probability of failure* and *criticality*, is greater than a pre-set limit, depending on the type of flagged for action plan. The probability of failure is as determined by the Health Index. Criticality is determined as shown in the following section.

It is assumed in this study that each asset group has a base criticality value, Criticality_{min}. The individual units in the asset group are assigned Criticalities that are multiples of Criticality_{min}. A unit becomes a candidate for replacement when its risk value, the product of its probability of failure and criticality, is greater than or equal to 1.

--- Criticality

The minimum criticality, Criticality_{min}, is 1.25. This value is selected such that a unit with a probability of failure of 80% becomes a candidate for replacement (i.e. 80% * 1.25 = 1). The maximum criticality, $\text{Criticality}_{max,}$ is twice the base criticality ($\text{Criticality}_{max,} = 1.25*2 = 2.5$).

Each unit's criticality is defined as follows:

$$Criticality = (Criticality_{max} – Criticality_{min})*Criticality\_Multiple + Criticality_{min}$$

where the Criticality_Multiple (CM) is defined by criticality factors, weights, and scores:

$$CM = \frac{\sum_{CF=1}^{\forall CF}(CFS_{CF} \times WCF_{CF})}{\sum_{CF=1}^{\forall CF}(WCF_{CF})}$$

Where

CFS	Criticality Factor Score
WCF	Weight of Condition Factor

The following table shows an example of criticality matrix for an sset group.

Table 7 Example of Criticality Matrix

Criticality Factor (CF)	Description	Weight (WCF)	Score (CFS)
Location (near waterbeds)	Environmental stewardship is of the utmost importance.	35	No = 0 Yes = 1
Number of Customers	Reliable service to the greatest number of customers is vital. Does the unit serve more than 1000 customers?	25	Low = 0 High = 1
Bus Structure (open/enclosed)	Is the unit under consideration located in an open-bus scheme within a residential subdivision? Can public safety be affected if a catastrophic failure were to occur?	20	No = 0 Yes = 1
Backup Capabilities	Can the unit under consideration be backed-up with the portable?	10	Yes =0 No = 1
Oil Containment	Does the unit have Oil Containment capabilities?	5	Yes =0 No = 1
Primary Protection	Is the unit's primary protection a fuse or breaker?	5	Breaker = 0 Fuse = 1

The following tables show examples of criticality calculation.

Table 8 Criticality Calculation Examples

	Example 1			Example 2			Example 3		
Criticality Factor	**Values**	**CFS**	**CFS x WCF**	**Values**	**CFS**	**CFS x WCF**	**Values**	**CFS**	**CFS x WCF**
Location (near waterbeds)	No	0	0	Yes	1	35	Yes	1	35
Number of Customers	Low	0	0	High	1	25	High	1	25
Bus Structure (open/enclosed)	No	0	0	No	0	0	Yes	1	20
Backup Capabilities	Yes	0	0	Yes	0	0	No	1	10
Oil Containment	Yes	0	0	Yes	0	0	No	1	5
Primary Protection	Breaker	0	0	Breaker	0	0	Fuse	1	5
	Criticality Multiple		0	Criticality Multiple		0.6	Criticality Multiple		1
	Criticality$_{Example1}$		(2.5-1.25)*0 + 1.25 = 1.25	**Criticality$_{Example2}$**		(2.5-1.25) *0.6 + 1.25 = 2	**Criticality$_{Example3}$**		(2.5-1.25)*1 + 1.25 =2.5

In the example shown below, Asset 1 and Asset 2 are candidates for replacement.

Table 9 Sample Replacement Ranking

Asset Name	Age	Health Index (HI)	Consequence of Failure (Criticality)	Probability of Failure (POF) Corresponding to HI	Risk (POF*Criticality)	Replacement Ranking
Asset 1	41	30.00%	2	78.20%	1.564	1
Asset 2	29	30.00%	1.5	78.20%	1.173	2
Asset 3	37	30.00%	1	78.20%	0.782	3
Asset 4	42	50.00%	2	12.80%	0.256	4
Asset 5	18	50.00%	1.5	12.80%	0.192	5
Asset 6	20	50.00%	1	12.80%	0.128	6

II.3 Optimal and Max Deferral Flagged for Action Plans

The optimal Condition-Based ”flagged for action” plan shows the optimal time of replacement which is when the probability of failure is equal to or exceeds a specific limit (typically 80%). As it may not always be feasible to replace as per the optimal plan, a maximum deferred replacement plan may allow a utility to better manage capital investments, some of the units with the probability of failure exceeding 80% could.be “flagged for action” at a later date (but not to exceed probability of failure of typically 95%), based upon unit’s criticality. The latest possible 'flaged or action" date is when the unit's risk exceeds 1.25 (the lowest criticality multiple) x the highest acceptable probability of failure (e.g. 95%).

The deferred flagged for action plan for proactively replaced assets allows for investments to be accelerated or deferred for a limited number of years. There is no deferred flagged for action plan for reactively replaced assets.

III DATA ASSESSMENT

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III Data Assessment

The condition data used in this study were obtained from Manitoba Hydro and included the following:

- Asset Properties (e.g. age, PCB content, location information)
- Test Results (e.g. Oil Quality, DGA) in StarLIMS, IPM databases
- Corrective Maintenance Records in RMS, TLine database
- Preventive Maintenance Records in IPM database

There are two components that assess the availability and quality of data used in this study: data availability indicator (DAI) and data gap.

III.1 Data Availability Indicator (DAI)

The Data Availability Indicator (DAI) is a measure of the amount of condition parameter data that an asset has, as measured against the condition parameters included in the Health Index formula. It is determined by the ratio of the weighted condition parameters score and the subset of condition parameters data available for the asset over the "best" overall weighted, total condition parameters score. The formula is given by:

$$HI = \frac{\sum_{m=1}^{\forall m} (DAI_{CPS\,m} \times WCP_m)}{\sum_{m=1}^{\forall m} (WCP_m)}$$

Equation 6

where

$$DAI_{CPSm} = \frac{\sum_{n=1}^{\forall n} \beta_n (CPF_{n\max} \times WCFn)}{\sum_{n=1}^{\forall n} (CPF_{n.\max} \times WCPFn)}$$

Equation 7

DAI_{CPSm}	Data Availability Indicator for Condition Parameter m with n Condition Parameter Factors (CPF)
β_n	Data availability coefficient for sub-condition parameter (=1 when data available, =0 when data unavailable)
$WCPF_n$	Weight of Condition Parameter Factor n
DAI	Overall Data Availability Indicator for the m Condition Parameters
WCP_m	Weight of Condition Parameter m

For example, say an asset has condition parameters A, B, and C with weights of 1, 2, and 3 respectively. Condition parameter scores are rated from 0 through 4, so the maximum score is

4. The maximum product of score and weight is therefore given by (maximum score)*weight. Thus, for conditions A, B, and C, the maximum products are 4*1 = 4, 4*2 = 8, and 4*3 = 12 respectively. It follows that the sum of maximum products for all possible conditions = 4+8+12 = 24. If asset X only has data for conditions A and B, the sum of maximum product of available conditions = 4+8 = 12. Its DAI is therefore 12/24 = 50%.

An asset with all condition parameter data represented will, by definition, have a DAI value of 100%. In this case, an asset will have a DAI of 100% regardless of its Health Index score.

It is important to note that DAI is measured against the parameters make up the Health Index formula and that the Health Index formula is based only on data that is collected by MH. There are additional parameters are important indicators of degradation that may not be collected (discussed in Section III.2). An asset may have a high DAI but the quality of parameters used in the Health Index formula may need improvement. When the condition parameters used in the Health Index formula are of good quality with little data gaps and the DAI is high, there will be a high degree of confidence that the Health Index score accurately reflects the asset's condition.

III.2 Data Gap

The Health Index formulations developed and used in this study are based only on MH's available data. There are additional parameters or tests that MH may not collect but that are important indicators of the deterioration and degradation of assets. The set of unavailable data are referred to as data gaps. I.e. a data gap is the case where none of the units in an asset group has data for a particular item. The situation where data is provided for only a sub-set of the population is not considered as a data gap.

As part of this study, the data gaps of each asset category are identified. In addition, the data items are ranked in terms of importance. There are three priority levels, the highest being most indicative of asset degradation.

Priority	Description	Symbol
High	Critical data; most useful as an indicator of asset degradation	☆☆☆
Medium	Important data; can indicate the need for corrective maintenance or increased monitoring	☆☆
Low	Helpful data; least indicative of asset deterioration	☆

It is generally recommended that data collection be initiated for the most critical items because such information will result in higher quality Health Index formulas.

The more critical and important data included in the Health Index formula of a certain asset group, and the higher the Data Availability Indicator of a particular unit in that group, the higher the confidence in the Health Index calculated for the particular unit.

If an asset group has significant data gaps and lacks good quality condition, there is less confidence that the Health Index score of a particular unit accurately reflects its condition, regardless of the value of its DAI.

To facilitate the incorporation of data gap items into improved Health Index formulas for future assessments, the data gaps items are presented in this report as sub-condition parameters. For each item, the parent condition parameter is identified. Also given are the object or component addressed by the parameter, a description of what to assess for each component or object, and the possible source of data.

The following is an example for “Cooling” on a Substation Transformer.

Data Gap (Sub-Condition Parameter)	**Parent Condition Parameter**	**Priority**	**Object or Component Addressed**	**Description**	**Source of Data**
Cooling	Cooling	☆ ☆ ☆	Cooling oil	Abnormal oil flow	Visual Inspection / On-site Reading
				Abnormal oil pump motor	
			Cooling fan	Abnormal fan operation	
			Radiator	Plugged radiator	
			Valves	Broken valves	
			Transformer tank	High top oil temperature	
			Winding	High winding temperature	

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IV RESULTS

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IV Results

This section summarizes the findings of this study.

Health Index Results

A summary of the Health Index evaluation results is shown in Table 10. The population and sample size, or number of assets with sufficient data for Health Indexing, are given. For each group the Health Index Distribution, total number of units in Poor and Very Poor Condition, and average Health Index are shown. Also given are the average age of each group and the percentage of the population for which age is available.

It can be seen from the results that for both transformers and LTCs are generally in a good condition with no units "flagged for action" for several years. Going forward, the units at 138 kV are of somewhat more concern than those at 115 kV or 230 kV.

For circuit breakers, although generally in a good condition, some of the bulk oil breakers are of more concern than the other 3 types and are "flagged for action" in the current year.

Wood pole structures and spar arms are generally in a good condition.

Condition Based "Flagged or Action" Plan

The condition-based replacement plan for the first year and the assets"flagged for action"are shown for each asset group in Table 11. Table 12 shows the 20 year optimized and levelized replacement plan.

It is important to note that the "flagged for action" plan suggested in this study is based solely on asset condition. It uses a probabilistic, non-deterministic, approach and as such can only show expected failures or probable number of units "flagged for action". While the Condition-Based "flagged for action" Plan can be used as a guide or input to MH's Asset Management Plan, it is not expected that it be followed directly or as the final deciding factor in making sustainment capital decisions. There are numerous other factors and considerations that will influence MH's asset management decisions, such as obsolescence, system growth, regulatory requirements etc.

MH's most significant expected replacements were found to be for wood pole structures and SPAR arms. 57 wood pole structures and approximately 113 SPAR arms are candidates flagged for action in the current year. Also 6 circuit breakers (slightly less than 2% of population) are flagged for action in the current year.

Table 10 Health Index Results Summary

Asset	Sub-Category	Population	Sample Size	Health Index Distribution (Units)					Total of Poor and Very Poor (Units)	Average Health Index	Age Availability (% of Population with Age Data)	Average Age
				Very Poor (< 25%)	Poor (25 - <50%)	Fair (50 - <70%)	Good (70 - <85%)	Very Good (≥ 85%)				
Substation Transformers	115 kV	156	156	0	0	13	57	86	0	84%	99%	37
	138 kV	31	31	0	0	7	20	4	0	76%	100%	23
	230 kV	76	76	0	1	9	22	44	1	84%	100%	27
Substation Load Tap Changers (LTCs)	115 kV	72	72	0	0	4	14	54	0	84%	100%	25
	138 kV	18	18	0	0	2	0	16	0	82%	100%	19
	230 kV	80	80	0	2	8	9	61	2	84%	100%	27
Substation Transformers/LTCs (10% Approach)	115 kV	156	156	0	0	13	57	86	0	84%	-	-
	138 kV	31	31	0	0	7	20	4	0	77%	-	-
	230 kV	76	76	0	1	9	21	45	1	84%	-	-
Circuit Breakers	Air Blast	30	30	0	0	8	16	6	0	74%	100%	45
	SF6	147	146	0	0	8	36	102	0	88%	99%	12
	Bulk Oil	114	114	1	4	34	69	6	5	71%	99%	48
	Minimum Oil	75	75	0	0	6	19	50	0	86%	99%	34
Wood Pole Structures	Condition Based	18469	18047	6	8	0	1230	16803	14	92%	98%	39
	Age based	18469	18047	6	8	0	1354	16679	14	95%	100%	39
Spar Arms	Age Based	27999	27217	6	8	0	1408	25795	14	96%	97%	39

Table 11 Year 1 Condition Based Replacements

Asset	Sub-Category	Optimal Condition-Based Replacement Plan for Year 1 [Number of Units]	Replacement Strategy
Substation Transformers/LTCs	115 kV	0	proactive
	138 kV	0	proactive
	230 kV	0	proactive
Circuit Breakers	Air Blast	0	proactive
	SF6	0	proactive
	Bulk Oil	3	proactive
	Minimum Oil	0	proactive
Wood Pole Structures	-	57	reactive
Spar Arms	-	113	reactive

Table 12 Twenty Year Condition/Age Based Replacement Plan

Asset	Sub-Category	Replacement Strategy	Replacement Year																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Substation Transformers / LTCs	115 kV	Optimal	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0
		Deferred	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0
	138 kV	Optimal	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
		Deferred	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	230 kV	Optimal	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2	0	0	1
		Deferred	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2	0	0	0
Circuit Breakers	Air Blast	Optimal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		Deferred	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SF6	Optimal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
		Deferred	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bulk Oil	Optimal	3	0	0	2	0	0	0	0	0	0	0	0	1	1	3	0	1	1	0	5
		Deferred	3	0	0	2	0	0	0	0	0	0	0	0	1	1	2	1	0	1	0	5
	Minimum Oil	Optimal	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1
		Deferred	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1
Wood Pole Structure	-	Optimal	57	61	67	72	78	83	89	96	103	111										
Spar Arms	-	Optimal	113	122	133	144	155	168	180	194	209	224										

Data Assessment Results

For station transformers, tap changers, circuit breakers and wood poles most of the data required to develop a credible Health Index distribution were available. No condition data other than age were available for SPAR arms and for this asset category this is sufficient.

No condition data were available for transmission conductors and steel structures. Kinectrics will perform non-intrusive field testing on at limited a small number of conductors at critical locations (added to the project scope at no additional cost) to assess some critical locations selected by MH.

Except for transformers, no information was available regarding MH-specific failure curves (more information for transformers still needs to be collected but what was already done represents a very good start). MH's technical expertise was used in constructing MH-specific failure curves that were quite different from the typical industry curves.

Criticality tables were modified to reflect MH's view on criticality and attributes required to calculate Criticality Multiples were provided by MH's technical experts.

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V CONCLUSIONS AND RECOMMENDATIONS

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V Conclusions and Recommendations

1. An Asset Condition Assessment was conducted for 9 of MH's key transmission asset categories, namely Substation Transformers/Load Tap Changers (LTCs) (3 primary voltage levels), Circuit Breakers (4 types), Wood Pole Structures and SPAR Arms. For each asset category, the Health Index distribution was determined and a condition-based "flagged for action" replacement plan developed.

2. Transformers/LTCs and circuit breakers have the vast majority of their population generally in good to very good condition and their "effective age" was in most cases less tha the corresponding chronological age.

3. The approach to estimate the combined Health Index of Trransformers/LTCs depends on the maintenance and replacement strategy of MH. This means a decision on whether to replace both transformer and LTC or only LTC should be made on individual basis.

4. Almost all the wood poles and SPAR arms are generally in good or very good condition. The pole treatment appears to be effective as the MH-specific failure curves based on the information from MH technical experts indicated longer than typical lives. Moreover, using the "effective age" resulted in fewer expected replacements than when using chronological age.

5. It is important to note that the "flagged for action" plan presented in this study is based solely on asset condition and that there are numerous other considerations that may influence MH's Asset Management Plan.

6. MH has enough available data to determine a credible Health Index distribution for most of station transformers. For circuit breakers and wood poles however, only 50-60% of the population have sufficient data for yielding credible Health Index. For SPAR arms only age information is available. It is recommended that MH continues with the data collection effort and also start accumulating information required to develop failure curves by recoding age of assets when they are replaced, either due to failure or because they presented higher than acceptable risk.

7. MH needs to embark on a regular conductor testing program using a combination of conventional laboratory testing and non-intrusive LineVue field testing in order to increase the sample size with known data to a point that some projections on the overall population could be made.

8. It is recommended that MH start steel structure climbing inspections (a suggested climbing inspection form which also includes footing assesswement is shown in Appendix B) and start ultrasonic inspections of buried footings to determine the extent of their deterioration (the methodology description is also shown in Appendix B).

9. The "flagged for action" results should be used as a starting point in developing condition based long-term capital replacement plan and resourcing requirements.

Actual replacement plan should also take into account factors like obsolescence, system growth, regulatory requirements, etc.

10. For the next 1-2 year specific units should be identified for replacement or refurbishment while total expected levels of capital expenditures for each asset category will suffice for subsequent years capital planning.

11. Assuming that replacement is the best course of action, EOL economic assessment should be used to identify the most economical replacement for each major unit, such as station transformers and breakers.

12. Multi-purpose software is required to store the data, annually update results, prioritize investments and analyze impact of “what if” capital replacement scenarios.

VI APPENDIX A: RESULTS AND FINDINGS FOR EACH ASSET CATEGORY

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1 Substation Transformers/Load Tap Changers

While power transformers can be employed in either step-up or step-down mode, a majority of the applications in distribution stations involve step down of the transmission or sub-transmission voltage to distribution voltage levels. Power transformers vary in capacity and ratings over a broad range. There are two general classifications of power transformers: transmission station transformers and distribution station transformers. For Distribution stations, power transformer ratings typically range from 3 MVA to 30 MVA. The units included in this study range from 3 MVA to 20 MVA.

Power transformers employ many different design configurations, but they are typically made up of the following main components:

- Primary and secondary windings
- Laminated iron core
- Internal insulating mediums
- Main tank
- Bushings
- Cooling system, including radiators, fans and pumps (Optional)
- Off load tap changer (Optional)
- On load tap changer (Optional)
- Instrument transformers
- Control mechanism cabinets
- Instruments and gauges

The primary and secondary windings are installed on a laminated iron core and serve as the coils in which electromotive force is produced when alternating magnetic flux passing through the core links with the windings. The internal insulating mediums provide insulation for energized coils. Insulating oil serves as the insulating medium as well as serves as the coolant. Due to its low cost, high dielectric strength, excellent heat-transfer characteristics, and ability to recover after dielectric overstress mineral oil is most widely used transformer insulating material. The transformer coil insulation is reinforced with different forms of solid insulation that include wood-based paperboard (pressboard), wrapped paper and insulating tapes. Because the dielectric strength of oil is approximately half that of the pressboard, the dielectric stress in the oil ends up being higher than that in the pressboard, and the design structure is usually limited by the stress in the oil. The insulation on the conductors of the winding may be enamel or wrapped paper which is either wood or nylon based. The use of insulation directly on the conductor actually inhibits the formation of potentially harmful streamers in the oil, thereby increasing the strength of the structure. Heavy paper wrapping is also usually used on the leads coming from the windings.

The main tank holds the active components of the transformer in an oil volume and maintains a sealed environment through the normal variations of temperature and pressure. Typically the main tank is designed to withstand a full vacuum for initial and subsequent oil fillings and is able to sustain a positive pressure. The main tank also supports the internal and external components of the transformers. Main tank designs can be classified into 2 types those being conservator type and sealed type. Conservator types have an externally mounted tank that usually holds 10% of the main tank's volume. As the transformer oil expands and contracts due to system loading and ambient changes, the corresponding oil volume change must be accommodated. This tank is used to provide a holding mechanism for the expansion and contraction of the main tank's oil over these temperature variations. The liquid seal also provides some protection against moisture ingress into the insulation systems. A sealed tank design incorporates a gas header on top of the oil volume using nitrogen or dry air. This gas header can be either in a positive pressure or vacuum mode depending on the system loading or ambient changes. The pressure and vacuum conditions of a sealed tank design are controlled by the use of a regulator that ensures the tank is within its design limits.

Bushings are used to facilitate the egress of conductors to connect ends of the coils to power supply system in an insulated, sealed (oil-tight and weather-tight) manner. A bushing is typically composed of an outer porcelain body mounted on metallic flange. The phase leads are either independent paper insulated, or are an integral part of the bushing. At the higher voltage levels, additional insulation is incorporated in the form of mineral oil and/or wound paper leads installed within the porcelain column.

The purpose of cooling system in a power transformer is to efficiently dissipate heat generated due to copper and iron losses and help maintain the windings and insulation temperature within acceptable range. The utilization of a number of cooling stages allows for an increase in load carrying capability. Loss of any stage or cooling element may result in a forced de-rating of the transformer. Transformer cooling system ratings are typically expressed as:

- Self-cooled (radiators) with designation as ONAN (oil natural, air natural)
- Forced cooling first stage (fans) with designation as ONAF (oil natural, air forced)
- Forced cooling second stage (fans and pumps) with designation as OFAF (oil forced, air forced)

Off load tap changer allows the transformer turns ratio to be altered over a small range to effect changes in output voltage as required. An off load tap changer typically allows for an adjustment of 5% above nominal and 5% below nominal voltage in 2 ½ % steps. An off load tap changer must only be operated with the transformer off potential. Under load tap-changers (ULTCs) allow for automatic voltage regulation in response to varying load conditions on line. ULTCs consist of moving mechanical parts, a drive motor, linkages and voltage regulation sensing equipment. Instrument transformers include CT's and PTs for metering or control purposes. Power transformers are equipped with externally mounted control cabinets for voltage and current control relay, secondary control circuits, and in some cases the tap changer motor and position indicators.

Both from the view of financial and operational risk, power transformers are the most important asset employed on the distribution and transmission systems. A significant proportion of power transformers employed by North American utilities were installed in the 1950s, 1960s or early 1970s. So despite the fact that the number of transformer failures arising due to End Of Life (EOL) has to date been relatively small there is awareness that a majority of the transformer population will soon be reaching the end of life and it may significantly impact transformer failure rates.

1.1 Degradation Mechanism

For a majority of transformers, EOL is expected to be spelled by the failure of insulation system and more specifically the failure of pressboard and paper insulation. While the insulating oil can be treated or changed, it is not practical to change the paper and pressboard insulation. The condition and degradation of the insulating oil, however, plays a significant role in aging and deterioration of transformer, as it directly influences the speed of degradation of the paper insulation. The degradation of oil and paper in service in transformers is essentially an oxidation process. The three important factors that impact the rate of oxidation of oil and paper insulation are presence of oxygen, high temperature and moisture.

Transformer oil is made up of complex hydrocarbon compounds, containing anti-oxidation compounds. Despite the presence of oxidation inhibitors oxidation occurs slowly under normal operating conditions. The rate of oxidation is a function of internal operating temperature and age. The oxidation rate increases as the oil ages, reflecting both the depletion of the oxidation inhibitors and the catalytic effect of the oxidation products on the oxidation reactions. The products of oxidation of hydrocarbons are moisture, which causes further deterioration of insulation system and organic acids, which result in formation of solids in the form of sludge. Increasing acidity and water levels result in the oil being more aggressive with regard to the paper and hence accelerate the ageing of the paper insulation. Formation of sludge adversely impacts the cooling capability of the transformer and adversely impacts its dielectric strength. An indication of the condition of insulating oil can be obtained through measurements of its acidity, moisture content and breakdown strength.

The paper insulation consists of long cellulose chains. As the paper ages through oxidization, these chains are broken. The tensile strength and ductility of insulting paper are determined by the average length of the cellulose chains; therefore, as the paper oxidizes the tensile strength and ductility are significantly reduced and insulating paper becomes brittle. The average length of the cellulose chains can be determined by measurement of the degree of polymerization (DP). But this test can be performed only after de-tanking or the core and coil and therefore, is not a practical test. For a new transformer the DP value of the paper is normally greater than 1,000. As the paper ages this figure gradually decreases. When the DP value approaches below 250 the paper is in a very brittle and fragile condition. The lack of mechanical strength of paper insulation can result in failure if the transformer is subjected to mechanical shocks that may be experienced during normal operational situations.

In addition to the general oxidation of the paper, degradation and failure can also result from partial discharge which can be initiated if the level of moisture is allowed to develop in the paper or if there are other minor defects within active areas of the transformer.
The relative levels of carbon dioxide and carbon monoxide dissolved in oil can provide an indication of paper degradation. Detection and measurement of Furans in the oil provides a more direct measure of the paper degradation. Furans are a group of chemicals that are created as a bi-product of the oxidation process of the cellulose chains. The occurrence of partial discharge and other electrical and thermal faults in the transformer can be detected and monitored by measurement of hydrocarbon gases in the oil through Dissolved Gas Analysis (DGA).

Oil analysis is such a powerful diagnostic and condition assessment technique that combining it with background information, related to the specification, operating history, loading conditions and system related issues, provides a very effective means of assessing the condition of transformers and identifying units at high risk of failure. It is the ideal means on which to base an ongoing management strategy for aging transformers, identifying units that warrant consideration for continued use, consideration of remedial measures to extend life or identification of transformers that should be considered for replacement within a defined time frame.

Other condition assessment techniques for power transformers include the use of online monitors, capable of monitoring specific parameters, e.g. dissolved gas monitors, continuous moisture measurement or temperature monitoring, winding continuity checks, DC insulation resistance measurements and no load loss measurements. Dielectric measurements that attempt to give an indication of the condition of the insulation system include dielectric loss, dielectric spectroscopy, polarization index, and recovery voltage measurements. Doble testing is a procedure that falls within this general group. Other techniques that are commonly applied to transformers include infrared surveys, partial discharge detection and location using ultrasonics and/or electromagnetic detection and frequency response analysis.

Under load tap changers are prone to failure resulting from either mechanical or electrical degradation. Active maintenance is required for tap changers in order to manage these issues. It is normal practice to maintain tap changers either at a fixed time interval or after a number of operations. During operation wear of contacts and build up of oil degradation products, resulting from arcing activity during make and break of contacts, are the primary degradation processes. Maintenance, cleaning and replacement of contacts and any defective components in the mechanism, and changing or reprocessing of oil are the primary maintenance activities that deal with these issues. Oil analysis from tap changers is considered less useful than oil analysis for transformers due to the generation of gases and general degradation of the oil during arcing under normal ULTC operation.

Many transformers in service are now approaching this age but failure rates remain low and there is little evidence that many are at, or near, EOL. There are a number of contributory factors to the long life of transformers. In the 1950s and 1960s transformers were designed and manufactured conservatively such that the thermal and electrical stresses, even at high load, were relatively low compared to modern designs. In addition, the loading of many of these transformers has been relatively light during their working life.

Consequences of power transformer failure include customer interruptions over significantly long durations. Catastrophic failure of transformers may also result in injury or death, fire and damage to property. There are also environmental risks due to oil spills during tank failures. These risks are more pronounced where transformers are located near water bodies or contain PCBs.

1.2 Health Index Formulation

This section presents the Health Index Formula that was developed and used for MH Substation Transformers/Load Tap Changers. The Health Index equation is shown in Equation 1 of Section II.1; the condition, sub-condition parameters, weights, and condition criteria are as follows.

Assume a parameter scoring system of 0 though 4, where 0 and 4 represent the "worst" and "best" scores respectively. Thus, the maximum score for any condition or sub-condition parameter (maximum CPS and CPF) is "4".

1.2.1 Condition and Sub-Condition Parameters

The condition parameters, weights, and criteria are as follows:

Table 13 Transformer Condition Parameter and Weights

m	Condition Parameter	WCP_m	Sub-Condition Parameters
1	Insulation	6	Table 14
2	Cooling	1	Table 15
3	Sealing & Connection	3	Table 16
4	Service Record	3	Table 17
De-Rating	De-rating is based on: variation in DGA tests, bushing issues, fault exposure, performance	Equation 1-3	

Table 14 Transformer Insulation Sub-Condition Parameters and Weights (m=1)

n	Sub-Condition Parameter	$WCPF_n$	Condition Criteria Table
1	Oil Quality	3	Table 18
2	Oil DGA	6	Table 19
3	Power Dissipation Factor	6	Table 20
4	Insulation Issues (CM)	1	Table 22

Table 15 Transformer Cooling Sub-Condition Parameters and Weights (m=2)

n	Sub-Condition Parameter	$WCPF_n$	Condition Criteria Table
1	Cooling System Issues (CM)	1	Table 22

Table 16 Transformer Sealing & Connection Sub-Condition Parameters and Weights (m=3)

n	Sub-Condition Parameter	$WCPF_n$	Condition Criteria Table
1	Insulation Containment (CM)	2	Table 22
2	Tank Condition (CM)	2	Table 22
3	Grounding Complete (CM)	1	Table 22
4	Oil Conservator (CM)	2	Table 22
5	Connections (CM)	2	Table 22

Table 17 Transformer Service Record Sub-Condition Parameters and Weights (m=4)

n	Sub-Condition Parameter	$WCPF_n$	Condition Criteria Table
1	Loading	5	Table 21
2	Age	3	Figure 15 - Figure 17

1.2.2 Condition Criteria

The condition criteria are as follows:

Oil Quality

The “Oil Quality” parameter is a composite of the following oil properties: moisture, dielectric strength, interfacial tension, color, and acidity.

Table 18 Transformer Oil Quality Test Criteria

Score	Description
4	Overall Factor is less than 1.2
3	Overall Factor between 1.2 and 1.5
2	Overall Factor is between 1.5 and 2.0
1	Overall Factor is between 2.0 and 3.0
0	Overall Factor is greater than 3.0

Where the Overall factor is the weighted average of the following gas scores:

Oil Quality Test	Voltage Class [kV]	Scores				
		1	2	3	4	Weight
Water Content (D1533) [ppm]	V ≤ 69	< 30	30-35	35-40	> 40	5
	69 < V < 230	< 20	20-25	25-30	> 35	
	V ≥ 230	< 15	15-20	20-25	> 25	
Dielectric Strength (D1816 - 2 mm gap) [kV]	V ≤ 69	> 40	35-40	30-35	< 30	4
	69 < V < 230	> 47	42-47	35-42	< 35	
	V ≥ 230	> 50	50-45	40-45	< 40	
Dielectric Strength (D877) [kV]	All	> 40	30-40	20-30	< 20	
IFT (D971) [dynes/cm]	V ≤ 69	> 25	20-25	15-20	< 15	4
	69 < V < 230	> 30	23-30	18-23	< 18	
	V ≥ 230	> 32	25-32	20-25	< 20	
Color	All	< 1.5	1.5-2.0	2.0-2.5	> 2.5	1

Oil Quality Test	Voltage Class [kV]	Scores				
		1	2	3	4	Weight
Acid Number [mg KOH/g]	V $\leq$ 69	< 0.05	0.05-0.1	0.1-0.2	> 0.2	4
	69 < V < 230	< 0.04	0.04-0.1	0.1-0.15	> 0.15	
	V $\geq$ 230	< 0.03	0.03-0.07	0.07-0.1	> 0.1	
Dissipation Factor (D924 - 25^{0}C)	All	< 0.5%	0.5%-1%	1-2%	> 2%	5
Dissipation Factor (D924 - 100^{0}C)	All	< 5%	5%-10%	10%-20%	> 20%	

Overall Factor = $\dfrac{\sum Score_i \times Weight_i}{\sum Weight}$

For example if all data is available, Overall Factor = $\dfrac{\sum Score_i \times Weight_i}{23}$

Oil DGA

Table 19 Transformer DGA Criteria

Score*	Description
4	DGA overall factor is less than 1.2
3	DGA overall factor between 1.2 and 1.5
2	DGA overall factor is between 1.5 and 2.0
1	DGA overall factor is between 2.0 and 3.0
0	DGA overall factor is greater than 3.0
*In the case of a score other than 4, check the variation rate of DGA parameters. If the maximum variation rate (among all the parameters) is greater than 30% for all samplings, overall Health Index is multiplied by 0.9 for score 3, 0.85 for score 2, 0.75 for score 1 and 0.5 for score 0.	

Where the DGA overall factor is the weighted average of the following gas scores:

2.5 MVA to 10 MVA

Dissolved Gas	Scores						
	1	2	3	4	5	6	Weight
H2	<=70	<=100	<=200	<=400	<=1000	>1000	**4**
CH4 (Methane)	<=70	<=120	<=200	<=400	<=600	>600	**3**
C2H6 (Ethane)	<=75	<=100	<=150	<=250	<=500	>500	**3**
C2H4 (Ethylene)	<=60	<=100	<=150	<=250	<=500	>500	**3**
C2H2 (Acetylene)	<=3	<=7	<=35	<=50	<=100	>100	**5**
CO	<=750	<=1000	<=1300	<=1500	<=1700	>1700	**2***
CO2	<=7500	<=8500	<=9000	<=12000	<=15000	>15000	**2***
CO2/CO	3 - <10	<12	<15 Or <3	<18	<20	>20	**4***
*If CO ≥ 500 ppm and CO2 ≥ 5000 ppm, use CO2/CO ratio (e.g. CO and CO2 weights = 0, CO2/CO weight = 4) If CO < 500 ppm and CO2 < 5000 ppm, use CO2 and CO limits (e.g. CO and CO2 weights = 4, CO2/CO weight = 0)							

10 MVA and Higher

Dissolved Gas	Scores						
	1	2	3	4	5	6	Weight
H2	<=40	<=100	<=300	<=500	<=1000	>1000	**4**
CH4(Methane)	<=80	<=150	<=200	<=500	<=700	>700	**3**
C2H6(Ethane)	<=70	<=100	<=150	<=250	<=500	>500	**3**
C2H4(Ethylene)	<=60	<=100	<=150	<=250	<=500	>500	**3**
C2H2(Acetylene)	<=3	<=7	<=35	<=50	<=80	>80	**5**
CO	<=350	<=500	<=600	<=1000	<=1500	>1500	**2***
CO2	<=3000	<=4500	<=5700	<=7500	<=10000	>10000	**2***
CO2/CO	3 - <8	< 10	<13 Or <3	<14	<15	>15	**4***
*If CO ≥ 500 ppm and CO2 ≥ 5000 ppm, use CO2/CO ratio (e.g. CO and CO2 weights = 0, CO2/CO weight = 4) If CO < 500 ppm and CO2 < 5000 ppm, use CO2 and CO limits (e.g. CO and CO2 weights = 4, CO2/CO weight = 0)							

Overall Factor = $\frac{\sum Score_i \times Weight_i}{\sum Weight}$

Power Dissipation Factor Test

Table 20 Transformer Winding Doble Test Criteria

Score	Description
4	%PF < 0.5%
3	0.5% < %PF < 0.7%
2	0.7% < %PF < 1.0%
1	1.0% < %PF < 2.0%
0	%PF > 2.0%

Loading

Table 21 Transformer Loading History

Data: S1, S2, S3, …, SN recorded data
SB= rated MVA NA=Number of Si/SB which is lower than 0.6 NB= Number of Si/SB which is between 0.6 and 0.8 NC= Number of Si/SB which is between 0.8 and 1.0 ND= Number of Si/SB which is between 1 and 1.2 NE= Number of Si/SB which is greater than 1.2 **Score** = $\frac{NA \times 4 + NB \times 3 + NC \times 2 + ND \times 1}{N}$
Note: If there are 2 numbers in NA to NE greater than 1.5, then Score should be multiplied by 0.6 to show the effect of overheating.

Age

Assume that the failure rate for Power Transformers exponentially increases with age and that the failure rate equation is as follows:

$$f = e^{\beta(t-\alpha)}$$

Equation 1-1

f	= failure rate of an asset (percent of failure per unit time)
t	= time
α, β	= constant parameters that control the rise of the curve

The corresponding survivor function is therefore:

$$S_f = 1 - P_f = e^{-(f-e^{\alpha\beta})/\beta}$$

Equation 1-2

S_f	= survivor function
P_f	= cumulative probability of failure

Assuming that at the ages of 50 and 70 years the probabilities of failure (P_f) are 10% and 90% result in the survival curves shown below. It follows that the CPF for Age is the survival curve normalized to the maximum CPF score of 4 (i.e. 4*Survival Curve). The CPF vs. Age is also shown in the figure below.

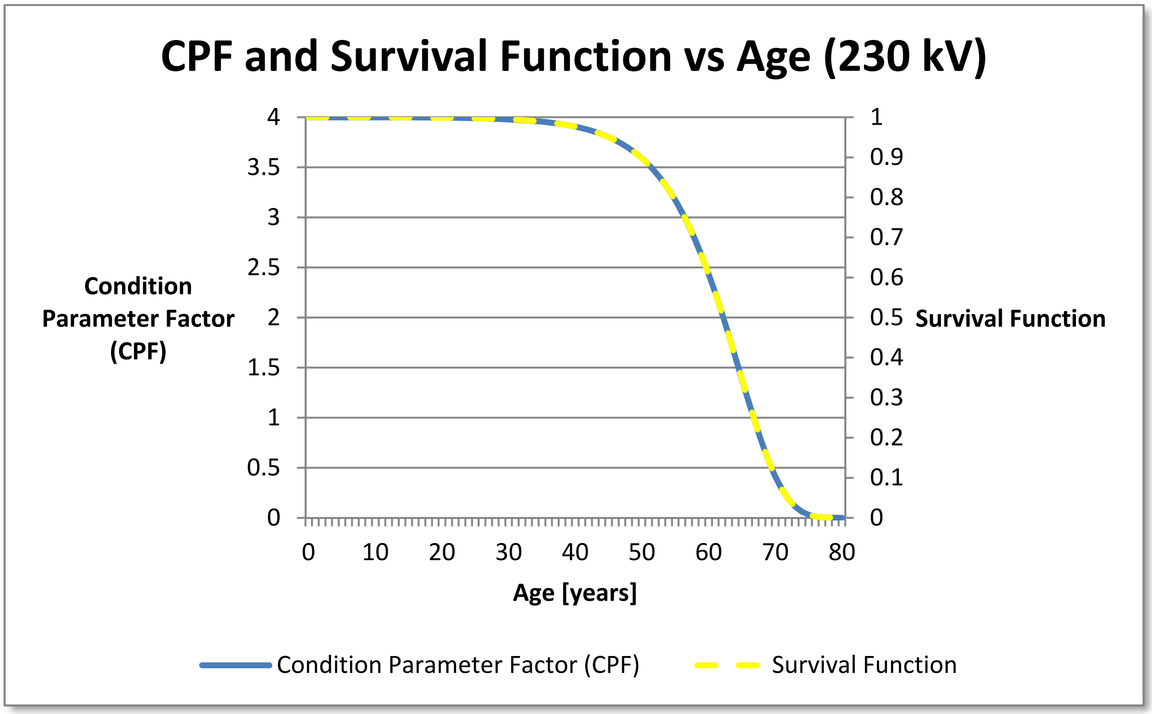

Figure 15 Power Transformer CPF and Survival Function vs. Age (230 kV)

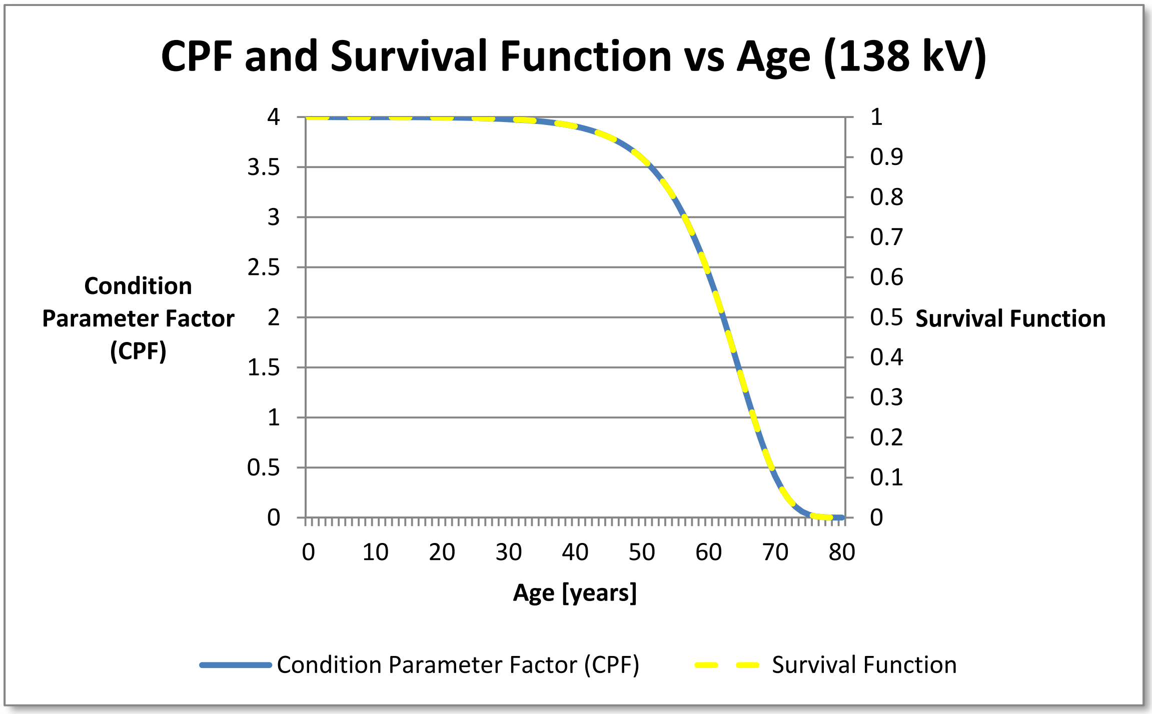

Figure 16 Power Transformer CPF and Survival Function vs. Age (138 kV)

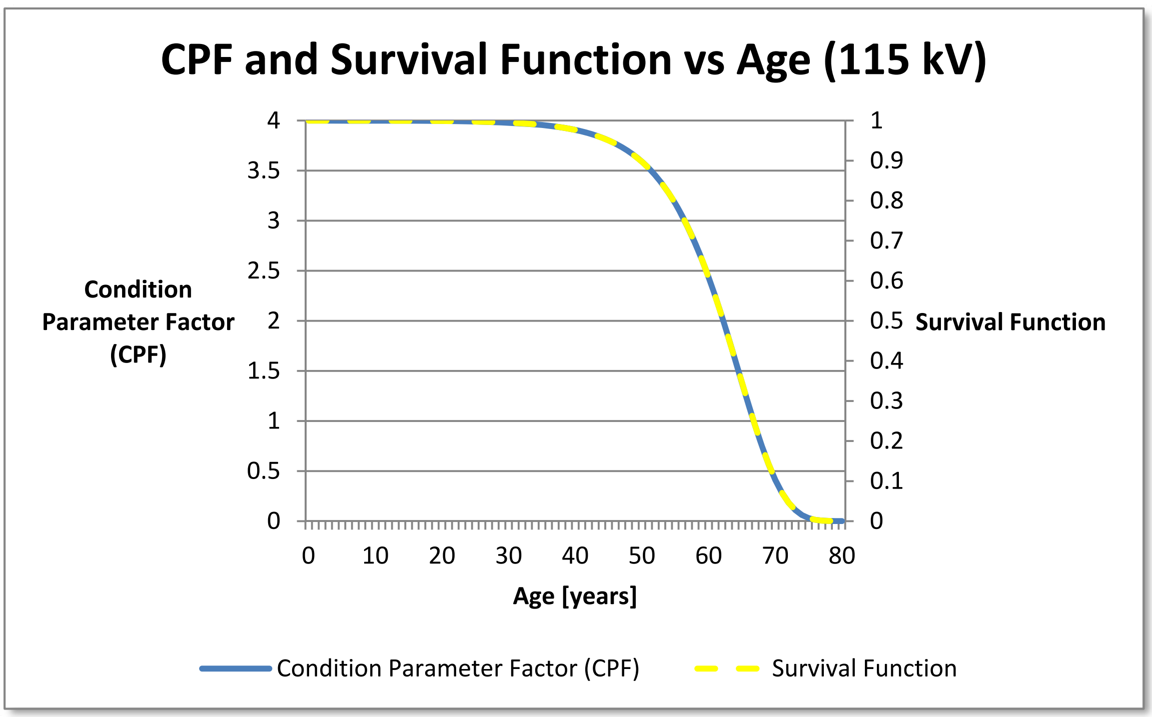

Figure 17 Power Transformer CPF and Survival Function vs. Age (115 kV)

Prioritized Corrective Maintenance

Table 22 Transformer Priority Weighted Notifications

Condition Rating	CPF	Condition Description
A	4	$0 \le K \le 2$
B	3	$3 \le K \le 5$
C	2	$6 \le K \le 7$
E	0	$K \ge 9$

Where

$K = N_{P1}*4 + N_{P2}*3 + N_{P3}*2 + N_{P4}*1$

N_{P1} Priority 1

N_{P2} Priority 2

N_{P3} Priority 3

N_{P4} Priority 4

Priority # is based on Manitoba Hydro's Corrective Maintenance Severity;

Priority 1 = Forced Outage

Priority 2 = Functional Failure

Priority 3 = Potential Failure

Priority 4 = Incidental

1.2.3 De-Rating Factors

The de-rating is based on the following equation:

$$DR = \min\left(DRF_1, DRF_2, DRF_3, DRF_4\right)$$

Equation 1-3

Where DRF are as described in Table 23

Table 23 Transformer De-Rating Factors

De-Rating Factor (DRF)	De-Rating Factor	Description
DRF_1	DGA Variations	In the case of a score other than 4, check the variation rate of DGA parameters. If the maximum variation rate (among all the parameters) is greater than 30% for all samplings, overall Health Index is multiplied by 0.9 for score 3, 0.85 for score 2, 0.75 for score 1 and 0.5 for score 0.

De-Rating Factor (DRF)	De-Rating Factor	Description
DRF_2	Bushing Issues	Transformer utilizes bushing type/family which has record of high rates of failure or maintenance problems (increases risk of transformer failure)
DRF_3	Fault Exposure	Transformer is protected by fuses (and not breakers)
DRF_4	Known Performance Problems	Transformer has known performance issue that increase the likelihood of future failures (e.g. design issues, re-occurring component problems, thru-faults)

1.3 On-Load Tap Changers (LTC) Health Index Formulation

The Health Index equation is shown in Table 24; the condition, sub-condition parameters, weights, and condition criteria are as follows.

1.3.1 Condition and Sub-Condition Parameters

Table 24 LTC Condition Weights and Maximum CPS

m	Condition Parameter	WCP_m		Sub-Condition Parameters
		Arcing type	Vacuum type	
1	Operating Mechanism	14	7	Table 25
2	Sealing & Connection	3	3	Table 26
3	Arc Extinction	9	2	Table 27
4	Insulation	7	7	Table 28
5	Service Record	5	5	Table 29
De-Rating	De-rating is based on: obsolescence	Table 34		

Table 25 LTC Operating Mechanism (m=1) Weights and Maximum CPF

n	Sub-condition Parameter	$WCPF_n$		Condition Criteria Table
		Arcing type	Vacuum type	
1	Switch / Contact (CM)	9	5	Table 30
2	Tap Selector Head (CM)	3	3	Table 30
3	Diverter (CM)	1	1	Table 30
4	Control - Electrical (CM)	5	2	Table 30
5	Control - Mechanical (CM)	2	2	Table 30
6	Cabinet (CM)	2	2	Table 30
7	Pressure Relief (CM)	2	2	Table 30

Table 26 LTC Sealing & Connection (m=2) Weights and Maximum CPF

n	Sub-condition Parameter	$WCPF_n$		Condition Criteria Table
		Arcing type	Vacuum type	
1	Gasket or Sealant (CM)	2		Table 30
2	Oil Level (CM)	2		Table 30
3	Breather (CM)	1		Table 30

Table 27 LTC Arc Extinction (m=3) Weights and Maximum CPF

n	Sub-condition Parameter	$WCPF_n$		Condition Criteria Table
		Arcing type	Vacuum type	
1	Diverter Vacuum Bottle (CM)	2	1	Table 30
2	Contacts (CM)	5		Table 30

Table 28 LTC Insulation (m=4) Weights and Maximum CPF

n	Sub-condition Parameter	$WCPF_n$ Arcing type	$WCPF_n$ Vacuum type	Condition Criteria Table
1	Oil DGA	4		Table 31
2	Oil quality	3		Table 32
3	Insulation (CM)	1		Table 30

Table 29 LTC Service Record (m=4) Weights and Maximum CPF

n	Sub-condition Parameter	$WCPF_n$ Arcing type	$WCPF_n$ Vacuum type	Condition Criteria Table
1	Age	1		Figure 15
2	Number of Operation	2		Table 33
3	Fails to Operate (CM)	2		Table 30

1.3.2 Condition Parameter Criteria

Prioritized Corrective Maintenance

Table 30 LTC Priority Weighted Notifications

Condition Rating	CPF	Condition Description
A	4	$0 \leq K \leq 2$
B	3	$3 \leq K \leq 5$
C	2	$6 \leq K \leq 7$
E	0	$K \geq 9$

Where

$K = N_{P1}*4 + N_{P2}*3 + N_{P3}*2 + N_{P4}*1$

N_{P1} Priority 1

N_{P2} Priority 2

N_{P3} Priority 3

N_{P4} Priority 4

Priority # is based on Manitoba Hydro's Corrective Maintenance Severity;

Priority 1 = Forced Outage

Priority 2 = Functional Failure

Priority 3 = Potential Failure

Priority 4 = Incidental

Oil DGA

Table 31 LTC DGA Criteria

Score	Description
4	DGA overall factor is less than 1.2
3	DGA overall factor between 1.2 and 1.5
2	DGA overall factor is between 1.5 and 2.0
1	DGA overall factor is between 2.0 and 3.0
0	DGA overall factor is greater than 3.0

Where the DGA overall factor is the weighted average of the following gas scores as below:

Dissolved Gas	Scores					Weight
	1	2	3	4	5	
C2H4/C2H2	<0.33	<0.67	<1.00	<1.33	>=1.33	3
C2H6/CH4	<0.20	<0.40	<0.60	<0.80	>=0.80	2
H2	<70	<500	<1000	<1500	>=1500	1

Overall Factor = $\frac{\sum Score_i \times Weight_i}{\sum Weight}$

Note: Overall Factor =1.2 when ALL the following conditions meet

- H2 (hydrogen)< 1500 ppm
- C2H4 (Ethylene) < 1000 ppm
- C2H2 (Acetylene) < 1000 ppm

Oil Quality

Table 32 LTC Oil Quality Test Criteria

Score	Description
4	Overall Factor is less than 1.2
3	Overall Factor between 1.2 and 1.5
2	Overall Factor is between 1.5 and 2.0
1	Overall Factor is between 2.0 and 3.0
0	Overall Factor is greater than 3.0

Where the Overall factor is the weighted average of the following gas scores:

	Scores				
	1	2	3	4	Weight
Dielectric Str. kV ASTM D1816-97 2mm gap	>27	>20	>10	< 10	3
IFT mN/m ASTM D971-99a	>25	20-25	15-20	< 15	1
Acid Number mg KOH/g	<0.015	0.015-0.02	0.02-0.03	>0.03	2
Water content mg/kg ASTM D1533-00	<25	<30	<35	>35	2

Overall Factor = $\dfrac{\sum Score_i \times Weight_i}{\sum Weight}$

Table 33 LTC Number of Operations

CPF	Condition Description
4	Measurement <= 80% Specification Limit*
3	80% < Measurement <= 100% Specification Limit*
1	100% < Measurement <= 120% Specification Limit*
0	Measurement > 120% Specification Limit*

*manufacturer specifications

Age

Assume that the failure rate for Load Tap Changers exponentially increases with age and that the failure rate equation is as follows:

$$f = e^{\beta(t-\alpha)}$$

Equation 1-4

f = failure rate of an asset (percent of failure per unit time)
t = time
α, β = constant parameters that control the rise of the curve

The corresponding survivor function is therefore:

$$S_f = 1 - P_f = e^{-(f-e^{\alpha\beta})/\beta}$$

Equation 1-5

S_f = survivor function
P_f = cumulative probability of failure

Assuming that at the ages of 50 and 70 years the probabilities of failure (P_f) are 10% and 90% result in the survival curves shown below. It follows that the CPF for Age is the survival curve normalized to the maximum CPF score of 4 (i.e. 4*Survival Curve). The CPF vs. Age is also shown in the figure below.

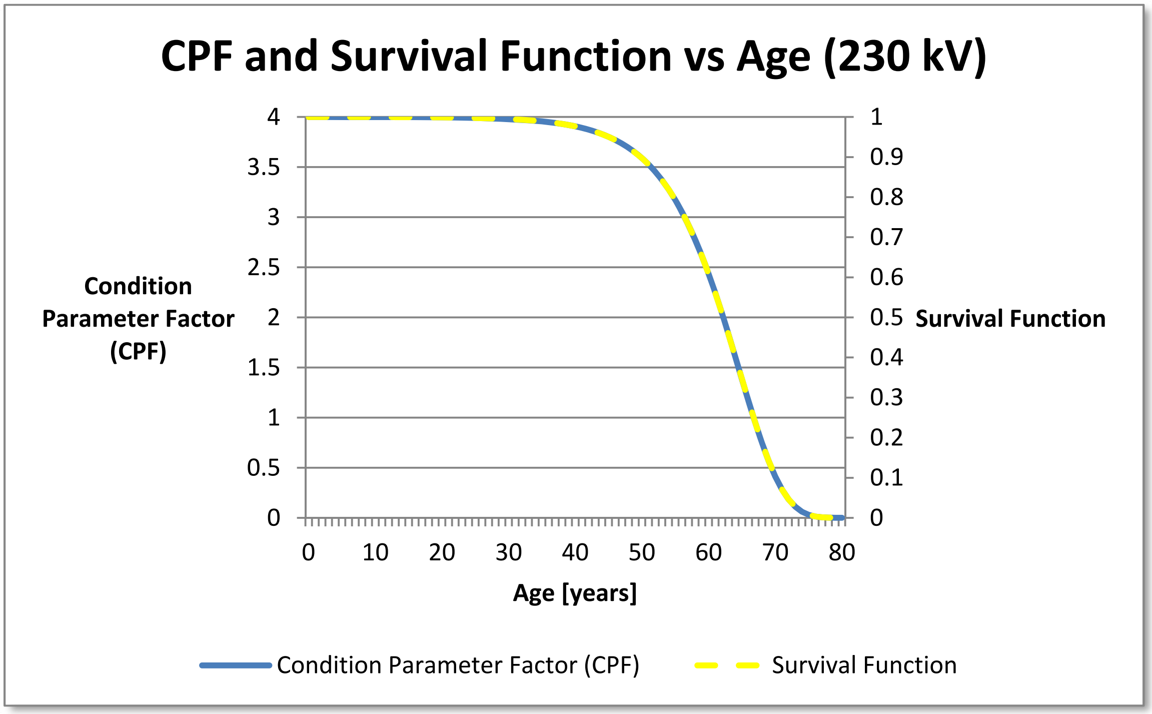

Figure 18 LTC CPF and Survival Function vs. Age (230 kV)

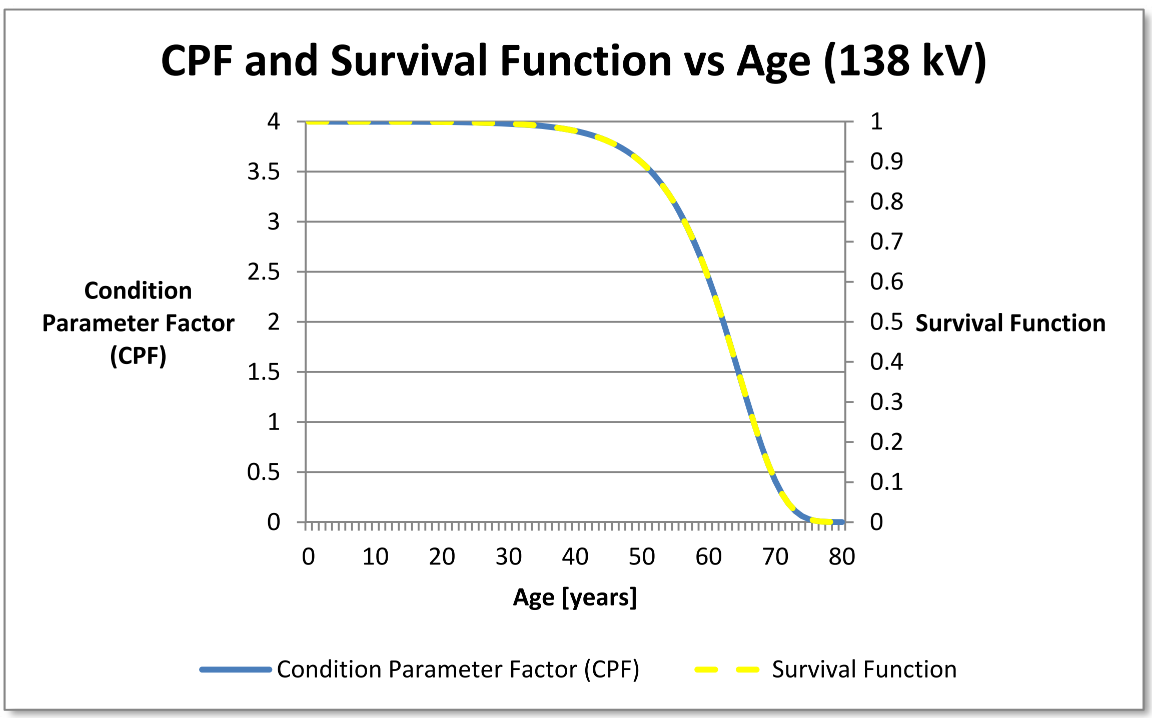

Figure 19 LTC CPF and Survival Function vs. Age (138 kV)

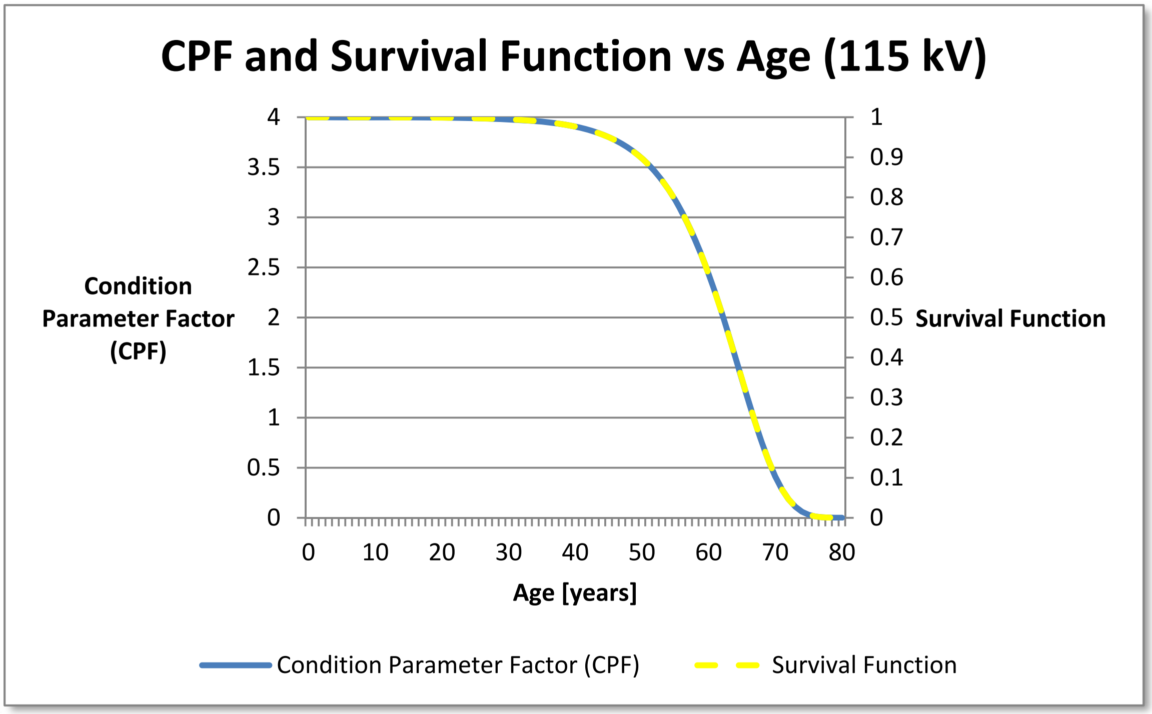

Figure 20 LTC CPF and Survival Function vs. Age (115 kV)

1.3.3 De-Rating Factors

The de-rating is based on the following equation:

$$DR = DRF_1$$

Equation 1-6

Where DRF is as described in Table 34

Table 34 LTC De-Rating Factors

De-Rating Factor (DRF)	De-Rating Factor	Description
DRF_1	Operation & Maintenance	Issues with obsolescence, getting spare part or other know maintenance

1.4 Age Distribution

The Power Transformer and LTC age distribution is shown in the figures below.

For power transformers, age was available for 100% of the population. The average age was found to be 33 years.

For LTCs, age was available for 100% of the population. The average age was found to be 26 years.

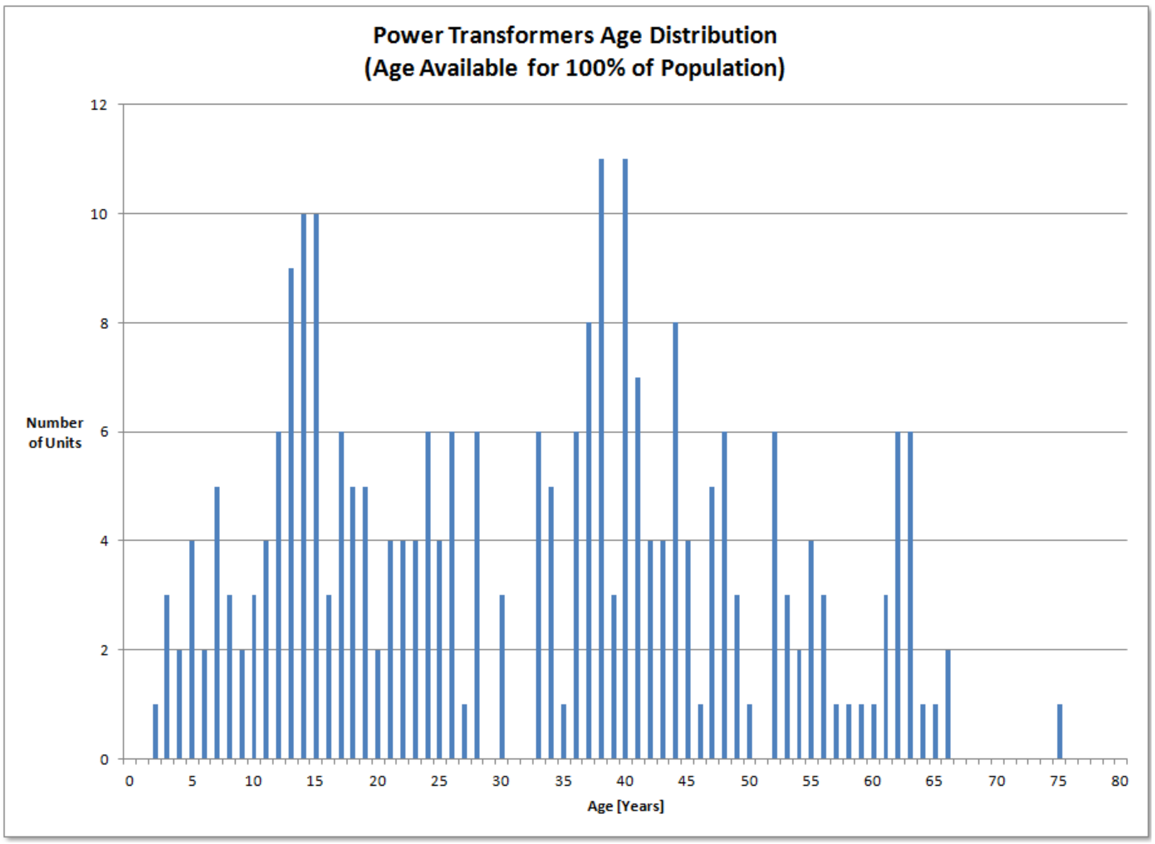

Figure 21 Power Transformer Age Distribution

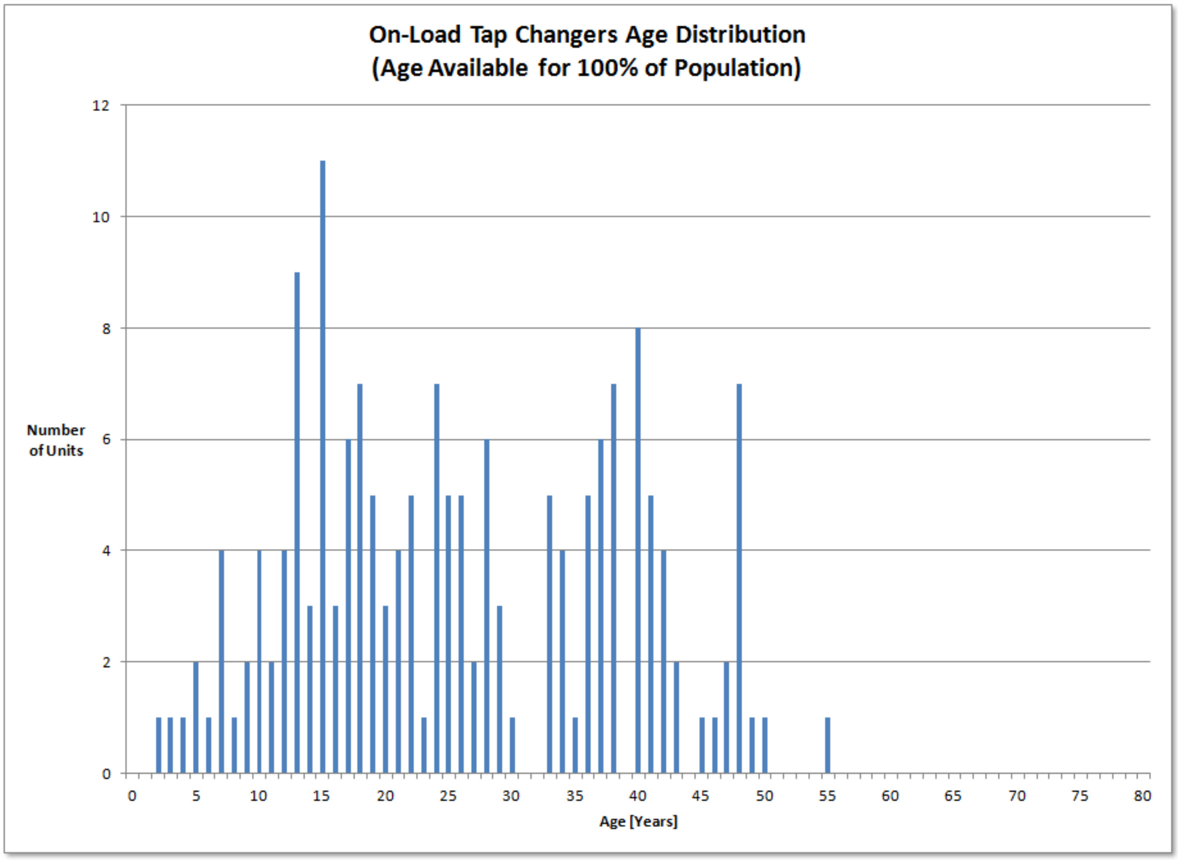

Figure 22 LTC Age Distribution

1.5 Health Index Results

There are 263 in service Substation Transformers/Load Tap Changers at MH. All of them had sufficient data for assessment.

There are 170 in service On-Load Tap Changers at MH. All of them had sufficient data for assessment.

The average Health Index results are 83% and 84%, for substation transformers and on-load tap changers respectively. 1 substation transformer at 230 kV and 2 on-load tap changers at 230 kV are in poor condition. The vast majority of both substation transformers and on-load tap changers are in good or very good condition.

The Health Index Distribution is shown in Figure 23 for all three voltage levels.

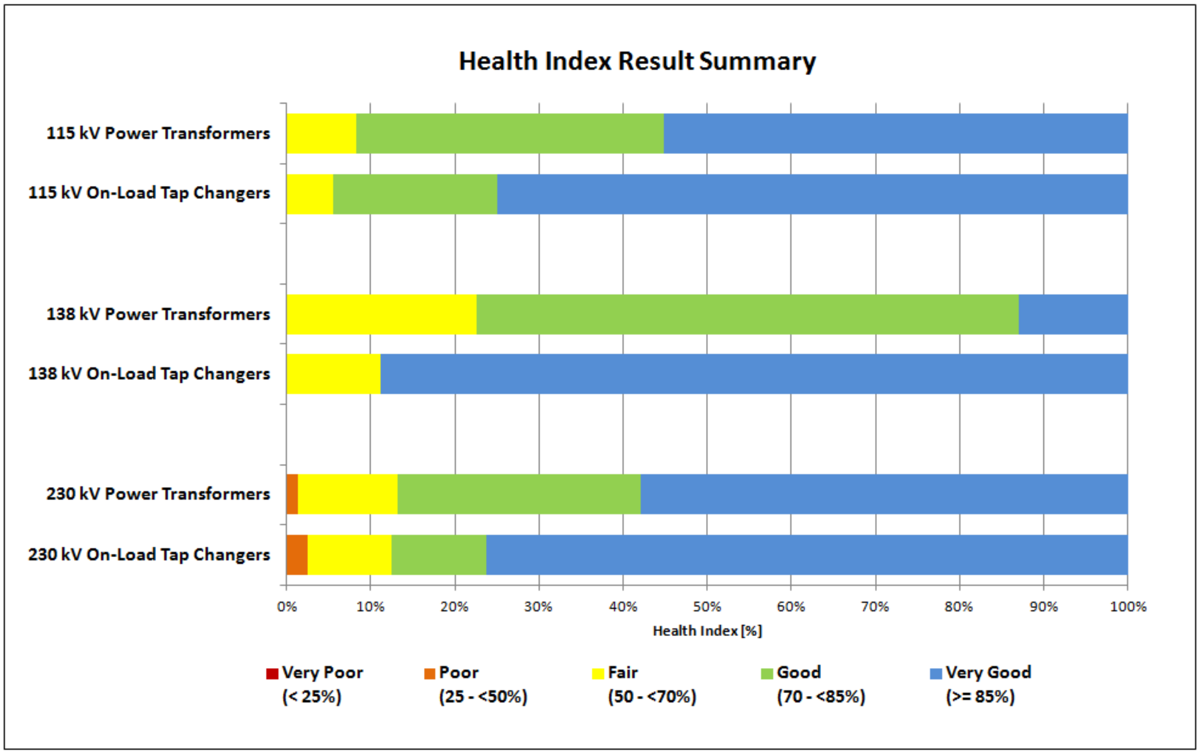

Figure 23 Substation Transformers/Load Tap Changers Health Index Distribution

The combined Health Index distribution is shown in Figure 24.

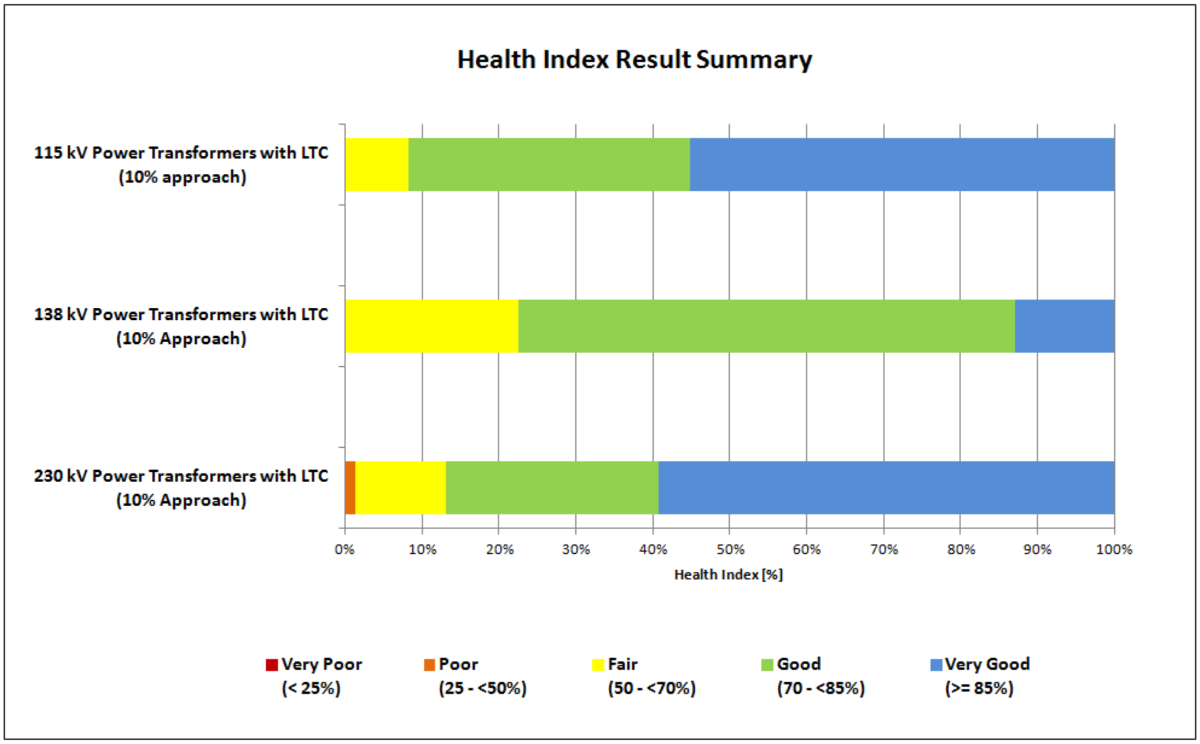

Figure 24 Combined Transformers/LTCs Health Index Distribution

1.6 Criticality and Condition-Based Flagged for Action Plans

As it is assumed that Substation Transformers/Load Tap Changers are proactively replaced, the risk assessment and replacement procedure described in Section II.2.3 was applied for this asset class.

The following table shows the detailed criticality matrix for transformers/LTCs. Such a matrix is used to calculate criticality of each unit.

Table 35 Criticality Factors for Transformers/LTCs

Criticality Factor (CF)	Description	Weight (WCF)	Score (CFS)	
Load Criticality	Outage to bank would not result in outage to restoration-time-sensitive customers (e.g. hospitals, government buildings, some industrial/commercial)	15	Low	0
	Outage to bank would result in outage to restoration-time-sensitive customers (e.g. hospitals, government buildings, some industrial/commercial)		High	1
Physical Protection	Transformer has oil containment AND deluge system, blast wall (or lots of physical space between transformers)	15	Low	0
	Transformer has oil containment but no blast wall or deluge system (transformers in close proximity)		Medium	0.5
	Transformer has no oil containment, blast wall or deluge system		High	1
Customer Impact	Outage impacts no customers	15	No	0
	Outage impacts less than 1,000 customer or outage less than 4 hours (any outage where ties can be used to restore service)		Low	0.5
	Outage impacts less than 10,000 customers or outage less than 24 hours (outage requiring spare or mobile to restore customers)		Medium	1
Location	Not located in populated area (residential) or close to environmentally sensitive area (e.g. river or lake)	15	No	0
	Located in populated area (residential) or close to environmentally sensitive area (e.g. river or lake)		Yes	1
System Impact	System has firm capacity, no overload on parallel transformers or need to curtail exports	20	No	0
	System does not have firm capacity, potential overloads on parallel transformers or need to curtail exports		Yes	1
Expected Outage Duration	Spare or mobile substation available for transformer, ability to transfer load	10	Low	0
	No spare or mobile substation available for transformer, insufficient ability to transfer load		High	1

The priority list based on risk cost for all the transformers /LTCs is shown in the following table.

Table 36 Priority List of Transformers/LTCs based on Risk Cost

Rank	Unique ID (NpHandle)	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Cost (Criticality* POF)
[redacted]			8	47.84	59.3	0.38209	**1.74**	**0.663**
			35	51.96	56.6	0.27425	**1.77**	**0.486**
			40	53.75	55.1	0.22663	**1.56**	**0.354**
			10	53.51	55.1	0.22663	**1.49**	**0.338**
			45	54.65	54.4	0.19766	**1.56**	**0.309**
			36	57.34	51.9	0.14686	**1.88**	**0.275**
			38	56.41	52.8	0.15866	**1.56**	**0.248**
			12	57.40	51.9	0.14686	**1.49**	**0.219**
			40	61.60	48.4	0.08851	**1.35**	**0.120**
			49	63.63	46.5	0.06681	**1.67**	**0.111**
			36	65.74	44.4	0.04947	**1.98**	**0.098**
			38	64.09	45.5	0.05480	**1.67**	**0.091**
			27	64.18	45.5	0.05480	**1.67**	**0.091**
			18	64.44	45.5	0.05480	**1.67**	**0.091**
			11	63.94	46.5	0.06681	**1.35**	**0.090**
			44	64.13	45.5	0.05480	**1.60**	**0.088**
			34	66.08	43.4	0.04006	**1.94**	**0.078**
			13	66.15	43.4	0.04006	**1.60**	**0.064**
			21	66.15	43.4	0.04006	**1.56**	**0.063**
			44	66.35	43.4	0.04006	**1.56**	**0.063**
			48	66.29	43.4	0.04006	**1.49**	**0.060**
			24	66.96	43.4	0.04006	**1.46**	**0.058**
			55	68.18	41.1	0.02872	**1.91**	**0.055**
			38	68.15	41.1	0.02872	**1.56**	**0.045**
			58	68.10	41.1	0.02872	**1.56**	**0.045**
			21	69.61	39.9	0.02559	**1.67**	**0.043**
			23	68.45	41.1	0.02872	**1.46**	**0.042**
			40	70.51	38.7	0.02018	**1.98**	**0.040**
			13	69.04	39.9	0.02559	**1.49**	**0.038**
			7	70.00	39.9	0.02559	**1.46**	**0.037**
			17	69.61	39.9	0.02559	**1.35**	**0.035**
			38	70.55	38.7	0.02018	**1.56**	**0.032**
			39	70.15	38.7	0.02018	**1.56**	**0.032**
			47	71.17	37.5	0.01786	**1.67**	**0.030**

Rank	Unique ID (NpHandle)	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Cost (Criticality* POF)
[redacted]			52	71.99	37.5	0.01786	1.60	0.029
			43	71.96	37.5	0.01786	1.56	0.028
			75	71.49	37.5	0.01786	1.56	0.028
			24	71.27	37.5	0.01786	1.35	0.024
			39	72.55	36.2	0.01390	1.67	0.023
			50	72.97	36.2	0.01390	1.60	0.022
			40	72.05	36.2	0.01390	1.56	0.022
			14	72.05	36.2	0.01390	1.49	0.021
			4	73.17	34.9	0.01222	1.67	0.020
			40	73.29	34.9	0.01222	1.67	0.020
			38	72.96	36.2	0.01390	1.46	0.020
			38	72.96	36.2	0.01390	1.46	0.020
			7	72.76	36.2	0.01390	1.46	0.020
			21	72.78	36.2	0.01390	1.46	0.020
			52	73.93	34.9	0.01222	1.60	0.020
			18	73.42	34.9	0.01222	1.60	0.020
			3	73.65	34.9	0.01222	1.56	0.019
			23	72.78	36.2	0.01390	1.35	0.019
			63	74.79	33.6	0.00939	1.98	0.019
			14	74.56	33.6	0.00939	1.81	0.017
			17	73.07	34.9	0.01222	1.35	0.017
			11	73.08	34.9	0.01222	1.35	0.017
			10	75.00	33.6	0.00939	1.67	0.016
			14	74.52	33.6	0.00939	1.67	0.016
			13	75.00	33.6	0.00939	1.60	0.015
			15	74.46	33.6	0.00939	1.60	0.015
			15	74.46	33.6	0.00939	1.60	0.015
			44	74.22	33.6	0.00939	1.56	0.015
			44	74.80	33.6	0.00939	1.56	0.015
			15	74.46	33.6	0.00939	1.49	0.014
			16	74.80	33.6	0.00939	1.46	0.014
			37	74.70	33.6	0.00939	1.46	0.014
			17	75.00	33.6	0.00939	1.46	0.014
			14	75.96	32.2	0.00820	1.67	0.014
			40	75.20	32.2	0.00820	1.56	0.013
			6	75.10	32.2	0.00820	1.56	0.013
			39	75.92	32.2	0.00820	1.56	0.013

Rank	Unique ID (NpHandle)	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Cost (Criticality* POF)
[redacted]			82	75.28	32.2	0.00820	1.56	0.013
			26	74.79	33.6	0.00939	1.35	0.013
			8	76.08	30.8	0.00621	1.77	0.011
			54	76.66	30.8	0.00621	1.67	0.010
			11	76.54	30.8	0.00621	1.56	0.010
			37	76.44	30.8	0.00621	1.56	0.010
			8	76.54	30.8	0.00621	1.56	0.010
			26	76.52	30.8	0.00621	1.46	0.009
			19	76.53	30.8	0.00621	1.46	0.009
			18	76.53	30.8	0.00621	1.46	0.009
			52	77.04	29.4	0.00539	1.60	0.009
			25	76.52	30.8	0.00621	1.35	0.008
			60	78.74	27.9	0.00402	1.84	0.007
			30	78.98	27.9	0.00402	1.67	0.007
			82	78.17	27.9	0.00402	1.56	0.006
			82	78.17	27.9	0.00402	1.56	0.006
			41	78.43	27.9	0.00402	1.56	0.006
			38	79.05	26.4	0.00298	2.01	0.006
			62	78.04	27.9	0.00402	1.46	0.006
			48	78.09	27.9	0.00402	1.35	0.005
			40	79.71	26.4	0.00298	1.56	0.005
			33	79.98	26.4	0.00298	1.46	0.004
			12	80.40	24.9	0.00256	1.67	0.004
			15	80.39	24.9	0.00256	1.60	0.004
			15	80.39	24.9	0.00256	1.60	0.004
			13	80.81	24.9	0.00256	1.60	0.004
			15	80.39	24.9	0.00256	1.49	0.004
			40	80.83	24.9	0.00256	1.46	0.004
			22	80.39	24.9	0.00256	1.46	0.004
			63	80.54	24.9	0.00256	1.35	0.003
			21	80.39	24.9	0.00256	1.35	0.003
			20	80.39	24.9	0.00256	1.35	0.003
			48	81.14	23.4	0.00187	1.84	0.003
			34	81.77	23.4	0.00187	1.77	0.003
			24	81.85	23.4	0.00187	1.77	0.003
			24	81.85	23.4	0.00187	1.77	0.003
			41	81.44	23.4	0.00187	1.70	0.003

Rank	Unique ID (NpHandle)	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Cost (Criticality* POF)
[redacted]			36	81.39	23.4	0.00187	1.56	0.003
[redacted]			40	81.76	23.4	0.00187	1.46	0.003
[redacted]			54	82.61	21.8	0.00159	1.67	0.003
[redacted]			13	82.47	21.8	0.00159	1.60	0.003
[redacted]			47	82.73	21.8	0.00159	1.60	0.003
[redacted]			17	82.79	21.8	0.00159	1.60	0.003
[redacted]			12	82.47	21.8	0.00159	1.49	0.002
[redacted]			11	82.69	21.8	0.00159	1.46	0.002
[redacted]			59	83.65	20.2	0.00114	1.98	0.002
[redacted]			56	83.89	20.2	0.00114	1.74	0.002
[redacted]			38	83.98	20.2	0.00114	1.67	0.002
[redacted]			62	84.46	18.7	0.00097	1.88	0.002
[redacted]			37	84.98	18.7	0.00097	1.88	0.002
[redacted]			62	84.74	18.7	0.00097	1.74	0.002
[redacted]			61	83.22	20.2	0.00114	1.46	0.002
[redacted]			12	83.80	20.2	0.00114	1.46	0.002
[redacted]			26	83.78	20.2	0.00114	1.46	0.002
[redacted]			5	84.17	18.7	0.00097	1.67	0.002
[redacted]			20	84.73	18.7	0.00097	1.60	0.002
[redacted]			45	84.44	18.7	0.00097	1.46	0.001
[redacted]			63	85.56	17.1	0.00069	1.98	0.001
[redacted]			26	85.93	17.1	0.00069	1.70	0.001
[redacted]			57	86.49	15.5	0.00058	1.98	0.001
[redacted]			48	85.27	17.1	0.00069	1.60	0.001
[redacted]			62	86.39	15.5	0.00058	1.88	0.001
[redacted]			19	85.19	17.1	0.00069	1.56	0.001
[redacted]			49	86.97	15.5	0.00058	1.84	0.001
[redacted]			48	86.39	15.5	0.00058	1.84	0.001
[redacted]			33	85.79	17.1	0.00069	1.49	0.001
[redacted]			52	85.62	17.1	0.00069	1.46	0.001
[redacted]			14	85.78	17.1	0.00069	1.46	0.001
[redacted]			23	86.67	15.5	0.00058	1.67	0.001
[redacted]			5	86.10	15.5	0.00058	1.67	0.001
[redacted]			7	86.14	15.5	0.00058	1.67	0.001
[redacted]			65	86.75	15.5	0.00058	1.67	0.001
[redacted]			17	86.68	15.5	0.00058	1.60	0.001
[redacted]			18	86.68	15.5	0.00058	1.56	0.001

Rank	Unique ID (NpHandle)	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Cost (Criticality* POF)
[redacted]			19	86.68	15.5	0.00058	1.56	0.001
[redacted]			19	86.68	15.5	0.00058	1.56	0.001
[redacted]			36	86.61	15.5	0.00058	1.56	0.001
[redacted]			41	86.71	15.5	0.00058	1.56	0.001
[redacted]			63	86.65	15.5	0.00058	1.46	0.001
[redacted]			63	86.65	15.5	0.00058	1.46	0.001
[redacted]			63	86.65	15.5	0.00058	1.46	0.001
[redacted]			53	87.82	13.9	0.00040	1.77	0.001
[redacted]			62	87.15	13.9	0.00040	1.74	0.001
[redacted]			53	87.34	13.9	0.00040	1.67	0.001
[redacted]			44	87.37	13.9	0.00040	1.67	0.001
[redacted]			13	87.78	13.9	0.00040	1.60	0.001
[redacted]			46	88.13	12.4	0.00034	1.88	0.001
[redacted]			15	87.05	13.9	0.00040	1.46	0.001
[redacted]			25	88.62	12.4	0.00034	1.74	0.001
[redacted]			53	88.34	12.4	0.00034	1.67	0.001
[redacted]			66	88.19	12.4	0.00034	1.67	0.001
[redacted]			66	88.19	12.4	0.00034	1.67	0.001
[redacted]			22	88.72	12.4	0.00034	1.67	0.001
[redacted]			47	88.77	12.4	0.00034	1.63	0.001
[redacted]			38	88.96	12.4	0.00034	1.56	0.001
[redacted]			45	88.39	12.4	0.00034	1.46	0.000
[redacted]			36	88.35	12.4	0.00034	1.46	0.000
[redacted]			41	89.76	10.9	0.00023	1.88	0.000
[redacted]			28	89.69	10.9	0.00023	1.84	0.000
[redacted]			28	89.31	10.9	0.00023	1.84	0.000
[redacted]			25	89.48	10.9	0.00023	1.84	0.000
[redacted]			62	89.07	10.9	0.00023	1.74	0.000
[redacted]			34	90.50	9.4	0.00019	2.01	0.000
[redacted]			64	89.16	10.9	0.00023	1.67	0.000
[redacted]			41	89.43	10.9	0.00023	1.63	0.000
[redacted]			24	90.78	9.4	0.00019	1.88	0.000
[redacted]			9	90.24	9.4	0.00019	1.84	0.000
[redacted]			26	90.85	9.4	0.00019	1.70	0.000
[redacted]			22	90.57	9.4	0.00019	1.70	0.000
[redacted]			34	90.42	9.4	0.00019	1.67	0.000
[redacted]			52	90.68	9.4	0.00019	1.63	0.000

Rank	Unique ID (NpHandle)	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Cost (Criticality* POF)
[redacted]	[redacted]	[redacted]	23	90.57	9.4	0.00019	**1.56**	**0.000**
[redacted]	[redacted]	[redacted]	55	90.48	9.4	0.00019	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	48	90.08	9.4	0.00019	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	12	90.32	9.4	0.00019	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	37	90.62	9.4	0.00019	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	47	90.37	9.4	0.00019	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	37	90.50	9.4	0.00019	**1.35**	**0.000**
[redacted]	[redacted]	[redacted]	10	90.62	9.4	0.00019	**1.35**	**0.000**
[redacted]	[redacted]	[redacted]	14	91.86	8.0	0.00013	**1.81**	**0.000**
[redacted]	[redacted]	[redacted]	28	91.52	8.0	0.00013	**1.81**	**0.000**
[redacted]	[redacted]	[redacted]	56	91.54	8.0	0.00013	**1.74**	**0.000**
[redacted]	[redacted]	[redacted]	25	91.86	8.0	0.00013	**1.70**	**0.000**
[redacted]	[redacted]	[redacted]	44	91.86	8.0	0.00013	**1.67**	**0.000**
[redacted]	[redacted]	[redacted]	43	91.91	8.0	0.00013	**1.60**	**0.000**
[redacted]	[redacted]	[redacted]	33	91.91	8.0	0.00013	**1.60**	**0.000**
[redacted]	[redacted]	[redacted]	13	91.88	8.0	0.00013	**1.56**	**0.000**
[redacted]	[redacted]	[redacted]	22	91.87	8.0	0.00013	**1.56**	**0.000**
[redacted]	[redacted]	[redacted]	42	91.68	8.0	0.00013	**1.56**	**0.000**
[redacted]	[redacted]	[redacted]	38	91.11	8.0	0.00013	**1.56**	**0.000**
[redacted]	[redacted]	[redacted]	47	92.93	6.7	0.00011	**1.88**	**0.000**
[redacted]	[redacted]	[redacted]	40	92.99	6.7	0.00011	**1.88**	**0.000**
[redacted]	[redacted]	[redacted]	38	91.20	8.0	0.00013	**1.49**	**0.000**
[redacted]	[redacted]	[redacted]	43	91.43	8.0	0.00013	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	61	91.87	8.0	0.00013	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	61	91.15	8.0	0.00013	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	26	91.86	8.0	0.00013	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	14	92.64	6.7	0.00011	**1.67**	**0.000**
[redacted]	[redacted]	[redacted]	30	91.56	8.0	0.00013	**1.35**	**0.000**
[redacted]	[redacted]	[redacted]	9	91.88	8.0	0.00013	**1.35**	**0.000**
[redacted]	[redacted]	[redacted]	5	91.88	8.0	0.00013	**1.35**	**0.000**
[redacted]	[redacted]	[redacted]	49	92.58	6.7	0.00011	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	6	92.67	6.7	0.00011	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	52	92.57	6.7	0.00011	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	17	92.95	6.7	0.00011	**1.46**	**0.000**
[redacted]	[redacted]	[redacted]	41	92.84	6.7	0.00011	**1.35**	**0.000**
[redacted]	[redacted]	[redacted]	28	92.37	6.7	0.00011	**1.35**	**0.000**
[redacted]	[redacted]	[redacted]	33	92.68	6.7	0.00011	**1.35**	**0.000**

Rank	Unique ID (NpHandle)	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Cost (Criticality* POF)
[redacted]			14	93.15	5.4	0.00007	**1.81**	**0.000**
[redacted]			16	93.68	5.4	0.00007	**1.70**	**0.000**
[redacted]			33	93.11	5.4	0.00007	**1.60**	**0.000**
[redacted]			28	94.43	4.2	0.00006	**1.81**	**0.000**
[redacted]			24	93.25	5.4	0.00007	**1.46**	**0.000**
[redacted]			15	93.07	5.4	0.00007	**1.46**	**0.000**
[redacted]			18	94.58	4.2	0.00006	**1.74**	**0.000**
[redacted]			40	94.19	4.2	0.00006	**1.67**	**0.000**
[redacted]			42	94.32	4.2	0.00006	**1.67**	**0.000**
[redacted]			41	94.36	4.2	0.00006	**1.67**	**0.000**
[redacted]			14	93.07	5.4	0.00007	**1.35**	**0.000**
[redacted]			36	93.40	5.4	0.00007	**1.35**	**0.000**
[redacted]			14	93.25	5.4	0.00007	**1.35**	**0.000**
[redacted]			2	93.51	5.4	0.00007	**1.35**	**0.000**
[redacted]			7	94.95	4.2	0.00006	**1.60**	**0.000**
[redacted]			19	94.45	4.2	0.00006	**1.49**	**0.000**
[redacted]			3	94.24	4.2	0.00006	**1.49**	**0.000**
[redacted]			37	94.10	4.2	0.00006	**1.35**	**0.000**
[redacted]			43	95.36	3.1	0.00004	**1.88**	**0.000**
[redacted]			42	95.40	3.1	0.00004	**1.77**	**0.000**
[redacted]			34	95.59	3.1	0.00004	**1.77**	**0.000**
[redacted]			37	95.54	3.1	0.00004	**1.67**	**0.000**
[redacted]			16	95.66	3.1	0.00004	**1.67**	**0.000**
[redacted]			42	95.37	3.1	0.00004	**1.63**	**0.000**
[redacted]			7	95.67	3.1	0.00004	**1.60**	**0.000**
[redacted]			13	95.67	3.1	0.00004	**1.46**	**0.000**
[redacted]			15	95.67	3.1	0.00004	**1.46**	**0.000**
[redacted]			56	96.87	2.2	0.00003	**1.74**	**0.000**
[redacted]			4	95.67	3.1	0.00004	**1.35**	**0.000**
[redacted]			5	95.67	3.1	0.00004	**1.35**	**0.000**
[redacted]			28	95.64	3.1	0.00004	**1.35**	**0.000**
[redacted]			55	96.25	2.2	0.00003	**1.46**	**0.000**
[redacted]			12	97.83	1.4	0.00002	**1.77**	**0.000**
[redacted]			33	98.13	0.8	0.00002	**1.88**	**0.000**
[redacted]			55	97.41	1.4	0.00002	**1.46**	**0.000**
[redacted]			45	98.86	0.8	0.00002	**1.60**	**0.000**
[redacted]			44	98.91	0.8	0.00002	**1.56**	**0.000**

[redacted]	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Cost (Criticality* POF)
	37	99.87	0.3	0.00001	**1.81**	**0.000**
	44	99.63	0.3	0.00001	**1.81**	**0.000**
	30	99.96	0.3	0.00001	**1.49**	**0.000**
	15	99.27	0.3	0.00001	**1.46**	**0.000**
	13	100.00	0.3	0.00001	**1.46**	**0.000**
	3	100.00	0.3	0.00001	**1.35**	**0.000**
		100.00	0.1	0.00001	**1.46**	**0.000**

1.6.1 Flagged for Action Plans

The condition-based flagged for action plan for Substation Transformers/Load Tap Changers/LTCs is plotted in Figure 25 to Figure 27. Note that three different replacement scenarios are shown.

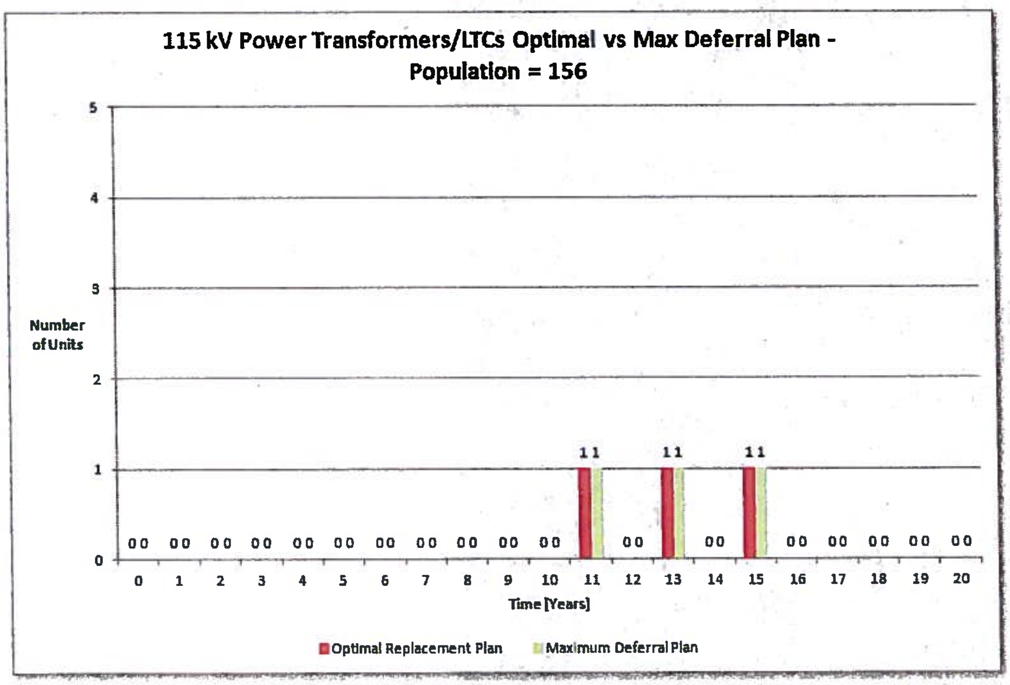

Figure 25 Transformers/LTCs Optimal vs Max Deferral Flagged for Action Plan (115 kV)

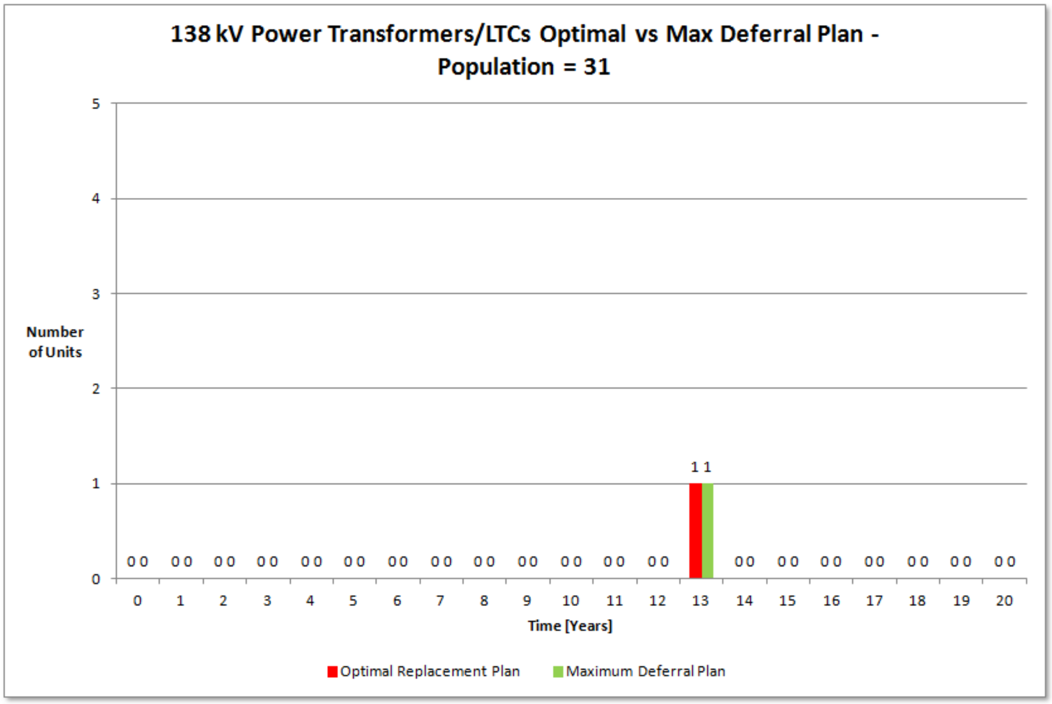

Figure 26 Transformers/LTCs Optimal vs Max Deferral Flagged for Action Plan (138 kV)

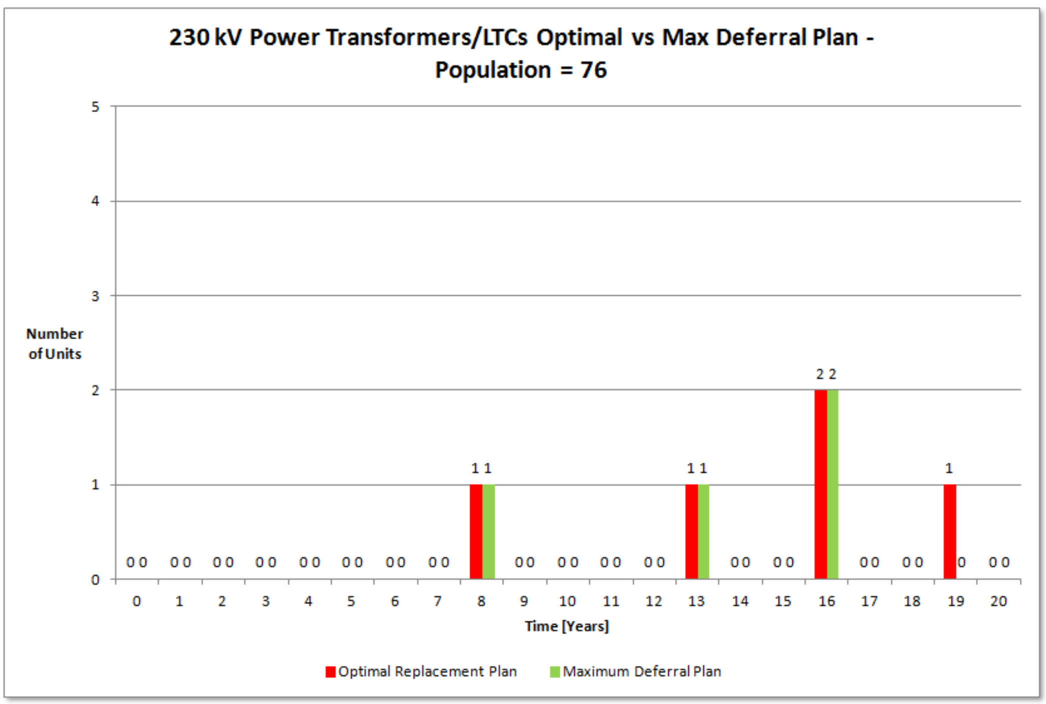

Figure 27 Transformers/LTCs Optimal vs Max Deferral Flagged for Action Plan (230 kV)

The “optimal” plan flags a unit for action in the year that its POF becomes greater than or equal to 80% (failure tolerance). Details for each unit are shown in Table 37.

In the maximum deferred plan, replacements are pushed back or deferred such that a unit is flagged for replacement either when the risk cost is greater than a pre-set minimum risk value, or when its POF becomes greater than or equal to 95% (maximum failure tolerance), whichever comes earlier.

The optimal criticality and flagged for action year for each unit is shown in the table below.

Table 37 Optimal and Max Deferral Flagged for Action for Each Transformer/LTC Unit

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]	[redacted]	8	47.84	**1.74**	8	8
[redacted]	[redacted]	35	51.96	**1.77**	11	11
[redacted]	[redacted]	40	53.75	**1.56**	13	13
[redacted]	[redacted]	10	53.51	**1.49**	13	13
[redacted]	[redacted]	45	54.65	**1.56**	13	13
[redacted]	[redacted]	38	56.41	**1.56**	15	15
[redacted]	[redacted]	36	57.34	**1.88**	16	16
[redacted]	[redacted]	12	57.40	**1.49**	16	16
[redacted]	[redacted]	40	61.60	**1.35**	19	21
[redacted]	[redacted]	49	63.63	**1.67**	21	21
[redacted]	[redacted]	11	63.94	**1.35**	21	23
[redacted]	[redacted]	38	64.09	**1.67**	22	22
[redacted]	[redacted]	27	64.18	**1.67**	22	22
[redacted]	[redacted]	18	64.44	**1.67**	22	22
[redacted]	[redacted]	44	64.13	**1.60**	22	22
[redacted]	[redacted]	36	65.74	**1.98**	23	23
[redacted]	[redacted]	34	66.08	**1.94**	24	24
[redacted]	[redacted]	13	66.15	**1.60**	24	24
[redacted]	[redacted]	21	66.15	**1.56**	24	24
[redacted]	[redacted]	44	66.35	**1.56**	24	24
[redacted]	[redacted]	48	66.29	**1.49**	24	24
[redacted]	[redacted]	24	66.96	**1.46**	24	25
[redacted]	[redacted]	55	68.18	**1.91**	27	27
[redacted]	[redacted]	38	68.15	**1.56**	27	27
[redacted]	[redacted]	58	68.10	**1.56**	27	27
[redacted]	[redacted]	23	68.45	**1.46**	27	27
[redacted]	[redacted]	21	69.61	**1.67**	28	28
[redacted]	[redacted]	13	69.04	**1.49**	28	28

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]	[redacted]	7	70.00	**1.46**	28	28
[redacted]	[redacted]	17	69.61	**1.35**	28	30
[redacted]	[redacted]	40	70.51	**1.98**	29	29
[redacted]	[redacted]	38	70.55	**1.56**	29	29
[redacted]	[redacted]	39	70.15	**1.56**	29	29
[redacted]	[redacted]	47	71.17	**1.67**	30	30
[redacted]	[redacted]	52	71.99	**1.60**	30	30
[redacted]	[redacted]	43	71.96	**1.56**	30	30
[redacted]	[redacted]	75	71.49	**1.56**	30	30
[redacted]	[redacted]	24	71.27	**1.35**	30	32
[redacted]	[redacted]	39	72.55	**1.67**	32	32
[redacted]	[redacted]	50	72.97	**1.60**	32	32
[redacted]	[redacted]	40	72.05	**1.56**	32	32
[redacted]	[redacted]	14	72.05	**1.49**	32	32
[redacted]	[redacted]	38	72.96	**1.46**	32	32
[redacted]	[redacted]	38	72.96	**1.46**	32	32
[redacted]	[redacted]	7	72.76	**1.46**	32	32
[redacted]	[redacted]	21	72.78	**1.46**	32	32
[redacted]	[redacted]	23	72.78	**1.35**	32	33
[redacted]	[redacted]	4	73.17	**1.67**	33	33
[redacted]	[redacted]	40	73.29	**1.67**	33	33
[redacted]	[redacted]	52	73.93	**1.60**	33	33
[redacted]	[redacted]	18	73.42	**1.60**	33	33
[redacted]	[redacted]	3	73.65	**1.56**	33	33
[redacted]	[redacted]	17	73.07	**1.35**	33	35
[redacted]	[redacted]	11	73.08	**1.35**	33	35
[redacted]	[redacted]	63	74.79	**1.98**	34	34
[redacted]	[redacted]	14	74.56	**1.81**	34	34
[redacted]	[redacted]	10	75.00	**1.67**	34	34
[redacted]	[redacted]	14	74.52	**1.67**	34	34
[redacted]	[redacted]	13	75.00	**1.60**	34	34
[redacted]	[redacted]	15	74.46	**1.60**	34	34
[redacted]	[redacted]	15	74.46	**1.60**	34	34
[redacted]	[redacted]	44	74.22	**1.56**	34	34
[redacted]	[redacted]	44	74.80	**1.56**	34	34
[redacted]	[redacted]	15	74.46	**1.49**	34	34
[redacted]	[redacted]	16	74.80	**1.46**	34	35

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]	[redacted]	37	74.70	**1.46**	34	35
[redacted]	[redacted]	17	75.00	**1.46**	34	35
[redacted]	[redacted]	26	74.79	**1.35**	34	36
[redacted]	[redacted]	14	75.96	**1.67**	36	36
[redacted]	[redacted]	40	75.20	**1.56**	36	36
[redacted]	[redacted]	6	75.10	**1.56**	36	36
[redacted]	[redacted]	39	75.92	**1.56**	36	36
[redacted]	[redacted]	82	75.28	**1.56**	36	36
[redacted]	[redacted]	8	76.08	**1.77**	37	37
[redacted]	[redacted]	54	76.66	**1.67**	37	37
[redacted]	[redacted]	11	76.54	**1.56**	37	37
[redacted]	[redacted]	37	76.44	**1.56**	37	37
[redacted]	[redacted]	8	76.54	**1.56**	37	37
[redacted]	[redacted]	26	76.52	**1.46**	37	37
[redacted]	[redacted]	19	76.53	**1.46**	37	37
[redacted]	[redacted]	18	76.53	**1.46**	37	37
[redacted]	[redacted]	25	76.52	**1.35**	37	39
[redacted]	[redacted]	52	77.04	**1.60**	38	38
[redacted]	[redacted]	60	78.74	**1.84**	40	40
[redacted]	[redacted]	30	78.98	**1.67**	40	40
[redacted]	[redacted]	82	78.17	**1.56**	40	40
[redacted]	[redacted]	82	78.17	**1.56**	40	40
[redacted]	[redacted]	41	78.43	**1.56**	40	40
[redacted]	[redacted]	62	78.04	**1.46**	40	40
[redacted]	[redacted]	48	78.09	**1.35**	40	42
[redacted]	[redacted]	38	79.05	**2.01**	41	41
[redacted]	[redacted]	40	79.71	**1.56**	41	41
[redacted]	[redacted]	33	79.98	**1.46**	41	42
[redacted]	[redacted]	12	80.40	**1.67**	43	43
[redacted]	[redacted]	15	80.39	**1.60**	43	43
[redacted]	[redacted]	15	80.39	**1.60**	43	43
[redacted]	[redacted]	13	80.81	**1.60**	43	43
[redacted]	[redacted]	15	80.39	**1.49**	43	43
[redacted]	[redacted]	40	80.83	**1.46**	43	43
[redacted]	[redacted]	22	80.39	**1.46**	43	43
[redacted]	[redacted]	63	80.54	**1.35**	43	45
[redacted]	[redacted]	21	80.39	**1.35**	43	45

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		20	80.39	1.35	43	45
		48	81.14	1.84	44	44
		34	81.77	1.77	44	44
		24	81.85	1.77	44	44
		24	81.85	1.77	44	44
		41	81.44	1.70	44	44
		36	81.39	1.56	44	44
		40	81.76	1.46	44	45
		54	82.61	1.67	46	46
		13	82.47	1.60	46	46
		47	82.73	1.60	46	46
		17	82.79	1.60	46	46
		12	82.47	1.49	46	46
		11	82.69	1.46	46	46
		59	83.65	1.98	48	48
		56	83.89	1.74	48	48
		38	83.98	1.67	48	48
		61	83.22	1.46	48	48
		12	83.80	1.46	48	48
		26	83.78	1.46	48	48
		62	84.46	1.88	49	49
		37	84.98	1.88	49	49
		62	84.74	1.74	49	49
		5	84.17	1.67	49	49
		20	84.73	1.60	49	49
		45	84.44	1.46	49	50
		63	85.56	1.98	51	51
		26	85.93	1.70	51	51
		48	85.27	1.60	51	51
		19	85.19	1.56	51	51
		33	85.79	1.49	51	51
		52	85.62	1.46	51	51
		14	85.78	1.46	51	51
		57	86.49	1.98	52	52
		62	86.39	1.88	52	52
		49	86.97	1.84	52	52
		48	86.39	1.84	52	52

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		23	86.67	1.67	52	52
[redacted]		5	86.10	1.67	52	52
[redacted]		7	86.14	1.67	52	52
[redacted]		65	86.75	1.67	52	52
[redacted]		17	86.68	1.60	52	52
[redacted]		18	86.68	1.56	52	52
[redacted]		19	86.68	1.56	52	52
[redacted]		19	86.68	1.56	52	52
[redacted]		36	86.61	1.56	52	52
[redacted]		41	86.71	1.56	52	52
[redacted]		63	86.65	1.46	52	53
[redacted]		63	86.65	1.46	52	53
[redacted]		63	86.65	1.46	52	53
[redacted]		53	87.82	1.77	54	54
[redacted]		62	87.15	1.74	54	54
[redacted]		53	87.34	1.67	54	54
[redacted]		44	87.37	1.67	54	54
[redacted]		13	87.78	1.60	54	54
[redacted]		15	87.05	1.46	54	54
[redacted]		46	88.13	1.88	55	55
[redacted]		25	88.62	1.74	55	55
[redacted]		53	88.34	1.67	55	55
[redacted]		66	88.19	1.67	55	55
[redacted]		66	88.19	1.67	55	55
[redacted]		22	88.72	1.67	55	55
[redacted]		47	88.77	1.63	55	55
[redacted]		38	88.96	1.56	55	55
[redacted]		45	88.39	1.46	55	56
[redacted]		36	88.35	1.46	55	56
[redacted]		41	89.76	1.88	57	57
[redacted]		28	89.69	1.84	57	57
[redacted]		28	89.31	1.84	57	57
[redacted]		25	89.48	1.84	57	57
[redacted]		62	89.07	1.74	57	57
[redacted]		64	89.16	1.67	57	57
[redacted]		41	89.43	1.63	57	57
[redacted]		34	90.50	2.01	58	58

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		24	90.78	**1.88**	58	58
		9	90.24	**1.84**	58	58
		26	90.85	**1.70**	58	58
		22	90.57	**1.70**	58	58
		34	90.42	**1.67**	58	58
		52	90.68	**1.63**	58	58
		23	90.57	**1.56**	58	58
		55	90.48	**1.46**	58	59
		48	90.08	**1.46**	58	59
		12	90.32	**1.46**	58	59
		37	90.62	**1.46**	58	59
		47	90.37	**1.46**	58	59
		37	90.50	**1.35**	58	60
		10	90.62	**1.35**	58	60
		14	91.86	**1.81**	60	60
		28	91.52	**1.81**	60	60
		56	91.54	**1.74**	60	60
		25	91.86	**1.70**	60	60
		44	91.86	**1.67**	60	60
		43	91.91	**1.60**	60	60
		33	91.91	**1.60**	60	60
		13	91.88	**1.56**	60	60
		22	91.87	**1.56**	60	60
		42	91.68	**1.56**	60	60
		38	91.11	**1.56**	60	60
		38	91.20	**1.49**	60	60
		43	91.43	**1.46**	60	60
		61	91.87	**1.46**	60	60
		61	91.15	**1.46**	60	60
		26	91.86	**1.46**	60	60
		30	91.56	**1.35**	60	62
		9	91.88	**1.35**	60	62
		5	91.88	**1.35**	60	62
		47	92.93	**1.88**	61	61
		40	92.99	**1.88**	61	61
		14	92.64	**1.67**	61	61
		49	92.58	**1.46**	61	62

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		6	92.67	**1.46**	61	62
		52	92.57	**1.46**	61	62
		17	92.95	**1.46**	61	62
		41	92.84	**1.35**	61	63
		28	92.37	**1.35**	61	63
		33	92.68	**1.35**	61	63
		14	93.15	**1.81**	62	62
		16	93.68	**1.70**	62	62
		33	93.11	**1.60**	62	62
		24	93.25	**1.46**	62	63
		15	93.07	**1.46**	62	63
		14	93.07	**1.35**	62	64
		36	93.40	**1.35**	62	64
		14	93.25	**1.35**	62	64
		2	93.51	**1.35**	62	64
		28	94.43	**1.81**	64	64
		18	94.58	**1.74**	64	64
		40	94.19	**1.67**	64	64
		42	94.32	**1.67**	64	64
		41	94.36	**1.67**	64	64
		7	94.95	**1.60**	64	64
		19	94.45	**1.49**	64	64
		3	94.24	**1.49**	64	64
		37	94.10	**1.35**	64	65
		43	95.36	**1.88**	65	65
		42	95.40	**1.77**	65	65
		34	95.59	**1.77**	65	65
		37	95.54	**1.67**	65	65
		16	95.66	**1.67**	65	65
		42	95.37	**1.63**	65	65
		7	95.67	**1.60**	65	65
		13	95.67	**1.46**	65	65
		15	95.67	**1.46**	65	65
		4	95.67	**1.35**	65	67
		5	95.67	**1.35**	65	67
		28	95.64	**1.35**	65	67
		56	96.87	**1.74**	66	66

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		55	96.25	**1.46**	66	66
[redacted]		12	97.83	**1.77**	66	66
[redacted]		55	97.41	**1.46**	66	67
[redacted]		33	98.13	**1.88**	67	67
[redacted]		45	98.86	**1.60**	67	67
[redacted]		44	98.91	**1.56**	67	67
[redacted]		37	99.87	**1.81**	67	67
[redacted]		44	99.63	**1.81**	67	67
[redacted]		30	99.96	**1.49**	67	67
[redacted]		15	99.27	**1.46**	67	67
[redacted]		13	100.00	**1.46**	67	67
[redacted]		3	100.00	**1.35**	67	67
[redacted]			100.00	**1.46**	68	68

1.7 Data Analysis

The data available for Substation Transformers/Load Tap Changers/LTCs includes age, inspection results, oil quality, dissolved gas analysis, Doble tests, and loading.

1.7.1 Data Availability Distribution

The average DAI for Substation Transformers/Load Tap Changers is 94%. All units had CM inspection results available. The other data are available for majority of the units.

The data availability distribution for the transformer population is shown in Figure 28.

The average DAI for LTCs is 86%. All units had CM inspection results and age information available. However less than 50% of the population had oil DGA or oil quality test data.

The data availability distribution for the LTC population is shown in Figure 28.

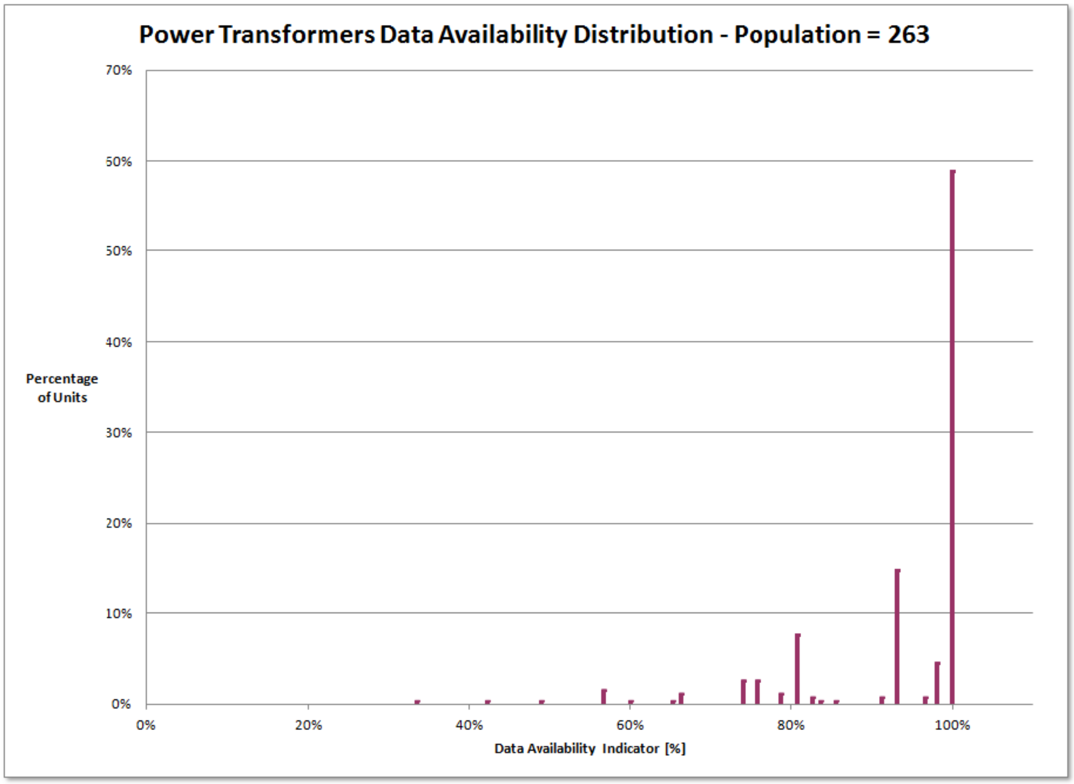

Figure 28 Transformers Data Availability Distribution

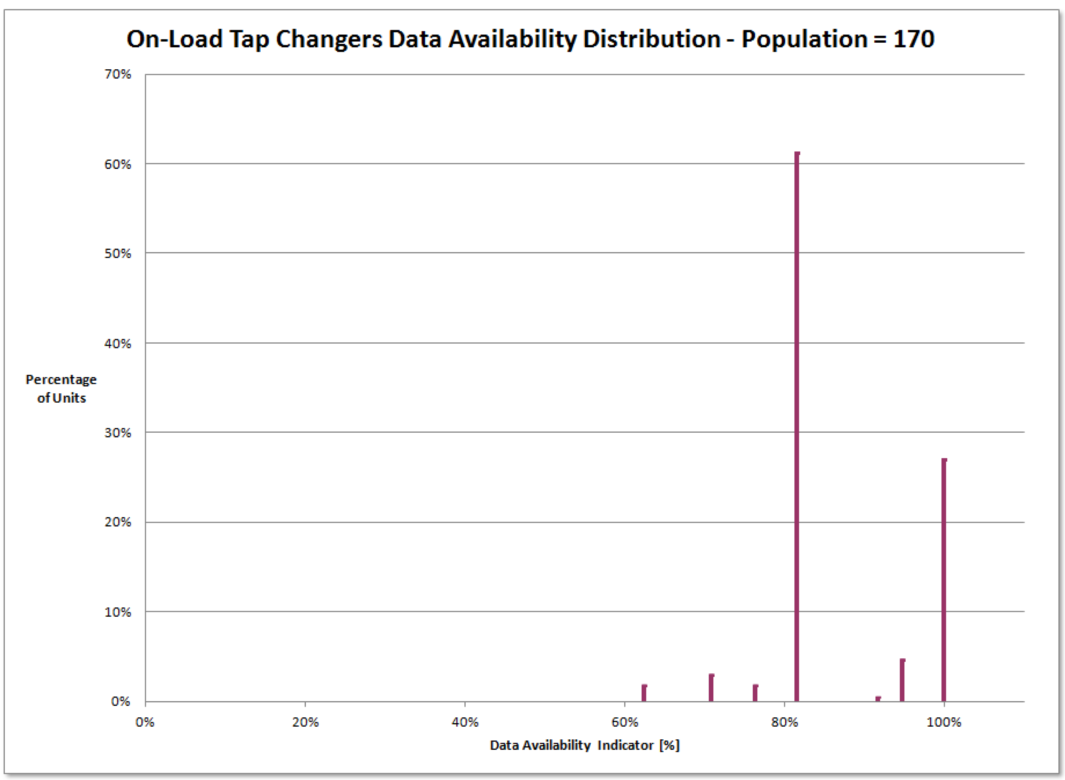

Figure 29 On-Load Tap Changers Data Availability Distribution

1.7.2 Data Gap

For this asset category, most of the critical data, namely test data, are already available and included in the Health Index formula.

Additional data are as follows:

Table 38 Transformers/LTCs Data Gaps

Data Gap (Sub-Condition Parameter)	**Parent Condition Parameter**	**Priority**	**Object or Component Addressed**	**Description**	**Source of Data**
FURAN	Insulation	☆ ☆ ☆	Transformer insulation	Degradation of paper insulation	Sampling and Analysis
Infrared (IR) Thermography	Sealing & Connection	☆ ☆ ☆	Cooling system	Poor ventilation/circulation	IR Camera Scan
			Transformer connection	Poor connection	
Loading	Service Record	☆ ☆	Loading	Monthly 15 min peak load throughout years	Loading Records

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2 Substation Circuit Breakers

Circuit breakers used in transmission and distribution power systems to sectionalize and isolate circuits are often categorized by the insulation medium used in the breaker and the interruption process. The common breaker types include oil circuit breakers, air circuit breakers, vacuum circuit breakers, and SF6 circuit breakers.

Oil circuit breakers (OCB) have been in use for over 70 years. OCBs interrupt current under oil and use the gas generated by the decomposition of the oil to assist in arc extinguishing. They are available in single or multi-tank configurations. Two types of designs exist among OCBs: bulk oil breakers (in which oil serves as the insulating and arc quenching medium), and minimum oil breakers (in which oil provides the arc quenching function only). MH uses both oil breakers. OCBs are available from 25kV class and up, with continuous currents up to 1200A and interrupting capacities up to 40kA.

Air insulated breakers are generally used at distribution system voltages and below. Air-type circuit breakers fall into two classifications: air- blast and air- magnetic. Air-blast breakers use compressed air as the quenching, insulating and actuating mechanism. In a typical device a blast of air carries the arc into an arc chute to be extinguished. Air blast breakers at distribution voltages are often in metal-enclosed switchgear. Continuous current ratings of these devices are in the range of 1200 to 5000 A, and fault interrupting from 20 to 140kA.

Air magnetic breakers use the magnetic effect of the current undergoing interruption to draw an arc into an arc chute for cooling, splitting and extinction. Sometimes, an auxiliary puffer or air blast piston may help interrupt low-level currents. These designs are commonly used in metal-clad switchgear applications. Air magnetic breakers are available in voltages ratings up to 15kV, with continuous currents up to 3000A, and interrupting ratings as high as 40 kA. These breakers are relatively inexpensive and relatively easy to maintain. The air magnetic breakers have short duty cycles, require frequent maintenance and approach their end-of-life at much faster rates than either SF6 or vacuum breakers. They also have limited transient recovery voltage capabilities and can experience re-strike when switching capacitive currents.

In vacuum breakers, the parting contacts are placed in an evacuated chamber (i.e. bottle). There is generally one fixed and one moving contact in a butting configuration. A bellows attached to the moving contact permits the required short stroke to occur while maintaining the vacuum. Arc interruption occurs at current zero after withdrawal of the moving contact. Utilities typically install vacuum breakers indoors in metal-clad switchgear. Current medium voltage vacuum breakers require low mechanical drive energy, have high endurance, can interrupt fully rated short circuits up to 100 times, and operate reliably over 30,000 or more switching operations. Vacuum breakers also are safe and protective of the environment.

SF6 Circuit breakers were first developed in the late 1960s and based on air blast technology. SF6 breakers interrupt currents by opening a blast valve and allowing high pressure SF6 to flow through a nozzle along the arc drawn between fixed and moving contacts. This process rapidly deionizes, cools and interrupts the arc. After interruption, low-pressure gas is compressed for re-use in the next operation.

2.1 Degradation Mechanism

In general, circuit breakers have many moving parts that are subject to wear and stress. They frequently “make” and “break” high currents and experience the erosion caused by arcing accompanying these operations. All circuit breakers undergo some contact degradation every time they open to interrupt an arc. Also, arcing produces heat and decomposition products that degrade surrounding insulation materials, nozzles, and interrupter chambers. The mechanical energy needed for the high contact velocities of these assets adds mechanical deterioration to their degradation processes.

The rate and severity of degradation depends on many factors, including insulating and conducting materials, operating environments, and a breaker’s specific duties. Outdoor circuit breakers may experience adverse environmental conditions that influence their rate and severity of degradation. For outdoor mounted circuit breakers, the following represent additional degradation factors:

- Corrosion
- Effects of moisture
- Bushing/insulator deterioration
- Mechanical

Corrosion and moisture commonly cause degradation of internal insulation, breaker performance mechanisms, and major components like bushings, structural components, and oil seals. Corrosion presents problems for almost all circuit breakers, irrespective of their location or housing material. Rates of corrosion degradation, however, vary depending on exposure to environmental elements. Underside tank corrosion causes problem in many types of breakers, particularly those with steel tanks. Another widespread problem involves corrosion of operating mechanism linkages that result in eventual link seizures. Corrosion also causes damage to metal flanges, bushing hardware and support insulators.

Moisture causes degradation of the insulating system. Outdoor circuit breakers experience moisture ingress through defective seals, gaskets, pressure relief and venting devices. Moisture in the interrupter tank can lead to general degradation of internal components. Also, sometimes free water collects in tank bottoms, creating potential catastrophic failure conditions.

For circuit breakers, mechanical degradation presents greater end-of-life concerns than electrical degradation. Generally, operating mechanisms, bearings, linkages, and drive rods represent components that experience most mechanical degradation problems. Oil leakage also occurs. Contacts, nozzles, and highly stressed components can also experience electrical-related degradation and deterioration. Other effects that arise with aging include:

- Loose primary and grounding connections
- Oil contamination and/or leakage
- Deterioration of concrete foundation affecting stability of breaker

For OCBs, the interruption of load and fault currents involves the reaction of high pressure with large volumes of hydrogen gas and other arc decomposition products. Thus, both contacts and oil degrade more rapidly in OCBs than they do in either SF6 or vacuum designs, especially when the OCB undergoes frequent switching operations. Generally, 4 to 8 fault interruptions with contact erosion and oil carbonisation will lead to the need maintenance, including oil filtration. Oil breakers can also experience restrike when switching low load or line charging currents with high recovery voltage values. Sometimes this can lead to catastrophic breaker failures.

SF6 circuit breakers rarely fail from internal degradation or insulation breakdowns. When such failures do occur, they typically result from design or manufacture deficiencies, and they happen early in the breaker's life. There is insufficient experience with failures from long-term SF6 chamber degradation. SF6 insulation systems are sensitive to enhanced stress caused by metal particles or other protrusions on live parts. Metallic particles generated by moving metal parts in the tank can accumulate and cause internal flashovers. Particle initiated failures do not appear age-related, since the problem has occurred on relatively new breakers. Low temperatures have caused operational problems and failures of SF6 breakers. Most international testing standards for these breakers specify minimum temperatures of -30° C, but many Canadian users require operation at -40° C or below. At low temperatures, early double pressure designs experience gas leaks as well as mechanism and ancillary system problems, including failures. Single pressure designs also may have gas leaks, with gas seals and valves presenting weak points. SF6 loss and the ingress of moisture and air compromise breaker performance. Generally, earlier models have more problems than later ones, since modern equipment has improved seal and valve designs.

SF6 is extremely stable. Even at high arcing temperatures limited SF6 breakdown occurs. Also, with use of a suitable desiccant most breakdown products recombine to form SF6. Consequently, SF6 breakers can operate under fault conditions much longer than OCBs or ABCBs before needing maintenance. Manufacturers generally state that these breakers can perform 20 to 50 operations at full rated fault levels before requiring maintenance.

Recently, concerns have arisen about the greenhouse properties of SF6. It is one of the gases specifically mentioned in the Kyoto Agreement. Canada has not issued regulations for SF6, but has made a commitment to reduce the country's overall greenhouse gas emissions.

The diagnostic tests to assess the condition of circuit breakers include:

- Visual inspections
- Travel time tests
- Contact resistance measurements
- Bushing - Doble Test
- Stored energy tests (Air/Hydraulic/Spring Recharge Time)
- Insulating medium tests

As indicated above, the useful life of circuit breakers can vary significantly depending on the duty cycle and typically lies within a broad range of 25 to 50 years.

In some cases, the end of life for circuit breakers may not be governed by technical considerations but rather by operational, maintenance and obsolescence issues. The International Council on Large Electric Systems' (CIGRE) have identified the following factors that lead to end-of-life for this asset class:

- Decreasing reliability, availability and maintainability
- High maintenance and operating costs
- Changes in operating conditions, rendering the existing asset obsolete;
- Maintenance overhaul requirements; and

Consequences of circuit breaker failure may be significant as they can directly lead to catastrophic failure of the protected equipment, leading to customer interruptions, health and safety consequences and adverse environmental impacts.

2.2 Health Index Formula

This section presents the Health Index Formula that was developed and used for MH's Circuit Breakers. The Health Index equation is shown in Equation 1 of Section II.1; the condition, sub-condition parameters, weights, and condition criteria are as follows.

Assume a parameter scoring system of 0 though 4, where 0 and 4 represent the "worst" and "best" scores respectively. Thus, the maximum score for any condition or sub-condition parameter (maximum CPS and CPF) is "4".

2.2.1 Condition and Sub-Condition Parameters

Table 39 Circuit Breakers Condition Weights and Maximum CPS

m	Condition parameter	WCP_m			CPS Lookup Table
		Oil	SF6	Air Blast	
1	Operating mechanism	14	11	14	Table 40
2	Contact performance	7	7	7	Table 41
3	Arc extinction	9	5	5	Table 42
4	Insulation	2	2	2	Table 43
5	Service Record	5	5	5	Table 44
	Derating Factor	As a multiplier for overall HI			Table 53

Table 40 Circuit Breakers Operating Mechanism (m=1) Weights and Maximum CPF

n	Sub-Condition Parameter	CPF lookup table	$WCPF_n$			$CPF_{n.max}$
			Oil	SF6	Air Blast	
1	Lubrication	Table 45	9	7	9	4
2	Linkage	Table 45	5	4	5	4
3	Cabinet	Table 45	2	1	2	4
	Operating type	Table 51	As a multiplier for operating mechanism, based on different type			

Table 41 Circuit Breakers Contact Performance (m=2) Weights and Maximum CPF

n	Sub-Condition Parameter	CPF lookup table	$WCPF_n$			$CPF_{n.max}$
			Oil	SF6	Air Blast	
1	Closing timing	Table 45	1			4
2	Trip timing	Table 45	2			4
3	Contact Resistance	Table 45	1			4
4	Contact Over-travel	Table 45	1			4
5	Arcing contact	Table 45	1			4

Table 42 Circuit Breakers Arc Extinction (m=3) Weights and Maximum CPF

n	Sub-Condition Parameter	CPF lookup table	$WCPF_n$			$CPF_{n.max}$
			Oil	SF6	Air Blast	
1	Heater	Table 45	1	0	0	4
2	Leakage	Table 45	2	2	2	4
3	Interrupter	Table 45	1	1	1	4
4	Oil DGA	Table 46	8	0	0	4

Table 43 Circuit Breakers Insulation (m=4) Weights and Maximum CPF

n	Sub-Condition Parameter	CPF lookup table	$WCPF_n$			$CPF_{n.max}$
			Oil	SF6	Air Blast	
1	Power Factor	Table 45	1	1	1	4
2	Oil Quality	Table 48	2	0	0	4
3	Insulation	Table 45	1	1	1	4

Table 44 Circuit Breakers Service Record (m=5) Weights and Maximum CPF

n	Sub-Condition Parameter	CPF lookup table	$WCPF_n$			$CPF_{n.max}$
			Oil	SF6	Air Blast	
1	Operating Counter	Table 52	2			4
2	Age	Figure 30	1			4

2.3 Condition Parameter Criteria

Individual Condition Based on Corrective Maintenance Count

Table 45 Circuit Breakers CM Count Condition Criteria

Condition Rating*	CPF	Description
A	4	0
B	3	1
C	2	2
D	1	3
E	0	4

Where CM count is calculated as below:

Year	Score				Weight
	1	2	3	4	
2012	Incidental Failure	Potential Failure	Functional Failure	Forced Outage	1
2011					1
2010					1
2009					1
2008					1

CM count = $\frac{\sum Score_i \times Weight_i}{\sum Weight}$

Where i refers to the year the CM was conducted

<u>Individual Condition Based on Measurement</u>

--- Oil DGA and Quality

Table 46 Circuit Breakers Oil DGA

Condition Rating*	CPF	Description
A	4	DGA overall factor is not greater than 1.2
B	3	DGA overall factor between 1.2 and 1.5
C	2	DGA overall factor is between 1.5 and 2.0
D	1	DGA overall factor is between 2.0 and 3.0
E	0	DGA overall factor is greater than 3.0

Where the DGA overall factor is the weighted average of the following gas scores as below:

Table 47 Circuit Breakers Oil DGA overall factoring

	Scores					Weight
	1	2	3	4	5	
C2H4/C2H2	<0.33	<0.67	<1.00	<1.33	>=1.33	3
C2H6/CH4	<0.20	<0.40	<0.60	<0.80	>=0.80	2
H2	<70	<500	<1000	<1500	>=1500	1

Overall Factor = $\frac{\sum Score_i \times Weight_i}{\sum Weight}$

Note: Overall Factor =1.2 when ALL the following conditions meet
--- H2 (hydrogen)< 1500 ppm
--- C2H4 (Ethylene) < 1000 ppm
--- C2H2 (Acetylene) < 1000 ppm

Table 48 Circuoit Breakers Oil quality

Condition Rating	CPF	Description
A	4	Overall factor is less than 1.2
B	3	Overall factor between 1.2 and 1.5
C	2	Overall factor is between 1.5 and 2.0
D	1	Overall factor is between 2.0 and 3.0
E	0	Overall factor is greater than 3.0

Where the Overall factor is the weighted average of the following gas scores:

Table 49 Circuit Breakers Oil quality overall factoring

	Scores				Weight
	1	2	3	4	
Dielectric Str. kV ASTM D1816-97 2mm gap	>27	>20	>10	< 10	3
IFT mN/m ASTM D971-99a	>25	20-25	15-20	< 15	1
Acid Number mg KOH/g ASTM D974-02	<0.015	0.015-0.02	0.02-0.03	>0.03	2
Water content mg/kg ASTM D1533-00	<25	<30	<35	>35	2

Overall Factor = $\frac{\sum Score_i \times Weight_i}{\sum Weight}$

--- Dielectric measurement

Table 50 Circuit Breakers Dielectric specification limit

Condition Rating	Factor	Condition Description (PF at 25 Deg. C, ASTM D924-99e1)
A	4	< 0.05%
B	3	0.05% - 0.5%
C	2	0.5% - 1%
D	1	1% - 2%
E	0	>2%

Individual Condition Based on CB Intrinsic Characteristics

--- Operating Mechanism

Table 51 Circuit Breakers Multiplier for operating mechanism

Operating type	Multiplier
Hydraulic	1
Spring	0.8
Solenoid/Motor Storage	0.6
Pneumatic, Air	0.5

--- Age

Assume that the failure rate for circuit breakers exponentially increases with age and that the failure rate equation is as follows:

$$f = e^{\beta(t-\alpha)}$$

f = failure rate of an asset (percent of failure per unit time)
t = time
α, β = constant parameters that control the rise of the curve

The corresponding survivor function is therefore:

$$S_f = 1 - P_f = e^{-(f-e^{\alpha\beta})/\beta}$$

S_f = survivor function
P_f = cumulative probability of failure

Assuming that at the ages of 50 and 80 years the probabilities of failure (P_f) are 10% and 90% result in the survival curves shown below. It follows that the CPF for Age is the survival curve normalized to the maximum CPF score of 4 (i.e. 4*Survival Curve). The CPF vs. Age is also shown in the figure below.

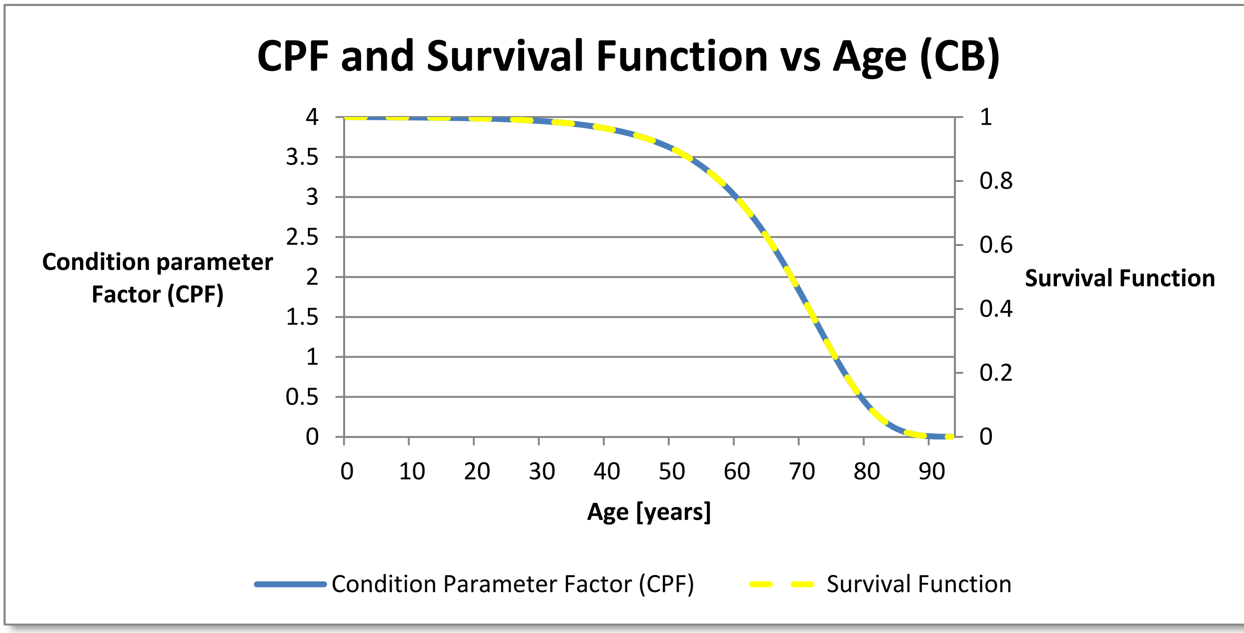

Figure 30 CPF and Survival Function vs. Age (Circuit Breakers)

Individual Condition Based on Operation Mode

--- Operating Counter

Table 52 Circuit Breaker Type and Maximum Operation Limits

Condition Rating	CPF	Condition Description
A	4	Measurement <= 80% AFO limit
B	3	Measurement (80%, 100%] AFO limit
D	1	Measurement (100%, 120%] AFO limit
E	0	Measurement > 120% AFO limit

Where AFO (Allowable fault operation) information is provided by Manitoba Hydro for each specific circuit breaker.

Derating Factor

The de-rating is based on the following equation:

$$DR = \min\left(DRF_1, DRF_2, DRF_3, DRF_4\right)$$

Equation 2-1

Where DRF are as described in Table 23

Table 53 Circuit Breakers De-Rating Factors

De-Rating Factor (DRF)	De-Rating Factor	Description
DRF_1	0.8 or 0.9	In the case of a circuit breaker with known performance issue, a derating factor of 0.8 or 0.9 is applied to the overall HI of a specific circuit breaker, based on Manitoba Hydro information

2.4 Age Distribution

The age distribution for this asset class is shown on the figure below. The average age of the population is 30 years old.

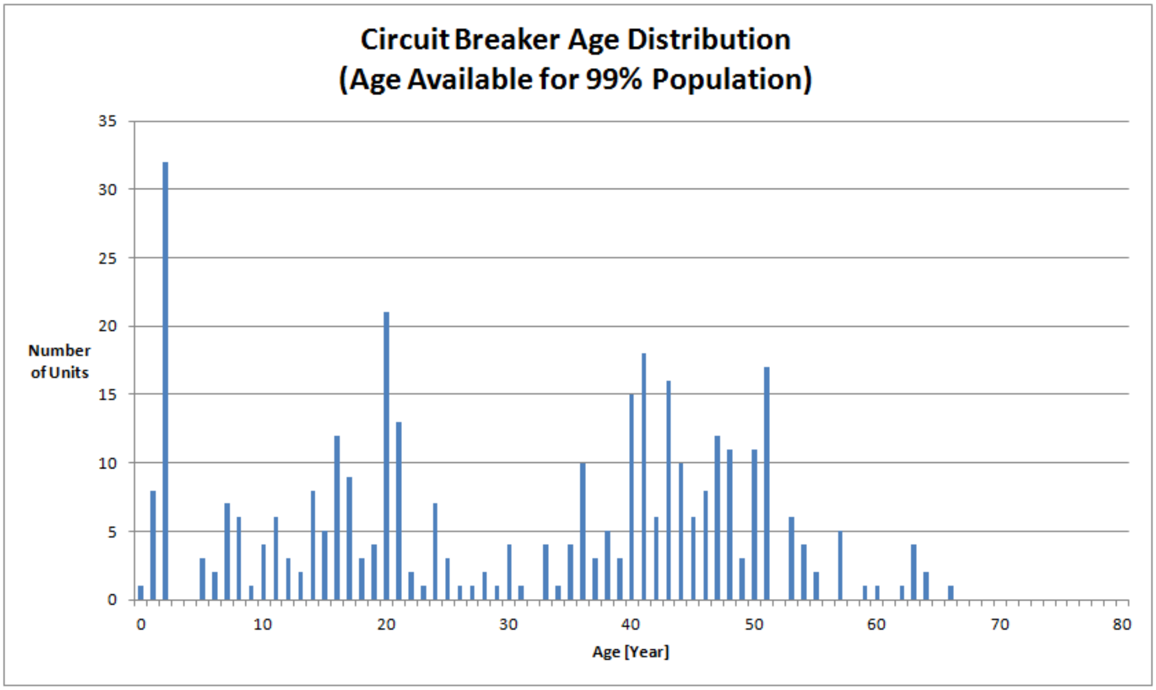

Figure 31 Circuit Breakers Age Distribution

2.5 Health Index Results

There are 366 Substation Circuit Breakers at MH. Of these, there are 365 units with sufficient data for a Health Indexing.

The Health Index Distribution is shown in Figure 32.

The average Health Index for this asset group is 81%. Slightly less than 2% of the population is found to be in poor or very poor condition.

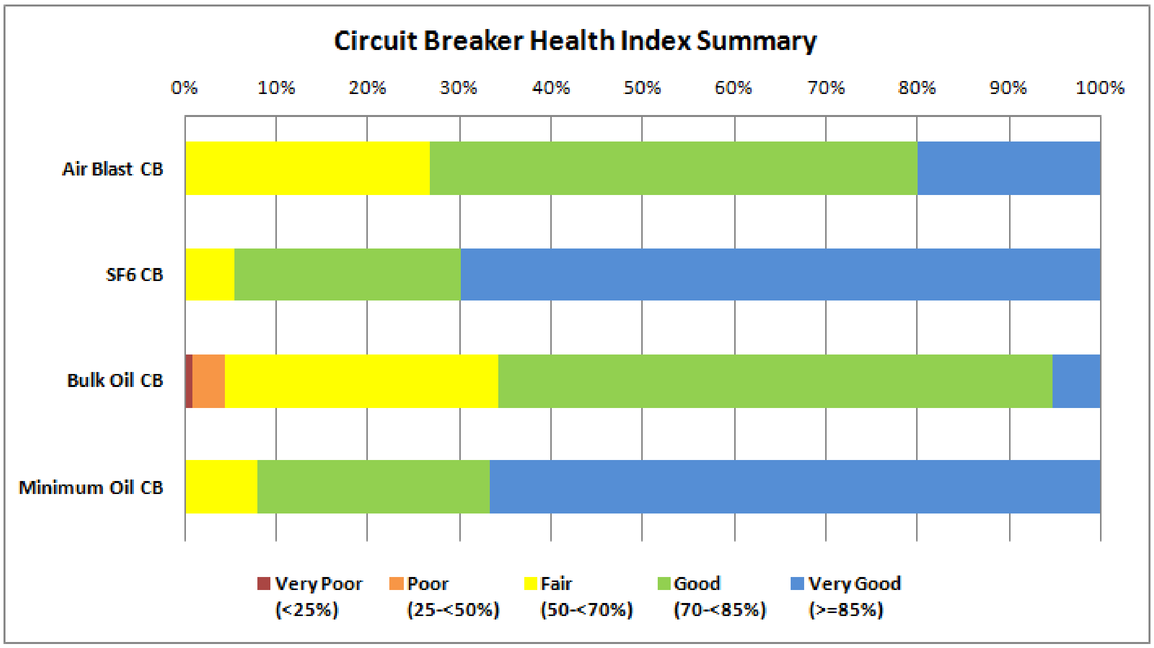

Figure 32 Circuit Breakers Health Index Distribution

2.6 Criticality and Condition-Based Flagged for Action Plans

As it is assumed that Substation Circuit Breakers are proactively replaced, the risk assessment and replacement procedure described in Section 0 was applied for this asset class.

As noted in Section 0, a unit becomes a candidate flagged for action when either its probability of failure (POF) reaches a pre-set limit, or its risk, product of its *probability of failure* and *criticality*, is greater than a pre-set limit, depending on the type of flagged for action plan. The probability of failure is as determined by the Health Index. Criticality is determined as shown in the following section.

2.6.1 *Criticality*

The following table shows the detailed criticality matrix for circuit breakers. Such a matrix is used to calculate criticality of each unit.

Table 54 Criticality Factors for Circuit Breakers

Criticality Factor (CF)	Description	Weight (WCF)	Score (CFS)	
Location	Not located in populated area (residential) or close to environmentally sensitive area (e.g. river or lake)	15	No	0
	Located in populated area (residential) or close to environmentally sensitive area (e.g. river or lake)		Yes	1
Load Criticality	Outage to breaker would not result in outage to restoration-time-sensitive customers (e.g. hospitals, government buildings, some industrial/commercial)	15	Low	0
	Outage to breaker would result in outage to restoration-time-sensitive customers (e.g. hospitals, government buildings, some industrial/commercial)		High	1
Customer Impact	Breaker failure to open or close impacts no customers	15	No	0
	Breaker failure to interrupt fault impacts less than 10,000 customer, or outage less than 24 hours OR breaker failure to open or close (or requirement to remove from service) impacts less than 1,000 customer or outage less than 4 hours (any outage where ties can be used to restore service)		Low	0.5
	Breaker failure to open or close (or requirement to remove from service) impacts less than 10,000 customers or outage less than 24 hours		Medium	1
Physical Protection	Station has oil containment (or no oil breakers) or deluge system or blast walls	5	Low	0
	Station has no oil containment (but has oil breakers) and no deluge system, or blast walls		High	1
System Expansion	No current plans to replace breaker within next ten years	10	No	0
	Plans in place to replace the breaker within next 10 years due to higher fault levels or other system expansion/development requirements		Yes	1
Operation & Maintenance	Breaker expected to be maintainable well into the future, obsolescence is not an issue	10	No	0
	Breaker maintenance is expected to become more and more difficult in the future, obsolescence is an issue		Yes	1
Expected Outage Duration	Spare breaker available or sufficient spare part to rebuild after major failure	10	No	0
	No spare breaker available and insufficient spare parts to rebuild after major failure		Yes	1
System Impact	Outage/failure does not result in export curtailment, equipment overloads or large system outages	20	Low	0
	Breaker failure to interrupt fault results in export curtailment, equipment overloads or large system outages (e.g. four or more 115 kV lines; supply lost to >100MVA of transformation; breaker failure at 230 kV station identified in report entitled “Manitoba Hydro 230 kV Transmission System Fault Clearing Study under Breaker or Protection Failure Scenarios” dated 2010-10-21)		Medium	0.5
	Breaker failure to operate (to open, close, or remain in service) results in export curtailment, equipment overloads or large system outages (e.g. four or more 115 kV lines; supply lost to >100MVA of transformation; breaker failure at 230 kV station identified in report entitled “Manitoba Hydro 230 kV Transmission System Fault Clearing Study under Breaker or Protection Failure Scenarios” dated 2010-10-21)		High	1

The priority list based on risk cost for all the circuit breakers is shown in the following table.

Table 55 Priority List of Circuit Breakers based on Risk Cost

Rank	NpHandle	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Factor (Criticality* POF)
[redacted]	[redacted]	[redacted]	63	20.8	86.0	0.98585	**1.47**	**1.448**
[redacted]	[redacted]	[redacted]	50	32.2	84.2	0.97441	**1.47**	**1.431**
[redacted]	[redacted]	[redacted]	63	33.7	83.6	0.96784	**1.47**	**1.422**
[redacted]	[redacted]	[redacted]	47	49.9	73.0	0.69146	**1.91**	**1.318**
[redacted]	[redacted]	[redacted]	47	49.9	73.0	0.69146	**1.91**	**1.318**
[redacted]	[redacted]	[redacted]	31	52.0	70.5	0.59871	**1.66**	**0.992**
[redacted]	[redacted]	[redacted]	51	60.4	62.7	0.32636	**1.91**	**0.622**
[redacted]	[redacted]	[redacted]	41	58.2	64.8	0.40129	**1.47**	**0.589**
[redacted]	[redacted]	[redacted]	51	60.2	62.7	0.32636	**1.78**	**0.581**
[redacted]	[redacted]	[redacted]	19	59.4	63.8	0.36317	**1.47**	**0.533**
[redacted]	[redacted]	[redacted]	63	60.3	62.7	0.32636	**1.47**	**0.479**
[redacted]	[redacted]	[redacted]	38	62.1	60.3	0.27425	**1.47**	**0.403**
[redacted]	[redacted]	[redacted]	43	63.8	59.1	0.24196	**1.66**	**0.401**
[redacted]	[redacted]	[redacted]	38	64.7	57.9	0.21186	**1.84**	**0.391**
[redacted]	[redacted]	[redacted]	53	66.6	55.2	0.17106	**2.03**	**0.347**
[redacted]	[redacted]	[redacted]	40	64.7	57.9	0.21186	**1.63**	**0.344**
[redacted]	[redacted]	[redacted]	49	66.5	55.2	0.17106	**1.91**	**0.326**
[redacted]	[redacted]	[redacted]	41	64.1	57.9	0.21186	**1.53**	**0.324**
[redacted]	[redacted]	[redacted]	55	65.8	56.6	0.19766	**1.63**	**0.321**
[redacted]	[redacted]	[redacted]	66	63.8	59.1	0.24196	**1.31**	**0.318**
[redacted]	[redacted]	[redacted]	50	64.3	57.9	0.21186	**1.47**	**0.311**
[redacted]	[redacted]	[redacted]	64	65.0	57.9	0.21186	**1.47**	**0.311**
[redacted]	[redacted]	[redacted]	57	64.2	57.9	0.21186	**1.47**	**0.311**
[redacted]	[redacted]	[redacted]	21	63.1	59.1	0.24196	**1.25**	**0.302**
[redacted]	[redacted]	[redacted]	21	63.9	59.1	0.24196	**1.25**	**0.302**
[redacted]	[redacted]	[redacted]	50	65.0	57.9	0.21186	**1.38**	**0.291**
[redacted]	[redacted]	[redacted]	50	65.3	56.6	0.19766	**1.47**	**0.290**
[redacted]	[redacted]	[redacted]	16	66.2	55.2	0.17106	**1.63**	**0.278**
[redacted]	[redacted]	[redacted]	44	67.8	53.8	0.14686	**1.78**	**0.262**
[redacted]	[redacted]	[redacted]	51	67.1	53.8	0.14686	**1.78**	**0.262**
[redacted]	[redacted]	[redacted]	21	66.9	55.2	0.17106	**1.50**	**0.257**
[redacted]	[redacted]	[redacted]	54	68.7	52.4	0.12507	**2.03**	**0.254**
[redacted]	[redacted]	[redacted]	46	67.6	53.8	0.14686	**1.72**	**0.252**
[redacted]	[redacted]	[redacted]	46	67.9	53.8	0.14686	**1.72**	**0.252**
[redacted]	[redacted]	[redacted]	57	66.5	55.2	0.17106	**1.47**	**0.251**
[redacted]	[redacted]	[redacted]	47	67.1	53.8	0.14686	**1.69**	**0.248**

Rank	NpHandle	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Factor (Criticality* POF)
[redacted]			53	69.5	50.9	0.11507	**2.03**	**0.234**
			45	68.2	52.4	0.12507	**1.78**	**0.223**
			51	68.4	52.4	0.12507	**1.78**	**0.223**
			48	68.7	52.4	0.12507	**1.78**	**0.223**
			45	69.4	50.9	0.11507	**1.91**	**0.219**
			49	69.4	50.9	0.11507	**1.91**	**0.219**
			63	67.1	53.8	0.14686	**1.47**	**0.216**
			39	68.8	52.4	0.12507	**1.72**	**0.215**
			22	68.4	52.4	0.12507	**1.72**	**0.215**
			20	68.4	52.4	0.12507	**1.72**	**0.215**
			43	66.3	55.2	0.17106	**1.25**	**0.214**
			44	67.7	53.8	0.14686	**1.44**	**0.211**
			43	69.5	50.9	0.11507	**1.78**	**0.205**
			50	69.4	50.9	0.11507	**1.72**	**0.198**
			20	69.5	50.9	0.11507	**1.72**	**0.198**
			20	69.6	50.9	0.11507	**1.72**	**0.198**
			44	69.9	50.9	0.11507	**1.66**	**0.191**
			47	70.1	49.4	0.09680	**1.91**	**0.185**
			40	68.1	52.4	0.12507	**1.47**	**0.184**
			48	68.6	52.4	0.12507	**1.47**	**0.184**
			47	70.5	49.4	0.09680	**1.84**	**0.178**
			39	70.7	49.4	0.09680	**1.84**	**0.178**
			40	70.4	49.4	0.09680	**1.84**	**0.178**
			41	69.6	50.9	0.11507	**1.53**	**0.176**
			41	69.9	50.9	0.11507	**1.53**	**0.176**
			45	70.2	49.4	0.09680	**1.78**	**0.172**
			51	70.1	49.4	0.09680	**1.78**	**0.172**
			47	70.2	49.4	0.09680	**1.78**	**0.172**
			47	70.2	49.4	0.09680	**1.78**	**0.172**
			36	70.4	49.4	0.09680	**1.78**	**0.172**
			48	69.4	50.9	0.11507	**1.47**	**0.169**
			19	69.0	50.9	0.11507	**1.47**	**0.169**
			53	71.4	47.8	0.08076	**2.03**	**0.164**
			53	71.2	47.8	0.08076	**2.03**	**0.164**
			54	72.0	47.8	0.08076	**2.03**	**0.164**
			54	72.0	47.8	0.08076	**2.03**	**0.164**
			12	70.8	49.4	0.09680	**1.69**	**0.163**

Rank	NpHandle	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Factor (Criticality* POF)
[redacted]			36	69.6	50.9	0.11507	1.38	0.158
			21	68.1	52.4	0.12507	1.25	0.156
			41	71.6	47.8	0.08076	1.91	0.154
			41	71.6	47.8	0.08076	1.91	0.154
			35	71.7	47.8	0.08076	1.91	0.154
			40	71.6	47.8	0.08076	1.91	0.154
			47	71.5	47.8	0.08076	1.91	0.154
			38	71.6	47.8	0.08076	1.91	0.154
			51	71.3	47.8	0.08076	1.91	0.154
			54	71.6	47.8	0.08076	1.91	0.154
			41	70.4	49.4	0.09680	1.53	0.148
			41	71.6	47.8	0.08076	1.78	0.144
			46	71.5	47.8	0.08076	1.78	0.144
			43	71.6	47.8	0.08076	1.78	0.144
			43	71.6	47.8	0.08076	1.78	0.144
			48	71.4	47.8	0.08076	1.78	0.144
			51	71.3	47.8	0.08076	1.78	0.144
			48	70.1	49.4	0.09680	1.47	0.142
			50	70.1	49.4	0.09680	1.47	0.142
			57	71.0	49.4	0.09680	1.47	0.142
			46	72.3	46.1	0.07353	1.91	0.140
			51	72.1	46.1	0.07353	1.91	0.140
			44	70.7	49.4	0.09680	1.44	0.139
			44	70.7	49.4	0.09680	1.44	0.139
			46	71.8	47.8	0.08076	1.72	0.139
			60	71.9	47.8	0.08076	1.66	0.134
			40	70.7	49.4	0.09680	1.38	0.133
			50	70.0	49.4	0.09680	1.38	0.133
				73.0	46.1	0.07353	1.78	0.131
			47	72.3	46.1	0.07353	1.78	0.131
			20	72.1	46.1	0.07353	1.72	0.126
			41	71.6	47.8	0.08076	1.53	0.124
			43	71.6	47.8	0.08076	1.53	0.124
			33	71.7	47.8	0.08076	1.47	0.119
			50	71.8	47.8	0.08076	1.47	0.119
			50	71.8	47.8	0.08076	1.47	0.119
			41	72.4	46.1	0.07353	1.53	0.113

Rank	NpHandle	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Factor (Criticality* POF)
[redacted]			41	72.4	46.1	0.07353	**1.53**	**0.113**
			59	72.2	46.1	0.07353	**1.53**	**0.113**
			40	72.7	46.1	0.07353	**1.47**	**0.108**
			38	72.4	46.1	0.07353	**1.47**	**0.108**
			48	72.2	46.1	0.07353	**1.47**	**0.108**
			51	72.1	46.1	0.07353	**1.47**	**0.108**
			17	72.1	46.1	0.07353	**1.47**	**0.108**
			18	72.1	46.1	0.07353	**1.47**	**0.108**
			43	72.6	46.1	0.07353	**1.47**	**0.108**
			46	73.2	44.5	0.06057	**1.72**	**0.104**
			46	73.2	44.5	0.06057	**1.72**	**0.104**
			48	73.1	44.5	0.06057	**1.72**	**0.104**
			48	73.1	44.5	0.06057	**1.72**	**0.104**
			46	73.2	44.5	0.06057	**1.72**	**0.104**
			47	72.4	46.1	0.07353	**1.38**	**0.101**
			16	71.4	47.8	0.08076	**1.25**	**0.101**
			48	73.1	44.5	0.06057	**1.63**	**0.098**
			55	73.7	44.5	0.06057	**1.53**	**0.093**
			35	73.9	44.5	0.06057	**1.50**	**0.091**
			40	73.3	44.5	0.06057	**1.47**	**0.089**
			40	73.3	44.5	0.06057	**1.47**	**0.089**
			64	73.7	44.5	0.06057	**1.47**	**0.089**
			62	73.9	44.5	0.06057	**1.47**	**0.089**
			53	74.6	42.7	0.04947	**1.78**	**0.088**
			25	75.0	42.7	0.04947	**1.78**	**0.088**
			23	74.8	42.7	0.04947	**1.72**	**0.085**
			40	74.1	42.7	0.04947	**1.72**	**0.085**
			47	73.1	44.5	0.06057	**1.38**	**0.083**
			34	73.4	44.5	0.06057	**1.38**	**0.083**
			44	74.1	42.7	0.04947	**1.66**	**0.082**
			44	74.1	42.7	0.04947	**1.66**	**0.082**
			44	74.1	42.7	0.04947	**1.66**	**0.082**
			20	74.9	42.7	0.04947	**1.59**	**0.079**
			51	74.8	42.7	0.04947	**1.53**	**0.076**
			21	73.3	44.5	0.06057	**1.25**	**0.076**
			20	75.9	40.9	0.04006	**1.72**	**0.069**
			12	75.9	40.9	0.04006	**1.72**	**0.069**

Rank	NpHandle	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Factor (Criticality* POF)
[redacted]			43	76.9	39.1	0.03593	1.78	0.064
			43	76.1	39.1	0.03593	1.53	0.055
			36	77.1	37.2	0.02872	1.59	0.046
			30	78.7	35.3	0.02275	1.66	0.038
			57	79.4	33.4	0.02018	1.38	0.028
			41	80.3	31.4	0.01578	1.53	0.024
			13	80.8	31.4	0.01578	1.34	0.021
			21	81.7	29.3	0.01222	1.72	0.021
			48	81.8	29.3	0.01222	1.72	0.021
			51	81.2	29.3	0.01222	1.53	0.019
			41	81.0	29.3	0.01222	1.53	0.019
			49	81.7	29.3	0.01222	1.47	0.018
			51	81.2	29.3	0.01222	1.47	0.018
			39	82.9	27.3	0.00939	1.91	0.018
			30	81.7	29.3	0.01222	1.41	0.017
			53	82.9	27.3	0.00939	1.78	0.017
			36	82.4	27.3	0.00939	1.78	0.017
			35	82.4	27.3	0.00939	1.78	0.017
			19	83.5	25.2	0.00820	1.91	0.016
			51	83.4	25.2	0.00820	1.91	0.016
			50	83.6	25.2	0.00820	1.91	0.016
			43	83.7	25.2	0.00820	1.78	0.015
			51	83.4	25.2	0.00820	1.78	0.015
			41	82.7	27.3	0.00939	1.53	0.014
			41	82.7	27.3	0.00939	1.53	0.014
			45	82.3	27.3	0.00939	1.53	0.014
			21	83.4	25.2	0.00820	1.72	0.014
			37	82.2	27.3	0.00939	1.34	0.013
			12	83.5	25.2	0.00820	1.47	0.012
			16	83.4	25.2	0.00820	1.47	0.012
			57	83.7	25.2	0.00820	1.47	0.012
			40	84.9	23.1	0.00621	1.91	0.012
			7	82.7	27.3	0.00939	1.25	0.012
			24	B3.B	25.2	0.00820	1.41	0.012
			42	84.7	23.1	0.00621	1.78	0.011
			8	84.3	23.1	0.00621	1.78	0.011
			7	83.4	25.2	0.00820	1.34	0.011

Rank	NpHandle	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Factor (Criticality* POF)
[redacted]			7	83.4	25.2	0.00820	1.34	0.011
			16	83.4	25.2	0.00820	1.25	0.010
			24	83.3	25.2	0.00820	1.25	0.010
			21	83.4	25.2	0.00820	1.25	0.010
			16	83.4	25.2	0.00820	1.25	0.010
			17	83.4	25.2	0.00820	1.25	0.010
			14	83.4	25.2	0.00820	1.25	0.010
			16	83.4	25.2	0.00820	1.25	0.010
			16	83.4	25.2	0.00820	1.25	0.010
			17	83.4	25.2	0.00820	1.25	0.010
			17	83.4	25.2	0.00820	1.25	0.010
			2	83.4	25.2	0.00820	1.25	0.010
			7	83.4	25.2	0.00820	1.25	0.010
			2	83.4	25.2	0.00820	1.25	0.010
			20	84.7	23.1	0.00621	1.59	0.010
			51	85.5	21.0	0.00466	1.91	0.009
			8	84.3	23.1	0.00621	1.34	0.008
			8	84.3	23.1	0.00621	1.34	0.008
			43	85.7	21.0	0.00466	1.78	0.008
			43	85.5	21.0	0.00466	1.78	0.008
			41	85.7	21.0	0.00466	1.69	0.008
			47	86.3	18.9	0.00402	1.91	0.008
			51	85.5	21.0	0.00466	1.53	0.007
			51	85.5	21.0	0.00466	1.53	0.007
			15	85.1	21.0	0.00466	1.44	0.007
			14	85.9	21.0	0.00466	1.44	0.007
			41	86.4	18.9	0.00402	1.53	0.006
			14	86.0	18.9	0.00402	1.53	0.006
			42	86.0	18.9	0.00402	1.44	0.006
			42	86.0	18.9	0.00402	1.44	0.006
			33	86.3	18.9	0.00402	1.41	0.006
			29	86.1	18.9	0.00402	1.34	0.005
			48	87.6	16.9	0.00298	1.72	0.005
				87.9	16.9	0.00298	1.72	0.005
			24	86.3	18.9	0.00402	1.25	0.005
			50	87.0	16.9	0.00298	1.38	0.004
			35	87.6	16.9	0.00298	1.34	0.004

Rank	NpHandle	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Factor (Criticality* POF)
[redacted]			43	88.5	14.8	0.00219	**1.78**	**0.004**
[redacted]			42	88.7	14.8	0.00219	**1.78**	**0.004**
[redacted]			43	89.0	14.8	0.00219	**1.78**	**0.004**
[redacted]			40	88.9	14.8	0.00219	**1.78**	**0.004**
[redacted]			42	88.7	14.8	0.00219	**1.78**	**0.004**
[redacted]			45	88.7	14.8	0.00219	**1.66**	**0.004**
[redacted]			14	88.5	14.8	0.00219	**1.59**	**0.003**
[redacted]			44	88.8	14.8	0.00219	**1.47**	**0.003**
[redacted]			44	88.4	14.8	0.00219	**1.47**	**0.003**
[redacted]			40	88.9	14.8	0.00219	**1.47**	**0.003**
[redacted]			40	88.9	14.8	0.00219	**1.47**	**0.003**
[redacted]			42	88.7	14.8	0.00219	**1.44**	**0.003**
[redacted]			40	88.9	14.8	0.00219	**1.34**	**0.003**
[redacted]			43	88.5	14.8	0.00219	**1.34**	**0.003**
[redacted]			40	88.9	14.8	0.00219	**1.25**	**0.003**
[redacted]			43	88.5	14.8	0.00219	**1.25**	**0.003**
[redacted]			20	89.9	12.9	0.00159	**1.72**	**0.003**
[redacted]			20	89.9	12.9	0.00159	**1.72**	**0.003**
[redacted]			21	89.9	12.9	0.00159	**1.72**	**0.003**
[redacted]			11	90.0	12.9	0.00159	**1.72**	**0.003**
[redacted]			8	90.0	12.9	0.00159	**1.72**	**0.003**
[redacted]			20	89.9	12.9	0.00159	**1.72**	**0.003**
[redacted]			20	89.9	12.9	0.00159	**1.72**	**0.003**
[redacted]			20	89.9	12.9	0.00159	**1.72**	**0.003**
[redacted]			20	89.9	12.9	0.00159	**1.72**	**0.003**
[redacted]			20	89.9	12.9	0.00159	**1.72**	**0.003**
[redacted]			20	89.9	12.9	0.00159	**1.72**	**0.003**
[redacted]			2	90.0	12.9	0.00159	**1.72**	**0.003**
[redacted]			5	90.0	12.9	0.00159	**1.72**	**0.003**
[redacted]			25	89.8	12.9	0.00159	**1.72**	**0.003**
[redacted]			21	89.9	12.9	0.00159	**1.59**	**0.003**
[redacted]			20	89.9	12.9	0.00159	**1.59**	**0.003**
[redacted]			15	89.9	12.9	0.00159	**1.59**	**0.003**
[redacted]			10	90.0	12.9	0.00159	**1.59**	**0.003**
[redacted]			20	89.9	12.9	0.00159	**1.59**	**0.003**
[redacted]			20	90.0	12.9	0.00159	**1.59**	**0.003**
[redacted]			10	90.0	12.9	0.00159	**1.59**	**0.003**

Rank	NpHandle	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Factor (Criticality* POF)
[redacted]			21	89.9	12.9	0.00159	**1.59**	**0.003**
			20	89.9	12.9	0.00159	**1.59**	**0.003**
			20	90.0	12.9	0.00159	**1.59**	**0.003**
			1	90.0	12.9	0.00159	**1.59**	**0.003**
			20	89.9	12.9	0.00159	**1.59**	**0.003**
			5	90.0	12.9	0.00159	**1.59**	**0.003**
			15	89.9	12.9	0.00159	**1.59**	**0.003**
			38	89.1	12.9	0.00159	**1.53**	**0.002**
			9	90.0	12.9	0.00159	**1.50**	**0.002**
			17	89.9	12.9	0.00159	**1.47**	**0.002**
			17	89.9	12.9	0.00159	**1.47**	**0.002**
			17	89.9	12.9	0.00159	**1.47**	**0.002**
			18	89.9	12.9	0.00159	**1.47**	**0.002**
			19	89.9	12.9	0.00159	**1.47**	**0.002**
			25	89.8	12.9	0.00159	**1.47**	**0.002**
			26	89.8	12.9	0.00159	**1.47**	**0.002**
			15	89.9	12.9	0.00159	**1.47**	**0.002**
			15	90.0	12.9	0.00159	**1.44**	**0.002**
			16	89.8	12.9	0.00159	**1.44**	**0.002**
			16	89.9	12.9	0.00159	**1.44**	**0.002**
			41	89.8	12.9	0.00159	**1.44**	**0.002**
			16	90.0	12.9	0.00159	**1.44**	**0.002**
			16	90.0	12.9	0.00159	**1.44**	**0.002**
			6	90.0	12.9	0.00159	**1.38**	**0.002**
			6	90.0	12.9	0.00159	**1.38**	**0.002**
			22	89.8	12.9	0.00159	**1.34**	**0.002**
			7	90.0	12.9	0.00159	**1.34**	**0.002**
			8	90.0	12.9	0.00159	**1.34**	**0.002**
			11	90.0	12.9	0.00159	**1.34**	**0.002**
			5	90.0	12.9	0.00159	**1.34**	**0.002**
			37	89.9	12.9	0.00159	**1.34**	**0.002**
			24	89.8	12.9	0.00159	**1.34**	**0.002**
			1	90.0	12.9	0.00159	**1.34**	**0.002**
			37	89.9	12.9	0.00159	**1.34**	**0.002**
			36	89.3	12.9	0.00159	**1.34**	**0.002**
			36	89.2	12.9	0.00159	**1.31**	**0.002**
			16	89.9	12.9	0.00159	**1.25**	**0.002**

Rank	NpHandle	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Factor (Criticality* POF)
[redacted]			13	89.9	12.9	0.00159	1.25	0.002
			10	90.0	12.9	0.00159	1.25	0.002
			14	89.9	12.9	0.00159	1.25	0.002
			14	89.9	12.9	0.00159	1.25	0.002
			14	89.9	12.9	0.00159	1.25	0.002
			14	89.9	12.9	0.00159	1.25	0.002
			10	90.0	12.9	0.00159	1.25	0.002
			21	89.9	12.9	0.00159	1.25	0.002
			2	90.0	12.9	0.00159	1.25	0.002
			21	89.9	12.9	0.00159	1.25	0.002
			8	90.0	12.9	0.00159	1.25	0.002
			17	89.9	12.9	0.00159	1.25	0.002
			2	90.0	12.9	0.00159	1.25	0.002
			2	90.0	12.9	0.00159	1.25	0.002
			2	90.0	12.9	0.00159	1.25	0.002
			2	90.0	12.9	0.00159	1.25	0.002
			17	89.9	12.9	0.00159	1.25	0.002
			18	90.1	10.9	0.00135	1.34	0.002
			45	93.8	5.7	0.00058	1.66	0.001
			28	92.4	7.4	0.00069	1.34	0.001
			36	92.3	7.4	0.00069	1.34	0.001
			11	92.7	7.4	0.00069	1.25	0.001
			36	99.2	0.2	0.00007	1.59	0.000
			30	99.6	0.2	0.00007	1.56	0.000
			1	100.0	0.2	0.00007	1.44	0.000
			1	100.0	0.2	0.00007	1.44	0.000
			1	100.0	0.2	0.00007	1.44	0.000
			1	100.0	0.2	0.00007	1.44	0.000
			1	100.0	0.2	0.00007	1.44	0.000
			1	100.0	0.2	0.00007	1.44	0.000
			33	99.4	0.2	0.00007	1.41	0.000
			30	99.7	0.2	0.00007	1.41	0.000
			7	100.0	0.2	0.00007	1.34	0.000
			2	100.0	0.2	0.00007	1.34	0.000
			24	99.8	0.2	0.00007	1.34	0.000
			24	99.8	0.2	0.00007	1.34	0.000
			33	99.4	0.2	0.00007	1.34	0.000

Rank	NpHandle	Location	Age	HI	Effective Age	POF at Effective Age	Criticality	Risk Factor (Criticality* POF)
[redacted]	[redacted]	[redacted]	27	99.7	0.2	0.00007	**1.34**	**0.000**
[redacted]	[redacted]	[redacted]	28	99.7	0.2	0.00007	**1.34**	**0.000**
[redacted]	[redacted]	[redacted]	7	100.0	0.2	0.00007	**1.34**	**0.000**
[redacted]	[redacted]	[redacted]	36	99.2	0.2	0.00007	**1.34**	**0.000**
[redacted]	[redacted]	[redacted]	36	99.2	0.2	0.00007	**1.34**	**0.000**
[redacted]	[redacted]	[redacted]	24	99.8	0.2	0.00007	**1.31**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	11	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	11	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	11	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	2	100.0	0.2	0.00007	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]	0	100.0	0.2	0.00006	**1.25**	**0.000**
[redacted]	[redacted]	[redacted]		-100.0			**1.25**	**-**

2.6.2 Flagged for Action Plan

The condition-based flagged for action plan for Circuit Breakers is plotted in Figure 25 to Figure 27. Note that three different replacement scenarios are shown.

The “optimal” plan flags a unit for action in the year that its POF becomes greater than or equal to 80% (failure tolerance). Details for each unit are shown in Table 37.

In the maximum deferred plan, replacements are pushed back or deferred such that a unit is flagged for action either when the risk cost is greater than a pre-set minimum risk value, or when its POF becomes greater than or equal to 95% (maximum failure tolerance), whichever comes earlier.

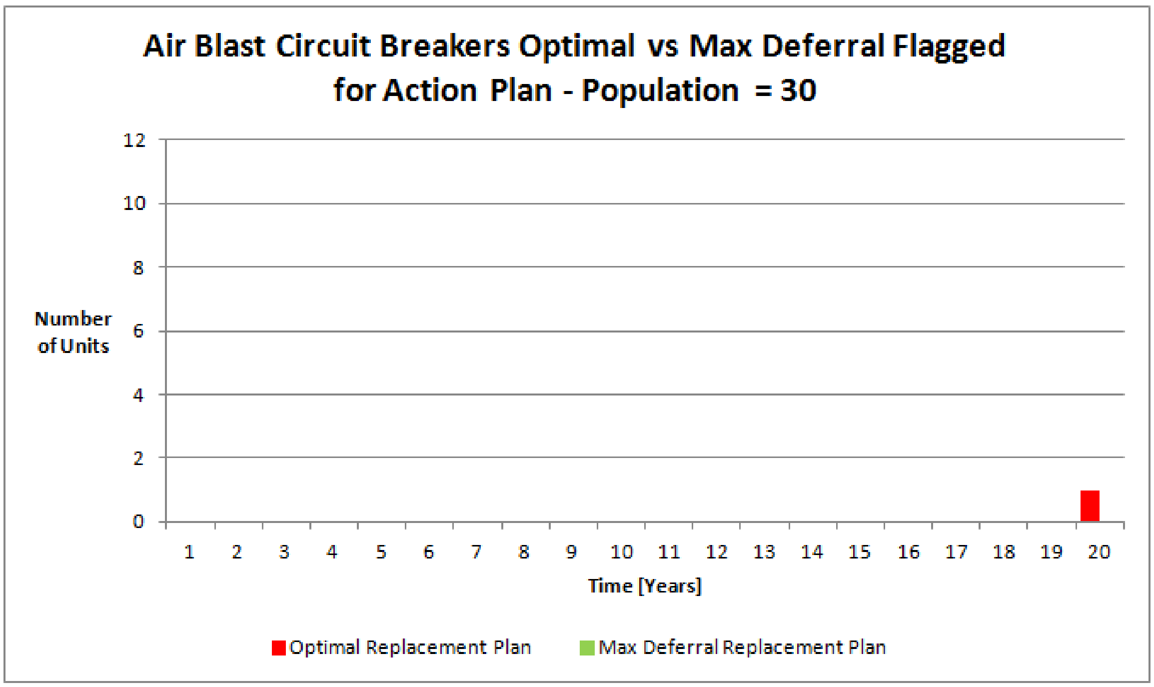

Figure 33 Circuit Breaker Condition-Based Flagged for Action Plan (Air Blast CB)

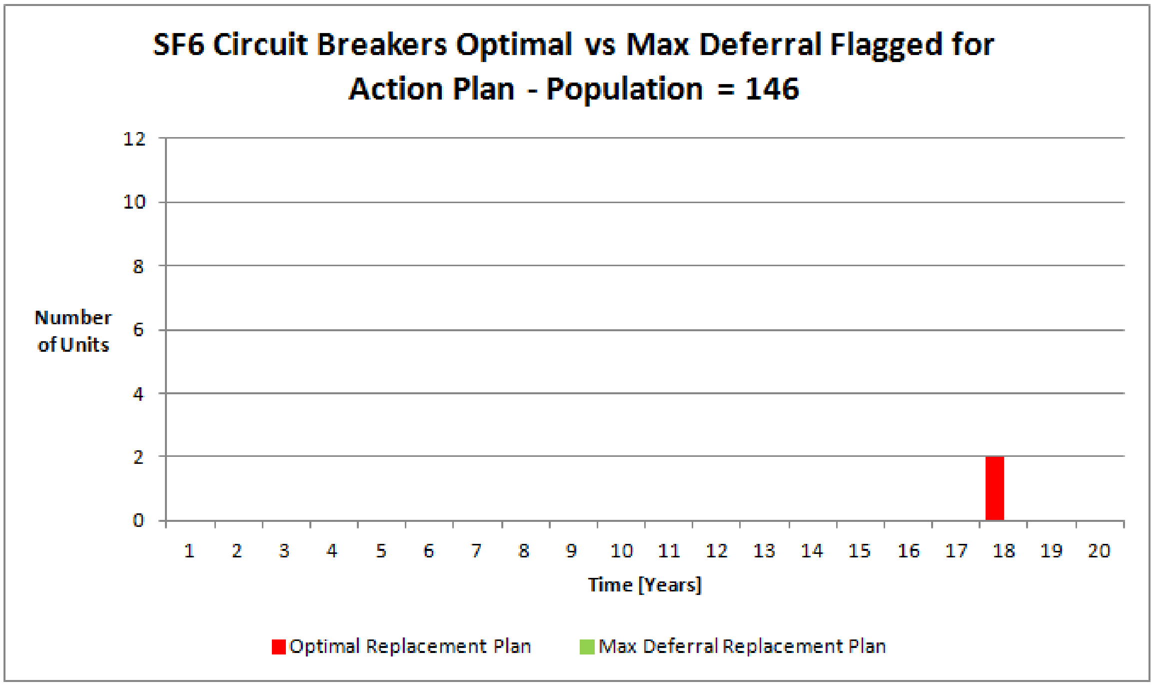

Figure 34 Circuit Breaker Condition-Based Flagged for Action Plan (SF6 CB)

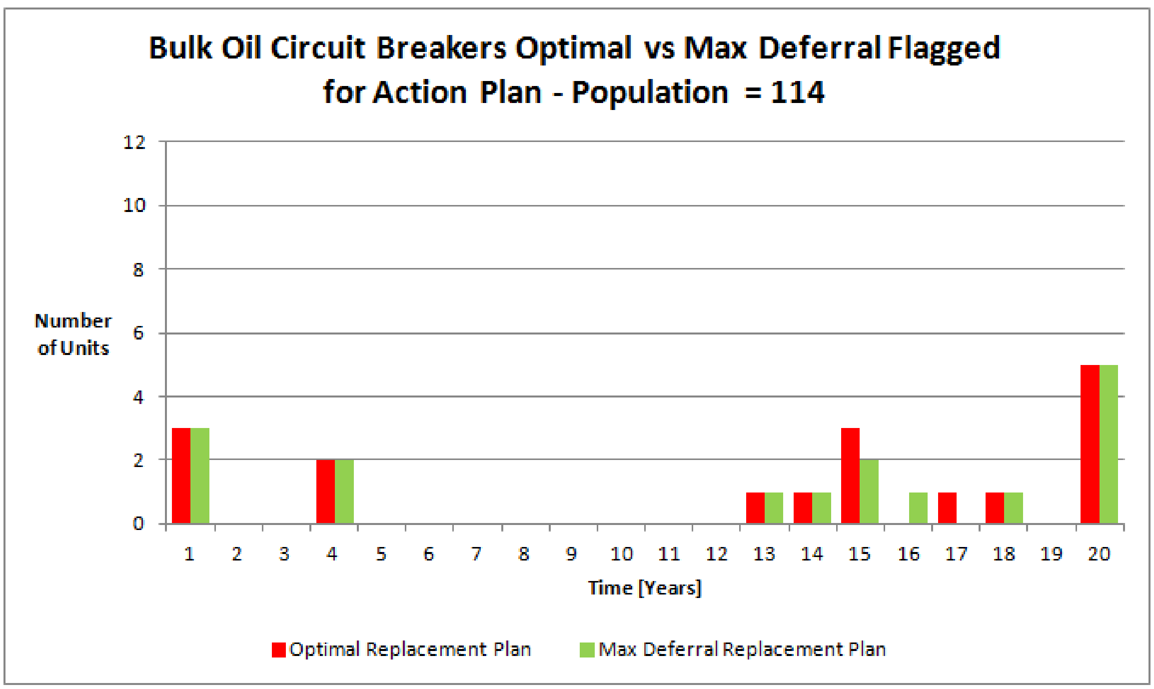

Figure 35 Circuit Breaker Condition-Based Flagged for Action Plan (Bulk Oil CB)

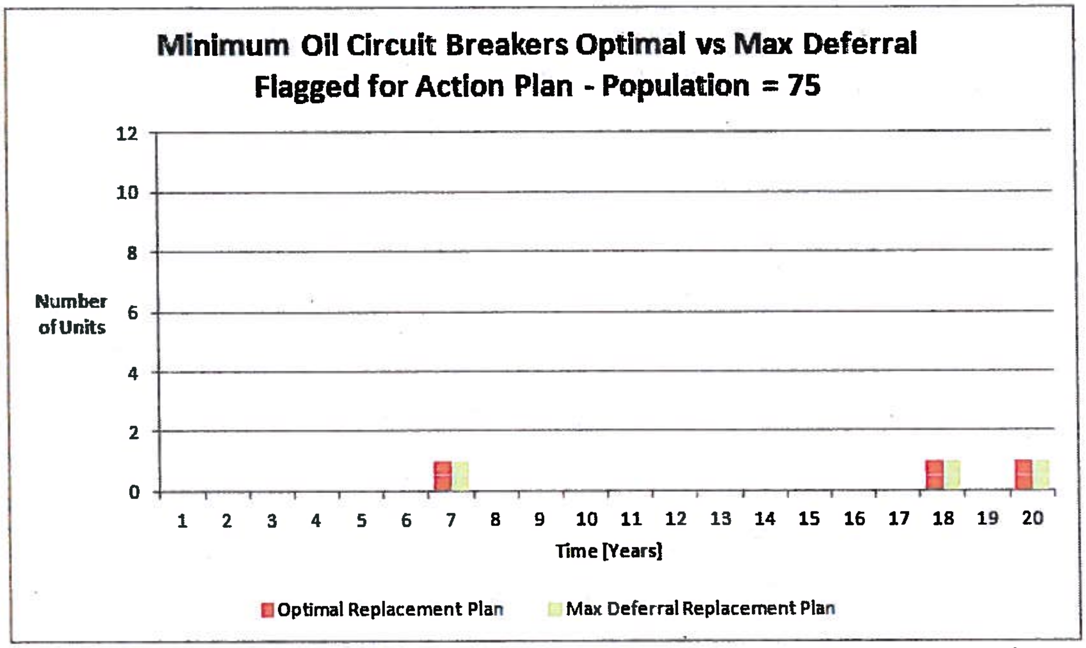

Figure 36 Circuit Breaker Condition-Based Flagged for Action Plan (Minimum Oil CB)

From the above diagrams it can be observed that most of the flagged for action units are with bulk oil circuit breakers. The major peak of flagged for action units comes after 12 years.

The optimal and max deferral flagged for action year for each unit is shown in the table below.

Table 56 Optimal and Max Deferral Flagged for Action for Each Circuit Breaker

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		50	32.2	1.47	0	0
		63	33.7	1.47	0	0
		47	49.9	1.91	3	3
		47	49.9	1.91	3	3
		31	52.0	1.66	6	6
		41	58.2	1.47	12	12
		19	59.4	1.47	13	13
		51	60.4	1.91	14	14
		51	60.2	1.78	14	14
		63	60.3	1.47	14	15
		38	62.1	1.47	16	17
		43	63.8	1.66	17	17

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		66	63.8	1.31	17	21
		21	63.1	1.25	17	24
		21	63.9	1.25	17	24
		38	64.7	1.84	19	19
		40	64.7	1.63	19	19
		41	64.1	1.53	19	19
		50	64.3	1.47	19	19
		64	65.0	1.47	19	19
		57	64.2	1.47	19	19
		50	65.0	1.38	19	21
		55	65.8	1.63	20	20
		50	65.3	1.47	20	21
		53	66.6	2.03	21	21
		49	66.5	1.91	21	21
		16	66.2	1.63	21	21
		21	66.9	1.50	21	21
		57	66.5	1.47	21	22
		43	66.3	1.25	21	28
		44	67.8	1.78	23	23
		51	67.1	1.78	23	23
		46	67.6	1.72	23	23
		46	67.9	1.72	23	23
		47	67.1	1.69	23	23
		63	67.1	1.47	23	23
		44	67.7	1.44	23	23
		54	68.7	2.03	24	24
		45	68.2	1.78	24	24
		51	68.4	1.78	24	24
		48	68.7	1.78	24	24
		39	68.8	1.72	24	24
		22	68.4	1.72	24	24
		20	68.4	1.72	24	24
		40	68.1	1.47	24	25
		48	68.6	1.47	24	25
		21	68.1	1.25	24	30
		53	69.5	2.03	26	26
		45	69.4	1.91	26	26
		49	69.4	1.91	26	26
		43	69.5	1.78	26	26

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		50	69.4	1.72	26	26
		20	69.5	1.72	26	26
		20	69.6	1.72	26	26
		44	69.9	1.66	26	26
		41	69.6	1.53	26	26
		41	69.9	1.53	26	26
		48	69.4	1.47	26	26
		19	69.0	1.47	26	26
		36	69.6	1.38	26	28
		47	70.1	1.91	27	27
		47	70.5	1.84	27	27
		39	70.7	1.84	27	27
		40	70.4	1.84	27	27
		45	70.2	1.78	27	27
		51	70.1	1.78	27	27
		47	70.2	1.78	27	27
		47	70.2	1.78	27	27
		36	70.4	1.78	27	27
		12	70.8	1.69	27	27
		41	70.4	1.53	27	27
		48	70.1	1.47	27	28
		50	70.1	1.47	27	28
		57	71.0	1.47	27	28
		44	70.7	1.44	27	28
		44	70.7	1.44	27	28
		40	70.7	1.38	27	29
		50	70.0	1.38	27	29
		53	71.4	2.03	29	29
		53	71.2	2.03	29	29
		54	72.0	2.03	29	29
		54	72.0	2.03	29	29
		41	71.6	1.91	29	29
		41	71.6	1.91	29	29
		35	71.7	1.91	29	29
		40	71.6	1.91	29	29
		47	71.5	1.91	29	29
		38	71.6	1.91	29	29
		51	71.3	1.91	29	29
		54	71.6	1.91	29	29

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		41	71.6	1.78	29	29
		46	71.5	1.78	29	29
		43	71.6	1.78	29	29
		43	71.6	1.78	29	29
		48	71.4	1.78	29	29
		51	71.3	1.78	29	29
		46	71.8	1.72	29	29
		60	71.9	1.66	29	29
		41	71.6	1.53	29	29
		43	71.6	1.53	29	29
		33	71.7	1.47	29	29
		50	71.8	1.47	29	29
		50	71.8	1.47	29	29
		16	71.4	1.25	29	35
		46	72.3	1.91	30	30
		51	72.1	1.91	30	30
			73.0	1.78	30	30
		47	72.3	1.78	30	30
		20	72.1	1.72	30	30
		41	72.4	1.53	30	30
		41	72.4	1.53	30	30
		59	72.2	1.53	30	30
		40	72.7	1.47	30	31
		38	72.4	1.47	30	31
		48	72.2	1.47	30	31
		51	72.1	1.47	30	31
		17	72.1	1.47	30	31
		18	72.1	1.47	30	31
		43	72.6	1.47	30	31
		47	72.4	1.38	30	32
		46	73.2	1.72	32	32
		46	73.2	1.72	32	32
		48	73.1	1.72	32	32
		48	73.1	1.72	32	32
		46	73.2	1.72	32	32
		48	73.1	1.63	32	32
		55	73.7	1.53	32	32
		35	73.9	1.50	32	32
		40	73.3	1.47	32	33

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]	[redacted]	40	73.3	1.47	32	33
		64	73.7	1.47	32	33
		62	73.9	1.47	32	33
		47	73.1	1.38	32	34
		34	73.4	1.38	32	34
		21	73.3	1.25	32	38
		53	74.6	1.78	34	34
		25	75.0	1.78	34	34
		23	74.8	1.72	34	34
		40	74.1	1.72	34	34
		44	74.1	1.66	34	34
		44	74.1	1.66	34	34
		44	74.1	1.66	34	34
		20	74.9	1.59	34	34
		51	74.8	1.53	34	34
		20	75.9	1.72	36	36
		12	75.9	1.72	36	36
		43	76.9	1.78	37	37
		43	76.1	1.53	37	37
		36	77.1	1.59	39	39
		30	78.7	1.66	41	41
		57	79.4	1.38	43	45
		41	80.3	1.53	45	45
		13	80.8	1.34	45	48
		21	81.7	1.72	47	47
		48	81.8	1.72	47	47
		51	81.2	1.53	47	47
		41	81.0	1.53	47	47
		49	81.7	1.47	47	48
		51	81.2	1.47	47	48
		30	81.7	1.41	47	49
		39	82.9	1.91	49	49
		53	82.9	1.78	49	49
		36	82.4	1.78	49	49
		35	82.4	1.78	49	49
		41	82.7	1.53	49	49
		41	82.7	1.53	49	49
		45	82.3	1.53	49	49
		37	82.2	1.34	49	52

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]	[redacted]	7	82.7	1.25	49	56
[redacted]	[redacted]	19	83.5	1.91	51	51
[redacted]	[redacted]	51	83.4	1.91	51	51
[redacted]	[redacted]	50	83.6	1.91	51	51
[redacted]	[redacted]	43	83.7	1.78	51	51
[redacted]	[redacted]	51	83.4	1.78	51	51
[redacted]	[redacted]	21	83.4	1.72	51	51
[redacted]	[redacted]	12	83.5	1.47	51	52
[redacted]	[redacted]	16	83.4	1.47	51	52
[redacted]	[redacted]	57	83.7	1.47	51	52
[redacted]	[redacted]	24	83.8	1.41	51	53
[redacted]	[redacted]	7	83.4	1.34	51	54
[redacted]	[redacted]	7	83.4	1.34	51	54
[redacted]	[redacted]	16	83.4	1.25	51	58
[redacted]	[redacted]	24	83.3	1.25	51	58
[redacted]	[redacted]	21	83.4	1.25	51	58
[redacted]	[redacted]	16	83.4	1.25	51	58
[redacted]	[redacted]	17	83.4	1.25	51	58
[redacted]	[redacted]	14	83.4	1.25	51	58
[redacted]	[redacted]	16	83.4	1.25	51	58
[redacted]	[redacted]	16	83.4	1.25	51	58
[redacted]	[redacted]	17	83.4	1.25	51	58
[redacted]	[redacted]	17	83.4	1.25	51	58
[redacted]	[redacted]	2	83.4	1.25	51	58
[redacted]	[redacted]	7	83.4	1.25	51	58
[redacted]	[redacted]	2	83.4	1.25	51	58
[redacted]	[redacted]	40	84.9	1.91	53	53
[redacted]	[redacted]	42	84.7	1.78	53	53
[redacted]	[redacted]	8	84.3	1.78	53	53
[redacted]	[redacted]	20	84.7	1.59	53	53
[redacted]	[redacted]	8	84.3	1.34	53	56
[redacted]	[redacted]	8	84.3	1.34	53	56
[redacted]	[redacted]	51	85.5	1.91	55	55
[redacted]	[redacted]	43	85.7	1.78	55	55
[redacted]	[redacted]	43	85.5	1.78	55	55
[redacted]	[redacted]	41	85.7	1.69	55	55
[redacted]	[redacted]	51	85.5	1.53	55	55
[redacted]	[redacted]	51	85.5	1.53	55	55
[redacted]	[redacted]	15	85.1	1.44	55	56

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]	[redacted]	14	85.9	1.44	55	56
[redacted]	[redacted]	47	86.3	1.91	58	58
[redacted]	[redacted]	41	86.4	1.53	58	58
[redacted]	[redacted]	14	86.0	1.53	58	58
[redacted]	[redacted]	42	86.0	1.44	58	58
[redacted]	[redacted]	42	86.0	1.44	58	58
[redacted]	[redacted]	33	86.3	1.41	58	60
[redacted]	[redacted]	29	86.1	1.34	58	60
[redacted]	[redacted]	24	86.3	1.25	58	64
[redacted]	[redacted]	48	87.6	1.72	60	60
[redacted]	[redacted]		87.9	1.72	60	60
[redacted]	[redacted]	50	87.0	1.38	60	62
[redacted]	[redacted]	35	87.6	1.34	60	62
[redacted]	[redacted]	43	88.5	1.78	62	62
[redacted]	[redacted]	42	88.7	1.78	62	62
[redacted]	[redacted]	43	89.0	1.78	62	62
[redacted]	[redacted]	40	88.9	1.78	62	62
[redacted]	[redacted]	42	88.7	1.78	62	62
[redacted]	[redacted]	45	88.7	1.66	62	62
[redacted]	[redacted]	14	88.5	1.59	62	62
[redacted]	[redacted]	44	88.8	1.47	62	62
[redacted]	[redacted]	44	88.4	1.47	62	62
[redacted]	[redacted]	40	88.9	1.47	62	62
[redacted]	[redacted]	40	88.9	1.47	62	62
[redacted]	[redacted]	42	88.7	1.44	62	62
[redacted]	[redacted]	40	88.9	1.34	62	64
[redacted]	[redacted]	43	88.5	1.34	62	64
[redacted]	[redacted]	40	88.9	1.25	62	68
[redacted]	[redacted]	43	88.5	1.25	62	68
[redacted]	[redacted]	20	89.9	1.72	64	64
[redacted]	[redacted]	20	89.9	1.72	64	64
[redacted]	[redacted]	21	89.9	1.72	64	64
[redacted]	[redacted]	11	90.0	1.72	64	64
[redacted]	[redacted]	8	90.0	1.72	64	64
[redacted]	[redacted]	20	89.9	1.72	64	64
[redacted]	[redacted]	20	89.9	1.72	64	64
[redacted]	[redacted]	20	89.9	1.72	64	64
[redacted]	[redacted]	20	89.9	1.72	64	64
[redacted]	[redacted]	20	89.9	1.72	64	64

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]	[redacted]	20	89.9	**1.72**	64	64
[redacted]	[redacted]	2	90.0	**1.72**	64	64
[redacted]	[redacted]	5	90.0	**1.72**	64	64
[redacted]	[redacted]	25	89.8	**1.72**	64	64
[redacted]	[redacted]	21	89.9	**1.59**	64	64
[redacted]	[redacted]	20	89.9	**1.59**	64	64
[redacted]	[redacted]	15	89.9	**1.59**	64	64
[redacted]	[redacted]	10	90.0	**1.59**	64	64
[redacted]	[redacted]	20	89.9	**1.59**	64	64
[redacted]	[redacted]	20	90.0	**1.59**	64	64
[redacted]	[redacted]	10	90.0	**1.59**	64	64
[redacted]	[redacted]	21	89.9	**1.59**	64	64
[redacted]	[redacted]	20	89.9	**1.59**	64	64
[redacted]	[redacted]	20	90.0	**1.59**	64	64
[redacted]	[redacted]	1	90.0	**1.59**	64	64
[redacted]	[redacted]	20	89.9	**1.59**	64	64
[redacted]	[redacted]	5	90.0	**1.59**	64	64
[redacted]	[redacted]	15	89.9	**1.59**	64	64
[redacted]	[redacted]	38	89.1	**1.53**	64	64
[redacted]	[redacted]	9	90.0	**1.50**	64	64
[redacted]	[redacted]	17	89.9	**1.47**	64	64
[redacted]	[redacted]	17	89.9	**1.47**	64	64
[redacted]	[redacted]	17	89.9	**1.47**	64	64
[redacted]	[redacted]	18	89.9	**1.47**	64	64
[redacted]	[redacted]	19	89.9	**1.47**	64	64
[redacted]	[redacted]	25	89.8	**1.47**	64	64
[redacted]	[redacted]	26	89.8	**1.47**	64	64
[redacted]	[redacted]	15	89.9	**1.47**	64	64
[redacted]	[redacted]	15	90.0	**1.44**	64	64
[redacted]	[redacted]	16	89.8	**1.44**	64	64
[redacted]	[redacted]	16	89.9	**1.44**	64	64
[redacted]	[redacted]	41	89.8	**1.44**	64	64
[redacted]	[redacted]	16	90.0	**1.44**	64	64
[redacted]	[redacted]	16	90.0	**1.44**	64	64
[redacted]	[redacted]	6	90.0	**1.38**	64	66
[redacted]	[redacted]	6	90.0	**1.38**	64	66
[redacted]	[redacted]	22	89.8	**1.34**	64	66
[redacted]	[redacted]	7	90.0	**1.34**	64	66
[redacted]	[redacted]	8	90.0	**1.34**	64	66

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		11	90.0	1.34	64	66
		5	90.0	1.34	64	66
		37	89.9	1.34	64	66
		24	89.8	1.34	64	66
		1	90.0	1.34	64	66
		37	89.9	1.34	64	66
		36	89.3	1.34	64	66
		36	89.2	1.31	64	68
		16	89.9	1.25	64	70
		13	89.9	1.25	64	70
		10	90.0	1.25	64	70
		14	89.9	1.25	64	70
		14	89.9	1.25	64	70
		14	89.9	1.25	64	70
		14	89.9	1.25	64	70
		10	90.0	1.25	64	70
		21	89.9	1.25	64	70
		2	90.0	1.25	64	70
		21	89.9	1.25	64	70
		8	90.0	1.25	64	70
		17	89.9	1.25	64	70
		2	90.0	1.25	64	70
		2	90.0	1.25	64	70
		2	90.0	1.25	64	70
		2	90.0	1.25	64	70
		17	89.9	1.25	64	70
		18	90.1	1.34	66	68
		28	92.4	1.34	69	72
		36	92.3	1.34	69	72
		11	92.7	1.25	69	75
		45	93.8	1.66	71	71
		36	99.2	1.59	76	76
		30	99.6	1.56	76	76
		1	100.0	1.44	76	77
		1	100.0	1.44	76	77
		1	100.0	1.44	76	77
		1	100.0	1.44	76	77
		1	100.0	1.44	76	77
		1	100.0	1.44	76	77

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		33	99.4	1.41	76	78
		30	99.7	1.41	76	78
		7	100.0	1.34	76	79
		2	100.0	1.34	76	79
		24	99.8	1.34	76	79
		24	99.8	1.34	76	79
		33	99.4	1.34	76	79
		27	99.7	1.34	76	79
		28	99.7	1.34	76	79
		7	100.0	1.34	76	79
		36	99.2	1.34	76	79
		36	99.2	1.34	76	79
		24	99.8	1.31	76	80
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		11	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		11	100.0	1.25	76	83
		11	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83
		2	100.0	1.25	76	83

Unique ID (NpHandle)	Location	Age	HI	Criticality	Year for Optimal Replacement	Year for Max Deferral Replacement
[redacted]		0	100.0	**1.25**	76	83
			-100.0	**1.25**		
			-100.0	**1.25**		

2.7 Data Analysis

The data available for this asset category includes age, contact resistance, and inspection results.

2.7.1 Data Availability Distribution

The average DAI for this asset group is only 52%. Although age and operation count are available for most of the units, inspection records are only available for approximately up to 50% of the population. Also the measurement data are available for only 30% of the population.

The data availability distribution for the entire population is as follows:

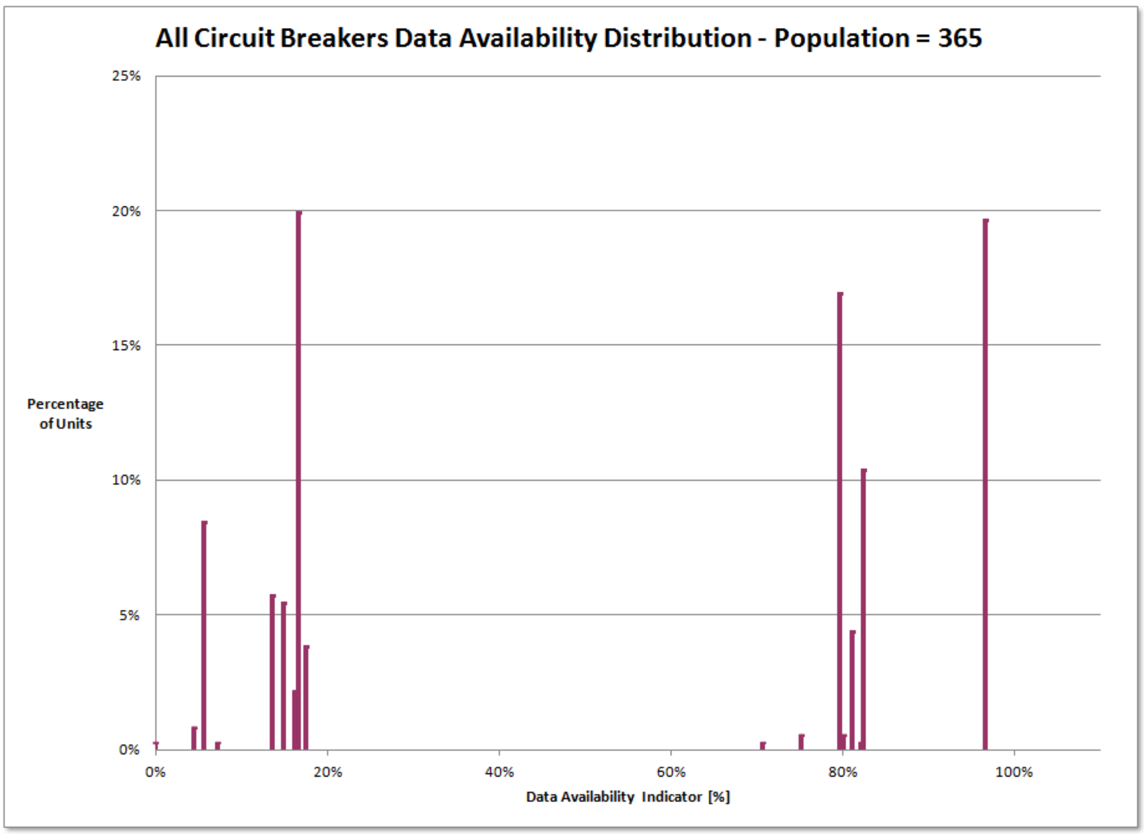

Figure 37 Circuit Breakers Data Availability Distribution

2.7.2 Data Gap

In this asset group, many of the required data have been incorporated into the Health Index formula. There are, however, some important data that remain to be collected:

Table 57 Substation Circuit Breakers Data Gaps

Data Gap (Sub-Condition Parameter)	Parent Condition Parameter	Priority	Object or Component Addressed	Description	Source of Data
Timing Test Results	Contact Performance	☆☆☆	Close/Trip timing	Trip time too long Close time too long	On-site testing
Contact Resistance	Contact Performance	☆☆☆	Main Contact	Contact erosion	On-site testing
Arc Contact	Contact Performance	☆	Arc contact	Arc Contact erosion	On-site testing
Oil DGA	Insulation	☆☆	Insulation oil	Insulation degradation	Sampling and Analysis
Loading	Service Record	☆	CB load	Loading History: e.g. hourly peak loads	Operation record

It is understood that MH does have timing and contact/arc contact resistance measurement. However such information needs to be elctronized and allow exporting.

3 Wood Pole Structures

This study considers wood poles at Manitoba Hydro.

Wood poles are used to support primary distribution lines at voltages from 4.16 kV to 44 kV. The wood species commonly used for distribution wood poles predominantly include Red Pine, Jack Pine and Western Red Cedar (WRC), either butt treated or full length treated. Smaller numbers of Larch, Fir, White Pine and Southern Yellow Pine have also been used.

Distribution line design standards dictate usage of poles of varying height and strength, depending upon the number and size of conductors, the average length of adjacent spans, maximum loadings, line angles, appropriate loading factors and the mass of installed equipment. Poles are categorized into Classes (1 to 7), which reflect the relative strength of the pole. Stronger poles (lower numbered classes) are used for supporting equipment and handling stresses associated with corner structures and directional changes in the line. The height of a pole is determined by a number of factors, such as the number of conductors it must support, equipment-mounting requirements, clearances below the conductors for roads and the presence of coaxial cable or other telecommunications facilities.

3.1 Degradation Mechanism

As wood is a natural material the degradation processes are somewhat different to those which affect other physical assets on electricity distribution systems. The critical processes are biological involving naturally occurring fungi that attack and degrade wood, resulting in decay. The nature and severity of the degradation depends both on the type of wood and the environment. Some fungi attack the external surfaces of the pole and some the internal heartwood. Therefore, the mode of degradation can be split into either external rot or internal rot. As the decay processes requires the presence of the water and oxygen, the area of the pole most susceptible to degradation is at and around the ground line or at the top of pole. Although it is possible in some circumstances for decay to occur in other locations it is normal to concentrate inspection and assessment of poles in these. In addition to the natural degradation processes, external damage to the pole by wildlife can also be a significant problem. This can vary from attack by termites, small mammals or woodpeckers.

To prevent attack and decay of wood poles they are treated with preservatives prior to being installed. The preservatives have two functions, firstly to keep out moisture that is necessary to support the attacking fungus and secondly as a biocide to kill off the fungus spores. Over the period of wood pole use in the electricity industry, the nature of the preservatives used has changed, as the chemicals previously used have become unacceptable from an environmental viewpoint. Preservative treatments applied prior to 1980, range from none on some WRC poles, to butt treated and full length Creosote or Pentachlorophenol (PCP) in oil. The present day treatment, regardless of species, is CCA-Peg (Chromated Copper Arsenate, in a Polyethylene Glycol solution). Other treatments such as Copper Naphthenate and Ammoniacal Copper Arsenate have also been used, but these are relatively uncommon.

As a structural item the sole concern when assessing the condition for a wood pole is the reduction in mechanical strength due to degradation or damage. A particular problem when assessing wood poles is the potentially large variation in their original mechanical properties. Depending on the species the mechanical strength of a new wood pole can vary greatly. Typically the first standard deviation has a width of ±15% for poles nominally in the same class. However in some test programs the minimum measured strength has been as low as 50% of the average.

Assessment techniques start with simple visual inspection of poles. This is often accompanied by basic physical tests, such as prodding tests and hammer tests to detect evidence of internal decay. Over the past 20 years, electricity companies have sought more objective and accurate means of determining condition and estimating remaining life. This has led to the development of a wide range of condition assessment and diagnostic tools and techniques for wood poles. These include techniques that are designed to apply the traditional probing or hammer tests in a more controlled, repeatable and objective manner. Devices are available that measure the resistance of a pin fired into the pole to determine the severity of external rot and instrumented hammers that record and analyze the vibration caused by a hammer blow to identify patterns that indicate the presence of decay. Direct assessment of condition by using a decay resistance drill or an auger to extract a sample through the pole, are also widely used. Indirect techniques, ultrasonic, X-rays, electrical resistance measurement have also been widely used.

Although wood pole condition assessment is driven by the condition of the wood pole itself, replacement of the ancillary components, foundations, cross-arms, guys, anchors and insulators may also be required. The poles, foundations and cross-arms support the required insulation and phase conductors. The guys and anchors maintain the mechanical integrity of the structure and the insulators electrically insulate the conductor from ground potential.

There are many factors considered by utilities when establishing condition of wood poles. These include types of wood, historic rates of decay and average lifetimes, environment, perceived effectiveness of available techniques and cost. However, perhaps the most significant is the policy of routine line inspections. A foot patrol of overhead lines undertaken on a regular cycle is extremely effective in addressing the safety and security obligations.

Consequences of an in-service pole failure are quite serious, as they could lead to a serious accident involving the public. Depending on the number of circuits supported, a pole failure may also lead to a power interruption for a significant number of customers.

3.2 Health Index Formulation

This section presents the Health Index Formula developed and used for wood pole structures. The Health Index equation is shown in Equation 1 of Section II.1; the condition, sub-condition parameters, weights, and condition criteria are as follows.

Assume a parameter scoring system of 0 though 4, where 0 and 4 represent the “worst” and “best” scores respectively. Thus, the maximum score for any condition or sub-condition parameter (maximum CPS and CPF) is “4”.

3.2.1 Condition and Sub-Condition Parameters

The condition parameters, weights, and criteria are as follows:

Table 58 Wood Pole Structure Condition Parameter and Weights

m	Condition Parameter	WCP_m	Sub-Condition Parameters
1	Pole Strength	5	Table 59
2	Pole Physical Condition	4	Table 60
3	Auxiliary Accessories	1	Table 61
4	Service Record	3	Table 62
	Derating factor	As a multiplier for overall HI	Table 66

Table 59 Pole Strength Sub-Condition Parameters and Weights (m=1)

n	Sub-Condition Parameter	$WCPF_n$	Condition Criteria Table
1	Pole strength	1	Table 64

Table 60 Pole Physical Condition Sub-Condition Parameters and Weights (m=2)

n	Sub-Condition Parameter	$WCPF_n$	Condition Criteria Table
1	Top Split/Feathering	2	Table 63
2	Rot	2	Table 63
3	Decay	3	Table 63
4	Woodpecker Holes	2	Table 63
5	Animals	1	Table 63
6	Damage	1	Table 63

Table 61 Pole Auxiliary Accessories Sub-Condition Parameters and Weights (m=3)

n	Sub-Condition Parameter	$WCPF_n$	Condition Criteria Table
1	Guy Wire	2	Table 63
2	Cross Arm	3	Table 63
3	Ground Wire	1	Table 63
4	Leaning	8	Table 63

Table 62 Pole Service Record Sub-Condition Parameters and Weights (m=4)

n	Sub-Condition Parameter	$WCPF_n$	Condition Criteria Table
1	Overall	1	Table 65
2	Age	2	Figure 38

3.3 Condition Parameter Criteria

3.3.1 Individual Condition Based on IPM Count

Table 63 IPM Count Condition Criteria (Total Count at Pole Structure Level)

Condition Rating*	CPF	Description
A	4	0
B	3	6
C	2	12
D	1	16
E	0	20

Where IPM count is calculated as below:

Year	Score		Weight
	0	4	
2012	Specific Defect Not Found	Specific Defect Found	1
2011			0.9
2010			0.8
2009			0.7
2008			0.6
2007			0.5
2006			0.4
2005			0.3
2004			0.2
2003			0.1
2002			0

IPM count = $\sum Score_i \times Weight_i$

Where i refers to the year the IPM was conducted

3.3.2 Individual Condition Based on Test

Table 64 Pole Strength Condition Criteria (Pole Structure Level)

Condition Rating*	CPF	Description
A	4	Class S (No Action)
B	3	Class XR (Reinforced)
C	2	Class X (Reject)
D	1	Class XD (Danger)

3.3.3 Overall Condition Based on CM Count

Table 65 Pole Overall CM Count Condition Criteria (Total Count at Pole Structure Level)

Condition Rating*	CPF	Description
A	4	0
B	3	6
C	2	12
D	1	16
E	0	20

Where CM count is calculated as below:

Year	Score 1	Score 2	Score 3	Score 4	Weight
2012	Low priority CM	Medium priority CM	High priority CM	Critical priority CM	1
2011					0.9
2010					0.8
2009					0.7
2008					0.6
2007					0.5
2006					0.4
2005					0.3
2004					0.2
2003					0.1
2002					0

CM count = $\sum Score_i \times Weight_i$

Where i refers to the year the IPM was conducted

3.3.4 Individual Condition Based on Pole Intrinsic Characteristics

--- Age

Assume that the failure rate for wood pole structure exponentially increases with age and that the failure rate equation is as follows:

$$f = e^{\beta(t-\alpha)}$$

f = failure rate of an asset (percent of failure per unit time)
t = time
α, β = constant parameters that control the rise of the curve

The corresponding survivor function is therefore:

$$S_f = 1 - P_f = e^{-(f-e^{\alpha\beta})/\beta}$$

S_f = survivor function
P_f = cumulative probability of failure

Assuming that at the ages of 55 and 90 years the probabilities of failure (P_f) are 10% and 90% result in the survival curves shown below. It follows that the CPF for Age is the survival curve normalized to the maximum CPF score of 4 (i.e. 4*Survival Curve). The CPF vs. Age is also shown in the figure below.

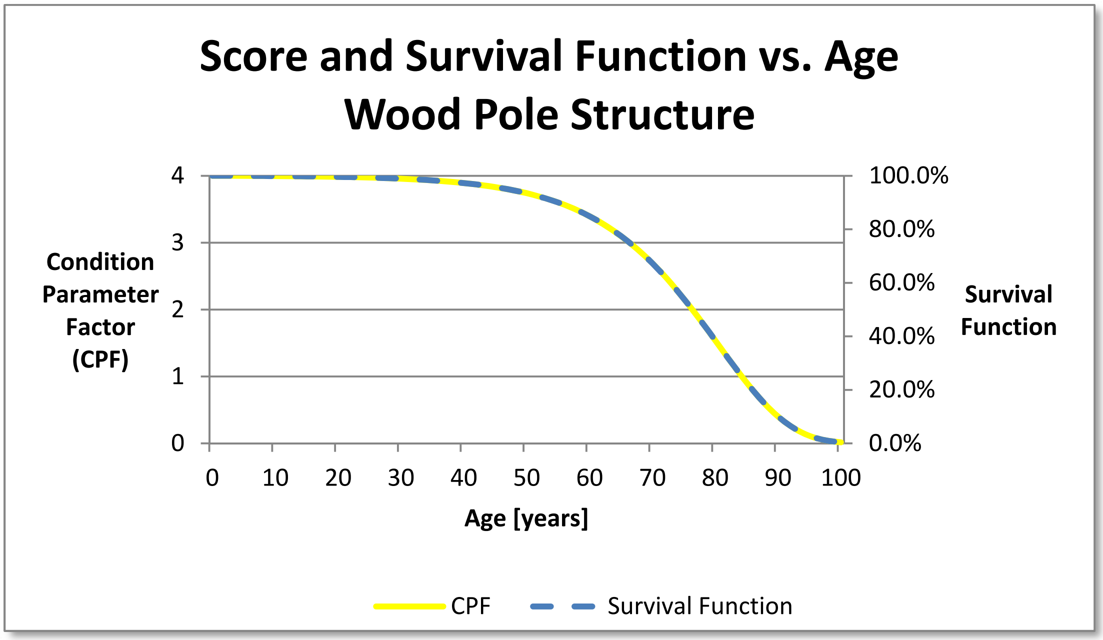

Figure 38 CPF and Survival Function vs. Age (Wood Pole Structures)

Derating Factor

The de-rating is based on the following equation:

$$DR = \min(DRF_1, DRF_2, DRF_3, DRF_4)$$

Equation 3-1

Where DRF are as described in Table 66

Table 66 Wood Pole Structure De-Rating Factors

De-Rating Factor (DRF)	De-Rating Factor	Description
DRF_1	0.95	In the case of a treatment happens after the initial installation, the overall HI of a specific wood pole will restore only 90% of its original strength

3.4 Age Distribution

The age distribution is shown in the figure below. Age was available for 98% of the population. The average age was found to be 39 years.

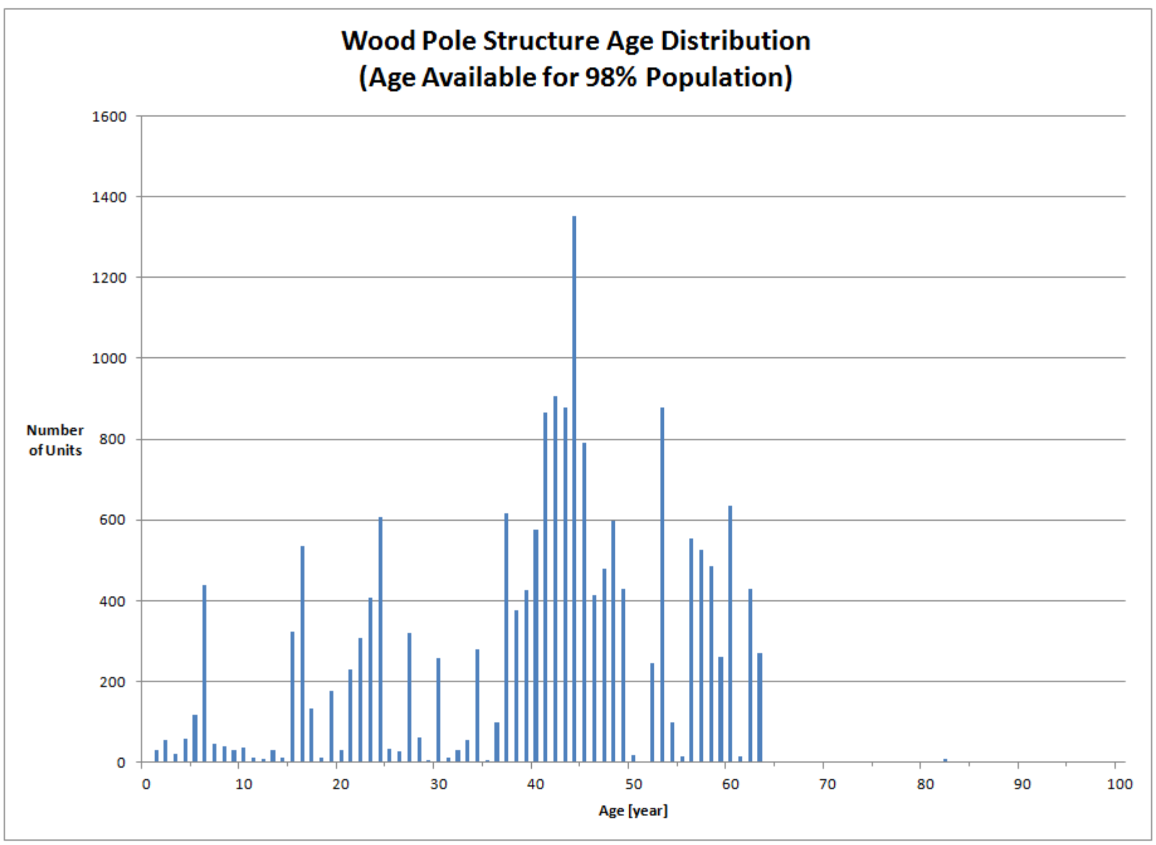

Figure 39 Wood Pole Structure Age Distribution

3.5 Health Index Results

There are 18469 in service wood pole structures at MH. Each wood pole structure might consist up to 6 individual wood poles. The Health Index of wood pole structure is computed by taking the average Health Index results of all the individual wood poles in the same structure.

The average Health Index for this asset group is 92%. Less than 1% of the structures were found to be in poor or very poor condition.

The Health Index Results are as follows:

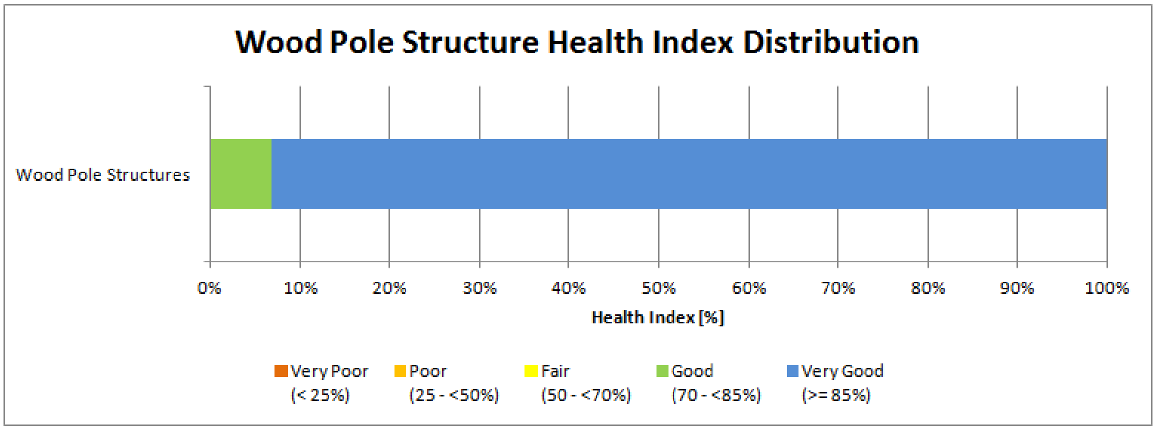

Figure 40 Wood Pole Structure Health Index Distribution

3.6 Condition-Based Flagged for Action Plan

As it is assumed that Wood Pole Structures at MH are reactively replaced, the flagged for action plan is based on asset failure rate f(t), as described in Section II.2.2.

The optimal flagged for action plan is based on the number of expected failures in a given year.

Figure 41 Wood Pole Structure Optimal Condition-Based Flagged for Action Plan

3.7 Data Analysis

The data available for Wood Pole Structures includes age and inspections.

3.7.1 Data Availability Distribution

Pole strength test data and inspection information was taken from the IPM database. If no entry was found for inspection on an asset, it was assumed that the inspection results were perfect. All parameters that are derived from inspection data are given a perfect score.

For overall evaluation of an individual pole structure, the information was taken from TLine. The score was calculated based on total number of corrective maintenance work orders as well as the years they were issued.

Assuming all inspection-based parameters are available, the average DAI for wood pole structures is 60%.

The following diagram shows the data availability distribution. It can be observed that roughly half of the population had all the data (i.e. recorded in IPM and TLine database), while the other half had age data only (contributing to 15% of data availability as per wood pole Health Index formulation).

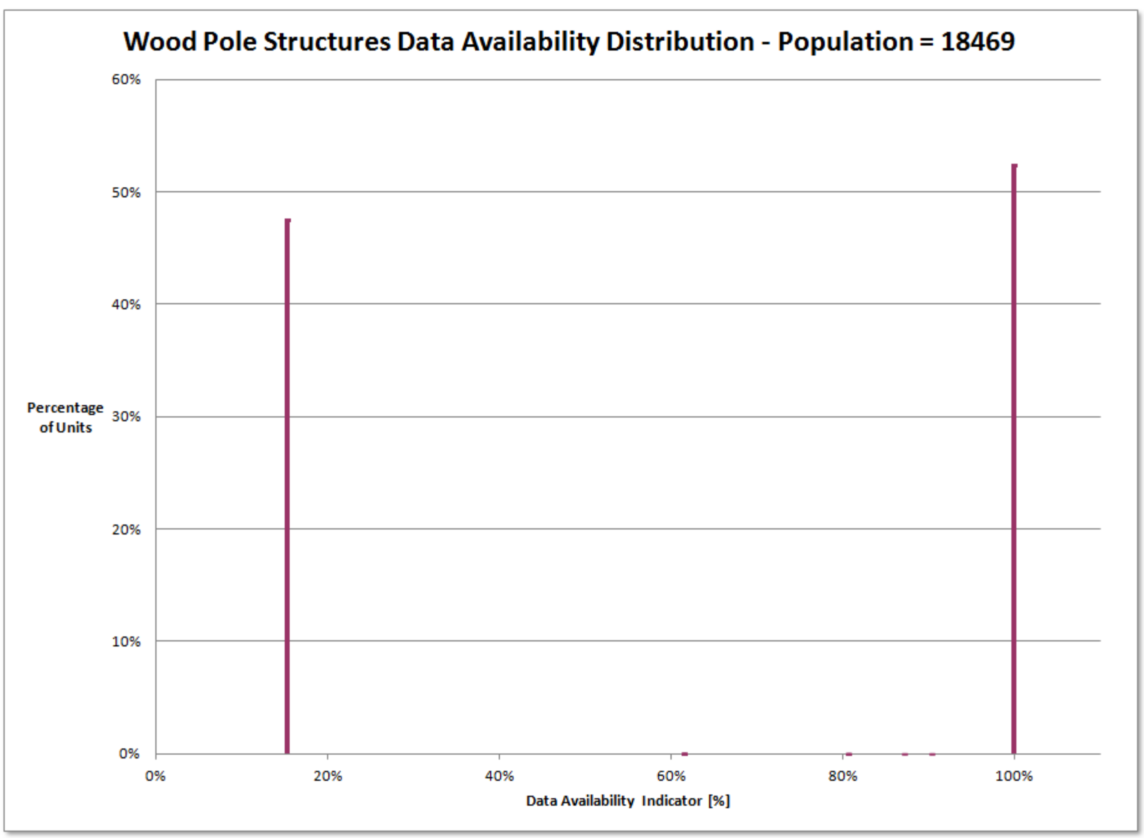

Figure 42 Wood Pole Structures Data Availability Distribution

3.7.2 Data Gap

The data gaps for MH wood pole structures are as follows:

- To standardize the code for CondDescription (Condition description) column in IPM database, so as to facilitate data exporting for each individual pole.

- To assign unique ID in TLine database so as to map to IPM database

- To expand the existing IPM and TLine databases to address the other half of the population currently not covered

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4 Spar Arms

Spar arms are normally considered as part of wood pole structures. Due to their independent maintenance and replacement philosophy at MH, they are addressed as a separate asset group in this study.

4.1 Health Index Formulation

Due to lask of inspection and maintenance information, in this study the Health Index study is solely based on the age. The following assumptions are made:

- All the spar arms in the same wood pole structure are of the same age
- The age of spar arms in the same wood pole structure is equal to the average age of all the wood poles in such a structure

--- Age

Assume that the failure rate for spar arms exponentially increases with age and that the failure rate equation is as follows:

$$f = e^{\beta(t-\alpha)}$$

f	= failure rate of an asset (percent of failure per unit time)
t	= time
α, β	= constant parameters that control the rise of the curve

The corresponding survivor function is therefore:

$$S_f = 1 - P_f = e^{-(f-e^{\alpha\beta})/\beta}$$

S_f	= survivor function
P_f	= cumulative probability of failure

Assuming that at the ages of 55 and 90 years the probabilities of failure (P_f) are 10% and 90% result in the survival curves shown below. It follows that the CPF for Age is the survival curve normalized to the maximum CPF score of 4 (i.e. 4*Survival Curve). The CPF vs. Age is also shown in the figure below.

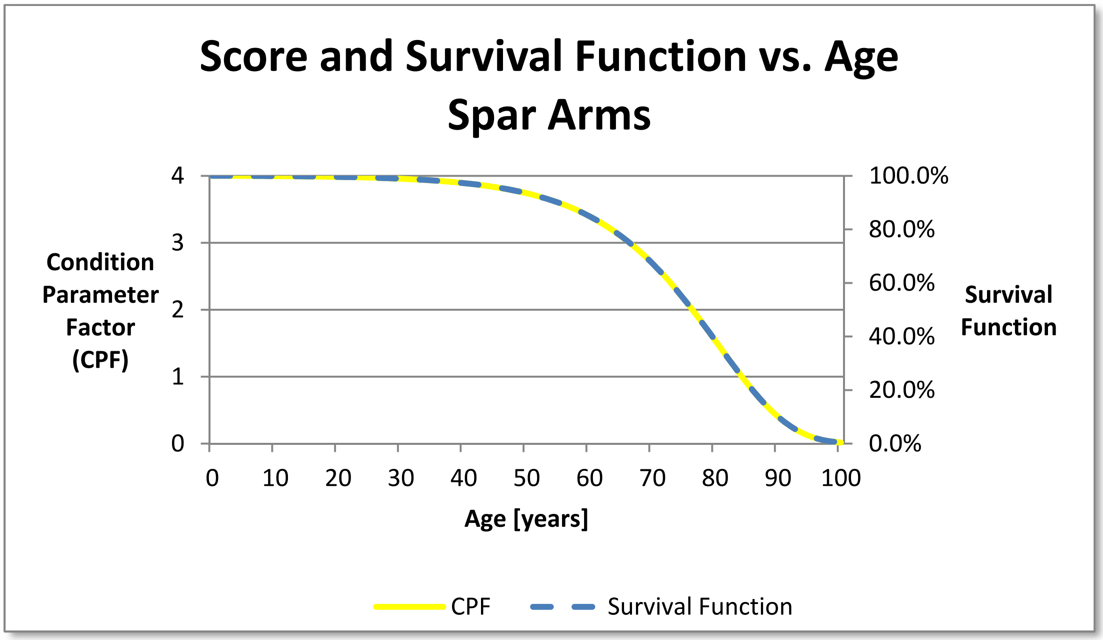

Figure 43 CPF and Survival Function vs. Age (Spar Arms)

4.2 Age Distribution

The age distribution is shown in the figure below. Age was available for 97% of the population. The average age was found to be 39 years.

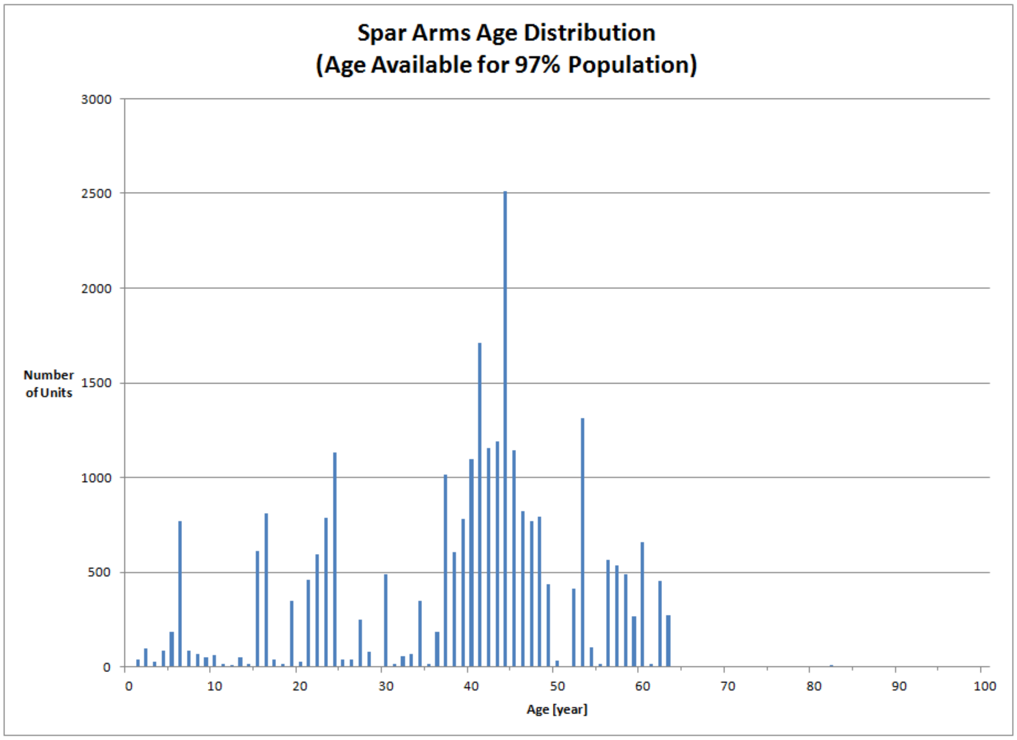

Figure 44 Spar Arms Age Distribution

4.3 Health Index Results

There are 27999 in service spar arms at MH. Several spar arms might serve the same wood pole structure. The Health Index of spar arms is computed based on age only.

The average Health Index for this asset group is 96%. Less than 1% of the spar arms were found to be in poor or very poor condition.

The Health Index Results are as follows:

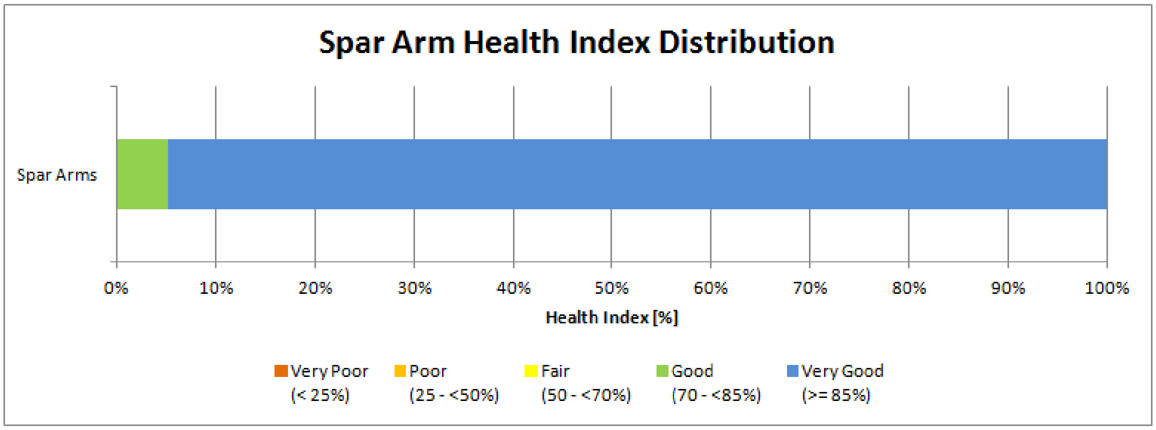

Figure 45 Spar Arms Health Index Distribution

4.4 Age-Based Flagged for Action Plan

As it is assumed that Spar Arms at MH are reactively replaced, the flagged for action plan is based on asset failure rate f(t), as described in Section II.2.2.

The flagged for action plan is based on the number of expected failures in a given year.

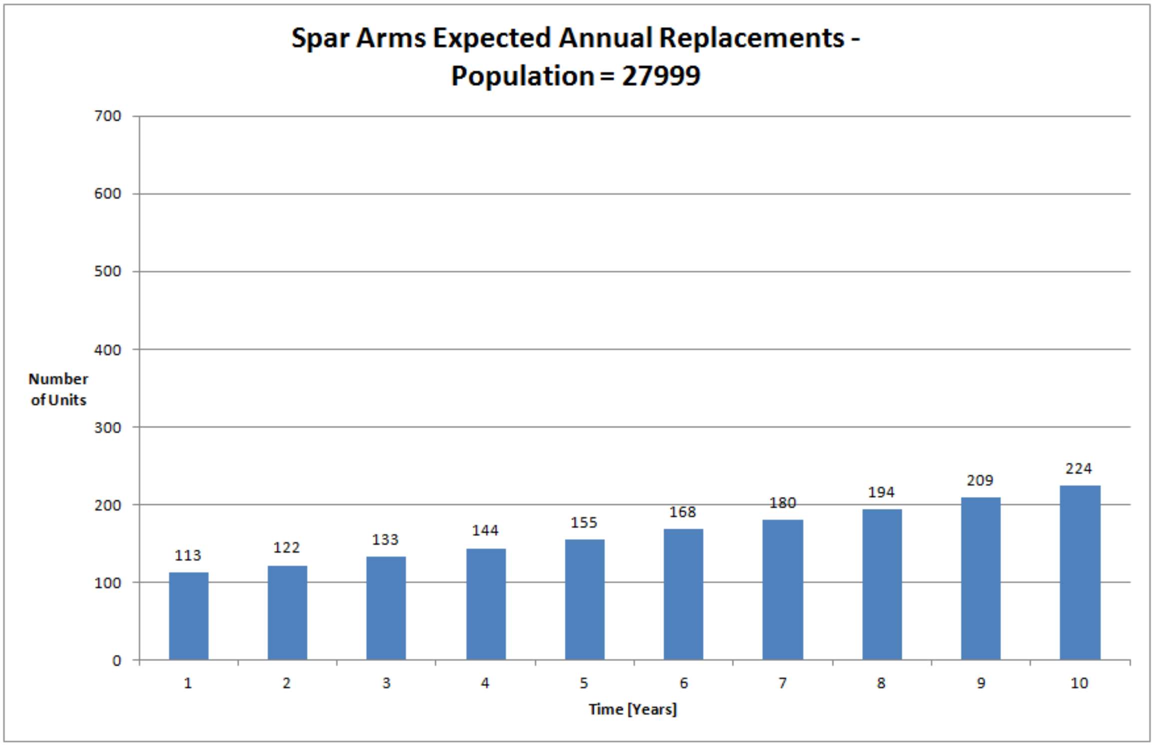

Figure 46 Spar Arms Age-Based Flagged for Action Plan

4.5 Data Analysis

The data available for Spar Arms includes age only.

4.5.1 Data Availability Distribution

For spar arms, normally only age is required for condition aceessment, the data availability is therefor equal to age availability. In this study, data availability is 97%.

4.5.2 Data Gap

If MH plans to treat spar arms as an independent asset group in terms of maintenance and replacement, the following data gaps need to be addressed:

- To include inspection on spar arms in IPM and TLine databases

- To assign unique ID for spar arms
- To record installation and replacement years for each spar arm.

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VII APPENDIX B: STEEL STRUCTURE CLIMBING AND FOOTING INSPECTION

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VII Appendix B: Steel Structure Climbing and Footing Inspection

1. Climbing Inspection

The following form shows the details for steel structure climbing inspection.

Table 67 Steel Structure Cimbing Inspection Form

Climbing Inspection Form for Steel Towers						Work Order Number		
Asset ID - Facing In Direction of Increasing Structure #'s								
Circuit		# of Circuits		Other Circuits on Tower				
Line Section Name								
Structure #		Tower Type	Suspension Angle Semi-Strain DE Transposition Tap ABS Other					
GPS Coordinates Decimal Degrees	Lat/N	**Example 44.0510292**	Long/W	**Example -79.73358262**				
GPS Coordinates Decimal Degrees	Lat/N		Long/W					
Steel Structure Above Ground								
Steel Surface Condition (1 - 5) - average, visual	1 2 3 4 5							
↓	# of Pieces of Steel Damaged & Mark #'s	↓	# of Damaged Braces					
	Bent Broken Corroded Cracked		Bent Broken Missing Corroded Cracked					
	Bent Broken Corroded Cracked		Bent Broken Missing Corroded Cracked					
	Bent Broken Corroded Cracked		Bent Broken Missing Corroded Cracked					
	Bent Broken Corroded Cracked		Bent Broken Missing Corroded Cracked					
			Bent Broken Missing Corroded Cracked					
Has Structure Been Painted/Recoated	Yes No	Coating Condition (1 - 5)	1 2 3 4 5					
Critical Location	Yes No	Structure in Swamp_Wet Location	Yes No					
Noticeable Vibrations	Yes No	Visual Cracks	Yes No	Missing Nuts or Bolts	Yes No			
Arm Defects	Yes No	Describe Arm Defects & Location						
Tower Security	Yes No	Security Method	Bolted Welded Other	Anti-Climbing Barriers	Yes No			
Barrier Defects	Yes No							
Additional Structure Defects & Locations								
Conductors and Shieldwire and U-Bolts								
Conductor Defects	**circuit**		**circuit**		**circuit**		**circuit**	
Conductor Clamp Loose		Yes No		Yes No		Yes No		Yes No
Conductor Strands Damaged		Yes No		Yes No		Yes No		Yes No
Conductor Vibration dampers as per design		Yes No		Yes No		Yes No		Yes No
Shieldwire Defects	**circuit**		**circuit**		**circuit**		**circuit**	
Shieldwire Type								
Shieldwire Condition (1 - 5)		1 2 3 4 5		1 2 3 4 5		1 2 3 4 5		1 2 3 4 5
Shieldwire Clamp Loose		Yes No		Yes No		Yes No		Yes No
Shieldwire Strands Damaged		Yes No		Yes No		Yes No		Yes No
Shieldwire Vibration dampers as per design		Yes No		Yes No		Yes No		Yes No
Shieldwire U-Bolt Surface Condition (1- 5)		1 2 3 4 5		1 2 3 4 5		1 2 3 4 5		1 2 3 4 5
Foundations								
Assessment Activity	**Leg # 1**	**Leg # 2**	**Leg # 3**	**Leg # 4**				
Soil Conditions (Earth, Clay, Sand, Gravel, Rock,								
Steel Grillage Surface Condition (1 - 5)								
Condition of Concrete (1 - 5)								
Hardware Surface Condition (1 - 5)								
Additional Comments								
Public Safety Comments								
Inspectors Name		Date (month/year)						

2. Non-Destructive UT Testing of Footing

Background: The footings of steel transmission towers (and other metal buried parts), like most metal structures, start to corrode once it has been installed and buried. The idea of ultrasonic (UT) assessment of the buried structures condition is based on employing traveling guided acoustic waves, propagating along the footing length and excited by the UT transducer located on the unburied part of the footing. Signals reflected from geometric irregularities in the buried part of the footing (e.g. from corroded areas) are detected in the pulse-echo mode by using the same transducer. Previously obtained results show that it is possible to detect corroded areas on the buried parts of the footings and even estimate their dimensions.

Benefits: Location and sizing of the corroded area in the buried part of the footing (and in any other buried structure) without excavation. As a result, the condition of the buried part of footing (or any other structure) will be assessed.

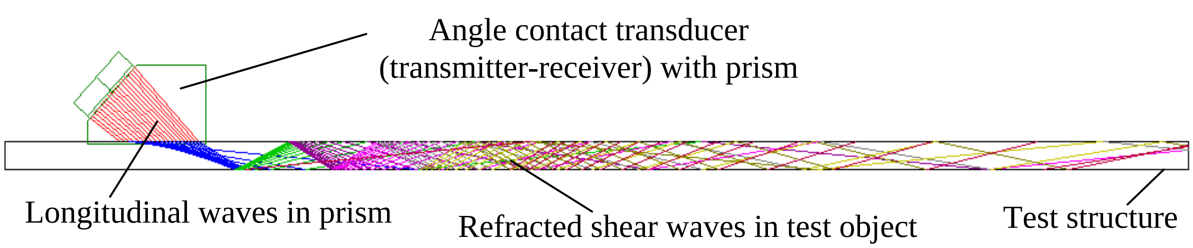

Figure 47 Beam tracing simulation for shear wave propagating within the footing along its length.

The results obtained on group of samples of tower legs showed that even small and shallow flaws (about ~10% of wall thickness and a few millimeters in size), located at the distance about 0.6-1m from transducer, could be reliably detected, and their location and dimensions could be estimated using response position and amplitude.

Shear waves, longitudinal waves, Lamb waves or surface waves can be used for inspection depending on the conditions in order to obtain maximum detection sensitivity and accuracy of measurements.

Figure 48 Setup of UT guided wave testing technique for inspection of tower leg samples.

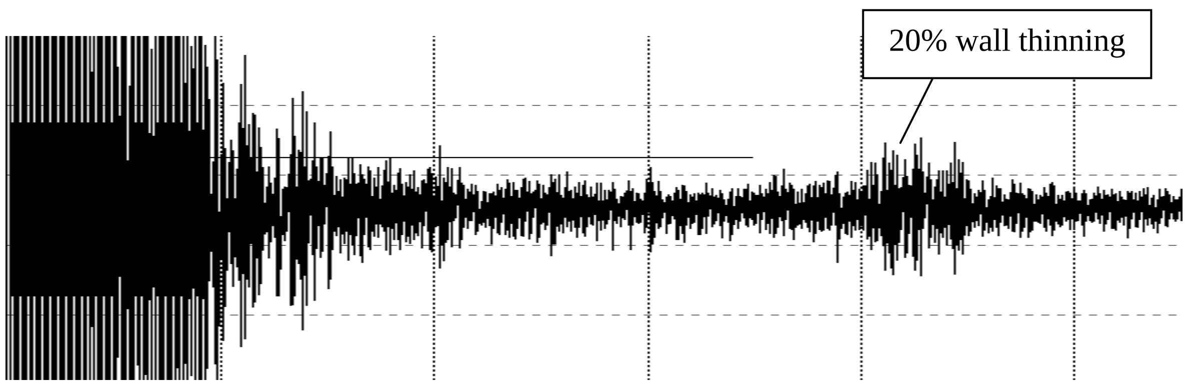

Figure 49 A-signals in PE mode, reflected from ~20% wall thinning (~10mm wide). Probe: Lamb wave, f=2.5MHz, β=70^0. Distance between probe and corrosion area is ~250mm.

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VIII REFERENCES

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VIII References

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Manitoba Hydro
October 19, 2012

Transmission Asset Condition Assessment Project Findings

KINECTRICS

Experts in Asset Management

Asset Categories Considered

KINECTRICS

Experts in Asset Management

Asset Grouping Considered

All assets within the scope of this project are part of the Manitoba Hydro's transmission asset base.

- Power Transformers (115 kV, 138 kV, 230 kV)
- Circuit Breakers (Air Blast, SF6, Bulk Oil, Min Oil)
- Wood Poles
- Wood SPAR arms
- Conductor
- Steele structures

Assessment Performed

KINECTRICS

Assets Grouping	ACA	RA	CRS	Prioritized List of Assets	Field Testing	Recommendations
Transformers	√	√	√	√		√
Circuit Breakers	√	√	√	√		√
Wood Poles	√	√	√			√
SPAR arms	√	√	√			√
Conductor					√	√
Steel Structures						√

Asset: Condition Assessment
RA: Risk Assessment
CRS: Capital Replacement Strategy

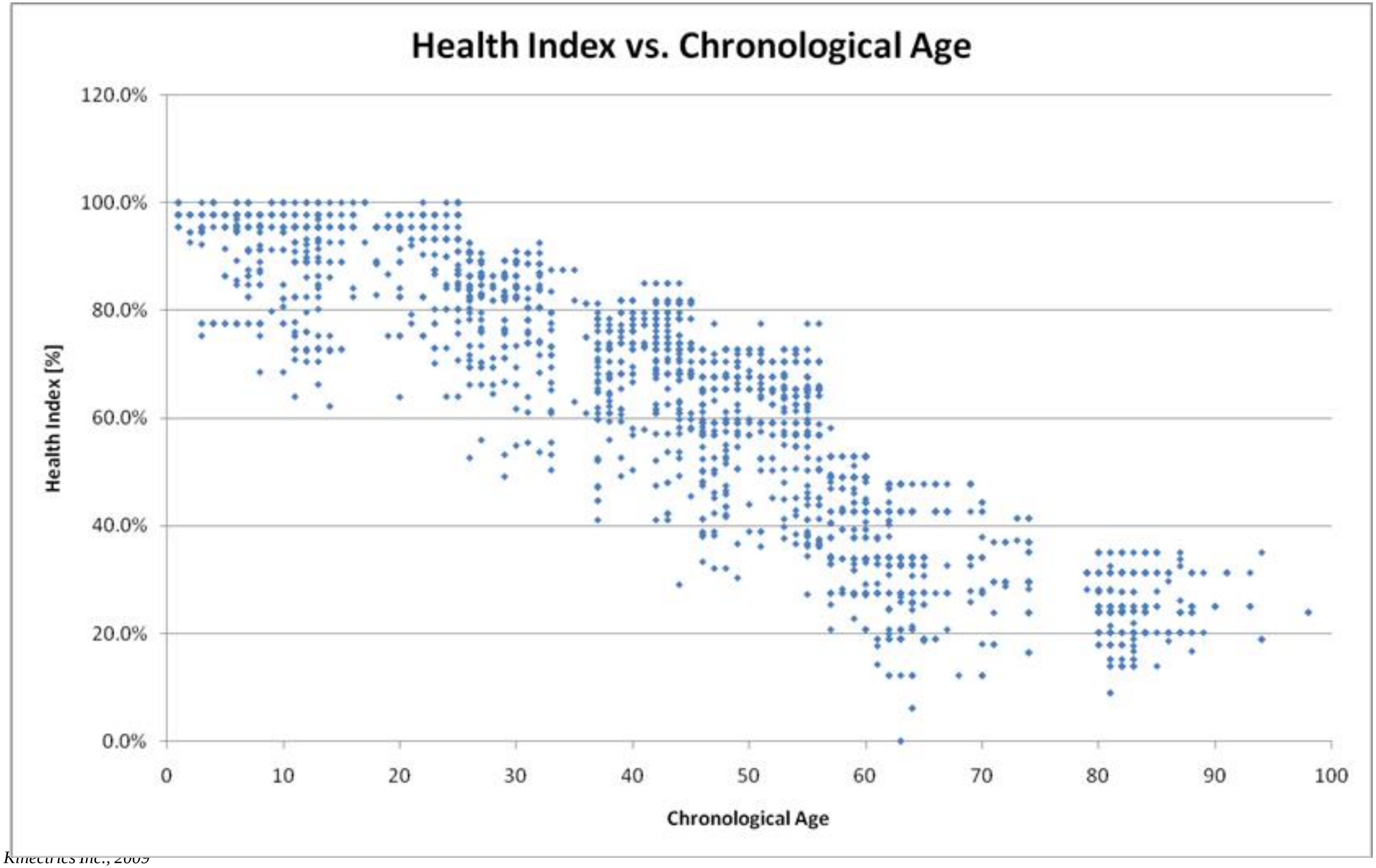
Brief Description of Methodology

KINECTRICS

Experts in Asset Management

Health Index vs Age

KINECTRICS

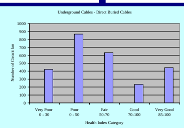


ACA & Risk Assessment Methodology Components

KINECTRICS

Asset Condition & Remaining Life

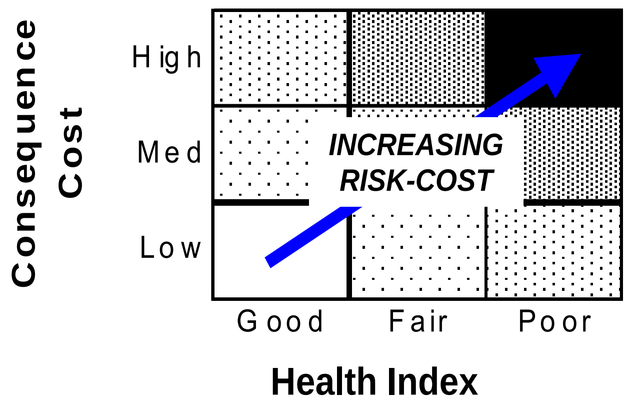
Asset Populations & Demographics



Asset Condition – Health Index

HI & Probability of Failure Correlation

Risk Analysis



Asset Criticality

Consequence Cost

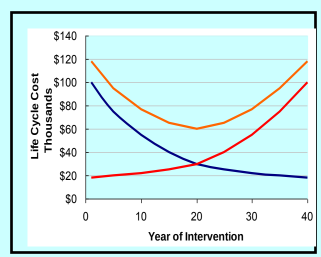
Asset Functionality

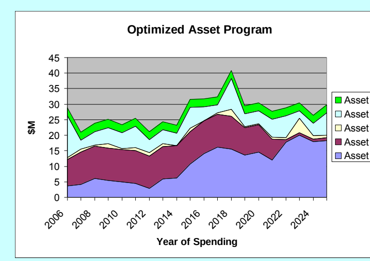
Functional Issues

Corporate Considerations

- **Economic/Financial Constraints**
- **Environmental and Safety**
- **Resource Capabilities**
- **Regulatory Requirements**
- **Superseding Programs**

Capital Plan





Optimized Capital Program based on End of Economic Life

General Asset Condition Data

KINECTRICS

Asset Condition data can include:

- **Age**
- **Historical and present utilization and stress**
  - loading, tension
- **Test Data**
  - unique to each component –DGA, Furan, moisture content, partial discharge, Doble, IR thermography, torsional strength, etc
- **Inspection Data**
  - corrosion, leaks, cracks, etc
- **Maintenance Program and Records**
- **Reliability Statistics, i.e. Failure and Outage Data**
- **Environmental Conditions**
- **Manufacture**
  - original quality, product performance industry wide
- **Information and opinions from client's staff**

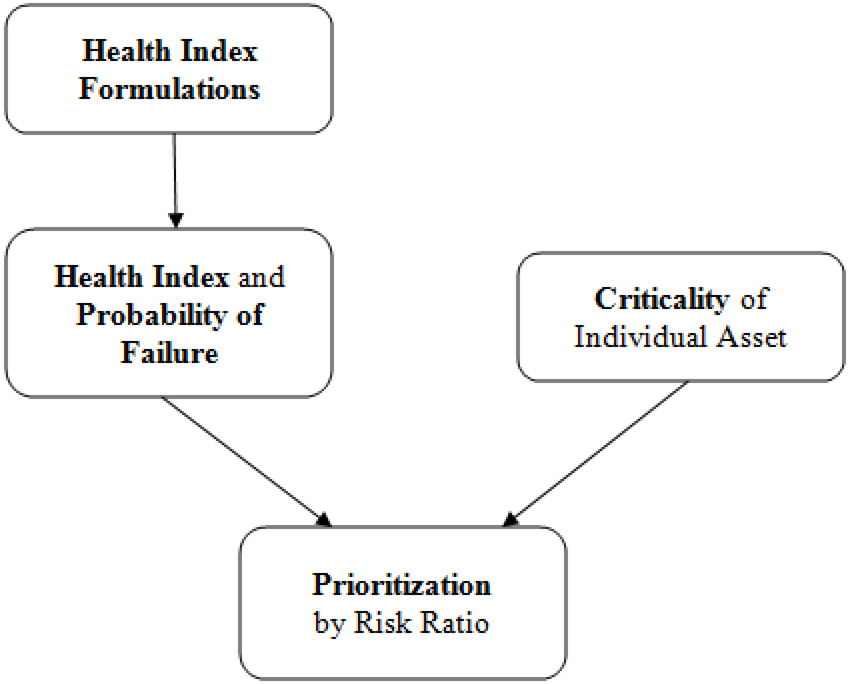
Age is one of the condition parameters used to calculate overall asset condition so that Asset Condition is not only a function of asset age.

Health Index

- **Health Index** is a composite quantitative measure of asset condition that takes into account available information about the asset, such as test results, reliability performance, age, visual inspections, maintenance records, loading
- **Health Index** indicates status of asset long-term degradation that leads to end-of-life (EOL) failure
- **Health Index** is expressed as a score from close to 0 to 100 where being close to 0 represents being near EOL and 100 corresponds to a brand new asset

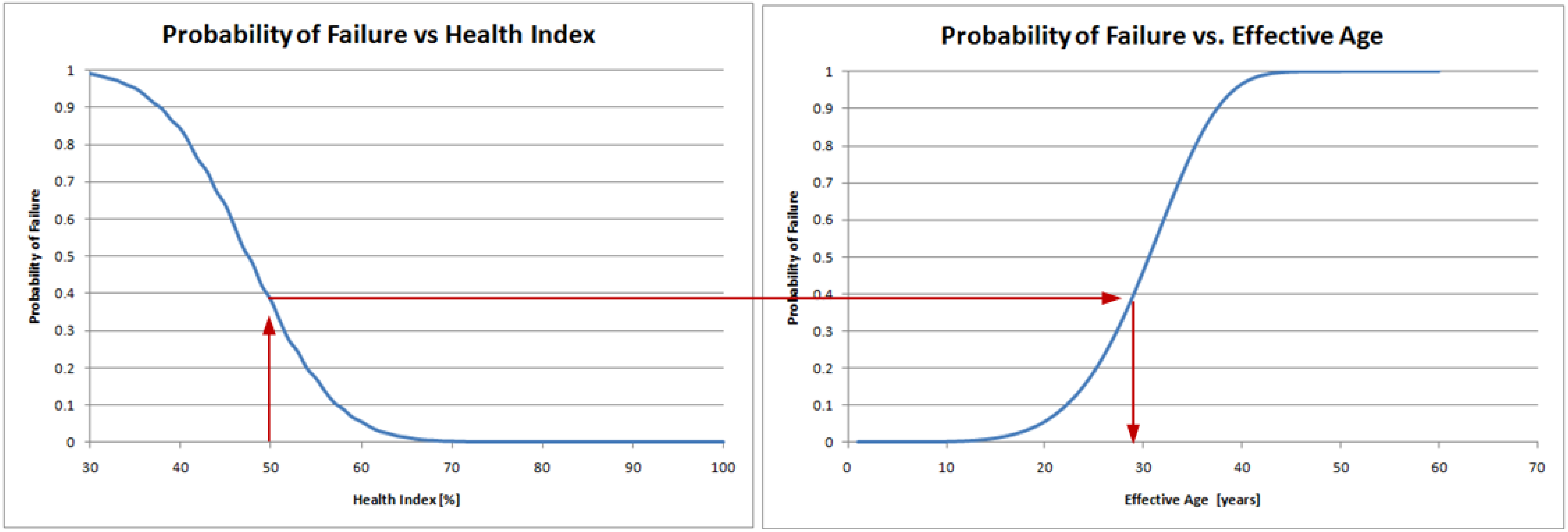
Estimating Risk Cost

Risk Cost = P (failure) x Consequence Cost (Criticality)



Health Index and Probability of Failure

- The "Effective Age" is found by :
  - determining the POF at a particular Health Index (the left hand graph)
  - finding the same POF on the POF vs. Age graph (right hand graph)
  - Reading the "effective age" from the horizontal axis of the right hand graph



Transformers Criticality Matrix

KINECTRICS

Criticality Factor (CF)	Description	Weight (WCF)	Score (CFS)	
Load Criticality	hospitals, provincial buildings, restoration time sensitive customers	15	Low	0
			High	1
Physical Protection	oil containment, blast wall, deluge system	20	Yes	0
			No	1
Customer Impact	# of customers	15	Low	0
			High	1
Location	public exposure, environmental impact	20	No	0
			Yes	1
System Impact	exports curtailment, need for load rejection, equipment overloading	20	No	0
			Yes	1
Short Circuit Fault Exposure	protection capabilities	10	No	0
			Yes	1

Breakers Criticality Matrix

KINECTRICS

Criticality Factor (CF)	Description	Weight (WCF)	Score (CFS)	
Environment & Safety	public exposure, environmental impact	20	No	0
			Yes	1
Reliability	customer importance (e.g. some critical customers are supplied) reliability concern (e.g. customer number, load capacity, redundancy)	20	No	0
			Yes	1
Long-term Development	system upgrading (e.g. higher voltage level, higher fault duty to be implemented)	20	No	0
			Yes	1
Operation & Maintenance	obsolescence of spare parts (e.g. manufacturers cease to produce old types of spare parts) known issues (e.g. not economical to have routine maintenance)	20	No	0
			Yes	1
System Impact	exports curtailment, need for load rejection, equipment overloading, delayed clearance consequences – how wide is the next zone	20	No	0
			Yes	1

Criticality Formulation

The minimum criticality, Criticality_{min}, is 1.25. This value is selected such that a unit with a probability of failure of 80% becomes a candidate for replacement (i.e. 80% * 1.25 = 1). The maximum criticality, $\text{Criticality}_{max,}$is twice the base criticality ($\text{Criticality}_{max,}$ = 1.25*2 = 2.5).

Each unit's criticality is defined as follows:

$$\text{Criticality} = (\text{Criticality}_{max} - \text{Criticality}_{min}) * \text{Criticality\_Multiple} + \text{Criticality}_{min}$$

where the Criticality_Multiple (CM) is defined by criticality factors, weights, and scores:

$$CM = \frac{\sum_{CF=1}^{\forall CF} (CFS_{CF} \times WCF_{CF})}{\sum_{CF=1}^{\forall CF} (WCF_{CF})}$$

Results Summary

KINECTRICS

Experts in Asset Management

Health Index Distribution

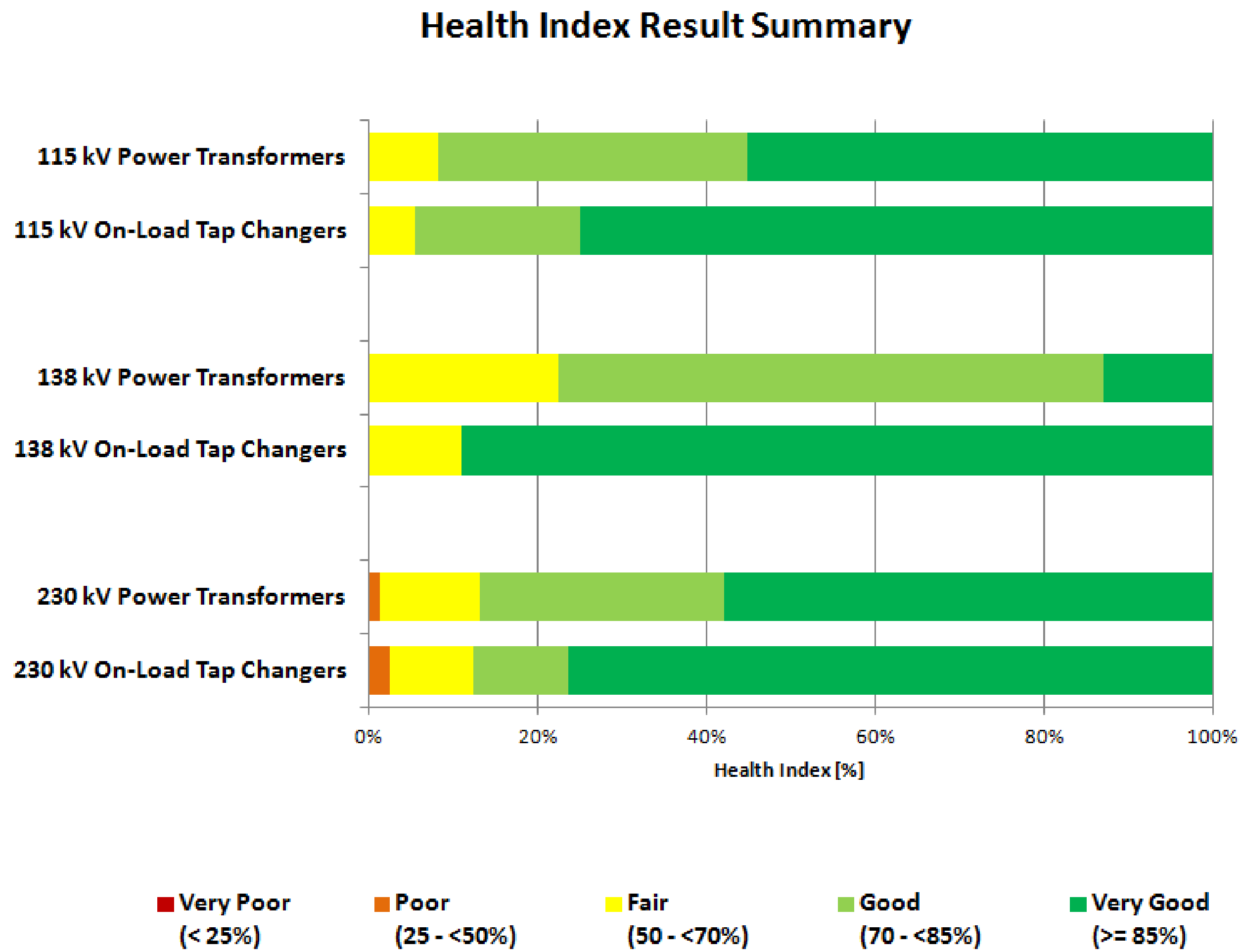
KINECTRICS

Experts in Asset Management

Transformers Health Index Distribution

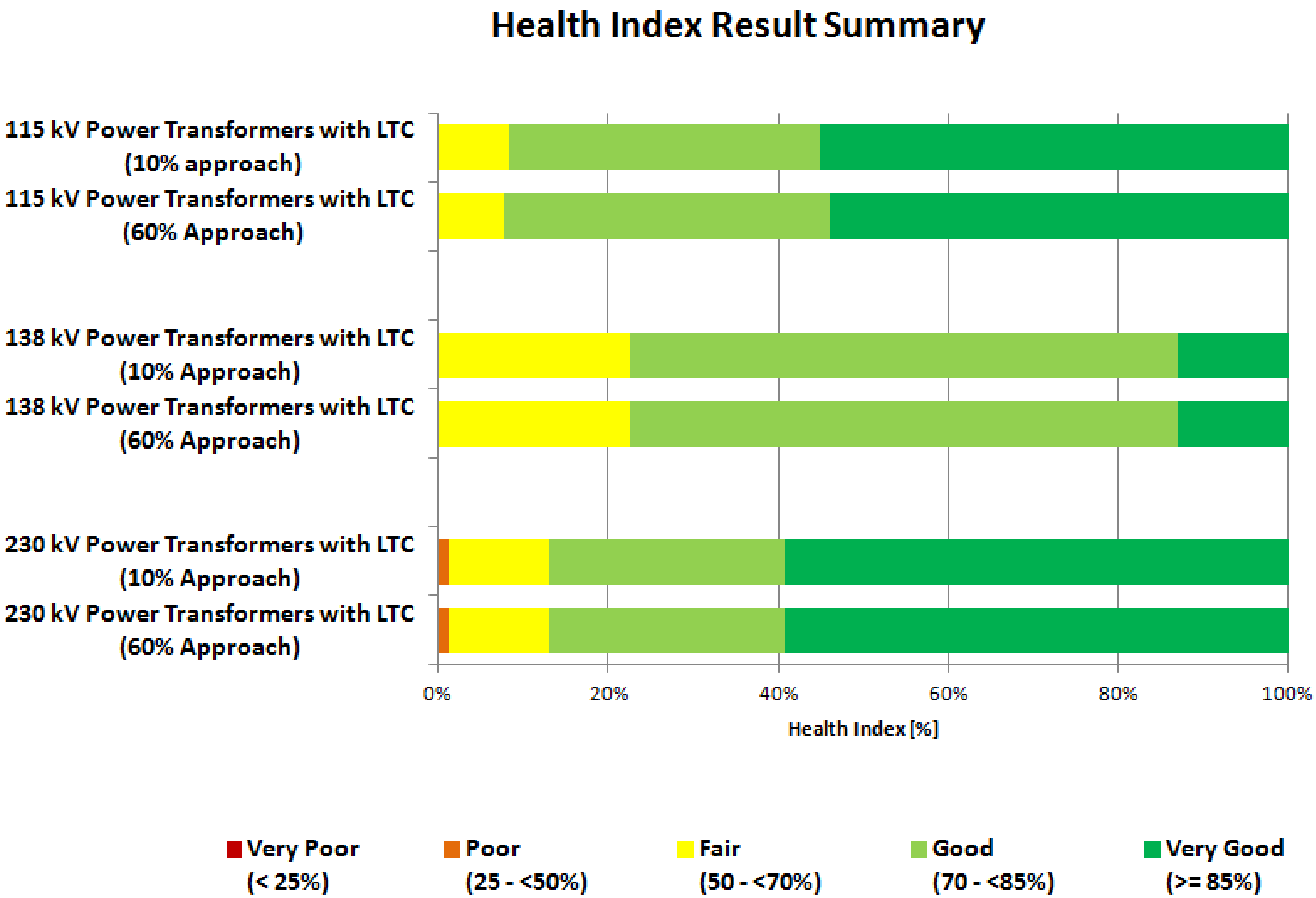
KINECTRICS

Transformers and Tap Changers Health Index Distribution Summary



Transformers Health Index Distribution - 2

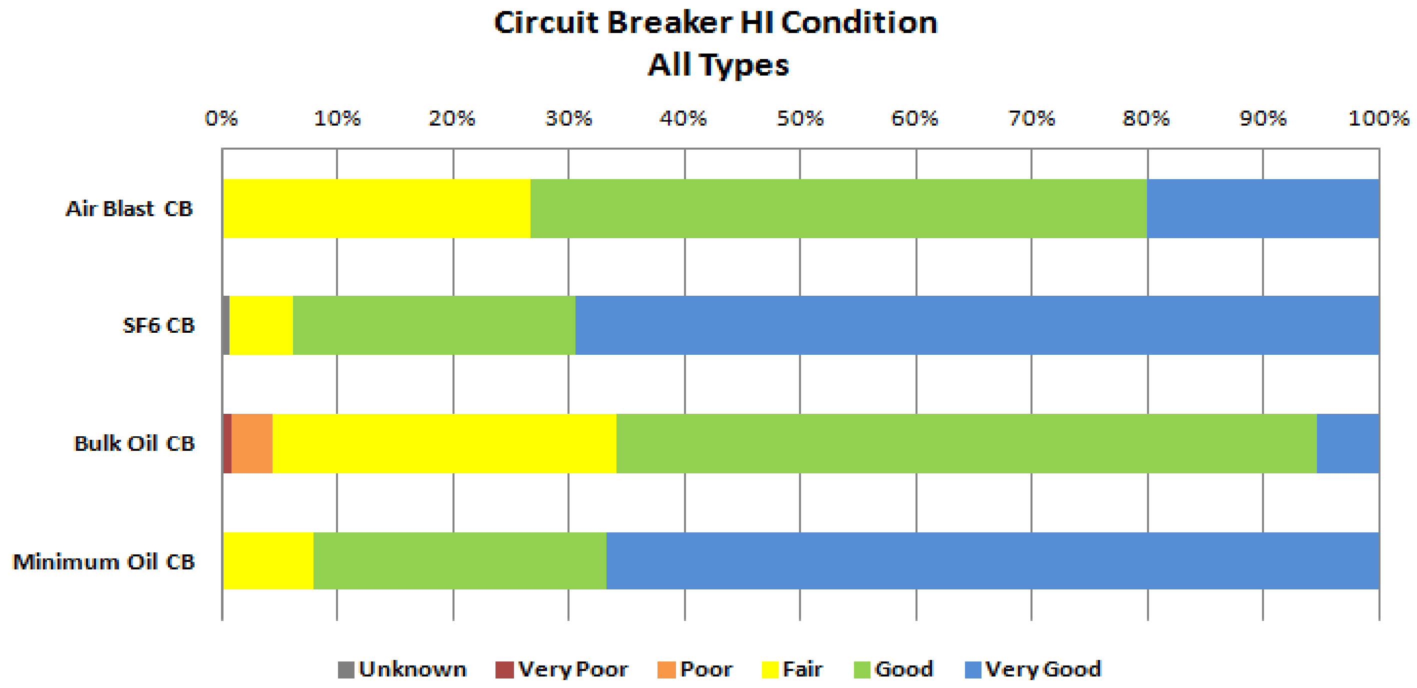
Combined Transformers/Tap Changers Health Index Distribution Summary



Breakers Health Index Distribution

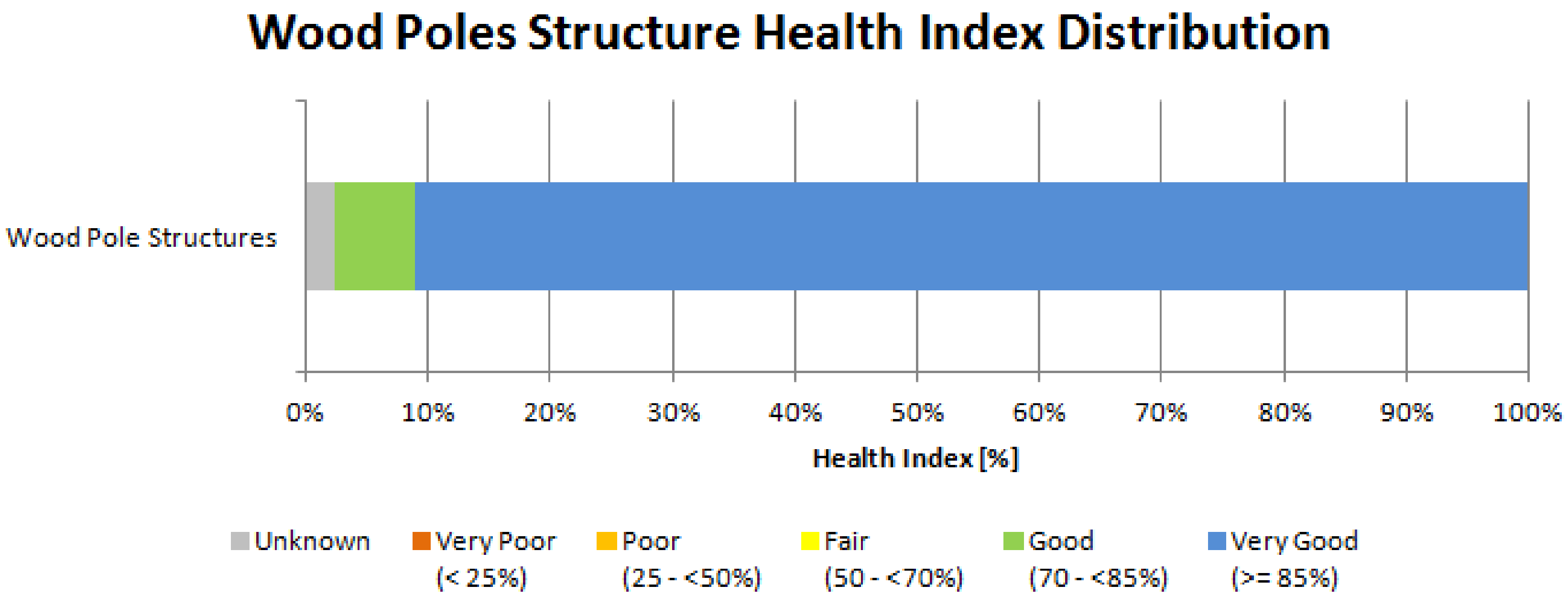
KINECTRICS

Circuit Breakers Health Index Distribution Summary



Wood Poles Health Index Distribution

Wood Poles Structure Health Index Distribution Summary



SPAR Arms Health Index Distribution

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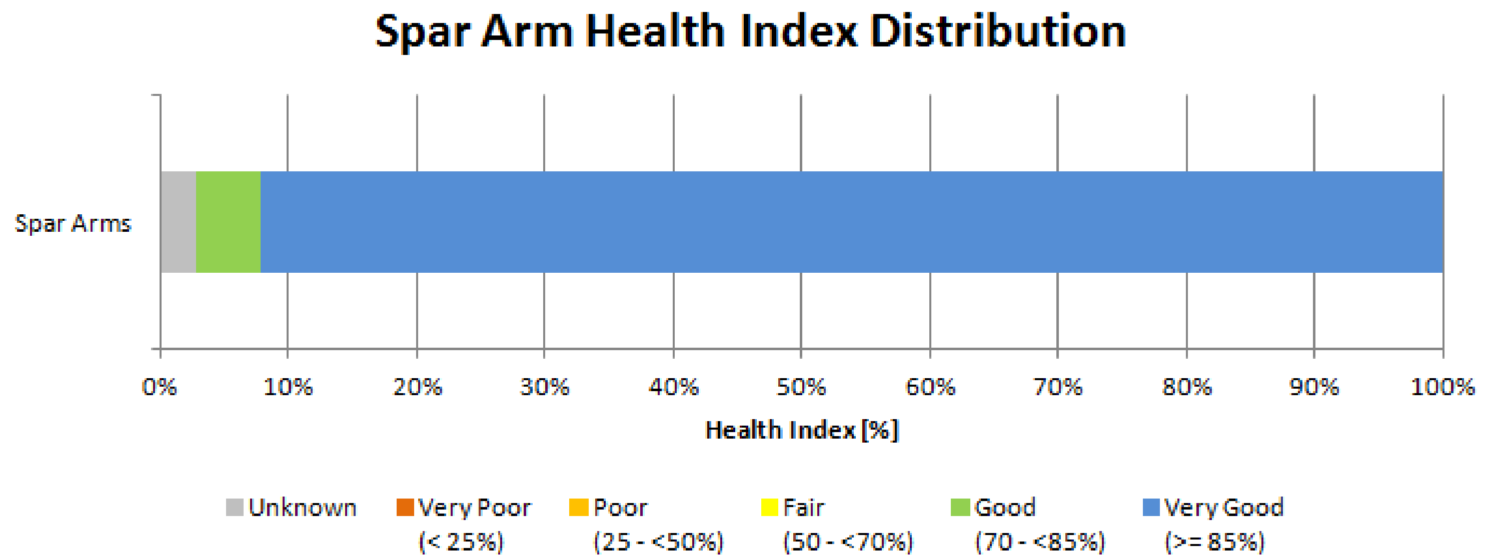
SPAR Arms Health Index Distribution Summary



Assets Flagged for Action

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Transformers Flagged for Replacements - 1

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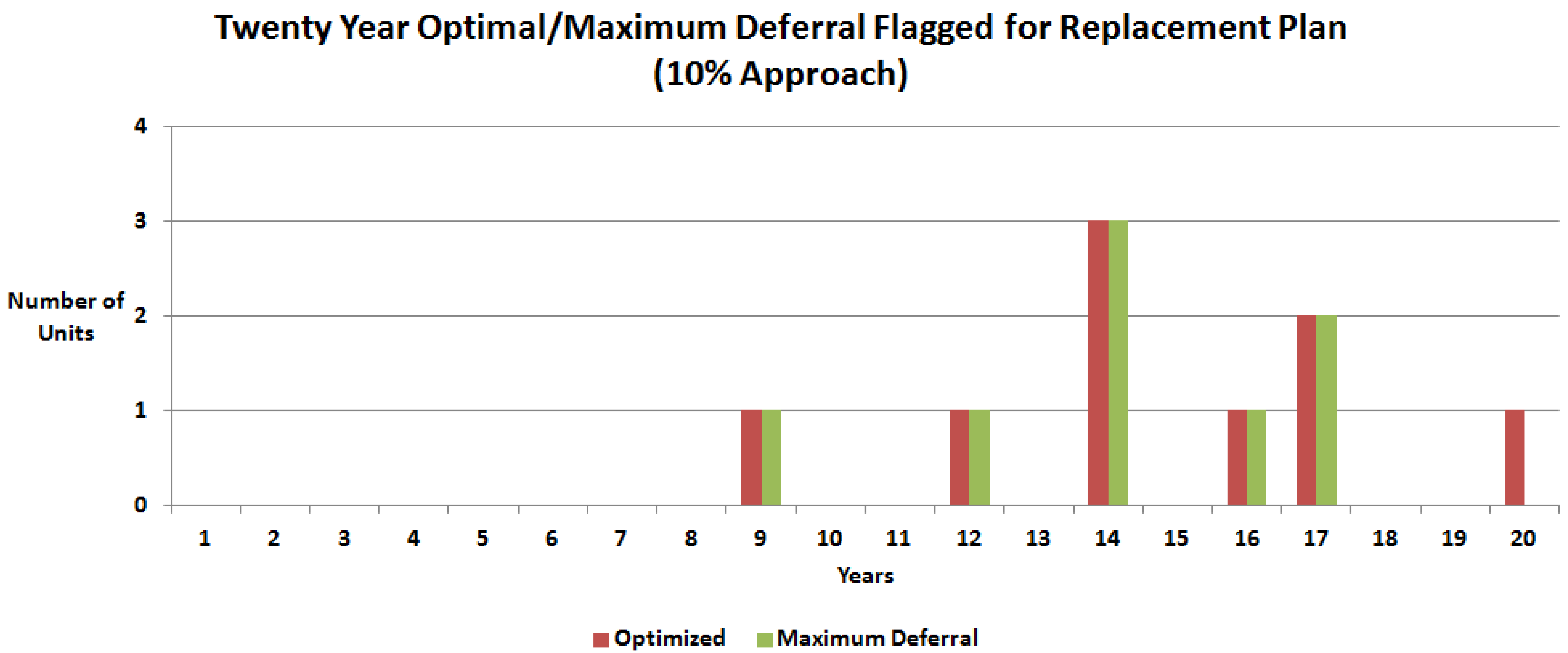
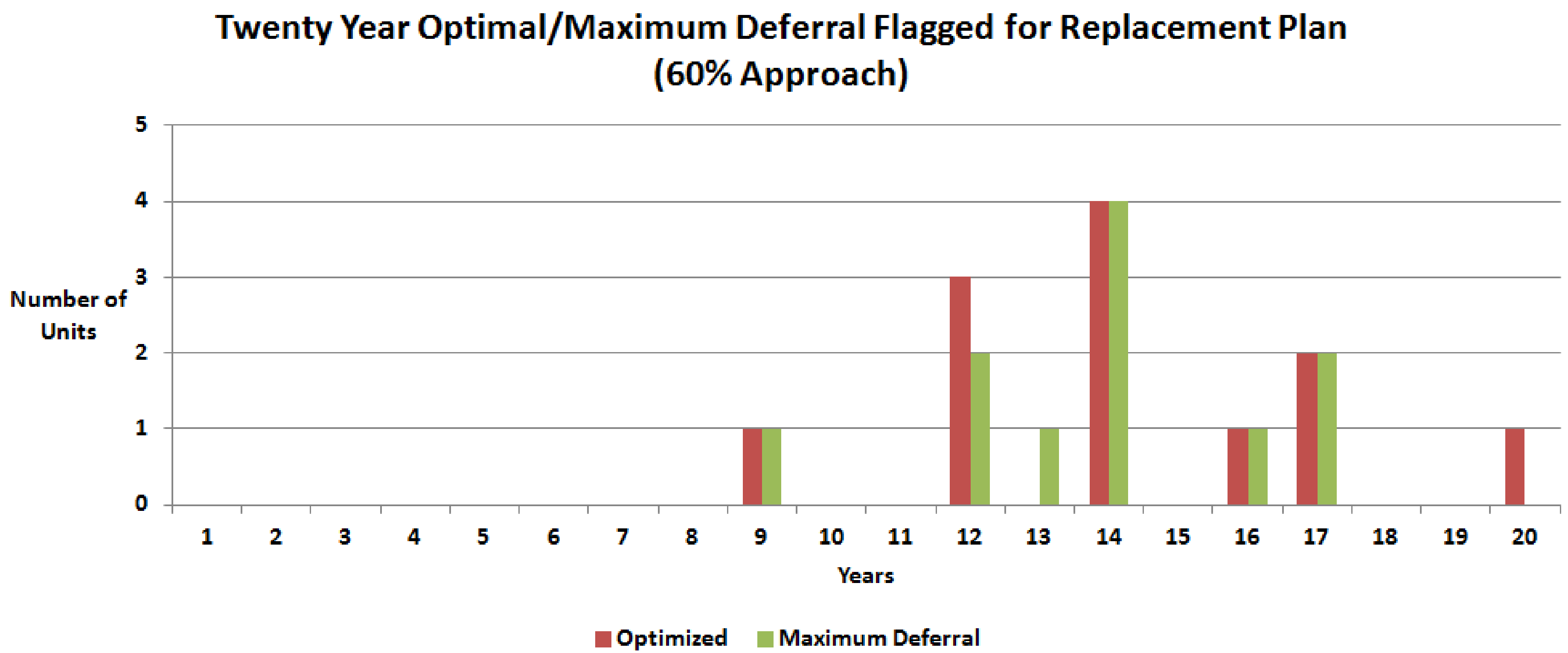
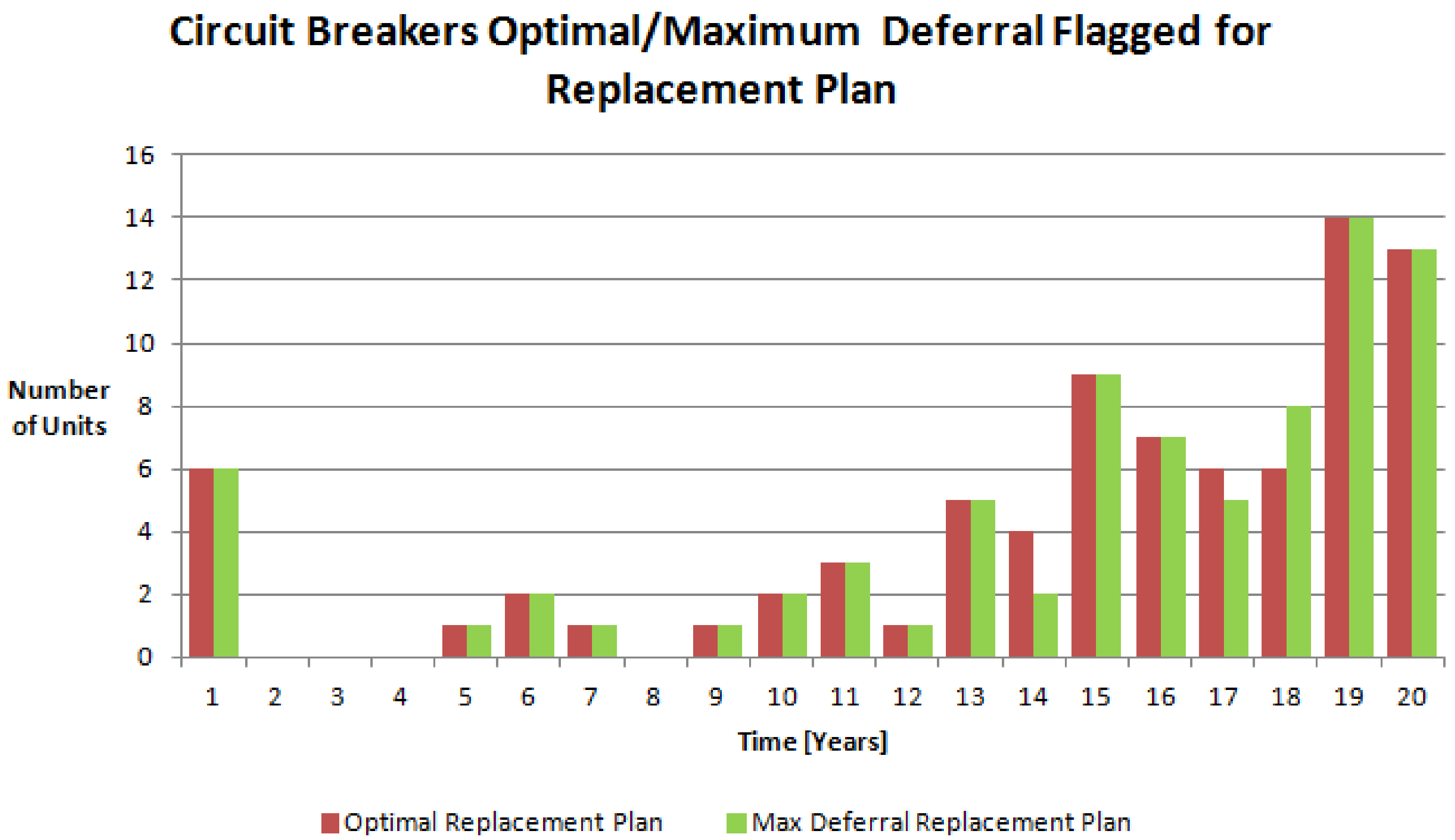


Transformers Flagged for Replacements - 2



Breakers Flagged for Replacements



Wood Poles Flagged for Replacements

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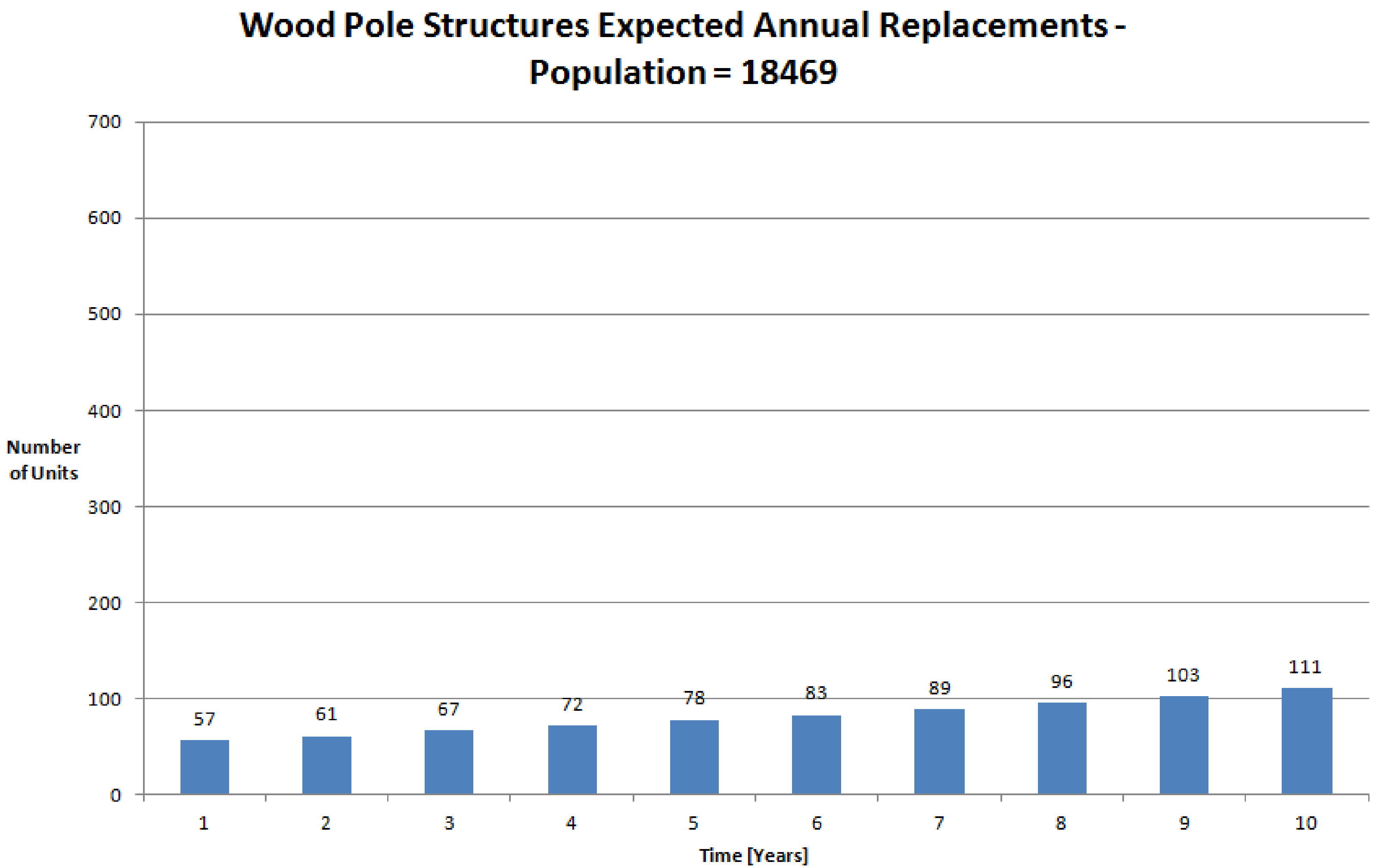
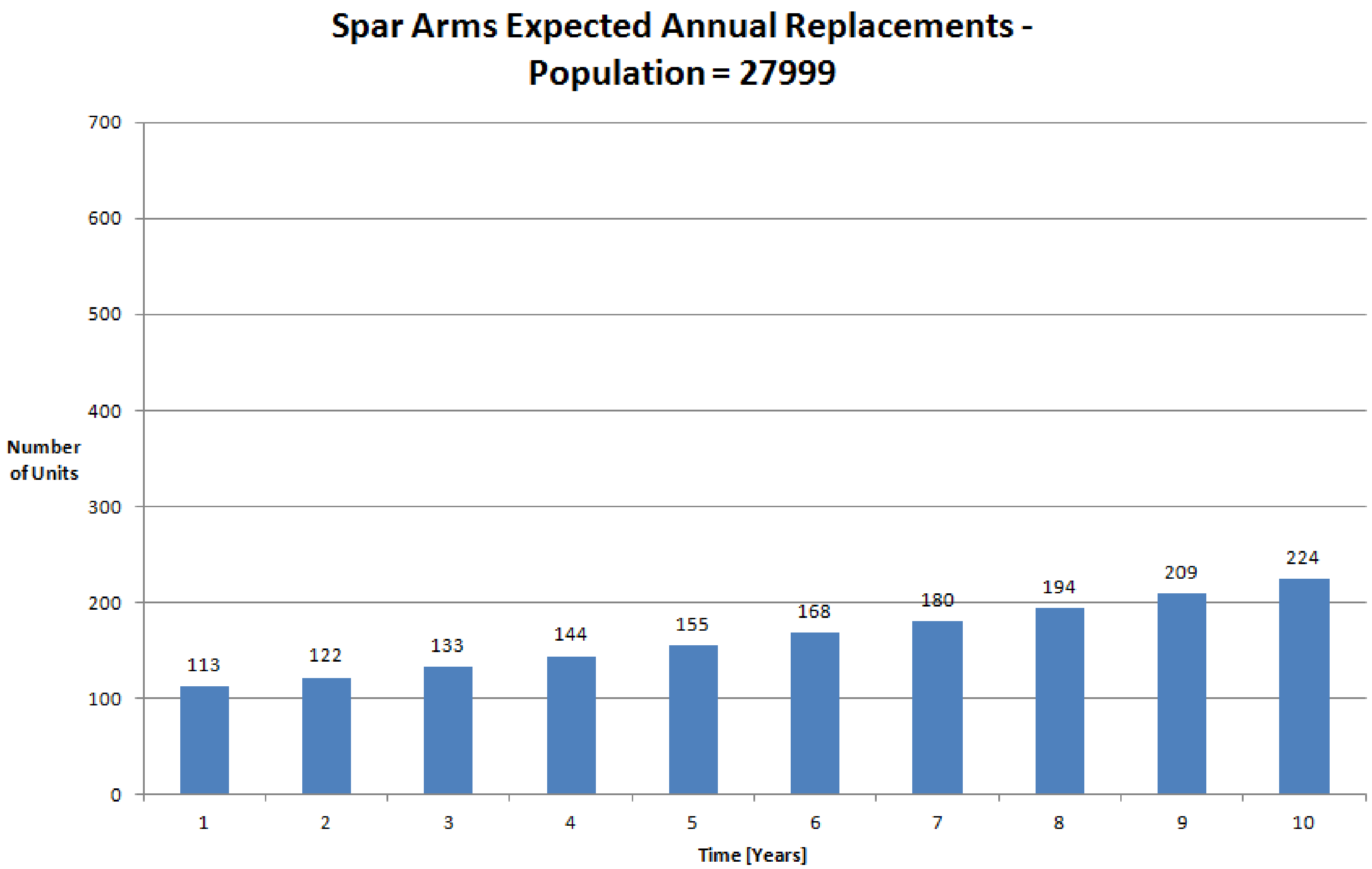


SPAR Arms Flagged for Replacements



Prioritized List of Transformers/LTCs – 10% Approach

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Unique ID (NpHandle)	Location	Age	HI (Final)	Effective Age (HI Final)	POF at Effective Age	Criticality	Risk Factor (Criticality*POF) 10% Approach
[redacted]		8	47.84	59.3	0.38209	1.74	0.663
		35	51.96	56.6	0.27425	1.77	0.486
		40	53.75	55.1	0.22663	1.56	0.354
		10	53.51	55.1	0.22663	1.49	0.338
		45	54.65	54.4	0.19766	1.56	0.309
		36	57.34	51.9	0.14686	1.88	0.275
		38	56.41	52.8	0.15866	1.56	0.248
		12	57.40	51.9	0.14686	1.49	0.219
		40	61.60	48.4	0.08851	1.35	0.120
		49	63.63	46.5	0.06681	1.67	0.111
		36	65.74	44.4	0.04947	1.98	0.098
		38	64.09	45.5	0.05480	1.67	0.091
		27	64.18	45.5	0.05480	1.67	0.091
		18	64.44	45.5	0.05480	1.67	0.091
		11	63.94	46.5	0.06681	1.35	0.090
		44	64.13	45.5	0.05480	1.60	0.088
		34	66.08	43.4	0.04006	1.94	0.078
		13	66.15	43.4	0.04006	1.60	0.064
		21	66.15	43.4	0.04006	1.56	0.063
		44	66.35	43.4	0.04006	1.56	0.063

Prioritized List of Transformers/LTCs – 60% Approach

KINECTRICS

Unique ID (NpHandle)	Location	Age	HI (Final)	Effective Age (HI Final)	POF at Effective Age	Criticality	Risk Factor (Criticality*POF) 60% Approach
[redacted]		8	47.84	59.3	0.38209	1.74	0.663
		43	49.71	58.0	0.32636	1.88	0.612
		43	47.61	59.3	0.38209	1.60	0.610
		37	51.69	56.6	0.27425	1.81	0.495
		35	51.96	56.6	0.27425	1.77	0.486
		37	51.69	56.6	0.27425	1.46	0.400
		19	51.71	56.6	0.27425	1.46	0.400
		18	51.71	56.6	0.27425	1.46	0.400
		34	54.77	54.4	0.19766	1.94	0.384
		40	53.75	55.1	0.22663	1.56	0.354
		10	53.51	55.1	0.22663	1.49	0.338
		38	53.66	55.1	0.22663	1.49	0.338
		41	52.38	55.9	0.24196	1.35	0.328
		37	52.69	55.9	0.24196	1.35	0.328
		45	54.65	54.4	0.19766	1.56	0.309
		36	57.34	51.9	0.14686	1.88	0.275
		37	54.77	54.4	0.19766	1.35	0.268
		38	56.41	52.8	0.15866	1.56	0.248
		30	56.30	52.8	0.15866	1.49	0.237
		12	57.40	51.9	0.14686	1.49	0.219

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Prioritized List of Breakers

NpHandle	Location	Age	HI (Final)	Effective Age (HI Final)	POF at Effective Age	Criticality	Risk Factor (Criticality*POF)
[redacted]		63	20.8	86.0	0.98585	1.47	1.448
		50	32.2	84.2	0.97441	1.47	1.431
		63	33.7	83.6	0.96784	1.47	1.422
		47	49.9	73.0	0.69146	1.91	1.318
		47	49.9	73.0	0.69146	1.91	1.318
		31	52.0	70.5	0.59871	1.66	0.992
		51	60.4	62.7	0.32636	1.91	0.622
		41	58.2	64.8	0.40129	1.47	0.589
		51	60.2	62.7	0.32636	1.78	0.581
		19	59.4	63.8	0.36317	1.47	0.533
		63	60.3	62.7	0.32636	1.47	0.479
		38	62.1	60.3	0.27425	1.47	0.403
		43	63.8	59.1	0.24196	1.66	0.401
		38	64.7	57.9	0.21186	1.84	0.391
		53	66.6	55.2	0.17106	2.03	0.347
		40	64.7	57.9	0.21186	1.63	0.344
		49	66.5	55.2	0.17106	1.91	0.326
		41	64.1	57.9	0.21186	1.53	0.324
		55	65.8	56.6	0.19766	1.63	0.321

Observations and Recommendations

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Data

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Condition Data Present Status

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- Most of the data required to develop a credible Health Index distribution were available for station transformers, tap changers, circuit breaker and wood poles: overall, a bit better than in most utilities.
- Some failure history data are available for transformers that allowed us to model failure curves for these assets: significantly better than in most utilities.
- No condition data other than age were available for SPAR arms, phase conductors and steel towers: about the same as in other utilities.

Recommended Condition Data Improvements - 1

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- In addition to the condition data being collected for transformers, tap changers, circuit breakers and poles start collecting failure data, i.e. age when assets are replaced, in order to establish a Manitoba Hydro-specific failure curves (a very good start already made with transformers, MH should continue refining and accumulating similar data).
- Institute an annual program for testing transmission lines phase conductors, starting with critical locations, using a combination of laboratory and in-situ non-intrusive testing methodologies. Health Index and prioritized replacement strategy for conductors could then be developed by extrapolating the sample results on a larger population of conductors.

Recommended Condition Data Improvements - 2

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- Start collecting information for creating a failure curve for SPAR arms. Age will then be used in conjunction with this failure curve to estimate number of units expected to be replaced annually.
- Start collecting condition data on steel structures by initiating a program of steel tower climbing inspections and footings assessments using ultra-sound methodology
- Use multi-purpose software to unable:

  a) storage of condition input data for multiple years,

  b) updating results based on the condition data changes

  c) analyzing options to deal with assets “flagged for action” and

  d) prioritizing the required investments portfolio

Results

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Results Interpretation – Transformers and Breakers - 1

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- Condition results indicate that MH's transformers and breakers have considerably longer lives than in other jurisdictions. This is due to a combination of rigorous maintenance practices combined with colder than average ambient temperature and moderate loading.
- The "Effective age" of assets was in most cases less than the corresponding chronological age so much so that even using industry failure curves to relate condition with the corresponding probability of failure still resulted in relatively few future replacements.

Results Interpretation – Transformers and Breakers - 2

- Using MH-specific failure statistics for transformers would have resulted in even fewer future replacements. However, it is suggested to collect more data before using it.

- Two approaches were used in assessing transformers condition in conjunction with under-load tap changers (ULTCs): one depending on how close were estimated conditions of ULTC and its parent transformer (10%), and the other depending on the worse condition of either ULTC or its parent transformer (60%). The latter approach resulted in more units “flagged for replacement”, mostly due to ULTCs condition.

Results Interpretation – Wood Poles and SPAR Arms

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- Results using “effective age” MH-specific failure curve resulted in replacement rate very close to the actual one with the predicted steady increase in the number of replacements over the next 20 years.
- Using chronological age instead of “effective age” would have resulted in almost doubling the actual replacement rate for wood poles.
- For SPAR arms only chronological age information was available. Using this information and MH-specific pole failure curves resulted in the replacement rate very close to the actual one. Going forward, failure curves for SPAR arms should be developed as their failure rate may be difference than that of wood poles.

How the Results Should be Used

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- The results presented support “condition based” long-term replacement strategy. It is important to note that:
  - ✓ The replacement strategy and prioritized list of units “flagged for action” should be used as a starting point. Actual decisions on overall long-term replacement plan and appropriate action for each unit (replace, refurbish, intensify maintenance, adjust spare units inventory, do nothing) should be made by Manitoba Hydro staff using Economic End-of-Life approach and investment prioritization techniques.
  - ✓ Factors other than condition should also be taken into account, such as obsolescence (included to some degree in developing Health Index), system growth requirements, impact on ageing from adjusting maintenance practices, regulatory requirements, etc.
  - ✓ The resultant long-term planning should include requirements for both capital expenditure and staffing as well as requirements for incremental operating costs associated with closing condition data gaps and potential increase in corrective maintenance

Contact

Yury Tsimberg

Director – Asset Management

Office: 416-207-6001 ext.6106

Cell: 416-578-6351

E-mail:

yury.tsimberg@kinectrics.com

www.kinectrics.com

Additional Background

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Health Index Formula - Transformers

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Power Transformers Condition and Sub-Condition Parameters and Weights:

Power Transformers				
Condition Parameter				Weight of Condition Parameter (WCP)
#	Sub-Condition Parameter		Weight of Sub-Condition Parameter (WCPF)	
1	**Insulation**			6
	1	Oil Quality	3	
	2	Oil DGA	6	
	4	Insulation Issues (CM)	1	
2	**Cooling**			1
	1	Cooling System Issues (CM)	1	
3	**Sealing & Connection**			3
	1	Insulation Containment (CM)	2	
	2	Tank Condition (CM)	2	
	3	Grounding Complete (CM)	1	
	4	Oil Conservator (CM)	2	
	5	Connections (CM)	2	
4	**Service Record**			3
	1	Loading	5	
	2	Age	3	

Health Index Formula – OLTCs

KINECTRICS

Tap Changers Condition and Sub-Condition Parameters and Weights:

On-Load Tap Changers						
Condition Parameter					Weight of Condition Parameter (WCP)	
#	Sub-Condition Parameter		Weight of Sub-Condition Parameter (WCPF) Oil	Weight of Sub-Condition Parameter (WCPF) Vacuum	Oil	Vacuum
1	**Operating Mechanism**				14	7
	1	Switch / Contact (CM)	9	5		
	2	Tap Selector Head (CM)	3	3		
	3	Diverter (CM)	1	1		
	4	Control - Electrical (CM)	5	2		
	5	Control - Mechanical (CM)	2	2		
	6	Cabinet (CM)	2	2		
	7	Pressure Relief (CM)	2	2		
2	**Sealing & Connection**				3	3
	1	Gasket or Sealant (CM)	2	2		
	2	Oil Level (CM)	2	2		
	3	Breather (CM)	1	1		
3	**Arc Extinction**				2	2
	1	Diverter Vacuum Bottle (CM)	2	1		
	2	Contacts (CM)	5			
4	**Insulation**				7	7
	1	Oil DGA	4	4		
	2	Oil quality	3	3		
	3	Insulation (CM)	1	1		
5	**Service Record**				5	5
	1	Age	1	1		
	2	Number of Operation	2	2		
	3	Fails to Operate (CM)	2	2		

Health Index Formulation

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$$HI = \frac{\sum_{m=1}^{5} \alpha_m (CPS_m \times WCP_m)}{\sum_{m=1}^{5} \alpha_m (CPS_{m.max} \times WCP_m)}$$

where

$$CPS = \frac{\sum_{n=1} \beta_n (CPF_n \times WCPF_n)}{\sum_{n=1} \beta_n (CPF_{n.max} \times WCPF_n)} \times 4$$

CPS --- Condition Parameter Score
WCP --- Weight of Condition Parameter

CPF --- Condition Parameter Factor
WCPF --- Weight of Condition Parameter Factor

α_m --- Data availability coefficient for condition parameter (=1 when data available, =0 when data unavailable)
β_n --- Data availability coefficient for condition factor (=1 when data available, =0 when data unavailable).

Health Index (Tier I)

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Health Index (HI)

- Condition Parameters
- Condition Parameter Score (CPS)
- Weight of Condition Parameter (WCP)

HI (Tier I)

$$HI = (\Sigma(CPS_i \times WCP_i) / \Sigma(\max CPS_i \times WCP_i)) \times 100\%$$

$$0 < HI < 100\%$$

Condition Parameter Score (Tier II)

Condition Parameter Score

- Condition Parameter Grade
- Condition Parameter Factor
- Condition Criteria
- Weight of Condition Parameter Factor

CPS (Tier II)

$$CPS = \left(\Sigma(CPF_i \times WCPF_i) / \Sigma(CPF_{imax} \times WCPF_i) \right) \times 4$$

$$0<CPS<4$$

Condition Parameter Factor and Condition Grade

Condition Parameter Grade is qualitative interpretation of the test results:

A – Very Good

B – Good

C – Acceptable

D – Poor

E – Very Poor

Condition Criteria

Condition Parameter Factor is a numerical equivalent of Condition Grade: a number between 0 and 4 (A=4, E=0)

Condition Criteria are measures of Condition Parameter Factors and are used to assign an appropriate Condition Grade, e.g. age, *furfural content level, # CMs/year due to different causes, etc.*

HI for Transformers

Table 1-1 Condition Weights and Maximum CPS

m	Condition parameter	WCP_m	$CPS_{m.max}$
1	Insulation	6	4
2	Cooling	2	4
3	Sealing & Connection	3	4
4	Service Record	3	4

Table 1-2 Insulation (m=1) Weights and Maximum CPF

n	Sub-Condition Parameter	$WCPF_n$	$CPF_{n.max}$
1	Oil Quality	4	4
2	Oil DGA	5	4
3	Winding Doble	5	4

Table 1-3 Cooling (m=2) Weights and Maximum CPF

n	Sub-Condition Parameter	$WCPF_n$	$CPF_{n.max}$
1	Temperature (peak reading)	1	4

Table 1-4 Sealing & Connection (m=3) Weights and Maximum CPF

n	Sub-Condition Parameter	$WCPF_n$	$CPF_{n.max}$
1	Tank Oil Leak	2	4
2	Conservator Oil Level	2	4
3	Grounding	1	4
4	IR Thermography	1	4

Table 1-5 Service Record (m=5) Weights and Maximum CPF

n	Sub-Condition Parameter	$WCPF_n$	$CPF_{n.max}$
1	Loading	5	4
2	Age	3	4

Example of Transformer Final HI Score

Insulation			Cooling			Sealing and Connection			Service Record		
Sub-Condition Parameter	CPF	Weight	Sub-Condition Parameter	CPF	Weight	Sub-Condition Parameter	CPF	Weight	Sub-Condition Parameter	CPF	Weight
Oil Quality	4	4	Temperature	3	1	Tank Oil Leak	3	2	Loading	4	5
Oil DGA	3	5				Conservator Oil Level	3	2	Age	3	3
Winding Doble	4	5				Grounding	4	1			
						IR Thermography	2	1			
Insulation CPS = (4*4+3*5+4*5) / (4+5+5) = 3.64			Cooling CPS = (3*1) / 1 = 3			Sealing and Connection CPS = (3*2+3*2+4*1+2*1) / (2+2+1+1) = 3			Service Record CPS = (4*5+3*3) / (5+3) = 3.63		
Weight = 6			*Weight = 2*			*Weight = 3*			*Weight = 3*		

$$\text{HI} = \frac{3.64*6 + 3*2 + 3*3 + 3.63*3}{(6+2+3+3)*4} = \mathbf{85.2\%}$$

HI Parameters for Circuit Breakers

KINECTRICS

Table 1-1 Condition Weights and Maximum CPS

m	Condition parameter	WCP_m	$CPS_{m.max}$
1	Operating Mechanism	14	4
2	Contact Performance	7	4
3	Arc Extinction	9	4
4	Insulation	2	4
5	Service record	5	4

Table 1-2 Operating Mechanism (m=1) Weights and Maximum CPF

n	Sub-Condition Parameter	$WCPF_n$	$CPF_{n.max}$
1	Lubrication	9	4
2	Linkage	5	4
3	Cabinet	2	4

Table 1-3 Contact Performance (m=2) Weights and Maximum CPF

n	Sub-Condition Parameter	$WCPF_n$	$CPF_{n.max}$
1	Closing Time	1	4
2	Trip Time	3	4
3	Contact Resistance	1	4
4	Arcing Contact	1	4

Table 1-4 Arc Extinction (m=3) Weights and Maximum CPF

n	Sub-Condition Parameter	$WCPF_n$	$CPF_{n.max}$
1	Moisture	8	4
2	Leakage	1	4
3	Tank	2	4
4	Oil Level	1	4
5	Oil Quality	8	4

Table 1-5 Insulation (m=4) Weights and Maximum CPF

n	Sub-Condition Parameter	$WCPF_n$	$CPF_{n.max}$
1	Insulation	1	4

Table 1-5 Service Record (m=5) Weights and Maximum CPF

n	Sub-Condition Parameter	$WCPF_n$	$CPF_{n.max}$
1	Operating Counter	2	4
2	Loading	2	4
3	Age	1	4

Example of Circuit Breaker Final HI Score

Operating Mechanism			Contact Performance			Arc Extinction			Insulation			Service Record		
Sub-Condition Parameter	CPF	Weight	Sub-Condition Parameter	CPF	Weight	Sub-Condition Parameter	CPF	Weight	Sub-Condition Parameter	CPF	Weight	Sub-Condition Parameter	CPF	Weight
Lubrication	4	9	Closing Time	2	1	Moisture	4	8	Insulation	4	1	Operating Counter	3	2
Linkage	2	5	Trip Time	3	3	Leakage	3	1				Loading	4	2
Cabinet	3	2	Contact R	2	1	Tank	3	2				Age	3	1
			Arcing Contact	3	1	Oil Level	2	1						
						Oil Quality	3	8						
Operating Mechanism CPS **= (4*9 + 2*5 + 3*2) / (9+5+2)** **3.25**			Contact Performance CPS **= (2*1 + 3*3 + 2*1 + 3*1) / (1+3+1+1)** **2.67**			Arc Extinction CPS **= (4*8 + 3*1 + 3*2 + 2*1 + 3*8) /** **3.35**			Insulation CPS **= (4*1) / (1)** **4**			Service Record CPS **= (3*2 + 4*2 + 3*1) / (2+2+1)** **3.4**		
Weight = 14			***Weight = 7***			***Weight =9***			***Weight = 2***			***Weight = 5***		

$$\mathbf{HI} = \frac{(3.25*14 + 2.67*7 + 3.35*9 + 4*2 + 3.4*5)}{(14 + 7 + 9 + 2 + 5)*4} = \mathbf{80.6\%}$$

HI Parameters for Conductors

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m	Condition Parameters	WCP_m
1	Mechanical Properties	6
2	Physical Condition	2
3	Service Record	1

*De-Rating Factor	Repairs / Splices , Remaining Tensile Strength

n	m=1: Mechanical Properties	$WSCP_n$
1	Torsional Ductility	2
2	Tension	4
3	Elongation	3
4	Wrap (Ductility)	1
5	Breaking Load	4

n	m=2: Physical Condition	$WSCP_n$
1	Visual Inspection	3
2	Remaining Zinc	2
3	Wrap Test (Zinc)	1

n	m=3: -Service Record	$WSCP_n$
1	Maintenance Records	1
2	Age	2

Health Index Formulation

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OH conductor health index based on LineVue data

m	Condition parameter	Weight
1	Mechanical properties	3
2	Physical condition	2
3	Service record	1
	De-rating factor	Multiplier to overall health index

- LineVue data (RTS, corrosion etc)
- Service data (Age, maintenance count etc)
- Pollution factor (ocean, industrial areas etc)

HI Parameters for Conductors

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m=1: Mechanical Properties

n	Sub-condition parameter	$WCPF_n$
1	Tensile strength	5
2	Fatigue strength (breaks)	2

m=2: Physical Condition

n	Sub-condition parameter	$WCPF_n$
1	Severity of Corrosion	4
2	Extent of Corrosion	3

m=3: Service Record

n	Sub-condition parameter	$WCPF_n$
1	Visual Inspections Record	1
2	Age	1

Risk Assessment and Prioritization

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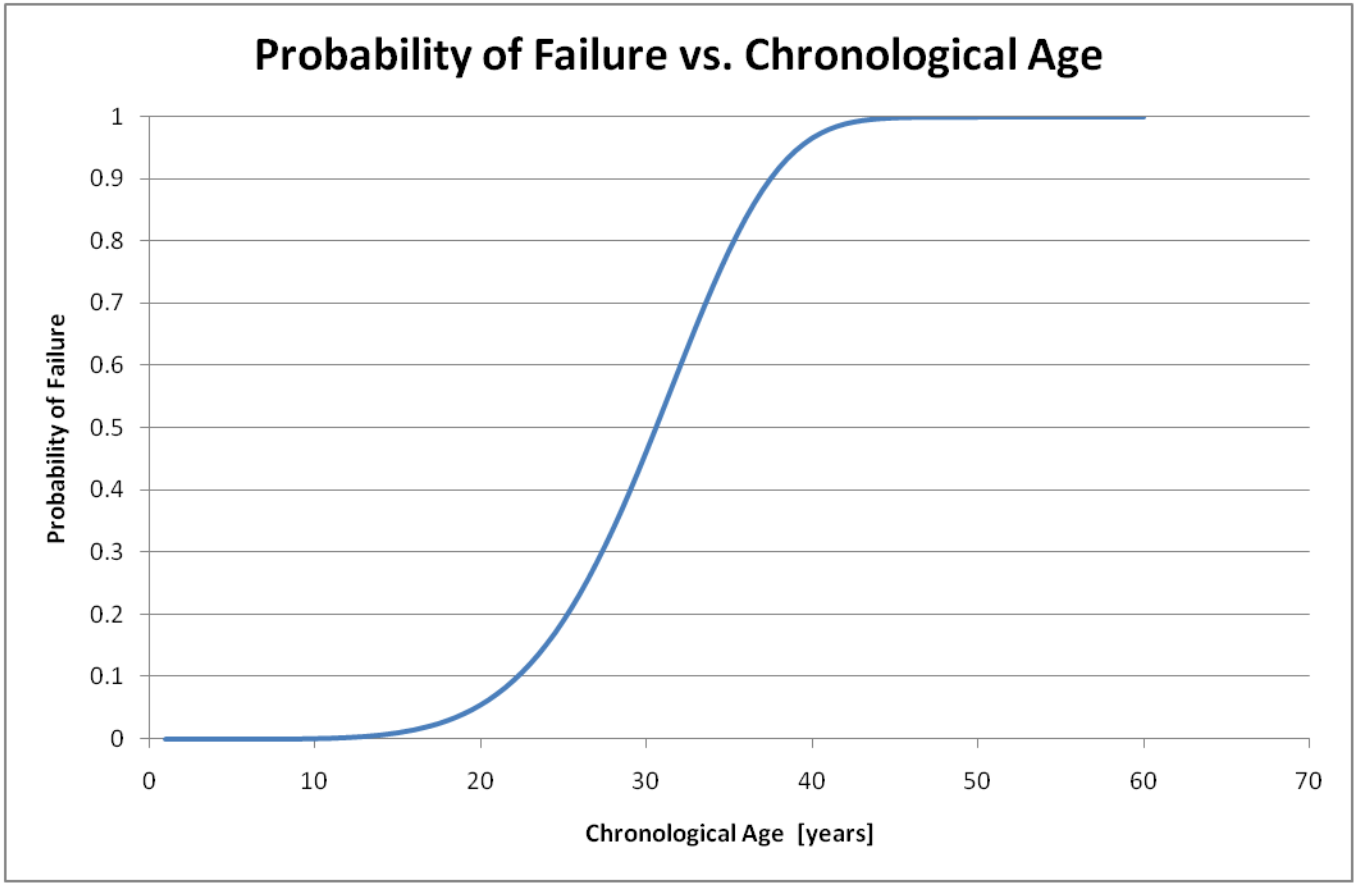
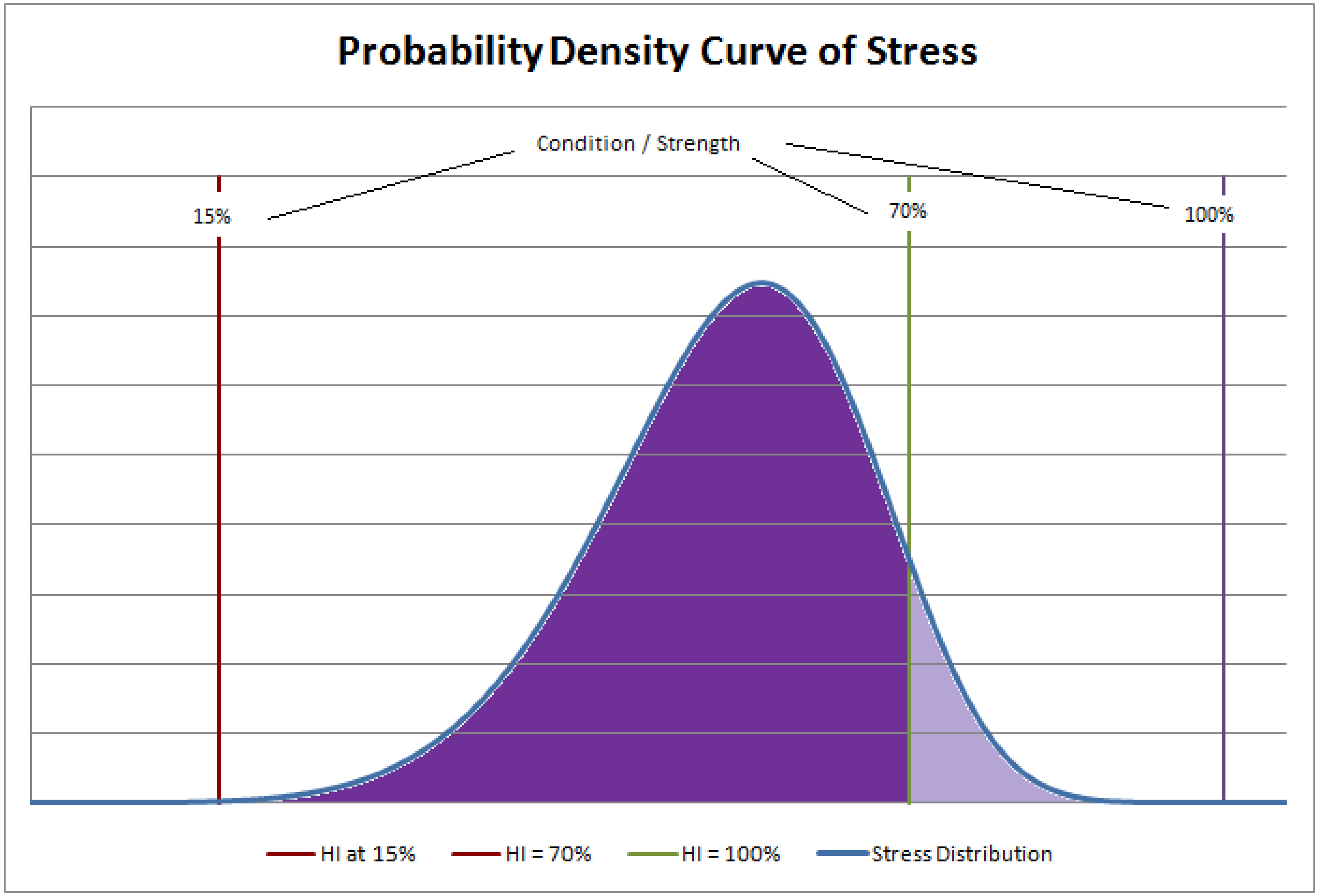
Example - Failure Rate vs Age



Additional data is required to improve probability of failure curves for many assets

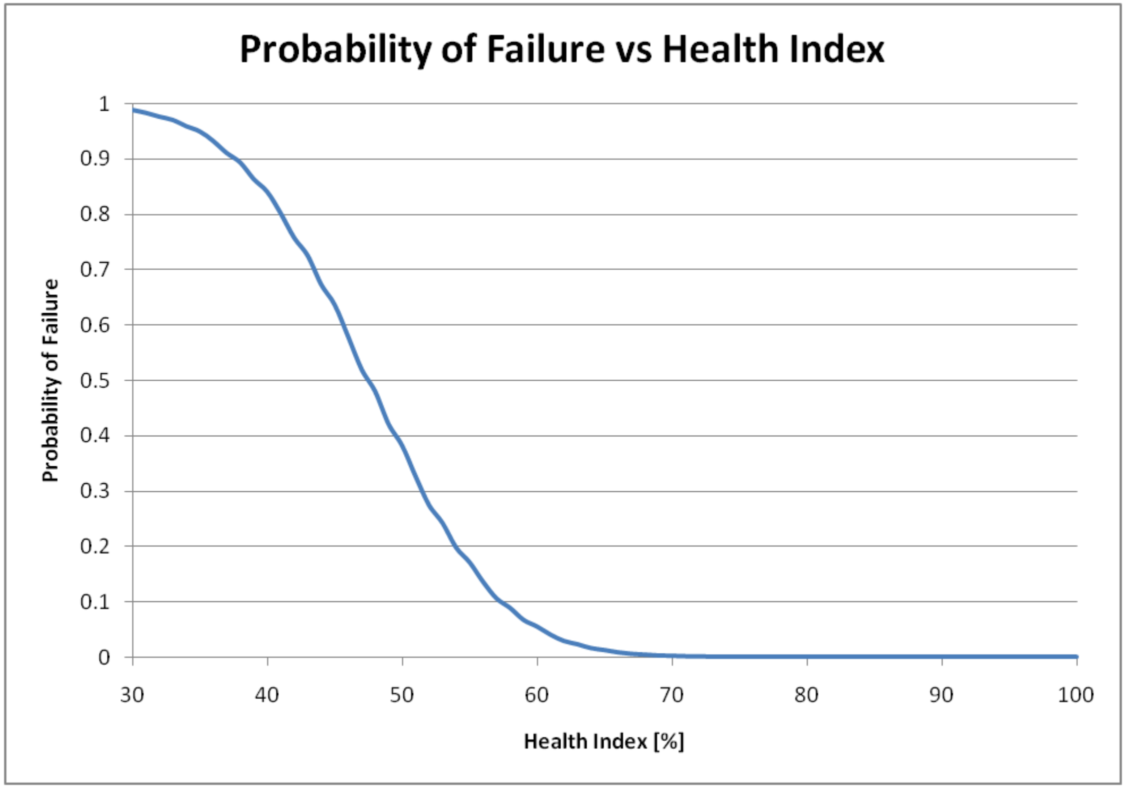
Health Index and Probability of Failure

Failure occurs when stress exceeds condition



Health Index and Probability of Failure

- Moving left from 100% to 15% gives us cumulative probabilities from 100% through 15%. i.e. a Health Index vs. Probability of Failure relationship



Capital Replacement Plan

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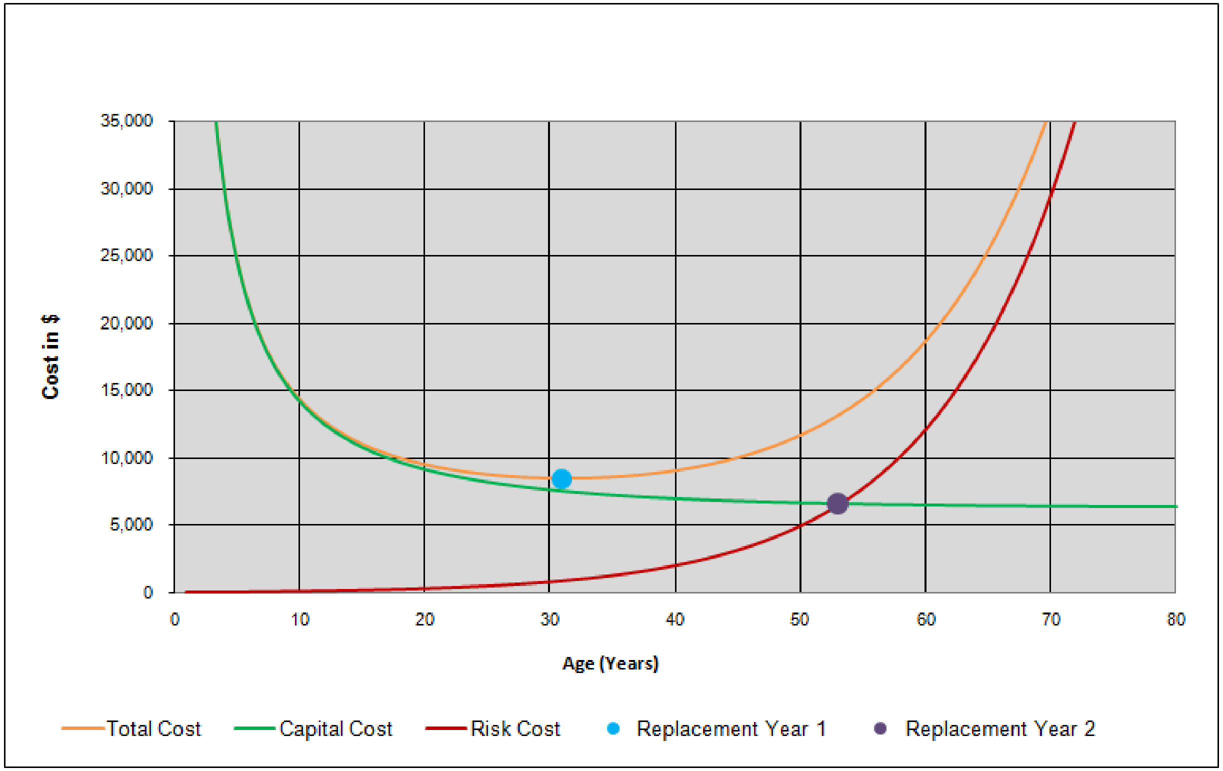
Economic End-of-Life

Economic End-of-Life at the point of least life cycle cost

Optimize replacement or rehabilitation timing

Compares Risk Cost to Capital Cost (includes benefit of delaying capital expenditures, and Maintenance Cost)



Optimized Capital Plan

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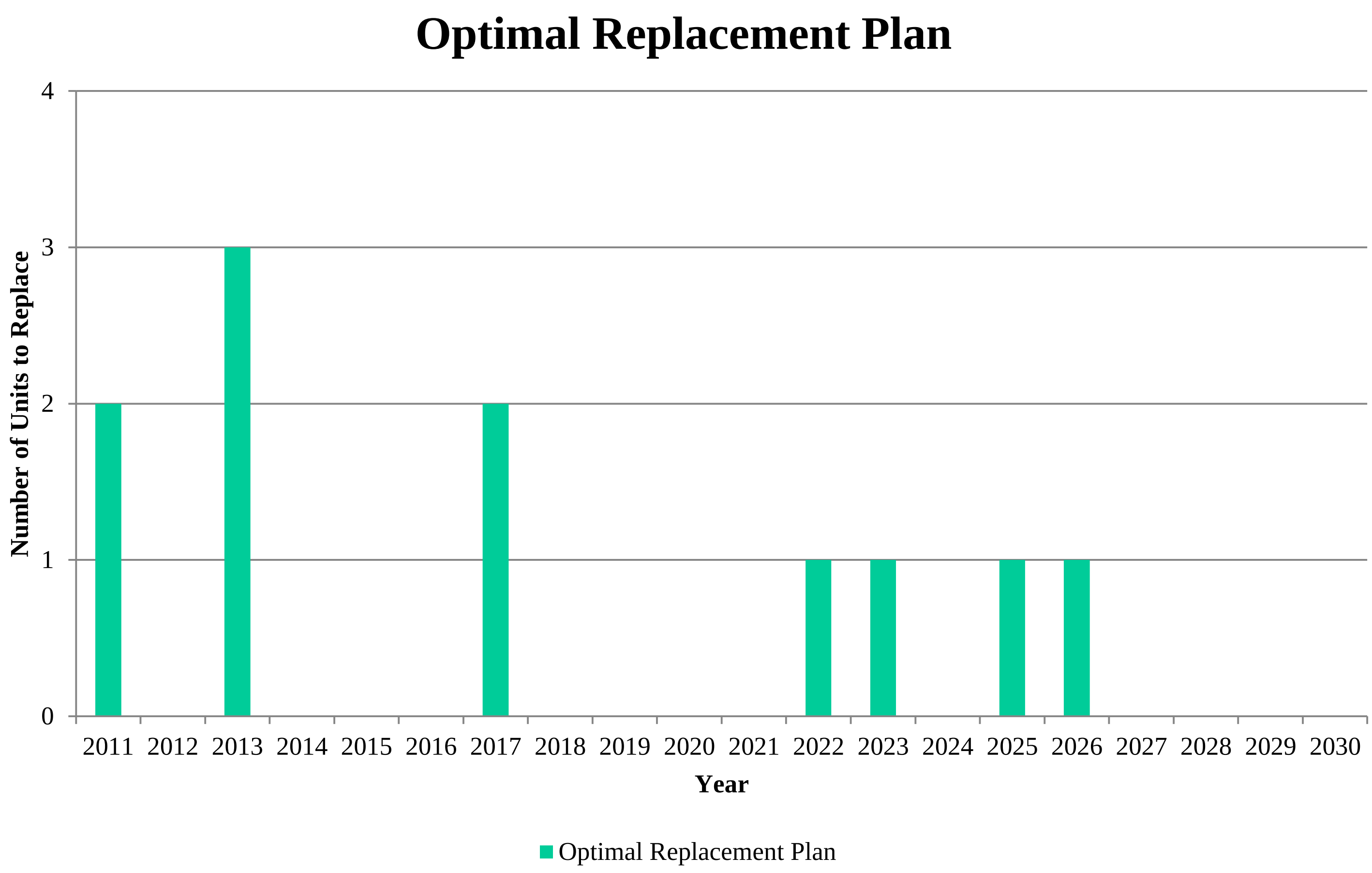
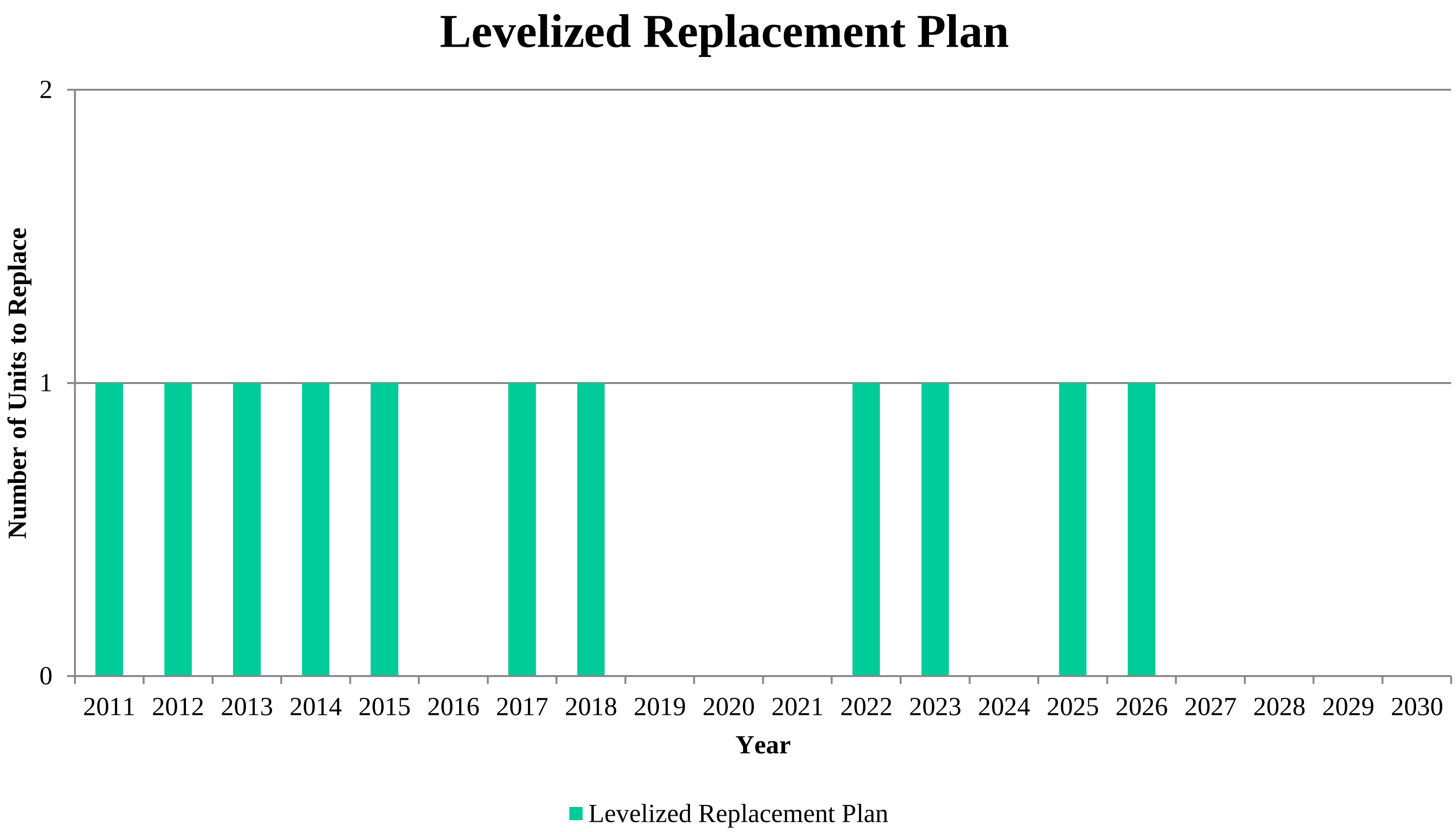


Levelized Capital Plan



Section:	Appendix 3.1 Appendix 3.4	**Page No.:**	Page A-1 Fiscal Year Basis Page 1 of 6
Topic:	Financing expense		
Subtopic:	Accuracy of 2 to 10 year interest rate forecasts for 10 Year +, and 90 day T-bill interest rates		
Issue:	Are "the proposed 3.95% rate increases" really "the minimum that are required to ... manage the deterioration in the Corporation's financial strength during the period of extensive investments" Tab 3, page 1 line 35		

PREAMBLE TO IR (IF ANY):

This question is a follow-up to COALITION/MH 1-107(a)(c)(g)

QUESTION:

a) The Coalition observes at least one missing data point and erroneous calculations of averages and percentages based on those averages. For example, the year 2 average error value of 1.18% was the value calculated without the inclusion of the 2008 forecast error. As the table now shows a forecast error of 3.73% for that year, the average error must have changed with the inclusion of that data point. The new value should be 1.50% and the variance to average forecast should also change to reflect that data.

i. Please add 7 year value to the 2008 row in the variance portion of the table [should be 3.61%], and recalculate the average variance [should be 3.48%] and recalculate the variance to average forecast for forecasts of seven years out [should be 0.79%].

ii. Please correct the average variance calculation for years 2 through 6 [should be 1.50%, 2.96%, 3.32%, 3.38%, 3.45% and 3.48%].

RATIONALE FOR QUESTION:

There appear to have been errors in the original table provided.

RESPONSE:

The table below includes the 7 year value to the 2008 row in the variance portion of the table and recalculates the average variance and the variance to average forecast for forecasts of two to seven years out. It is assumed that the reference in the question to the update to the variance to average forecast for forecasts of seven years out should be 79% and not 0.79%.

As stated in Manitoba Hydro's response to COALITION/MH-I-107 a,c,g the forecast variances are self-correcting at each GRA along with other counterbalancing factors and updates. As also noted in COALITION/MH I-107a,c,g the values used for this variance analysis reflect forecasts reported in the spring Economic Outlook reports and are not always the basis of the relevant year's IFF or revenue requirement.

90 Day T-bill	2006	2007	2008	2009	2010	2011	2012	2013	2014
Fiscal year	2007	2008	2009	2010	2011	2012	2013	2014	2015
2006	4.00%	4.05%	4.25%	4.25%	4.30%	4.50%	4.50%	4.50%	4.50%
2007		4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%
2008			3.40%	3.95%	4.50%	4.50%	4.50%	4.50%	4.50%
2009				0.80%	1.90%	3.80%	4.20%	4.25%	4.25%
2010					0.95%	2.50%	3.10%	3.65%	4.10%
2011						1.60%	2.80%	3.45%	3.80%
2012							1.00%	1.45%	2.95%
2013								1.05%	1.45%
2014									1.00%
Actual	4.16%	3.83%	1.84%	0.22%	0.78%	0.91%	0.97%	0.94%	0.89%

Variance	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year	7 Year	8 Year	9 Year
2006	-0.16%	0.22%	2.41%	4.03%	3.52%	3.59%	3.53%	3.56%	3.61%
2007	0.42%	2.41%	4.03%	3.47%	3.34%	3.28%	3.31%	3.36%	
2008	1.56%	3.73%	3.72%	3.59%	3.53%	3.56%	3.61%		
2009	0.58%	1.12%	2.89%	3.23%	3.31%	3.36%			
2010	0.17%	1.59%	2.13%	2.71%	3.21%				
2011	0.69%	1.83%	2.51%	2.91%					
2012	0.03%	0.51%	2.06%						
2013	0.11%	0.56%							
2014	0.11%								
Avg variance	0.39%	1.50%	2.82%	3.32%	3.38%	3.45%	3.48%	3.46%	3.61%
Avg Forecast	2.01%	2.79%	3.76%	4.11%	4.28%	4.38%	4.42%	4.38%	4.50%
Variance/AvgFcst	19%	54%	75%	81%	79%	79%	79%	79%	80%

Section:	Tab 8	**Page No.:**	1
Topic:	2013-2014 Power Smart Results		
Subtopic:	2013-2014 Power Smart Annual Review		
Issue:	Expected date for finalized 2013/14 results		

PREAMBLE TO IR (IF ANY):

QUESTION:

When does MH anticipate that the 2013-2014 Power Smart Annual Review will be finalized and delivered in response to MKO-COALITION/MH I-4?

RATIONALE FOR QUESTION:

These data are necessary to conduct analyses of Power Smart progress, and to review trends between historic reported performance and projected future performance

RESPONSE:

Attached are copies of the 2013/14 Power Smart Annual Review and the Power Smart Annual Provincial Report for the year ending March 31, 2014. Two reports are prepared; the 2013/14 Power Smart Annual Review prepared to meet the Corporation's requirements and the annual Provincial Report prepared to meet government needs and legislative requirements under the Energy Savings Act.

2013-2014
Power Smart Annual Review

Power Smart Planning, Evaluation & Research Department
Customer Care & Energy Conservation Business Unit

March 2015

Manitoba Hydro
POWER SMART*

EXECUTIVE SUMMARY

The 2013/14 Power Smart Annual Review reports the energy and demand savings, customer energy cost savings, customer participation and associated greenhouse gas emissions reduction achieved through Manitoba Hydro's Power Smart initiative, including an assessment against the 2013/14 planned targets outlined in the 2013 Power Smart Plan.

The Power Smart initiative, including persisting savings, has achieved 2,512 GW.h and 698 MW in electric savings (at generation), 93 million cubic metres in natural gas savings and 1,871 thousand tonnes of greenhouse gas emissions reduction. This level of savings represents 9.9% of electric load and 4.5% of natural gas load in 2013/14.

The electric savings resulting from the Power Smart initiative, including persisting savings, equate to over a third of Winnipeg's residential and commercial power needs. The natural gas savings, including persisting savings, equate to 1.4 times the residential and commercial natural gas needs of Brandon. Greenhouse gas emissions reduction resulting from the electric and natural gas savings equate to taking an estimated 374 thousand cars off the road for a year.

Overall, 2013/14 was a successful year for Manitoba Hydro's Power Smart portfolio. In 2013/14 alone, the electric Power Smart program achieved 260 GW.h and 221 MW in electric savings (at generation), which exceeded the planned savings of 177 GW.h and 203 MW. This level of savings represents 63% of the twenty-year average annual electric load growth and 1.0% of electric load in 2013/14. The natural gas Power Smart program achieved savings of 9.1 million cubic metres, which was slightly below the planned target of 10.3 million cubic metres. This level of savings represents 0.4% of natural gas load in 2013/14, further reducing natural gas consumption in Manitoba.

Total Power Smart expenditures in 2013/14 were $42 million, which consisted of $27 million from the Power Smart electric budget, $9 million from the Power Smart natural gas budget, $4 million from the Affordable Energy Fund and $2 million from the Furnace Replacement Budget. Including the Affordable Energy Fund and Furnace Replacement Budget, total Power Smart expenditures in 2013/14 were 7% below the planned $45 million.

To date, $522 million (nominal dollars) have been invested in the Power Smart initiative; $402 million from the Power Smart electric budget, $88 million from the Power Smart natural gas budget, $24 million from the Affordable Energy Fund and $8 million from the Furnace Replacement Budget. Including the Affordable Energy Fund and Furnace Replacement Budget, cumulative Power Smart expenditures are 1% below the planned $525 million.

Customer bill reduction due to 2013/14 Power Smart results, including persisting savings, amounts to an annual reduction of $108 million, with $79 million in reduced electricity bills and $30 million in reduced natural gas bills. By customer sector, $33 million was saved in the residential sector, $43 million in the commercial sector and $32 million in the industrial sector. Customer bill reduction relates only to incentive-based programs and DSM support programs.

Cumulative customer bill reduction is approximately $882 million, consisting of $712 million on electric bills and $170 million on natural gas bills.

Including support costs, the total resource cost (TRC) ratio for electric incentive-based programs was 2.5, the rate impact measure (RIM) ratio was 0.9, the levelized utility cost (LUC) was 1.4¢/kW.h and the levelized resource cost (LRC) was 2.5¢/kW.h. Including support costs and interactive effects, the TRC ratio for natural gas incentive-based programs was 1.0, the RIM ratio was 0.5, the LUC was 18.1¢/m^3 and the LRC was 26.6¢/m^3.

The combined TRC ratio for electric and natural gas incentive-based programs, including support costs and interactive effects, was 2.1.

Awareness of the Power Smart brand continues to remain high with 92% of Manitoba respondents saying that they recognize the brand name. Customers continue to report the strongest association between Power Smart and energy efficiency, with the vast majority (88%) of respondents agreeing that the brand projects this message. Customers continue to strongly agree that the Power Smart brand is greatly associated with helping customers save money on their energy bills, with 79% of respondents providing a 7 or higher out of 10, and one-third (32%) saying they had participated in a Manitoba Hydro Power Smart program.

This report utilizes an integrated approach to evaluating the net energy savings achieved through the Power Smart initiative. The results reported are due to combined electric and natural gas energy conservation efforts. In this regard, increased natural gas consumption resulting from electricity efficiency efforts (interactive effects) are

2013/14 Electricity Results

In 2013/14 alone, the Power Smart portfolio realized 260 GW.h, 47% above its respective target. Significant drivers of this positive varaince were the Bioenergy Optimization Program, Performance Optimization Program and Commercial Refrigeration Program, who in total achieved 61 GW.h more than planned.

The Power Smart portfolio also exceeded its demand savings target. With 221 MW of electric savings, the Power Smart portfolio was 9% above target. This variance can be attributed to the Bioenergy Optimization Program, Commercial Lighting Program and Performance Optimization Program, who in total achieved 10 MW more than anticipated.

The following tables outline the electricity savings achieved by the Power Smart portfolio and associated costs during 2013/14, and provide a comparison between achieved results and planned targets.

Exhibit E.1
Annual GW.h Savings (at generation) - Power Smart Portfolio

	2013/14 Actual	2013/14 Plan^	Total*
INCENTIVE-BASED PROGRAMS	183	108	1,777
CODES & STANDARDS	75	66	703
DSM SUPPORT PROGRAMS	2	3	31
OVERALL IMPACT	260	177	2,512

^ Plan estimates are from the 2013 Power Smart Plan.
* Savings include actual + persisting results, up to and including 2013/14.
Note: Figures may not add due to rounding.

Exhibit E.2

Annual Average Winter MW Savings (at generation) - Power Smart Portfolio

	2013/14 Actual	2013/14 Plan^	Total*
INCENTIVE-BASED PROGRAMS	198	186	516
CODES & STANDARDS	21	16	171
DSM SUPPORT PROGRAMS	1	1	11
OVERALL IMPACT	221	203	698

^ Plan estimates are from the 2013 Power Smart Plan.
* Savings include actual + persisting results, up to and including 2013/14.
Note: Figures may not add due to rounding.
MW savings are based on the average of the winter AM & PM system peak savings.
For the Curtailable Rates Program, MW savings are assumed to be achieved when a customer signs a contract. Therefore, MW savings reported is the load available for curtailment.

Exhibit E.3

2013/14 Power Smart Portfolio Electricity Costs

Power Smart Portfolio	2013/14 Actual	2013/14 Plan^	Cumulative
		millions of nominal dollars	
INCENTIVE-BASED PROGRAMS			
Efficiency Programs	16.7	16.9	238.9
Customer Self-Generation Programs	0.7	2.1	10.9
Rate/Load Management Programs	6.0	5.9	81.8
	23.3	24.9	331.7
SUPPORT COSTS, DSM SUPPORT PROGRAMS & STANDARDS	3.9	4.7	70.4
TOTAL ELECTRICITY PROGRAM COSTS	27.2	29.5	402.1

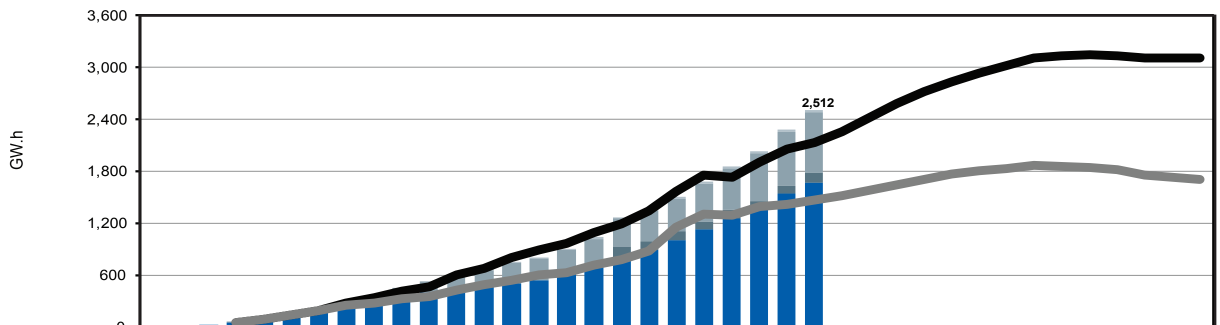
^ Plan estimates are from the 2013 Power Smart Plan.
Note: Figures may not add due to rounding.

Total Electricity Results (2013/14 Results & Persisting Savings)

Cumulatively, the Power Smart portfolio has saved a total of 2,512 GW.h and 698 MW, which were 17% and 13% more than planned to the end of 2013/14. Cumulative savings to date represent 81% and 83% of the forecasted energy and demand savings at the benchmark year of 2027/28. To date, $402 million has been invested in Power Smart electric activities.

The following graphs present the cumulative energy and average winter demand savings achieved and corresponding targets.

Exhibit E.4
Electric Energy Savings - Power Smart Portfolio
Total Savings Achieved vs. Plan
at generation

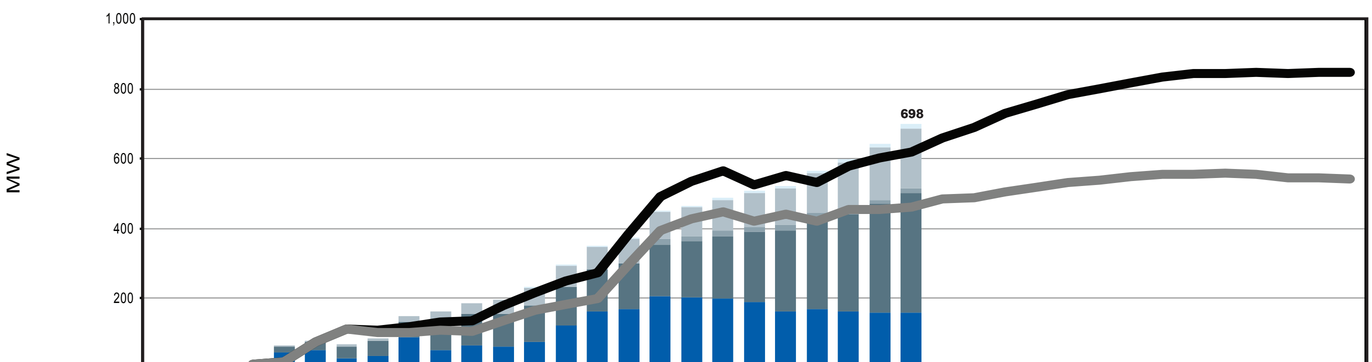


	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09
DSM Support Programs													2	4	7	11	13	16	20	22
Codes & Standards	-	-	-	2	8	16	25	40	63	93	125	156	189	228	248	274	298	323	352	382
Incentive-Based - Customer Self Generation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	132	93	103
Incentive-Based - Efficiency	6	10	31	59	99	151	209	259	285	363	407	419	467	511	546	620	715	799	895	1002
Plan	-			50	86	138	195	281	336	422	466	602	686	810	891	970	1088	1199	1350	1569
Plan (Incentive-Based Programs only)	-			50	86	138	195	252	279	327	350	435	491	544	603	634	713	782	879	1157
Total Achieved	6	10	31	62	107	167	235	299	348	456	532	575	659	743	801	904	1037	1270	1359	1509

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
DSM Support Programs	25	26	27	29	31														
Codes & Standards	430	481	553	628	703														
Incentive-Based - Customer Self Generation	88	95	77	91	109														
Incentive-Based - Efficiency	1135	1260	1374	1539	1668														
Plan	1753	1736	1906	2063	2140	2256	2422	2586	2719	2839	2935	3026	3113	3131	3143	3142	3107	3117	3113
Plan (Incentive-Based Programs only)	1310	1293	1388	1425	1469	1519	1576	1643	1705	1765	1804	1838	1870	1857	1850	1826	1758	1732	1707
Total Achieved	1678	1863	2031	2287	2512														

Note: Figures may not add due to rounding.

Exhibit E.5
Average Winter Demand Savings - Power Smart Portfolio
Total Savings Achieved vs. Plan
at generation



	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09
DSM Support Programs													1	1	2	3	3	4	6	6
Codes & Standards				1	2	4	6	10	15	23	32	40	49	59	64	70	76	82	89	97
Incentive-Based - Customer Self Generation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	16	16	16
Incentive-Based - Efficiency	0	1	4	10	17	26	34	42	46	86	91	93	105	113	119	131	146	162	179	200
Incentive-Based - Rate/Load	-	-	-	-	45	51	27	36	88	53	64	63	75	121	163	169	208	202	199	190
Plan				12	18	75	114	108	118	134	135	178	216	249	273	385	491	535	564	524
Plan (IncentiveBased Programs only)				12	18	75	114	101	104	110	105	136	166	183	200	296	394	429	449	421
Total	0	1	4	10	64	80	68	87	149	162	187	196	230	295	348	373	450	466	488	509

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
DSM Support Programs	8	9	9	10	11														
Codes & Standards	105	113	131	150	171														
Incentive-Based - Customer Self Generation	16	16	16	10	16														
Incentive-Based - Efficiency	231	258	280	311	340														
Incentive-Based - Rate/Load	164	170	162	159	161														
Plan	551	531	578	603	620	658	691	730	757	782	800	817	835	843	845	847	843	847	846
Plan (IncentiveBased Programs only)	442	421	454	454	462	484	490	505	519	533	540	547	554	557	557	556	547	545	541
Total	523	566	598	641	698														

Note: Figures may not add due to rounding.

2013/14 Natural Gas Results

In 2013/14, the Power Smart portfolio realized natural gas savings of 9.1 million cubic metres, 12% less than planned. Due to decreased participation and project delays, the Commercial New Buildings Program and Natural Gas Optimization Program both achieved 0.7 million cubic metres less than planned.

The following tables provide a comparison between achieved results and planned targets.

Exhibit E.6

Annual Natural Gas Savings - Power Smart Portfolio

	2013/14 Actual	2013/14 Plan^	Total*
		millions of cubic metres	
PROGRAM & INITIATIVE			
Incentive-Based Programs	6.6	8.2	68.8
Codes & Standards	2.8	2.7	16.0
DSM Support Programs	0.5	0.5	20.8
	9.9	11.4	105.6
INTERACTIVE EFFECTS			
Incentive-Based Interactive Effects	(0.9)	(1.1)	(13.0)
NET IMPACT OVERALL	9.1	10.3	92.7

^ Plan estimates are from the 2013 Power Smart Plan.
* Savings include actual + persisting results, up to and including 2013/14.
Note: Figures may not add due to rounding.

Exhibit E.7

2013/14 Power Smart Portfolio Natural Gas Costs

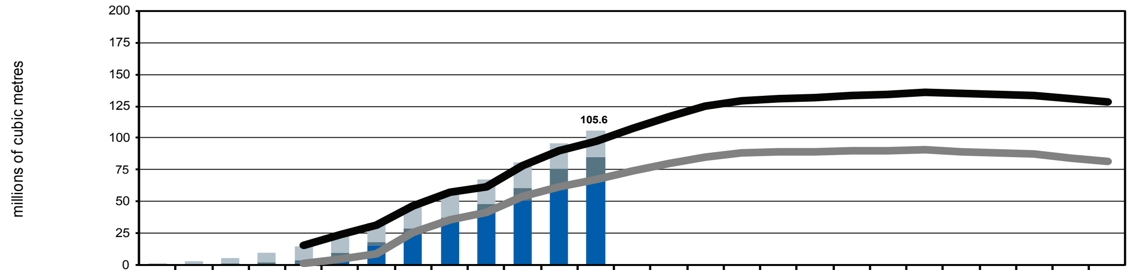
Power Smart Portfolio	2013/14 Actual	2013/14 Plan^	Total *
		millions of dollars	
INCENTIVE-BASED PROGRAMS			
Efficiency Programs	7.5	7.5	69.5
Customer Self-Generations Programs	0.0	0.2	0.1
	7.5	7.7	69.7
SUPPORT COSTS, DSM SUPPORT PROGRAMS & STANDARDS			
	1.0	1.9	17.9
TOTAL NATURAL GAS PROGRAM COSTS	8.5	9.6	87.6

^ Plan estimates are from the 2013 Power Smart Plan.
* Includes costs to the end of 2013/14
Note: Figures may not add due to rounding.

Total Natural Gas Results (2013/14 Results & Persisting Savings)

Cumulatively, the Power Smart portfolio has saved 92.7 million cubic metres of natural gas, 5% less than planned to the end of 2013/14. The cumulative savings to date represent 72% of the forecasted savings at benchmark year of 2027/28. To date, $88 million has been invested in Power Smart natural gas activities. The following graph presents cumulative natural gas savings achieved and corresponding targets.

Exhibit E.8
Natural Gas Savings - Power Smart Portfolio
Total Savings Achieved vs. Plan



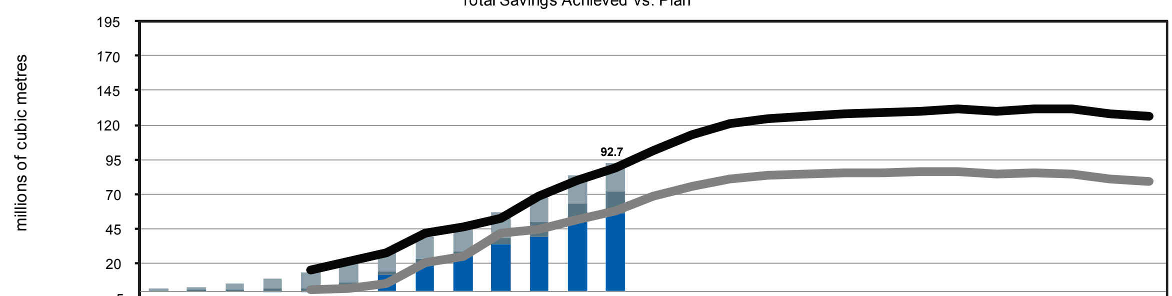
	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
DSM Support Programs	1.2	2.4	4.3	7.7	11.3	13.2	15.3	16.4	18.3	19.0	19.7	20.3	20.8														
Codes & Standards	0.3	0.7	1.1	1.6	2.0	2.4	2.7	3.0	3.5	4.4	9.9	13.2	16.0														
Incentive- Based Efficiency	0.0	0.1	0.1	0.2	1.6	7.3	15.5	25.9	34.1	44.0	50.9	62.2	68.8														
Plan					15.4	23.9	31.2	46.4	57.3	61.2	78.0	89.8	97.6	107.6	116.7	124.8	129.1	130.8	132.0	133.4	134.4	135.6	134.7	134.5	133.6	130.6	128.3
Plan (incentived-based programs only)					1.5	4.3	9.0	25.7	35.6	41.7	54.1	61.4	67.0	74.0	79.9	84.8	88.3	89.1	89.4	90.0	90.3	90.7	89.1	88.5	87.3	83.9	81.4
Total Achieved	1.6	3.1	5.5	9.4	14.8	22.8	33.5	45.2	55.9	67.5	80.4	95.7	105.6														

Note: Figures may not add due to rounding.

Natural Gas Integrated Results

Some electric Power Smart programs have interactive effects which increase the consumption of natural gas. For example, a more energy efficient lighting system emits less heat and therefore results in more energy required for space heating. The integrated natural gas results are adjusted for interactive effects, and are represented in the following graph.

Exhibit E.9
Integrated Natural Gas Savings-Power Smart Portfolio
Total Savings Achieved vs. Plan



	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
DSM Support Programs	1.2	2.4	4.3	7.7	11.3	13.2	15.3	16.4	18.3	19.0	19.7	20.3	20.8														
Codes & Standards	0.3	0.7	1.1	1.6	2.0	2.4	2.7	3.0	3.5	4.4	9.9	13.2	16.0														
Incentive -Based Integrated	0.0	0.1	0.1	- 1.0	- 1.0	4.3	11.7	20.0	25.3	33.5	39.6	50.1	55.9														
Integrated Plan					14.8	21.5	27.9	41.4	46.3	52.8	68.6	79.6	88.7	101.8	112.5	120.5	124.8	126.5	127.6	129.0	130.0	131.1	130.1	131.4	131.2	128.0	126.0
Integrated Plan (Incentive -Based Programs only)					0.8	1.9	5.7	20.8	24.6	42.2	44.7	51.3	58.2	68.2	75.7	80.6	84.0	84.8	85.1	85.6	85.8	86.2	84.5	85.3	84.9	81.3	79.1
Total Achieved	1.6	3.1	5.5	8.2	12.2	19.8	29.7	39.4	47.0	57.0	69.1	83.6	92.7														

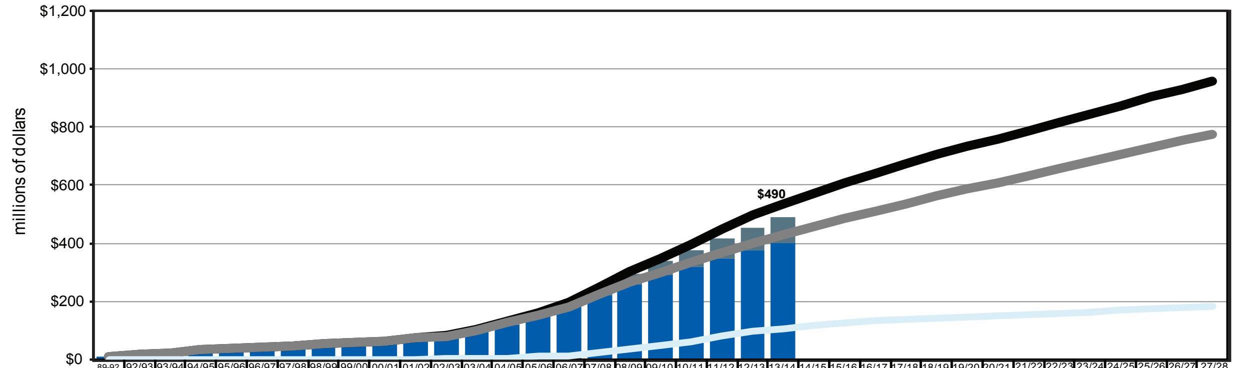
Note: Figures may not add due to rounding.
Targeted savings are unadjusted for programs not running or other revisions.

Power Smart Utility Costs

Total Power Smart expenditures in 2013/14 were $36 million, of which $27 million was spent on electric initiatives and $9 million was spent on natural gas initiatives. Total Power Smart expenditures in 2013/14 were 8% below the planned $39 million. Cumulative Power Smart expenditures were $490 million, or 9% less than the budgeted amount of $536 million. The positive spending variance can be credited to electric and natural gas efficiency spending, which were both below budget, 8% and 12% respectively. These costs do not include Affordable Energy Fund or Furnace Replacement Budget.

Cumulative Power Smart expenditures of $490 million represent 51% of the overall cumulative 2027/28 budget, as reported in the IFF13. The following graph depicts actual annual expenditures against planned.

Exhibit E.10
Utility Costs- Power Smart Portfolio
Cumulative Total Utility Cost vs. Plan
nominal dollars



	89-92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Eval - Natural Gas	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1	$1	$2	$3	$6	$14	$24	$35	$47	$58	$69	$79	$88
Eval - Electricity	$7	$14	$22	$29	$37	$42	$48	$52	$58	$63	$71	$84	$100	$121	$149	$185	$222	$257	$290	$319	$348	$375	$402
Plan - Electricity & Gas	$10	$16	$20	$32	$36	$41	$44	$54	$58	$63	$72	$81	$102	$130	$161	$195	$248	$302	$347	$396	$449	$496	$536
Plan - Electricity	$10	$16	$20	$32	$36	$41	$44	$54	$58	$63	$72	$80	$100	$128	$150	$182	$225	$265	$298	$335	$369	$400	$430
Plan - Gas	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1	$1	$2	$11	$13	$23	$37	$49	$61	$80	$96	$106
Total Eval	$7	$14	$22	$29	$37	$42	$48	$52	$58	$63	$72	$86	$102	$124	$155	$199	$246	$293	$337	$378	$417	$454	$490

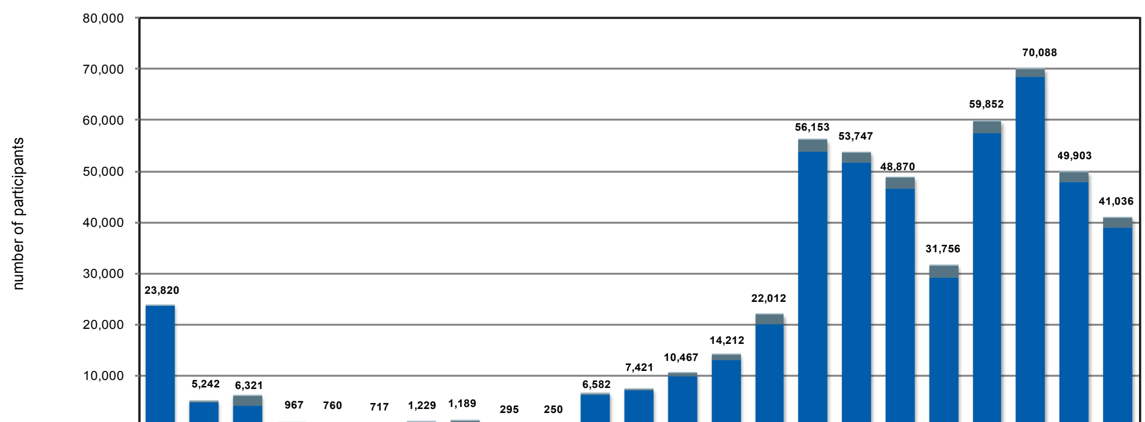
	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
Eval - Natural Gas														
Eval - Electricity														
Plan - Electricity & Gas	$572	$608	$643	$674	$705	$733	$760	$788	$815	$845	$875	$904	$931	$958
Plan - Electricity	$457	$484	$511	$537	$562	$586	$609	$633	$657	$681	$706	$731	$753	$776
Plan - Gas	$115	$124	$132	$138	$143	$147	$151	$155	$159	$164	$168	$173	$178	$182
Total Eval														

Note: Figures may not add due to rounding.

Customer Participation

The following graph illustrates that participation levels in Manitoba Hydro's Power Smart programs remain strong.

Exhibit E.11
Power Smart Program Participation



	89 - 92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03
Industrial	24	157	202	229	185	182	195	8	4	9	17	25
Commercial	65	273	1,959	738	575	334	325	500	291	241	304	363
Residential (excluding CFLs)	23,73	4,812	4,160	0	0	201	709	681	0	0	6,261	7,033
Total Achieved (excluding CFLs)	23,820	5,242	6,321	967	760	717	1,229	1,189	295	250	6,582	7,421

	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Industrial	32	48	50	49	81	99	116	90	73	110	57
Commercial	538	1,019	1,848	2,235	2,005	2,079	2,463	2,263	1,487	1,859	2,069
Residential (excluding CFLs)	9,897	13,145	20,114	53,869	51,661	46,692	29,177	57,499	68,528	47,934	38,910
Total Achieved (excluding CFLs)	10,467	14,212	22,012	56,153	53,747	48,870	31,756	59,852	70,088	49,903	41,036

Note: Includes electric and natural gas participants of DSM support programs, cost recovery and incentive-based programs.
Participation for codes and standards is excluded.
Curtailable Rates Program participation is included in the industrial sector.
Customers may participate in more than one Power Smart program.
The 343,381 sales under the Residential Compact Fluorescent Lighting Program during 2004/05-2010/11 are excluded.
Figures may not add due to rounding.

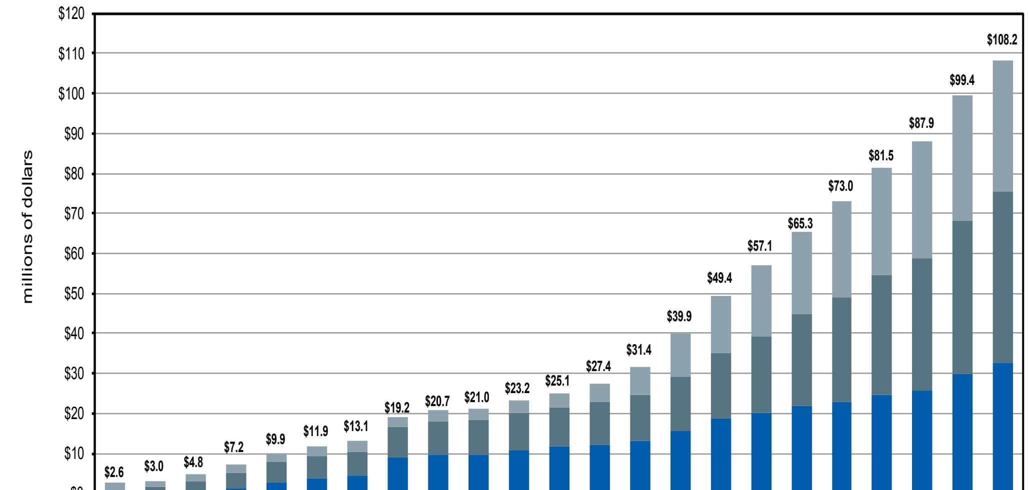
During 2013/14, there were over 41,000 participants in Power Smart DSM support programs and incentive-based programs. Excluding the Residential Compact Fluorescent Lighting Program, there have been nearly 513,000 participants cumulatively.

Participation of the Residential Compact Fluorescent Lighting Program has been excluded to provide a better indication of participation trends. The Residential Compact Fluorescent Lighting Program provided a low-cost option for achieving energy efficiency, and represents 41% of residential Power Smart participation and 40% of overall Power Smart participation.

Customer Bill Reduction

The annual bill reduction for participating customers due to annual and persisting savings in 2013/14 of over $108 million is comprised of $79 million of savings on electric bills and $30 million of savings on natural gas bills. Cumulatively, $882 million has been saved on electricity and natural gas bills.

Exhibit E.12
Combined Electricity & Natural Gas Customer Bill Reduction (2013$)
Total Annual Reductions by Sector
millions of dollars



	89-92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02
Residential	$2.0	$1.5	$1.7	$2.0	$2.1	$2.4	$2.6	$2.6	$2.5	$2.5	$3.1
Commercial	$0.5	$1.3	$2.6	$4.0	$5.2	$5.7	$6.2	$7.6	$8.4	$8.8	$9.2
Industrial	$0.0	$0.3	$0.5	$1.1	$2.5	$3.8	$4.3	$9.0	$9.7	$9.7	$10.9
Total	$2.6	$3.0	$4.8	$7.2	$9.9	$11.9	$13.1	$19.2	$20.7	$21.0	$23.2

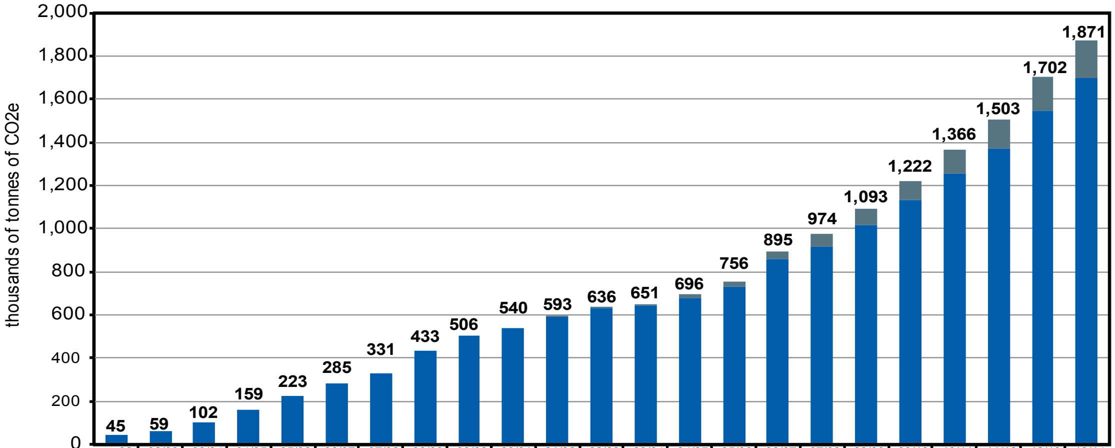
	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Residential	$3.6	$4.5	$6.6	$10.7	$14.4	$17.7	$20.3	$23.8	$26.9	$29.1	$31.3	$32.8
Commercial	$9.7	$10.7	$11.6	$13.5	$16.3	$19.4	$23.2	$26.4	$29.9	$33.1	$38.1	$43.0
Industrial	$11.8	$12.2	$13.2	$15.7	$18.8	$20.0	$21.8	$22.7	$24.7	$25.8	$30.0	$32.5
Total	$25.1	$27.4	$31.4	$39.9	$49.4	$57.1	$65.3	$73.0	$81.5	$87.9	$99.4	$108.2

Note: Includes electric and natural gas participants.
Bill reductions exclude savings due to codes & standards.
Demand savings resulting from the Curtailable Rates Program are excluded from this analysis.
Natural gas bill reduction includes primary and distribution rates only.
Figures may not add due to rounding.

Greenhouse Gas Emissions Reduction

The 2,512 GW.h of savings from electric Power Smart programs and 93 million cubic metres of savings from natural gas Power Smart programs equate to a greenhouse gas emissions reduction of approximately 1,871 thousand tonnes of carbon dioxide equivalent emissions. This is comparable to removing nearly 374 thousand vehicles from the road for one full year. The majority (91%) of the greenhouse gas emissions reduction results from electric Power Smart program activity through indirect emissions reduction from Manitoba Hydro export sales displacing coal and natural gas fuelled generation outside of Manitoba. The remaining 9% of emissions reduction is direct reduction that occurs as a result of lower natural gas consumption in Manitoba.

Exhibit E.13
Total Annual Greenhouse Gas Emissions Reduction
Due to Electric & Natural Gas Savings
thousands of tonnes of CO2e



	89-92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02
Natural Gas	-	-	-	-	-	-	-	433	506	540	3
Electric	45	59	102	159	223	285	331	433	506	540	590
Total	45	59	102	159	223	285	331	433	506	540	593

	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Natural Gas	6	10	16	23	38	56	75	89	108	131	159	176
Electric	630	641	680	733	857	917	1,018	1,133	1,258	1,372	1,543	1,695
Total	636	651	696	756	895	974	1,093	1,222	1,366	1,503	1,702	1,871

Note: Figures may not add due to rounding.

Additional Measurable Non-Energy Benefits

In 2013/14, the following Power Smart programs achieved additional measurable non-energy benefits in the form of water savings: Affordable Energy Program, Water & Energy Saver Program, Commercial Clothes Washers Program and Commercial Kitchen Appliances Program. The following table depicts in-year and cumulative water savings in litres from each of the aforementioned programs.

Exhibit E.14

Water Savings by Power Smart Program

	2013/14 Actual	Cumulative Total
	millions of litres	
RESIDENTIAL PROGRAMS		
Water & Energy Saver	6.6	798.2
Affordable Energy Program	80.0	76.4
COMMERCIAL PROGRAMS		
Commercial Clothes Washers	4.1	28.7
Commercial Kitchen Appliances	0.8	32.7
Commercial Rinse and Save	-	653.3
Power Smart Shops	-	9.7
DISCONTINUED/ COMPLETED PROGRAMS		
Residential Appliances Program	-	298.5
TOTAL	91.5	1,897.5

As well as water savings, the Power Smart programs have achieved additional non-energy benefits. To date, the Refrigerator Retirement Program has recycled over 2,100 metric tons of materials (metals, mercury, oil, etc.). By recycling these materials, future production of these materials has been avoided, nearly 10 metric tons of CFCs have been collected and destroyed and emissions have been reduced by more than 65,000 metric tons of C02e cumulatively. Another example is the Performance Optimization Program. This program reduces maintenance costs (approximately 30% reduction for air compressor projects) and increases production.

In addition to this, Power Smart programs have provided socio-economic benefits through job creation within the province. The Affordable Energy Program (two positions within the North End Community Renewal Corporation and Brandon Neighbourhood Renewal Corporation, plus local labour in First Nations communities, private contractors and social enterprise contractors); Refrigerator Retirement Program (as many as fifteen positions, depending on the season, including office staff, warehouse staff and drivers); Residential Earth Power Program and Commercial Geothermal Program (as a result of these programs, additional geothermal installers have been required in order to meet demand); Water & Energy Saver Program (three full-time office positions, as well as up to forty part-time installer positions, have been created at Ecofitt); Commercial Rinse & Save Program (numerous installer positions); and Power Smart Energy Manager Program (Power Smart Energy Manager positions created within school divisions) have all created additional jobs for Manitobans. Also, Power Smart programs yield increased tax dollars resulting from the wages associated with jobs created specifically for the programs.

Another example of how Power Smart programs are creating opportunities for Manitobans is with their geothermal programs. To date, Manitoba Hydro has provided training for approximately forty-five members of the Ground Source Heat Pump Association, seventeen of which have received full installer accreditation.

The Affordable Energy Fund

The Affordable Energy Fund was established in 2006/07 through the Winter Heating Cost Control Act. The purpose of the fund is to provide support for programs and services that achieve specific objectives. Theses objectives include encouraging energy efficiency and conservation through programs and services for rural and northern Manitobans, lower income customers and seniors, as well as encouraging the use of alternative energy sources such as renewable energy.

Exhibit E.15 outlines Affordable Energy Fund expenditures in 2013/14 and cumulatively.

Exhibit E.15

Summary of Affordable Energy Fund Expenditures

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative
					thousands of nominal dollars				
Affordable Energy Program	256	219	893	1,672	2,666	3,131	3,332	3,122	15,291
Geothermal Support									
Waverley West Demonstration Project*	619	252	5	0	-1	-1	-1	-1	872
Earth Power Loan Subsidy	0	19	69	105	108	108	91	0	500
Province of Manitoba Cooperative Advertising	0	0	18	0	0	0	0	28	46
Geothermal Support Total	619	270	92	104	108	107	91	27	1,419
Community Support & Outreach	0	0	35	130	133	139	114	123	674
Oil & Propane Heated Homes	0	75	85	31	32	24	0	4	250
Special Projects									
Res. Energy Assessment Services (ecoENERGY Audits)	0	61	241	85	119	39	0	0	545
Oil & Propane Furnace Replacement	0	0	6	36	42	17	10	23	135
Res. Solar Water Heating Program	0	0	89	119	56	11	10	0	285
Power Smart Residential Loan	0	0	0	130	312	354	510	365	1,671
Oil & Propane Heated Homes - Additional Funding	0	0	0	0	0	10	26	19	55
Special Projects Total	0	61	336	371	529	431	556	407	2,692
Community Energy Development									
ecoENERGY Program Funding - Additional Funding	0	0	0	0	0	2,817	1,241	0	4,059
Community Energy Development Total	0	0	0	0	0	2,817	1,241	0	4,059
DSM INITIATIVES SUBTOTAL	875	625	1,441	2,308	3,468	6,649	5,334	3,685	24,385
Manitoba Electric Bus	0	0	0	0	0	700	75	225	1,000
Energy & Resource Fund	0	0	0	750	0	0	0	0	750
Fort Whyte EcoVillage	0	0	0	0	0	120	0	0	120
Diesel Community Green Pilot Demonstration	0	0	0	0	0	3	-3	0	0
Métis Generation Fund	0	0	0	0	0	0	0	500	500
TOTAL EXPENDITURES	875	625	1,441	3,058	3,468	7,472	5,406	4,410	26,755

* Negative costs represent loop lease payments from customer to Manitoba Hydro.
** Reversal of an incorrect charge that took place in 2011/12 is indicated by the negative cost.

Furnace Replacement Budget

The Furnace Replacement Budget was established in 2007/08 as a result of Public Utilities Board Order 99/07. The purpose of the budget is to establish and administer a Furnace Replacement Program for lower income customers. In 2013/14 alone, customers installed 605 furnaces and 18 boilers through the Furnace Replacement Program. Cumulatively, 3,130 furnaces and 75 boilers have been installed as a result of the program. Exhibit E.16 outlines Furnace Replacement Budget expenditures to date.

Exhibit E.16
Summary of Furnace Replacement Budget Expenditures

	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative
			thousands of nominal dollars				
Natural Gas Furnace Replacement	264	815	1,312	1,627	2,153	2,012	8,183
TOTAL EXPENDITURES	264	815	1,312	1,627	2,153	2,012	8,183

Table of Contents

1.0 Introduction

1.1 Background

In 1989, Manitoba Hydro launched the first of many Demand Side Management (DSM) programs, the Outdoor Timer Program. Soon after in 1991, Manitoba Hydro established Power Smart, the customer-oriented brand for all of Manitoba Hydro's DSM programs, initiatives and activities. DSM resource options are assessed and included in Manitoba Hydro's Integrated Resource Planning process. These resource options are developed to provide alternatives to traditional sources of power generation. Power Smart initiatives are justified based on their relative cost compared to traditional generation resource options and the customer service value realized by customers.

Since purchasing Centra Gas in 1999, Manitoba Hydro has integrated natural gas conservation into the Corporation's overall Power Smart initiative. This report provides an integrated approach to evaluating the results. Net energy savings reported are due to the combined electricity and natural gas energy conservation efforts. In this regard, any increased natural gas consumption resulting from electricity efficiency efforts (due to interactive effects) are captured and netted against natural gas conservation efforts. Interactive effects were not accounted for prior to the 2002/03 reporting period.

Energy conservation initiatives are designed to reduce customer energy requirements through energy efficient measures (i.e. using less energy to obtain comparable or superior services). Rate/Load management activities are put in place to reduce energy demands through programs offered to alter the timing of customer demand (i.e. Curtailable Rates Program). Customer self-generation programs are created to encourage customer on-site generation.

Manitoba Hydro's Power Smart strategy focuses on creating a sustainable market change where energy efficient technologies and practices become the market standard (market transformation). The approach used to create and maintain market transformation varies by product and market segment, and generally involves a combination of the following activities:

- DSM support programs & cost recovery programs;
- Incentive-based promotional programs, including:
    - o Efficiency programs,
    - o Customer self-generation programs and
    - o Rate/Load management programs.
- Efforts to encourage and support implementation of energy efficiency into codes and standards.

The work in each of these different areas supports the overall Power Smart objective as well as other corporate goals, including: providing customers with exceptional value, protecting the environment and capturing additional electricity export sales.

The Power Smart DSM initiative is designed to encourage the efficient use of energy in the residential, commercial, agricultural, institutional and industrial customer sectors. More than forty incentive-based programs and many other DSM support programs have been offered over the last twenty-five years, with impact evaluations of all incentive-based programs prepared annually.

By evaluating the incentive-based programs, Manitoba Hydro can determine its overall progress in achieving its corporate objectives, and can adjust individual program targets and strategies to reflect market reaction and market changes.

1.2 Power Smart Strategy

Manitoba Hydro's Power Smart strategy is to create a sustainable market change where energy efficient technologies and practices become the market standard (market transformation). To be effective in achieving the desired outcome, the corporation's strategy involves working along multiple tracks, including:

- Providing customers with information and services related to energy efficiency;
- Offering incentive-based Power Smart programs designed to create market awareness, knowledge and acceptance of energy efficient technologies and products;
- Making available cost recovery financing to help customers overcome the financial barriers to the adoption of energy efficient technologies;
- Working with industry and trade allies to gain support for the Corporation's Power Smart efforts;
- Working with other utilities and government agencies in joint efforts to incorporate energy efficiency in codes, standards and regulations;
- Undertaking communication and marketing efforts focused on promoting Power Smart programs and the Power Smart brand name;
- Leveraging the Power Smart brand through activities such as establishing "Power Smart Design Standards"; and
- Making a sustainable and long-term commitment to the efficient use of energy.

1.3 Power Smart Brand & Perception

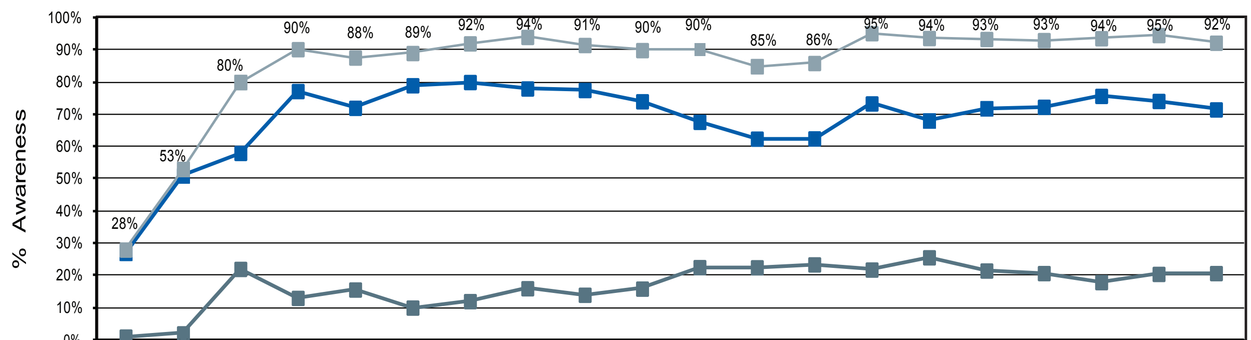
Power Smart is the brand name used by Manitoba Hydro since 1991 to promote its energy efficiency programs and services.

Manitoba Hydro continues to successfully maintain the Power Smart brand's profile with 92% of respondents currently indicating they recognize the brand name. This includes 21% of respondents who independently recall (unaided recall) the Power Smart brand name, and 72% of respondents who say they recognize the brand name when the Power Smart brand name is identified (aided recall).

The Power Smart campaign, being distinct from the marketing/promotional activities associated with specific Power Smart DSM programs, is a mass communication campaign undertaken to improve public awareness of the Power Smart brand and its association with energy efficiency, low electricity rates and environmental conservation.

Approximately one-third (32%) of respondents said they had participated in a Manitoba Hydro Power Smart Program.

Exhibit 1.3
Power Smart Brand Awareness



	90/91	91/92	92/93	95/96	96/97	98/99	99/00	00/01	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Unaided Awareness	1%	2%	22%	13%	16%	10%	12%	16%	14%	16%	23%	23%	23%	22%	26%	22%	21%	18%	20%	21%
Aided Awareness	27%	51%	58%	77%	72%	79%	80%	78%	78%	74%	68%	62%	63%	73%	68%	72%	72%	76%	74%	72%
Total Awareness	28%	53%	80%	90%	88%	89%	92%	94%	91%	90%	90%	85%	86%	95%	94%	93%	93%	94%	95%	92%

Note: Power Smart awareness was not measured in 93/94, 94/95, 97/98 or 01/02.
Figures may not add due to rounding.

Customers continue to strongly agree that the Power Smart brand and programs 'Encourage Customers to be more Energy Efficient' (88% answered 7 or higher on a 1-10 agreement scale), 'Help Customers Save Money on their Energy Bills' (79%), and 'Help Conserve the Environment' (73%). Respondents continue to report more moderate levels of agreement that the Power Smart brand and programs 'Ensure there will be Electricity Available for Manitobans in the Future' (70%) and 'Contribute to Manitobans paying among the Lowest Prices for electricity in North America' (55%).

The vast majority of customers report they are very satisfied with Manitoba Hydro's 'Efforts to Encourage Customers to be More Energy Efficient' with 82% reporting a satisfaction level of 7 or higher on a 1-10 satisfaction scale.

1.4 Purpose of Report

Power Smart is an important component of Manitoba Hydro's Integrated Power Resource Plan.

Manitoba Hydro's Power Smart DSM targets for electric energy and average winter demand savings at generation are 3,113 GW.h and 846 MW by 2027/28, as outlined in the 2013 Power Smart Plan. These targets represent the expected impact of efficiency codes and standards, DSM support programs and incentive-based program activities. Manitoba Hydro's Power Smart program activity is expected to contribute the greatest portion of the savings, with projected energy and demand savings of 1,707 GW.h and 541 MW by 2027/28.

Manitoba Hydro's Power Smart DSM target for natural gas savings is 126 million cubic metres by 2027/28, as outlined in the 2013 Power Smart Plan. This target represents the expected impact of incentive-based efficiency program activities, DSM support programs, interactive effects from electricity programs, as well as savings resulting from efficiency codes and standards. Manitoba Hydro's Power Smart program activity is expected to contribute the greatest portion of the savings, with projected savings of 79 million cubic metres by 2027/28.

While this report highlights all activities and results from the overall Power Smart portfolio, the emphasis will be on incentive-based programs. Annual results for 2013/14 will be measured against the planned savings specified in the 2013 Power Smart Plan.

More specifically, this will report:

- Energy and demand savings achieved by incentive-based Power Smart programs;
- Utility costs associated with all Power Smart programs and initiatives;
- Cost-effectiveness of incentive-based Power Smart programs.

Refer to APPENDIX A - 'Sources of Evaluation and Planning Estimates' for details of the information considered when preparing program plan estimates and program evaluation results. Refer to APPENDIX B - 'Explanation of Benefit-Cost Ratios used in DSM Economic Metrics' for formulas used to assess cost-effectiveness.

1.5 Demand Side Management Evaluation

Manitoba Hydro evaluates its DSM programs on an annual basis to validate electric and natural gas savings, and to provide feedback to program managers on program achievements and on improving data collection. Manitoba Hydro's DSM evaluation objectives are to provide timely, credible, actionable and cost-effective evaluations.

The California Evaluation Framework is used as a guide in Manitoba Hydro's DSM evaluations and related activities. This framework, which is widely used in the DSM evaluation industry, provides a consistent, systemized, cyclic approach for planning and conducting evaluations of energy efficiency programs. When verifying the energy and demand savings of its DSM programs, Manitoba Hydro uses the International Performance Measurement and Verification Protocol as a guide. This protocol provides an overview of current best practices for verifying the impacts of DSM activities in program impact evaluations.

Manitoba Hydro takes a comprehensive approach to evaluating its DSM programs. Impact evaluations are undertaken on an annual basis on all DSM programs to document Manitoba Hydro's DSM efforts and to determine the electric and natural gas savings and cost-effectiveness of the DSM programs.

2.0 Power Smart Portfolio Review

Manitoba Hydro's Power Smart efforts include DSM support programs, cost recovery programs, energy efficient codes and standards and incentive-based Power Smart programs. The following section includes a synopsis of the current Power Smart initiatives.

2.1 Power Smart DSM Support Programs & Cost Recovery Programs

One of the primary drivers in Manitoba Hydro's Power Smart activities is providing value-added customer service. This is achieved by offering customers information and advice, financing services, access to energy efficiency information and providing energy efficient solutions. Through these efforts, Manitoba residents and businesses are provided a number of benefits including:

- Enabling customers to improve the comfort and productivity of their work and home environments while reducing their energy bills;
- Lower electricity rates;
- Assisting businesses in becoming more competitive in national and international markets; and
- Creating employment opportunities within Manitoba for manufacturers, distributors, retailers, trade allies and installers of energy efficient products and services.

2.1.1 Launch Date of DSM Support Programs & Cost Recovery Programs

Exhibit 2.1.1-A identifies the launch dates of all current and discontinued DSM support programs and cost recovery programs.

Exhibit 2.1.1-A

Launch Date of DSM Support Programs & Cost Recovery Programs

INITIATIVE	LAUNCH DATE
RESIDENTIAL	
Power Smart Residential Loan	February, 2001
Residential Earth Power Program	April, 2002
Power Smart Residential PAYS Program	November, 2012
COMMERCIAL	
Power Smart Recreation Facility Survey	May, 1998
Religious Buildings Initiative	May, 2001
Power Smart for Business PAYS Program	September, 2013
DISCONTINUED/COMPLETED PROGRAMS	
ecoENERGY Program^	March, 2001
Wisdom in Saving Energy (W.I.S.E.) Home Program	June, 2001
Power Smart Energy Manager - Pilot	September, 2001
Energy Saver Presentations^^	January, 2002
New Home Program Workshop	January, 2002
R-2000 Home Program component of the New Home Program*	February, 2002
Power Smart Design Standards**	September, 2002
Solar Hot Water Heating	November, 2008

^ Formerly called EnerGuide.
^^ Formerly called Home Energy Saver Workshops.
* In 2004/05, the R-2000 Home Program was grouped under the New Home Program.
** Power Smart Design Standards is now a component of the commercial incentive-based New Buildings Program.

Exhibit 2.1.1-B provides an overview of the annual and total number of participants for DSM support programs and cost recovery programs.

Refer to APPENDIX C - 'Total Power Smart Participation' for a detailed list of historical participation.

Exhibit 2.1.1-B

DSM Support Programs & Cost Recovery Program Participation

INITIATIVE	2013/14	Cumulative
	Number of Participants	
RESIDENTIAL		
Financing Programs		
Power Smart Residential Loan*	5,504	75,862
Power Smart Residential PAYS Program	241	293
Residential Earth Power Program		
Geothermal Loan	19	1,229
Solar Hot Water Heating	0	14
Mail In/On-Line Energy Assessments	303	4,600
	6,067	81,998
COMMERCIAL		
Power Smart for Business PAYS Program	6	6
Religious Buildings Initiative	4	235
Power Smart Recreation Facility Survey	2	70
	12	311
DISCONTINUED/COMPLETED PROGRAMS		
ecoENERGY Program^	n/a	54,272
Wisdom in Saving Energy (W.I.S.E.) Home Program	n/a	5,391
Energy Saver Presentations^^	n/a	3,956
New Home Program Workshop	n/a	854
Earth Power Consumer Workshops**	n/a	688
R-2000 Home Program Component of the New Home Program ^^^	n/a	63
Power Smart Energy Manager - Pilot	n/a	38
Solar Hot Water Heating	n/a	36
	n/a	65,298
TOTAL	6,079	147,607

* Participation includes completed projects.
** Includes residential and commercial participants.
^ Formerly called EnerGuide. Participation includes 'D' & 'E' audits.
As Manitoba Hydro highly subsidized the evaluation cost of Amerispec and EnerGuy participants, they are included in the participation figures for 2011/12 and 2012/13.
^^ Formerly called Home Energy Saver Workshops.
^^^ In 2004/05, the R-2000 Home Program was grouped under the New Home Program.
Note: This table includes electric and natural gas Power Smart participants.
Customers may participate in more than one Power Smart program.
Participation is measured by completed projects, includes free riders, and excludes free drivers and market transformation.

2.1.2 DSM Support Programs & Cost Recovery Program Activity

DSM support programs and cost recovery programs provide numerous benefits to Manitobans. Depending on the nature of the program, savings resulting from specific programs will be quantified to the extent that these savings can be reasonably determined. Estimated savings are generally calculated using engineering estimates, as well as sales and market data provided by program coordinators. Regular assessments include a qualitative evaluation of the benefits, with service levels adjusted accordingly. The following outlines the Power Smart DSM support programs and cost recovery programs that were running in 2013/14.

Power Smart Residential Assistance

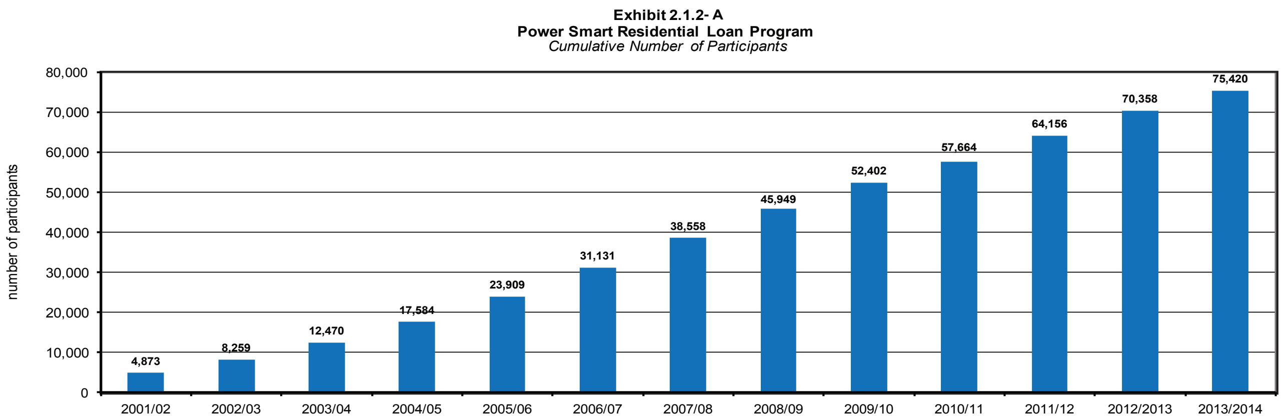
A number of tools are offered to residential customers to encourage and assist homeowners to make energy efficient renovations and energy use decisions that increase comfort and reduce home energy bills. The following services are offered under this initiative:

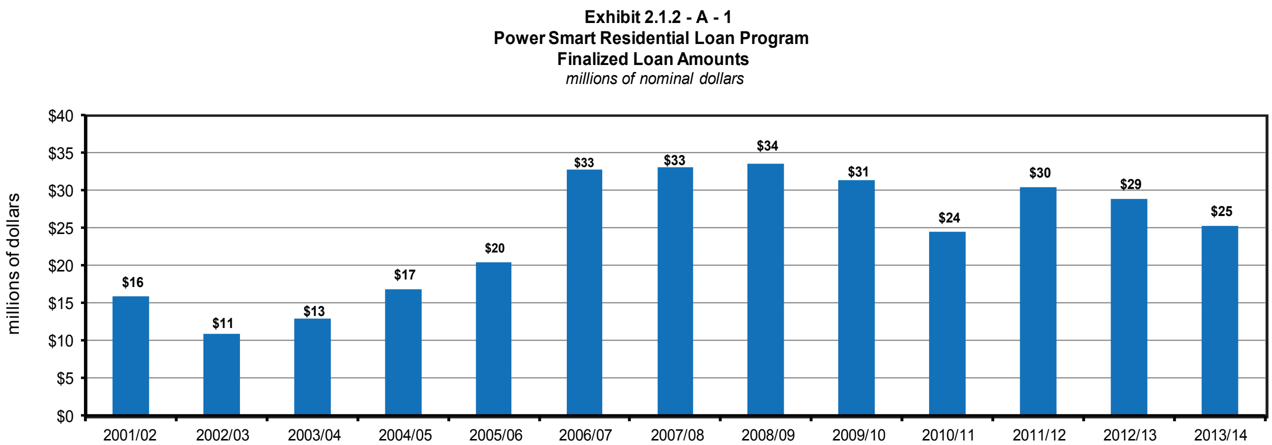
- Customers can complete a mail-in or online survey to evaluate energy use in their home. Regardless of the method of participation, the customer receives a customized report that includes easy-to-read graphs summarizing overall energy use, a breakdown of the house characteristics contributing to heating costs, a list of recommended upgrades and a Power Smart target comparing energy consumption of their home to a home upgraded with the recommended Power Smart measures;
- Detailed brochures and renovation booklets providing information for selecting and installing Power Smart measures and, tips for achieving low cost or no-cost energy savings in the home;
- Customers can email a Power Smart Energy Expert with energy conservation-related questions; and
- Convenient on-bill financing to complete energy efficient renovations as outlined below.

Power Smart Residential Loan

The Power Smart Residential Loan Program offers convenient on-bill financing to encourage homeowners to complete energy efficient renovations to increase comfort and reduce home heating bills. Participants can borrow up to $7,500 ($5,500 for natural gas furnaces) and repay the amount on their energy bill.

Since its inception, the Power Smart Residential Loan Program has had more than 75,000 participants, borrowing more than $317 million in total. To date, just over $63 million in loans remain outstanding. Exhibit 2.1.2-A displays participation under the Power Smart Residential Loan Program, and Exhibit 2.1.2-A-1 summarizes finalized loan amounts.





Power Smart Residential PAYS Program

In June 2012, the Province of Manitoba passed Bill 24 - The Energy Savings Act. In response, Manitoba Hydro launched the Power Smart Residential PAYS Program on November 5, 2012.

The Power Smart Residential PAYS Program offers extended financing terms for energy efficient upgrades. Customers can use their estimated annual utility bill savings from installing a particular efficient measure, to pay for that measure (or part thereof). Customers have the option to transfer the monthly payment to the next homeowner or tenant, who will also benefit from the upgrade.

In its first two years, the Power Smart Residential PAYS Program has had 293 participants, borrowing over $1.8 million.

Residential Earth Power Program

Manitoba continues to be a leader in the geothermal industry with close to 9,000 residential installations to date.

The Residential Earth Power Program's primary objective is to maximize the adoption of geothermal heat pump technology in order to offset the use of conventional electric heating systems.

To facilitate this objective, the Residential Earth Power Program has developed a comprehensive strategy to assist efforts of local stakeholders in developing a sustainable provincial geothermal industry. Since its launch in 2002, the program has focused efforts on mitigating three key market barriers which include:

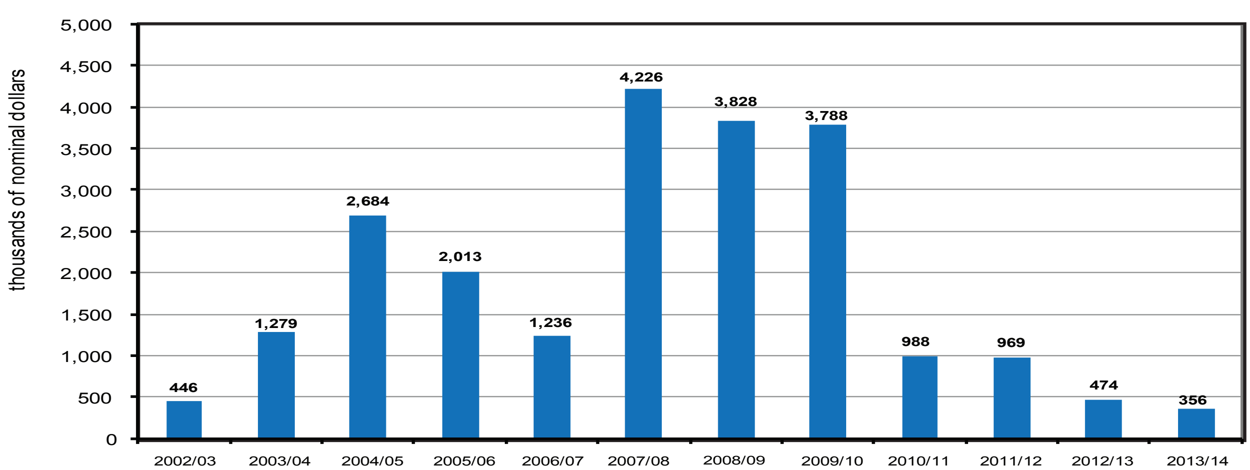
- Consumer awareness;
- Underdeveloped industry infrastructure; and
- High capital cost.

In 2002, the Residential Earth Power Program introduced convenient financing through the Residential Earth Power Loan, a vital component of the program.

The original terms of the loan offered financing up to $15,000 over a term up to fifteen years at a fixed interest rate of 6.5%. In April 2007, changes were made to the loan terms which increased the amount of financing available to $20,000 and lowered the interest rate to 4.9% for the first five years of a customer's loan. The interest rate on the balance of the loan term will be set at prevailing interest rates. The lower initial term interest rate is subsidized by the Affordable Energy Fund.

Manitoba Hydro's Residential Earth Power Loan has continued to be an effective tool in facilitating residential geothermal installations. In 2013/14, a total of 19 customers financed their geothermal systems through the Residential Earth Power Loan. This brings the total number of geothermal loan participants to 1,229 since its inception in 2002/03, equivalent to $19.7 million in financing. As well, residential geothermal market activity has been strong due to the Provincial Green Energy Tax Credit and the $4,375 federal ecoENERGY grant. Since November 2008, the Residential Earth Power Loan has also offered financing for residential solar water heating systems. For a maximum term of 15 years at 4.9%, up to $7,500 can be borrowed. A total of 14 solar installations, equivalent to $92,700 thousand have been financed to date.

Exhibit 2.1.2- B
Residential Earth Power Loan
Annual Loan Amounts
thousands of nominal dollars



Residential geothermal installations in Manitoba have continued to decrease over the past few years. The recession experienced in 2009 has led to lower disposable income and increased customer reluctance to take on more debt. All of which have had a dramatic effect on geothermal installations throughout Canada. Another factor contributing to the decrease is the falling price of gas due to increased supply through the emergence of shale gas exploration.

Power Smart Recreation Facilities Survey

The Power Smart Recreation Facilities Survey was created to help ice arenas and curling rinks reduce their operating costs by providing operators with an understanding of the energy use and potential energy saving measures within the facility. Technical staff at Manitoba Hydro review comprehensive surveys completed by facility operators and an evaluation report is prepared. The report compares the energy use of the facility with similar facilities in Manitoba and provides a list of possible energy saving opportunities. In October 2002, a guide called *Saving Money Through Energy Efficiency - Guidelines for Operators of Manitoba's Rinks and Arenas* was developed to assist rink operators to operate their facilities more efficiently, and to present practical ideas for saving money by reducing energy use. This guide has been updated and is now called *Energy Efficiency Guide for Ice Arenas and Curling Rinks*. An online version of the guide became available in January 2014.

Religious Buildings Initiative

The Religious Buildings Initiative was designed to assist religious organizations in finding ways to make their buildings more energy efficient. The initiative offers a benchmark audit and a loan of 5.5% to assist religious facilities in carrying out efficiency improvements. The benchmark audit report outlines how energy is being used in the building and indicates potential energy saving measures. As part of the Religious Buildings Initiative, a guide called *Energy Efficiency Guide for Religious Buildings* was created. This energy and water efficiency guide assists people involved in the operation and maintenance of religious buildings to develop an action plan and take steps toward improving the efficiency of their buildings.

Power Smart for Business PAYS Financing Program

Manitoba Hydro launched the Power Smart for Business PAYS Program September 3, 2013. This financing program offers extended financing terms for commercial and industrial energy efficient upgrades. The upgrades eligible for financing under the program will result in a monthly repayment that is less than the estimated annual utility savings generated by the upgrade, with the bill reductions being calculated on an average monthly basis over a year. As of March 31, 2014 the Power Smart for Business PAYS Program had six participants, borrowing approximately $35,000.

2.2 Energy Codes, Performance Standards & Energy Efficiency Regulations

Energy codes and performance standards are needed at every stage of market transformation, starting with initial evaluations of energy efficiency improvement opportunities, through to the design and implementation of incentive-based and non-incentive-based conservation programs intended to accelerate the adoption of energy efficient measures. And finally, as core ingredients for efficiency regulations aimed at removing laggard technologies from the market.

Performance standards provide the fundamental basis on which to measure, report and compare energy performance. As such, they form a core building block for evaluating the performance of energy efficient measures and comparing performance between competing products and technologies. Energy codes establish the criteria for understanding, quantifying and managing the energy performance of buildings and energy-consuming equipment operating within them. Performance standards are generally a key ingredient of energy codes, providing the basis on which to measure energy performance. While energy codes establish the metrics for evaluating building design and performance. Together, these two mechanisms are used to develop programs that support the optimal or minimum use of energy in the marketplace, limited only by technical potential and economic constraints.

Energy efficiency regulations are typically implemented towards the end of the market transformation process as energy efficient technologies mature and become generally accepted within the industry. Regulations are designed to remove technologies from the market that lag behind an established performance baseline agreed to by industry and government regulators. While the level of efficiency achieved through energy efficiency regulations is typically less than the optimal or minimum level of energy consumption achieved through directed incentive-based and non-incentive-based programming, regulation continues to be an effective and permanent method for removing products from the market with lower than desired energy performance.

Manitoba Hydro has adopted a proactive strategy that supports the development and acceptance of industry-wide performance standards and energy codes, through active participation in standards organizations such as the Canadian Standards Association Strategic Steering Committee on Performance, Energy Efficiency and Renewables (SCOPEER) and work with energy code steering committees at both the federal and provincial level. In many instances, Manitoba Hydro representatives are leaders within these working groups, driving forward development and acceptance of new performance standards and energy codes. Further to this, Manitoba Hydro adopts the use of these standards and codes in the design and implementation of its conservation programs, enhancing the overall effectiveness and market acceptance of these efforts. Finally, Manitoba Hydro works closely with federal, provincial and municipal regulators to identify and remove technologies from the market that lag behind accepted performance thresholds, providing support for the development and adoption of energy efficiency regulations. These efforts prevent products and measures with poor energy performance from gaining a foothold in the market and compromising efforts to transform markets to a more energy efficient state.

2.3 Power Smart Incentive-Based Programs

Power Smart incentive-based programs are designed in consideration of specific market parameters and characteristics impacting market acceptance of the targeted energy efficient technology or product. Examples of such factors are industry/customer awareness and appetite for acceptance, availability of competing products, state of product life cycles, cost barriers, training barriers, state of existing codes and standards, etc.

2.3.1 Launch Date & Participation of Incentive-Based Power Smart Programs

Exhibit 2.3.1-A identifies the launch dates of current and past Power Smart incentive-based programs.

Exhibit 2.3.1-B provides the annual and total participation of each incentive-based program.

Refer to APPENDIX C - 'Total Power Smart Participation' for a detailed summary of historical participation.

For a description of current incentive-based Power Smart programs, see list in Section 2.3.2. APPENDIX D provides a synopsis of discontinued Power Smart programs.

Exhibit 2.3.1-A

Launch Date of Incentive-Based Programs

PROGRAM	LAUNCH DATE
RESIDENTIAL	
Home Insulation	May, 2004
Affordable Energy Program	December, 2007
Affordable Energy Fund - Propane & Oil Furnace/Boiler	May, 2009
Water & Energy Saver	September, 2010
Refrigerator Retirement	June, 2011
Community Geothermal	June, 2013
COMMERCIAL	
Commercial Lighting	April, 1992
Internal Retrofit	July, 1995
Commercial Custom Measures	December, 1995
Commercial Building Envelope	December, 1995
Commercial Earth Power	December, 1995
Commercial HVAC	September, 2003
Commercial Building Optimization	April, 2006
Commercial Refrigeration	April, 2006
Commercial Kitchen Appliances	January, 2008
Commercial Network Energy Management	May, 2008
Commercial New Buildings	April, 2009
Commercial CO2 Sensors	April, 2009
LED Roadway Lighting Pilot	February, 2013
INDUSTRIAL	
Performance Optimization	June, 1993
Natural Gas Optimization	September, 2006
CUSTOMER SELF-GENERATION	
Bioenergy Optimization	March, 2006
RATE/LOAD MANAGEMENT	
Curtailable Rates	November, 1993
DISCONTINUED/COMPLETED	
RESIDENTIAL DISCONTINUED/COMPLETED	
Outdoor Timer	October, 1989
Refrigerator/Freezer Buy-Back Pilot	1991/92
Residential Shower Head Pilot	1991/92
EE Water Savings Measures Component of the 'No Worry Plan'	November, 1996
EE Water Tank Measures Component of the 'No Worry Plan'	November, 1996
New Home	February, 2004
Compact Fluorescent Lighting	September, 2004
Seasonal LED Lighting	November, 2005
High Efficiency Furnace / Boiler	November, 2005
Residential Appliances	June, 2006
Programmable Thermostat Pilot	October, 2006
Energy Efficient Light Fixtures	October, 2006
Solar Hot Water Heating (Incentive Component)	November, 2008
COMMERCIAL DISCONTINUED/COMPLETED	
Roadway Lighting	April, 1991
Sentinel Lighting Conversion	April, 1991
Commercial Shower Head Pilot	1991/92
Infrared Heat Lamps	1991/92
Agricultural Demand Controller	July, 1992
Livestock Waterer	October, 1994
Commercial Construction - Air Barrier Component	December, 1995
Commercial Construction - Air Conditioning Component	December, 1995
Commercial Parking Lot Controllers	December, 1995
Agricultural Heat Pads	April, 1998
City of Winnipeg Power Smart Agreement	September, 2002
Commercial Rinse & Save	July, 2006
Commercial Clothes Washers	July, 2008
Power Smart Energy Manager*	November, 2008
Power Smart Shops*	February, 2009
INDUSTRIAL DISCONTINUED/COMPLETED	
High Efficiency Motor	September, 1991

* During 2013/14, this program was undergoing redesign.

Exhibit 2.3.1-B

Incentive-Based Power Smart Program Participation

PROGRAM	2013/14*	Cumulative
	Number of Participants	
RESIDENTIAL		
Water & Energy Saver	19,659	118,856
Refrigerator Retirement	8,982	25,717
Home Insulation	2,273	34,097
Affordable Energy Program	1,847	8,462
Community Geothermal	82	82
	32,843	187,214
COMMERCIAL		
Commercial Lighting	779	13,136
Commercial Refrigeration	605	1,334
Commercial Building Envelope	438	2,535
Commercial HVAC/ CO2 Sensors	90	613
Internal Retrofit	35	1,324
LED Roadway Lighting Pilot	25	25
Commercial New Buildings	12	34
Commercial Earth Power	9	128
Commercial Custom Measures	8	77
Commercial Building Optimization	6	15
Commercial Network Energy Management	3	11
Commercial Kitchen Appliances	2	83
	2,012	19,315
INDUSTRIAL		
Performance Optimization	44	721
Natural Gas Optimization	8	83
	52	804
DISCONTINUED/COMPLETED	45	501,251^
EFFICIENCY PROGRAMS SUBTOTAL	34,952	708,584
CUSTOMER SELF-GENERATION		
Bioenergy Optimization**	2	24
	2	24
RATE/LOAD MANAGEMENT		
Curtailable Rates**	3	5
	3	5
TOTAL	34,957	708,613

* Participation is defined as one household for residential programs, and one project for commercial/industrial programs.

* * Participation represents the number of customers who participate each year. The cumulative number represents the actual number of customers who have participated to date,

^ This includes 343,381 participants of the Residential Compact Fluorescent Lighting Program.

Notes: This table includes electric and natural gas Power Smart participants.
Customers may participate in more than one Power Smart program and are counted multiple times (except for Bioenergy Optimization and Curtailable Rates, where only unique participants are counted).
Participation is measured by number of completed projects, includes free riders, and excludes free drivers and market transformation.

2.3.2 Residential Programs

The residential programs have been established to serve residential customers throughout the province.

Water & Energy Saver Program

The Water & Energy Saver Program offers free Water & Energy Saver kits to residential customers. Each kit contains a low-flow showerhead, low-flow faucet aerators, water heater pipe wrap and a refrigerator/freezer thermometer.

Affordable Energy Program

The Affordable Energy Program is designed to bring Power Smart and energy efficient measures to qualifying lower income households. The program leverages Manitoba Hydro Power Smart programs, the Affordable Energy Fund, the federal government's ecoENERGY Program (until the program ended in March 2011), provincial government programs and existing community-based infrastructures. Energy efficiency measures include pre- and post- in-home energy evaluations, installation of basic energy efficiency items such as CFLs and low-flow showerheads, insulation upgrades and natural gas furnace upgrades.

First Nations Power Smart Program

Through the First Nations Power Smart Program, First Nations communities can improve the energy efficiency and comfort of their homes. The program provides each First Nations community a Manitoba Hydro energy efficiency specialist to recommend the installation of energy efficient measures. Participants are also provided insulation and basic energy efficiency upgrades. Community members are trained to conduct the upgrades and deliver the Power Smart program. And on request, energy saving seminars can be arranged for the community.

Home Insulation Program

Information and financial incentives are offered to encourage owners of existing homes to upgrade their insulation to Power Smart levels.

Community Geothermal Program

The Power Smart Community Geothermal Program launched in June 2013. The program utilizes the existing framework of a pilot conducted with AKI Energy, a non-profit social enterprise group, whereby geothermal heat pump systems are installed on a mass scale throughout First Nations communities. Bulk purchasing heat pumps helps mitigate the high capital cost barrier to installing geothermal systems. Manitoba Hydro's Residential PAYS Program allows community members to pay for the majority of the geothermal system through the energy savings realized by converting their heating/air conditioning systems to a geothermal system. In cases where customers will not achieve enough savings to justify the cost of the geothermal system, Manitoba Hydro will provide a financial incentive. Through partnership with AKI Energy, the program also creates employment opportunities for First Nations communities. Band members are trained to take part in the installation and ongoing maintenance of the geothermal systems. The training is funded by the First Nations communities themselves. As of March 31, 2014, the program had two First Nations communities participating, with 82 installations.

Refrigerator Retirement Program

The Refrigerator Retirement Program provides residential customers with free in-home pick-up of their old, inefficient refrigerators and freezers, paying customers a $40 incentive for each appliance retired. This province-wide program is set run until March 2017.

2.3.3 Commercial Programs

The commercial programs have been established to serve commercial, institutional and industrial customers.

Commercial Lighting Program

The Commercial Lighting Program encourages commercial customers to install cost-effective energy efficient lighting systems. Manitoba Hydro also works with lighting distributors, installers, contractors and manufacturers to assist customers in saving electricity, and to ensure optimal lighting design based on use.

Commercial Building Optimization Program

The Commercial Building Optimization Program encourages commercial customers with existing buildings to use an investigation and adjustment process known as retro-commissioning to help return their buildings to their intended operating methods.

New Buildings Program

The New Buildings Program provides technical guidance and financial incentives for designing, constructing and operating new, energy efficient buildings in Manitoba.

Commercial Building Envelope Program

The Building Envelope Program encourages building owners to install window systems and/or insulation levels that meet Power Smart levels in their renovation or new building plans, and helps to reduce air leakage. Upgrading a building's envelope can reduce air leakage which will affect energy costs to heat and cool the building, while providing improved thermal comfort for occupants and improve indoor air quality.

Internal Retrofit Program

Energy efficiency in Manitoba Hydro buildings is encouraged by retrofitting existing and constructing new buildings to Power Smart levels.

Commercial HVAC Program

The Commercial HVAC Program encourages the use of high efficiency heating, ventilation and cooling systems, such as near-condensing and condensing boilers, CO2 sensors and energy efficient water-cooled chillers.

Commercial Earth Power Program

This program provides information and financial incentives to customers who install a geothermal heat pump system to offset a conventional electric heating system in commercial buildings.

Commercial Refrigeration Program

This program encourages grocery stores and restaurants to install energy efficient refrigeration equipment for their walk-ins, display cases and mechanical rooms to reduce energy consumption and create a more comfortable environment for their customers.

Commercial Kitchen Appliances Program

The Commercial Kitchen Appliances Program encourages customers to upgrade to ENERGY STAR® qualified steamers and fryers.

Network Energy Management Program

The Network Energy Management Program encourages the installation of network management software. The software shuts down PCs when they are inactive while still allowing network administrators to perform regular maintenance tasks, such as software upgrades and security patches.

Custom Measures Program

The Custom Measures Program encourages commercial customers who are renovating, undergoing plant expansion or building new facilities to improve system performance by installing or upgrading technologies such as direct digital controllers, variable frequency drives and heat recovery ventilation systems. The program is designed to serve customers undertaking energy efficient projects that are not specifically supported by the other existing Power Smart programs.

LED Roadway Lighting Pilot Program

The LED Roadway Lighting Pilot Program installed a number of cobra head light fixtures in Winnipeg and Thompson to test the suitability of various products in advance of the creation of a formal program.

2.3.4 Industrial Programs

The industrial programs have been established to serve the industrial customers throughout the province to encourage the optimization and efficiency of their processes.

Performance Optimization Program

The Performance Optimization Program encourages industrial and large commercial customers to study and implement energy efficiency measures in their electrotechnology processes and motor-drive systems.

Natural Gas Optimization Program

This program provides industrial and large commercial customers with the technical support and financial incentives necessary to identify, investigate and implement systematic efficiency improvements in the natural gas-fired systems throughout their facilities.

2.3.5 Rate/Load Management Programs

Curtailable Rates Program

Large industrial customers are provided with financial incentives by way of a monthly credit on their electricity bill in exchange for having electrical load available for curtailment if called upon by Manitoba Hydro.

2.3.6 Customer Self-Generation Programs

Bioenergy Optimization Program

This program encourages industrial customers to install, operate and maintain generation equipment at their site in order to displace their internal load.

3.0 Power Smart Success Stories

Rona Brightens up Stores with High Efficiency Lighting

In 2013, all three Winnipeg Rona stores (1333 Sargent Avenue, 1636 Kenaston Boulevard and 775 Panet Road) underwent major lighting upgrades with the assistance of Manitoba Hydro's Commercial Lighting Program. Each store had over five hundred 400-watt pulse start metal halide fixtures replaced with 6-lamp, T8 high bay fluorescent fixtures.

Rona received a total rebate of $248,697 from Manitoba Hydro and they are anticipating annual energy and demand savings of 1.8 GW.h and 0.4 MW respectively.

Towers Realty Group Rejuvenates Lanark Gardens

Towers Realty Group recently undertook a number of building envelope upgrades on their Lanark Gardens apartment/condominium buildings at 525 and 495 Lanark Street in Winnipeg. The retrofit included upgraded roof insulation and the installation of energy efficient windows. Due to their efforts, Towers Realty Group received an incentive of nearly $88,000. They anticipate annual energy and demand savings of 0.2 GW.h and 0.1 MW, as well as almost 28,000 m3 of natural gas savings.

Garden Valley Celebrates Commitment to Energy Efficiency with Newest School

Winkler's newest and largest school, Northlands Parkway Collegiate, celebrated its official grand opening in 2013. The 112,000 square foot high school was designed in accordance with Power Smart Design Standards and features high levels of roof, wall and floor insulation, high performance triple-pane windows, ventilation heat-recovery with 100% outdoor air, ample amounts of natural daylight combined with lighting controls and energy efficient lighting fixtures, ground source heat pumps, chilled beams and floor heating, rainwater recovery for flush toilets, low-flow lavatory faucets and waterless urinals.

The Garden Valley School Division received Manitoba Hydro's Power Smart Designation for its commitment to energy efficient building design and environmental leadership. Since 2006, Garden Valley School Division has added three new schools, all of which received the Power Smart Designation.

PAYS Financing Now Available for Commercial Customers

The Power Smart for Business PAYS (Pay as You Save) Program for commercial customers was launched in September 2013. PAYS is an attractive financing tool, in addition to Manitoba Hydro's broad portfolio of Power Smart for Business incentive programs, to help mitigate the capital cost barrier often associated with upgrading to an energy efficient technology.

The program offers extended financing terms for energy efficient upgrades such as the following: insulation, lighting (T5, T8 and LED), furnaces, boilers, geothermal heat pump systems, CO2 sensors, and WaterSense® labeled toilets and urinals. The upgrades eligible for financing under the program are those energy efficiency opportunities where the monthly repayment is less than the estimated annual utility savings generated by the upgrade. The bill reductions are calculated on an average monthly basis over a year. Financing is available for extended terms with ten to twenty-five year amortization periods, depending on the upgrade, with the interest rate of 5.9% fixed for the first five years.

Loblaws Undergoes High Efficiency Upgrades

During 2013/14, Loblaws Companies Limited undertook an extensive energy efficiency upgrade in the Manitoba market place. These upgrades include high efficiency lighting and refrigeration.

Fifteen of Loblaws' grocery store locations converted their existing 400-watt metal halide lighting systems to an 8-lamp, T8 high bay fluorescent system. Having replaced 7,800 units overall, Loblaws anticipates 7.3 GW.h and 1.2 MW of energy and demand savings each year. For Loblaws' lighting upgrades, the Commercial Lighting Program provided a financial incentive of nearly $800,000.

Loblaws also took advantage of Manitoba Hydro's Commercial Refrigeration Program to reduce refrigeration costs in ten of their grocery stores. Loblaws anticipates annual energy and demand savings of 1.7 GW.h and 0.2 MW, as well as over 62,000 m3 of natural gas savings from these upgrades. Loblaws received approximately $184,000 in incentives from the Commercial Refrigeration Program for completing this initiative.

Gaynor Family Regional Library Built to Meet Power Smart Design Standards

Selkirk celebrated the official grand opening of its much anticipated public library in January 2014.

The 20,000 square foot building was designed in accordance to Power Smart Design Standards and features high levels of roof, wall and floor insulation, high performance dual-pane windows, ventilation heat-recovery, ample amounts of natural daylight combined with lighting controls and energy efficient lighting fixtures, ground source heat pumps for heating and cooling, point-of-use water heaters, low-flow lavatory faucets and a direct digital control system to help optimize the operations of the facility.

Manitoba Hydro was included throughout the facility's design process and helped Gaynor Family Regional Library achieve its goal of constructing an energy efficient facility with low operating costs. The building was made possible thanks to consultation with and financial incentives from Manitoba Hydro's New Buildings Program.

Morguard Investments Actively Upgrading Lighting

Morguard Investments manages a multi-use building at 1780 Wellington Avenue. In 2013/14, they removed more than two hundred halogen lamps, ranging between 40 to 90 watts each, and replaced them with LED screw-in lamps. For Morguard's efforts, they received an incentive of more than $10,000 through Manitoba Hydro's Commercial Lighting Program. The company expects to see annual energy and demand savings of 0.03 GW.h and 0.1 MW.

As well, during 2012/13, Morguard replaced their T12 fluorescent system with a T8 fluorescent system, which consisted of more than 640 lighting fixtures. This project produces annual energy and demand savings of 0.2 GW.h and 0.1 MW. To assist with the completion of this upgrade, more than $65,000 was paid out to the customer.

Grand Opening for La Salle's Power Smart Community Centre

The LSCU Complex, La Salle's newly-constructed community centre, celebrated its official grand opening in 2013/14. Manitoba Hydro was involved throughout the facility's design process and helped the LSCU Complex achieve its goal of constructing an energy efficient facility for the La Salle community. This new community centre boasts low operating costs thanks to ongoing consolations with and financial incentives from Manitoba Hydro's New Building Program. The new community centre was officially designated a Power Smart Building for its energy efficient building design.

Designed in accordance with Power Smart Design Standards, the building is at least 33% more efficient than a typical community centre and features high levels of roof, wall and floor insulation, ventilation heat-recovery, ample amounts of natural daylight combined with lighting controls and energy efficient lighting fixtures, high efficiency condensing hot water heater and low-flow lavatory faucets.

First Nations Communities Explore Geothermal Heating

The Power Smart Community Geothermal Program launched in June 2013. The program utilizes the existing framework from a pilot conducted with AKI Energy, a non-profit social enterprise group. This pilot installed geothermal heat pump systems on a mass scale throughout First Nations communities. Bulk purchasing heat pumps helps mitigate the high capital cost barrier to installing geothermal systems.

Manitoba Hydro is working with AKI Energy by providing technical guidance, energy bill assessments and exploring opportunities to further maximize the number of geothermal installations. Manitoba Hydro's Residential PAYS Program is utilized to enable community members to pay for the majority of the geothermal system through the energy savings that are realized by converting their heating and air conditioning systems to a geothermal system.

Through the partnership with AKI Energy, the Community Geothermal Program also creates employment opportunities within the First Nations. Band members are trained on the installation and ongoing maintenance of geothermal systems. The training is funded by the First Nations themselves.

Currently, the program has seen participation from two First Nations communities, with eighty-two geothermal installations completed in the 2013/14 fiscal year.

St. Joseph's First Power Smart Building

St. Joseph's first Power Smart building, the Centre Parent community facility, officially opened in May 2013. The facility is product of extensive fundraising efforts, with Manitoba Hydro Power Smart recognized as an official benefactor thanks to financial support, as well as waived service connection fees. Among other supporters is Pattern Energy, owner and operator of the adjacent St. Joseph Wind Farm, who provided capital funding for the new facility and dedicated operating funds for the centre for the next twenty-five years.

Manitoba Hydro Power Smart was involved throughout the facility's design process in order to help Centre Parent achieve its goal of building an energy efficient building. Energy efficient features include high levels of roof, wall and foundation insulation, high performance windows, energy efficient lighting fixtures and control systems, low-flow water fixtures and high efficiency heating and cooling systems.

4.0 Market Results

In the past, the success of Manitoba Hydro's Power Smart initiative was evaluated based on DSM incentive-based program activity alone. However, the true impact of Power Smart also includes the impact of the programs on the market as a whole, or market transformation. Although, market transformation is more difficult to measure. Manitoba Hydro has made significant in-roads in developing program-specific methodologies for measuring Power Smart's impact. Wherever possible, Manitoba Hydro has attempted to obtain sales/technology-specific data to calculate a program's true impact. In some instances, qualitative information is used to determine a program's impact on the market. Manitoba Hydro plans on continuing to further quantify and report the influence of market transformation within the Manitoba marketplace.

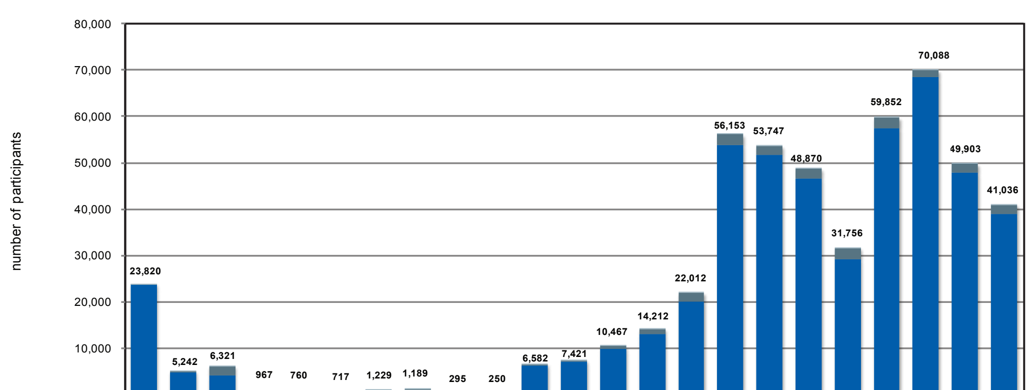
4.1 Power Smart Portfolio Results

The following sections provide an overview of Power Smart portfolio results to date.

4.1.1 Participation in Power Smart Programs

The following graph outlines total Power Smart participation in incentive-based programs, DSM support programs and cost-recovery programs, with participation presented by sector (i.e. residential, commercial and industrial programs).

Exhibit 4.1.1
Power Smart Program Participation



	89 - 92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Industrial	24	157	202	229	185	182	195	8	4	9	17	25	32	48	50	49	81	99	116	90	73	110	57
Commercial	65	273	1,959	738	575	334	325	500	291	241	304	363	538	1,019	1,848	2,235	2,005	2,079	2,463	2,263	1,487	1,859	2,069
Residential (excluding CFLs)	23,73	4,812	4,160	0	0	201	709	681	0	0	6,261	7,033	9,897	13,145	20,114	53,869	51,661	46,692	29,177	57,499	68,528	47,934	38,910
Total Achieved (excluding CFLs)	23,820	5,242	6,321	967	760	717	1,229	1,189	295	250	6,582	7,421	10,467	14,212	22,012	56,153	53,747	48,870	31,756	59,852	70,088	49,903	41,036

Note: Includes electric and natural gas participants of DSM support programs, cost recovery and incentive-based programs.
Participation for codes and standards is excluded.
Curtailable Rates Program participation is included in the industrial sector.
Customers may participate in more than one Power Smart program.
The 343,381 sales under the Residential Compact Fluorescent Lighting Program during 2004/05-2010/11 are excluded.
Figures may not add due to rounding.

As displayed in the preceding graph, participation in Manitoba Hydro's Power Smart programs continues to be strong. During 2013/14 there were more than 41,000 participants in Power Smart DSM support programs and incentive-based programs. Excluding the Residential Compact Fluorescent Lighting Program, there have been nearly 513,000 participants cumulatively.

Participation of the Residential Compact Fluorescent Program has been excluded to provide a better indication of participation trends. The Residential Compact Fluorescent Program provided a low-cost option for achieving energy efficiency, and represents 41% of residential Power Smart participation and 40% of overall Power Smart participation.

Refer to APPENDIX C for historical Power Smart participation.

4.1.2 Power Smart Portfolio - Impact of Electric Programs

The following tables outline the electricity savings achieved by the Power Smart portfolio during 2013/14 and provide a comparison between achieved results and planned targets, where applicable:

Exhibit 4.1.2-A

Annual GW.h Savings (at generation) - Power Smart Portfolio

	2013/14 Actual	2013/14 Plan^	Total*
INCENTIVE-BASED PROGRAMS	183	108	1,777
CODES & STANDARDS	75	66	703
DSM SUPPORT PROGRAMS	2	3	31
OVERALL IMPACT	260	177	2,512

^ Plan estimates are from the 2013 Power Smart Plan.
* Savings include actual + persisting results, up to and including 2013/14.
Note: Figures may not add due to rounding.

Exhibit 4.1.2-B

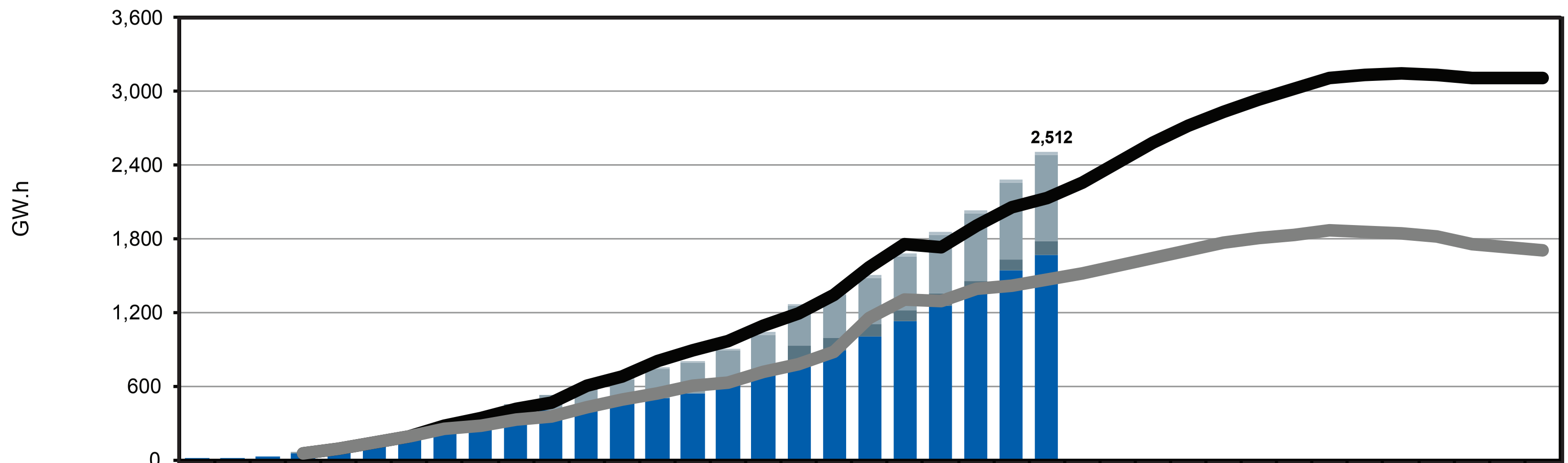
Annual Average Winter MW Savings (at generation) - Power Smart Portfolio

	2013/14 Actual	2013/14 Plan^	Total*
INCENTIVE-BASED PROGRAMS	198	186	516
CODES & STANDARDS	21	16	171
DSM SUPPORT PROGRAMS	1	1	11
OVERALL IMPACT	221	203	698

^ Plan estimates are from the 2013 Power Smart Plan.
* Savings include actual + persisting results, up to and including 2013/14.
Note: MW savings are based on the average of the winter AM & PM system peak savings.
For the Curtailable Rates Program, MW savings are assumed to be achieved when a customer signs a contract. Therefore, MW savings reported is the load available for curtailment.
Figures may not add due to rounding.

The following graphs present the electric energy and demand savings achieved to date by the Power Smart portfolio and the corresponding targets.

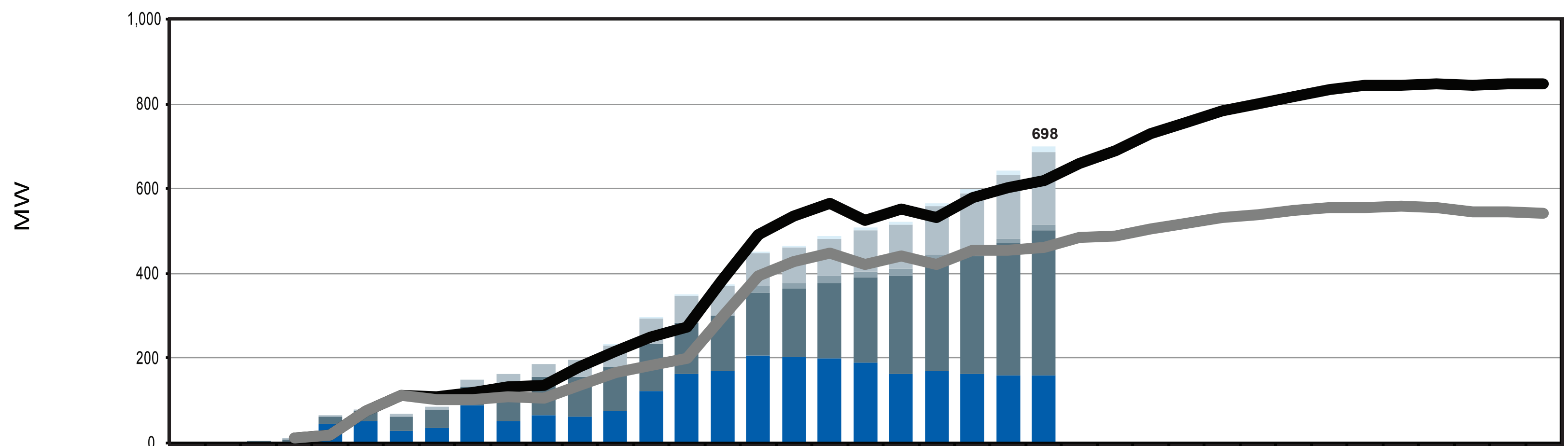
Exhibit 4.1.2-C
Electric Energy Savings - Power Smart Portfolio
Total Savings Achieved vs. Plan
at generation



	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
DSM Support Programs													2	4	7	11	13	16	20	22	25	26	27	29	31														
Codes & Standards	-	-	-	2	8	16	25	40	63	93	125	156	189	228	248	274	298	323	352	382	430	481	553	628	703														
Incentive-Based-Customer Self Generation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	132	93	103	88	95	77	91	109														
Incentive-Based-Efficiency	6	10	31	59	99	151	209	259	285	363	407	419	467	511	546	620	715	799	895	1002	1135	1260	1374	1539	1668														
Plan	-			50	86	138	195	281	336	422	466	602	686	810	891	970	1088	1199	1350	1569	1753	1736	1906	2063	2140	2256	2422	2586	2719	2839	2935	3026	3113	3131	3143	3142	3107	3117	3113
Plan (Incentive-Based Programs only)	-			50	86	138	195	252	279	327	350	435	491	544	603	634	713	782	879	1157	1310	1293	1388	1425	1469	1519	1576	1643	1705	1765	1804	1838	1870	1857	1850	1826	1758	1732	1707
Total Achieved	6	10	31	62	107	167	235	299	348	456	532	575	659	743	801	904	1037	1270	1359	1509	1678	1863	2031	2287	2512														

Note: Targeted savings are unadjusted for programs not running or other revisions.
Figures may not add due to rounding.

Exhibit 4.1.2-D
Average Winter Demand Savings - Power Smart Portfolio
Total Savings Achieved vs. Plan
at generation



	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09
DSM Support Programs													1	1	2	3	3	4	6	6
Codes & Standards				1	2	4	6	10	15	23	32	40	49	59	64	70	76	82	89	97
Incentive-Based - Customer Self Generation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	16	16	16
Incentive-Based - Efficiency	0	1	4	10	17	26	34	42	46	86	91	93	105	113	119	131	146	162	179	200
Incentive-Based - Rate/Load	-	-	-	-	45	51	27	36	88	53	64	63	75	121	163	169	208	202	199	190
Plan				12	18	75	114	108	118	134	135	178	216	249	273	385	491	535	564	524
Plan (Incentive-Based Programs only)				12	18	75	114	101	104	110	105	136	166	183	200	296	394	429	449	421
Total	0	1	4	10	64	80	68	87	149	162	187	196	230	295	348	373	450	466	488	509

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
DSM Support Programs	8	9	9	10	11														
Codes & Standards	105	113	131	150	171														
Incentive-Based - Customer Self Generation	16	16	16	10	16														
Incentive-Based - Efficiency	231	258	280	311	340														
Incentive-Based - Rate/Load	164	170	162	159	161														
Plan	551	531	578	603	620	658	691	730	757	782	800	817	835	843	845	847	843	847	846
Plan (Incentive-Based Programs only)	442	421	454	454	462	484	490	505	519	533	540	547	554	557	557	556	547	545	541
Total	523	566	598	641	698														

Note: Targeted savings are unadjusted for programs not running or other revisions.
Figures may not add due to rounding.

Cumulatively, the entire Power Smart portfolio has saved 2,512 GW.h and 698 MW (at generation), 17% and 13% above their respective targets.

4.1.3 Power Smart Portfolio - Impact of Natural Gas Programs

The following table and graph present natural gas savings achieved by the Power Smart portfolio:

Exhibit 4.1.3 - A
Annual Natural Gas Savings

	2013/14 Actual	2013/14 Plan^	Total*
	millions of cubic metres		
PROGRAM & INITIATIVE			
Incentive-Based Programs	6.6	8.2	68.8
Codes & Standards	2.8	2.7	16.0
DSM Support Programs	0.5	0.5	20.8
	9.9	11.4	105.6
INTERACTIVE EFFECTS			
Incentive-Based Interactive Effects	(0.9)	(1.1)	(13.0)
NET IMPACT OVERALL	9.1	10.3	92.7

^ Plan estimates are from the 2013 Power Smart Plan.
* Savings include actual + persisting results, up to and including 2013/14.
Note: Figures may not add due to rounding.

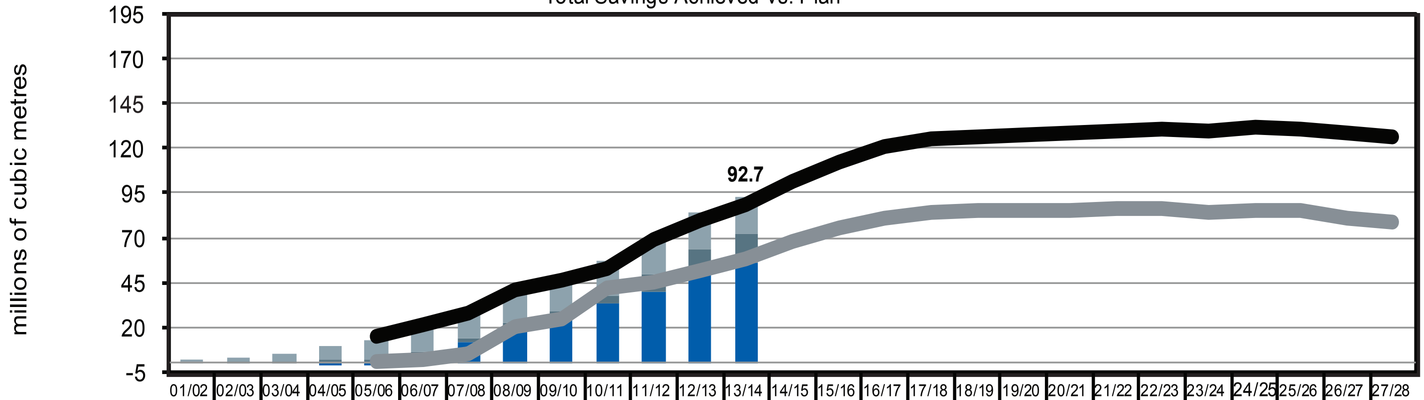
The Power Smart portfolio provided natural gas savings of 9.9 million cubic metres in 2013/14, which was 13% less than planned.

Some electric Power Smart programs result in an increase or decrease in natural gas consumption (interactive effects). For example, a more energy efficient lighting system emits less heat, requiring more energy to heat the space. In cases where the heat is produced through electric heating sources, interactive effects are taken into account when calculating the anticipated electricity savings that will result from the program. In cases where the heat is produced through natural gas heating systems, the interactive effects are taken into account when determining the natural gas savings. These interactive effects represent the increase in natural gas consumption for gas-heated homes resulting from the installation of energy efficient lighting systems.

After interactive effects, the Power Smart portfolio achieved net natural gas savings of 9.1 million cubic metres in 2013/14, 12% less than planned.

To date, after interactive effects, the Power Smart portfolio has saved nearly 93 million cubic metres of natural gas, 5% above target.

Exhibit 4.1.3 - B
Integrated Natural Gas Savings - Power Smart Portfolio
Total Savings Achieved vs. Plan



	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
DSM Support Programs	1.2	2.4	4.3	7.7	11.3	13.2	15.3	16.4	18.3	19.0	19.7	20.3	20.8
Codes & Standards	0.3	0.7	1.1	1.6	2.0	2.4	2.7	3.0	3.5	4.4	9.9	13.2	16.0
Incentive - Based Integrated	0.0	0.1	0.1	-1.0	-1.0	4.3	11.7	20.0	25.3	33.5	39.6	50.1	55.9
Integrated Plan					14.8	21.5	27.9	41.4	46.3	52.8	68.6	79.6	88.7
Integrated Plan (Incentive-Based Programs only)					0.8	1.9	5.7	20.8	24.6	42.2	44.7	51.3	58.2
Total Achieved	1.6	3.1	5.5	8.2	12.2	19.8	29.7	39.4	47.0	57.0	69.1	83.6	92.7

	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
DSM Support Programs														
Codes & Standards														
Incentive - Based Integrated														
Integrated Plan	101.8	112.5	120.5	124.8	126.5	127.6	129.0	130.0	131.1	130.1	131.4	131.2	128.0	126.0
Integrated Plan (Incentive-Based Programs only)	68.2	75.7	80.6	84.0	84.8	85.1	85.6	85.8	86.2	84.5	85.3	84.9	81.3	79.1
Total Achieved														

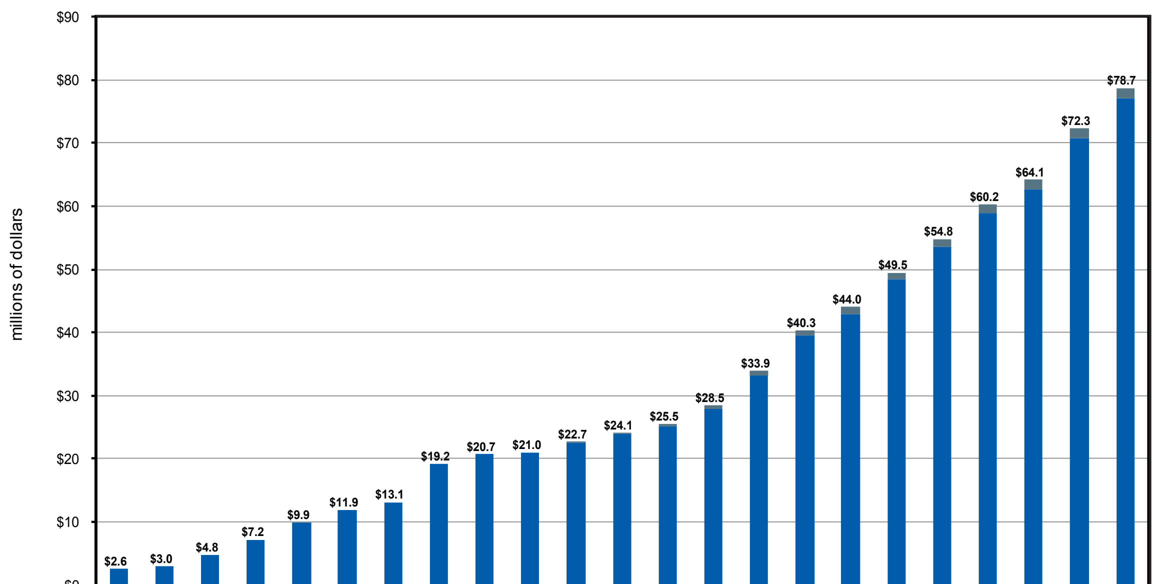
Note: Targeted savings are unadjusted for programs not running or other revisions.
Figures may not add due to rounding.

4.1.4 Customer Bill Reduction

Electricity Bill Reduction

When customers save electricity through Manitoba Hydro's Power Smart programs, it translates into lower electricity bills for participating customers. Displayed in Exhibit 4.1.4-A are the annual customer bill reductions resulting from DSM support program and incentive-based Power Smart program electric savings to date.

Exhibit 4.1.4 - A
Customer Electricity Bill Reduction (2013$)
millions of dollars



	89 - 92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
DSM Support Program Savings	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.1	$0.2	$0.3	$0.5	$0.7	$0.8	$1.0	$1.1	$1.3	$1.4	$1.5	$1.6	$1.7
Incentive - Based Savings	$2.6	$3.0	$4.8	$7.2	$9.9	$11.9	$13.1	$19.2	$20.7	$21.0	$22.6	$23.9	$25.2	$28.0	$33.2	$39.5	$43.0	$48.3	$53.5	$58.8	$62.6	$70.7	$77.0
Total	$2.6	$3.0	$4.8	$7.2	$9.9	$11.9	$13.1	$19.2	$20.7	$21.0	$22.7	$24.1	$25.5	$28.5	$33.9	$40.3	$44.0	$49.5	$54.8	$60.2	$64.1	$72.3	$78.7

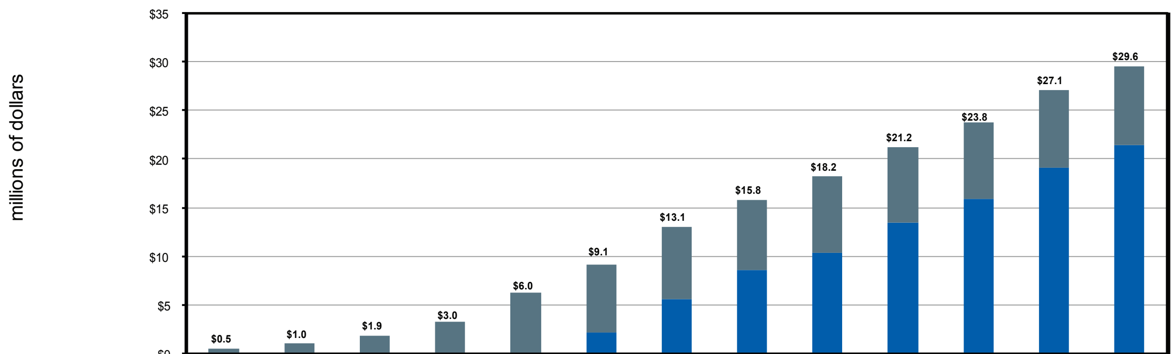
Note: Bill reductions exclude savings due to codes & standards.
Demand savings resulting from the Curtailable Rates Program are excluded from this analysis.
Figures may not add due to rounding.

Power Smart DSM support programs and incentive-based programs saved participating customers nearly $79 million in 2013/14 and over $712 million cumulatively on their electricity bills.

Natural Gas Bill Reduction

Customers also save on their natural gas bills when participating in applicable Power Smart initiatives. Exhibit 4.1.4-B displays annual customer bill reductions resulting from Power Smart natural gas savings to date (net of interactive effects).

Exhibit 4.1.4 - B
Customer Natural Gas Bill Reduction (2013$)
millions of dollars



	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
DSM Support Program Savings	$0.5	$1.0	$1.8	$3.3	$6.3	$6.9	$7.4	$7.3	$7.8	$7.8	$7.9	$8.0	$8.1
Incentive -Based Savings	$0.0	$0.0	$0.1	($0.3)	($0.3)	$2.2	$5.6	$8.5	$10.4	$13.4	$15.9	$19.1	$21.5
Total	$0.5	$1.0	$1.9	$3.0	$6.0	$9.1	$13.1	$15.8	$18.2	$21.2	$23.8	$27.1	$29.6

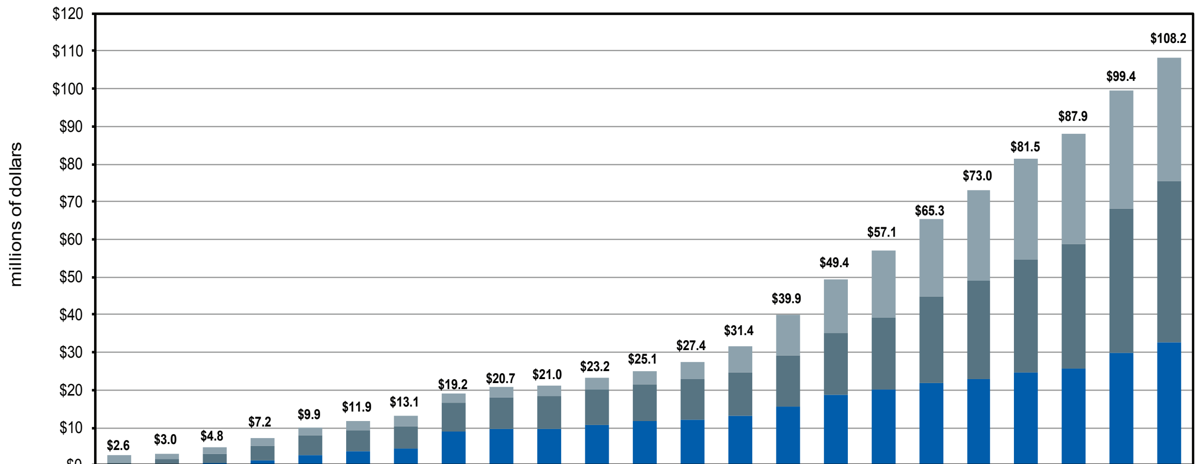
Note: Bill reduction excludes savings due to codes & standards.
Interactive effects in 2013/14 resulted in a $3.6 million increase in customer bills, which is captured within incentive-based savings.
Natural gas bill reduction includes primary and distribution rates only.
Figures may not add due to rounding.

As a result of Power Smart initiatives, participating customers saved nearly $30 million in 2013/14, and approximately $170 million cumulatively on their natural gas bills.

Combined Bill Reduction

The following graph presents the annual combined customer bill reduction for participants of Power Smart DSM support programs and incentive-based programs by sector. Savings include those from both electric and natural gas initiatives.

Exhibit 4.1.4 - C
Combined Electricity & Natural Gas Customer Bill Reduction (2013$)
Total Annual Reductions by Sector
millions of dollars



	89-92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Residential	$2.0	$1.5	$1.7	$2.0	$2.1	$2.4	$2.6	$2.6	$2.5	$2.5	$3.1	$3.6	$4.5	$6.6	$10.7	$14.4	$17.7	$20.3	$23.8	$26.9	$29.1	$31.3	$32.8
Commercial	$0.5	$1.3	$2.6	$4.0	$5.2	$5.7	$6.2	$7.6	$8.4	$8.8	$9.2	$9.7	$10.7	$11.6	$13.5	$16.3	$19.4	$23.2	$26.4	$29.9	$33.1	$38.1	$43.0
Industrial	$0.0	$0.3	$0.5	$1.1	$2.5	$3.8	$4.3	$9.0	$9.7	$9.7	$10.9	$11.8	$12.2	$13.2	$15.7	$18.8	$20.0	$21.8	$22.7	$24.7	$25.8	$30.0	$32.5
Total	$2.6	$3.0	$4.8	$7.2	$9.9	$11.9	$13.1	$19.2	$20.7	$21.0	$23.2	$25.1	$27.4	$31.4	$39.9	$49.4	$57.1	$65.3	$73.0	$81.5	$87.9	$99.4	$108.2

Note: Bill reduction excludes savings due to codes & standards.
Demand savings resulting from the Curtailable Rates Program are excluded from this analysis.
Natural gas bill reduction includes primary and distribution rates only.
Figures may not add due to rounding.

Power Smart DSM support programs and incentive-based programs saved participating customers over $108 million in 2013/14 alone. These savings are distributed relatively evenly between industrial, commercial and residential customers.

Cumulatively, participating customers have saved over $882 million on electricity and natural gas bills. These cumulative bill reductions are split between industrial, commercial and residential customers 34%, 38% and 28% respectively.

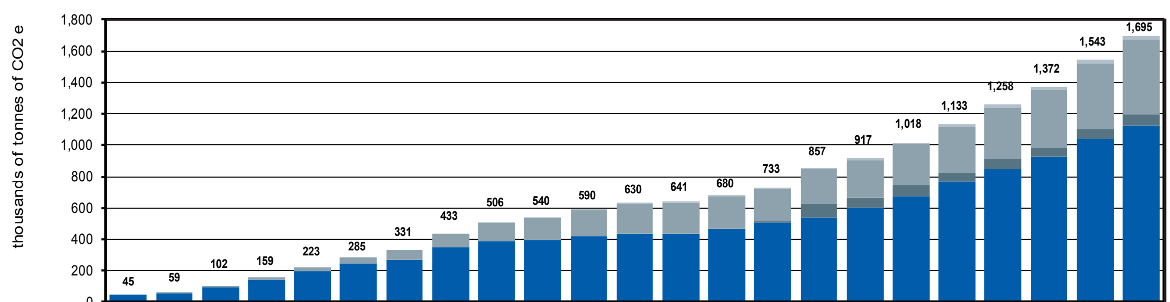
4.1.5 Power Smart Program Impact on Greenhouse Gas Emissions

The energy efficiency measures and improvements installed through Manitoba Hydro's Power Smart programs reduce the amount of greenhouse gas and other air polluting emissions indirectly from power generation, and directly from the transmission and distribution of natural gas, and will continue to do so over their product lives. Both electricity and natural gas consumption reductions have a positive impact on global greenhouse gas emissions.

Impact of Electricity Savings

As Manitobans conserve electric energy through Power Smart programs, more hydro electricity is available for export. These exports displace coal and natural gas fuelled generation outside of Manitoba, which results in significant global reduction of greenhouse gases and other emissions. Therefore, the impact of Power Smart programs on global greenhouse gas emissions is quantified based on estimates of reduced coal and natural gas fuelled generation outside the province, and is measured in carbon dioxide equivalent emissions. Because the emission reductions do not occur at the site of the participating customer, these reductions are referred to as *indirect* emissions reduction. Exhibit 4.1.5-A shows the equivalent reduction in carbon dioxide emissions resulting from Power Smart electric program activity to date.

Exhibit 4.1.5-A
Total Annual Indirect Greenhouse Gas Emissions Reduction due to Electric Savings
thousands of tonnes of CO2e



	89 -92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
DSM Support Programs	-	-	-	-	-	-	-	-	-	-	2	3	5	8	9	11	13	15	17	18	19	20	21
Codes & Standards	-	2	7	15	24	38	60	88	119	147	170	194	198	206	210	218	237	258	290	325	373	424	475
Self Generation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	89	63	70	59	64	52	61	74
Incentive-Based Savings	45	56	95	144	199	246	271	345	386	393	418	433	437	466	505	539	604	676	766	851	927	1,039	1,126
Total	45	59	102	159	223	285	331	433	506	540	590	630	641	680	733	857	917	1,018	1,133	1,258	1,372	1,543	1,695

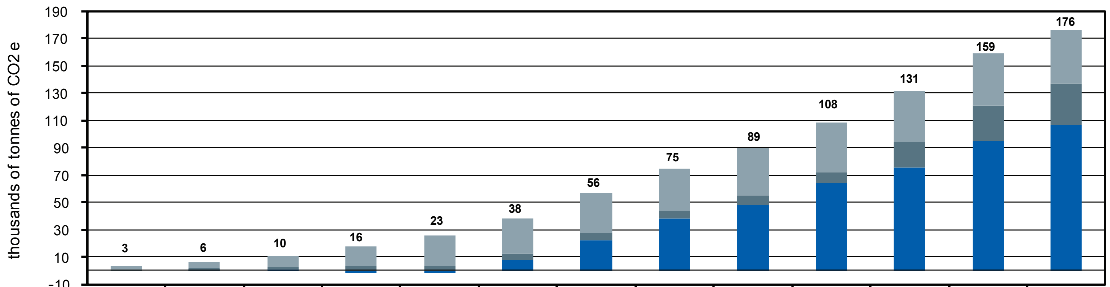
Note: Figures may not add due to rounding.

The 2,512 GW.h of savings resulting from electric Power Smart program activity and codes and standards initiatives to date have displaced greenhouse gas emissions by nearly 1,695 thousand tonnes of carbon dioxide equivalent emissions. This is comparable to removing 339 thousand cars off the road for one full year.

Impact of Natural Gas Savings

Power Smart natural gas programs result in *direct* emissions reduction at the location of the participating customer. The following chart displays direct greenhouse gas emissions reduction resulting from lower natural gas consumption in Manitoba.

Exhibit 4.1.5-B
Total Annual Direct Greenhouse Gas Emissions Reduction due to Natural Gas Savings
thousands of tonnes of CO2e



	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
DSM Support Programs	2	5	8	15	21	25	29	31	35	36	37	39	39
Codes & Standards	1	1	2	3	4	5	5	6	7	8	19	25	30
Incentive-Based Savings	0	0	0	-2	-2	8	22	38	48	64	75	95	106
Total	3	6	10	16	23	38	56	75	89	108	131	159	176

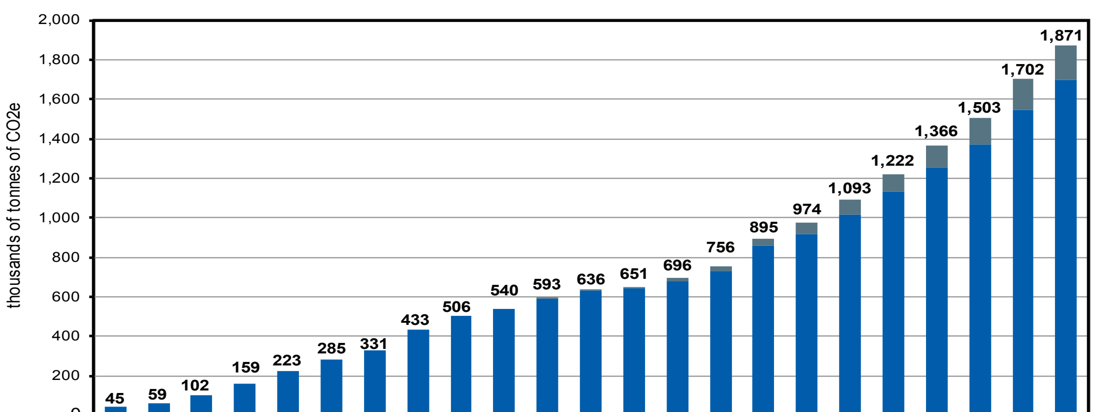
Note: Figures may not add due to rounding.

The 93 million cubic metres of reduced natural gas consumption (after interactive effects) from Power Smart programs to date has displaced approximately 176 thousand tonnes of greenhouse gas emissions. This is equivalent to removing nearly 35 thousand vehicles off the road for one full year.

Combined Impact of Electricity and Natural Gas Savings

The following graph presents the greenhouse gas emissions reduction that has resulted from all electric and natural gas Power Smart program activity to date.

Exhibit 4.1.5-C
Total Annual Greenhouse Gas Emissions Reduction Due to Electric & Natural Gas Savings
thousands of tonnes of CO2e



	89-92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Natural Gas	-	-	-	-	-	-	-	-	-	-	3	6	10	16	23	38	56	75	89	108	131	159	176
Electric	45	59	102	159	223	285-	331	433	506	540	590	630	641	680	733	857	917	1,018	1,133	1,258	1,372	1,543	1,695
Total	45	59	102	159	223	285	331	433	506	540	593	636	651	696	756	895	974	1,093	1,222	1,366	1,503	1,702	1,871

Note: Figures may not add due to rounding.

The 2,512 GW.h of savings from electricity and 93 million cubic metres of savings from natural gas Power Smart programs have resulted in greenhouse gas emissions reduction of approximately 1,871 thousand tonnes of carbon dioxide equivalent emissions. This is comparable to removing nearly 374 thousand vehicles off the road for one full year.

4.1.6 Additional Measurable Non-Energy Benefits

Additional Measurable Non-Energy Benefits

In 2013/14, the following Power Smart programs achieved additional measurable non-energy benefits in the form of water savings: Affordable Energy Program, Water and Energy Saver Program, Commercial Clothes Washers Program and Commercial Kitchen Appliances Program. The following table depicts in-year and cumulative water savings in litres from each of the aforementioned programs.

Exhibit 4.1.6

Water Savings by Power Smart Program

	2013/14 Actual	2013/14 Total
	millions of litres	
RESIDENTIAL PROGRAMS		
Water & Energy Saver	6.6	798.2
Affordable Energy Program	80.0	76.4
COMMERCIAL PROGRAMS		
Commercial Clothes Washers	4.1	28.7
Commercial Kitchen Appliances	0.8	32.7
Commercial Rinse and Save	-	653.3
Power Smart Shops	-	9.7
DISCONTINUED/ COMPLETED PROGRAMS		
Residential Appliances Program	-	298.5
TOTAL	91.5	1,897.5

As well as water savings, the Power Smart programs have achieved additional non-energy benefits. To date, the Refrigerator Retirement Program has recycled over 2,100 metric tons of materials (metals, mercury, oil, etc.). By recycling these materials, future production of these materials has been avoided, nearly 10 metric tons of CFCs have been collected and destroyed and emissions have been reduced by more than 65,000 metric tons of C02e cumulatively. Another example is the Performance Optimization Program. This program reduces maintenance costs (approximately 30% reduction for air compressor projects) and increases production.

In addition to this, Power Smart programs have provided socio-economic benefits through job creation within the province. The Affordable Energy Program (two positions within the North End Community Renewal Corporation and Brandon Neighbourhood Renewal Corporation, plus local labour in First Nations communities, private contractors and social enterprise contractors); Refrigerator Retirement Program (as many as fifteen positions, depending on the season, including office staff, warehouse staff and drivers); Residential Earth Power Program and Commercial Geothermal Program (as a result of these programs, additional geothermal installers have been required in order to meet demand); Water & Energy Saver Program (three full-time office positions, as well as up to forty part-time installer positions, have been created at Ecofitt); Commercial Rinse & Save Program (numerous installer positions); and Power Smart Energy Manager Program (Power Smart Energy Manager positions created within school divisions) have all created additional jobs for Manitobans. Also, Power Smart programs yield increased tax dollars resulting from the wages associated with jobs created specifically for the programs.

Another example of how Power Smart Programs are creating opportunities for Manitobans is with their geothermal programs. To date, Manitoba Hydro has provided training for approximately forty-five members of the Ground Source Heat Pump Association, seventeen of which have received full installer accreditation.

4.2 DSM Support Programs & Cost-Recovery Programs

4.2.1 Annual Energy & Demand Savings from DSM Support Programs & Cost-Recovery Programs

Exhibits 4.2.1-A through 4.2.1-C provide an overview of the estimated electricity and natural gas savings achieved to 2013/14 through DSM support programs and cost-recovery programs, for those programs where energy savings can be reasonably measured or estimated using engineering calculations.

Exhibit 4.2.1 - A

Annual GW.h Savings - Electric DSM Support Programs & Cost-Recovery Programs

	2013/14 Actual	2013/14 Plan^	Total*	2027/28 Plan^
RESIDENTIAL				
Power Smart Residential PAYS Program	1.2	0.3	1.3	3.5
Power Smart Residential Loan	0.5	0.3	8.8	13.5
Residential Earth Power Loan	(0.1)	1.5	13.2	35.4
	1.6	2.1	23.3	52.4
COMMERCIAL				
Power Smart for Business PAYS Program	0.1	0.2	0.1	2.2
	0.1	0.2	0.1	2.2
DISCONTINUED/COMPLETED PROGRAMS	-	-	3.8	3.8
	-	-	3.8	3.8
TOTAL (at customer meter)	1.8	2.3	27.3	58.4
TOTAL (at generation)	2.0	2.6	31.1	66.6

^ Plan estimates are from the 2013 Power Smart Plan.
* Savings include actual + persisting results, up to and including 2013/14.
Note: Figures may not add due to rounding.

Exhibit 4.2.1 - B

Average Winter MW Savings - Electric DSM Support Programs & Cost-Recovery Programs

	2013/14 Actual	2013/14 Plan^	Total*	2027/28 Plan^
RESIDENTIAL				
Power Smart Residential PAYS Program	0.3	0.1	0.3	1.6
Power Smart Residential Loan	0.2	0.2	5.0	7.4
Residential Earth Power Loan	(0.0)	0.3	3.9	9.2
	0.6	0.7	9.2	18.2
COMMERCIAL				
Power Smart for Business PAYS Program	0.0	0.1	0.0	0.6
	0.0	0.1	0.0	0.6
DISCONTINUED/COMPLETED PROGRAMS	-	-	0.2	0.2
	-	-	0.2	0.2
TOTAL (at customer meter)	0.6	0.7	9.4	19.0
TOTAL (at generation)	0.7	0.8	10.7	21.6

^ Plan estimates are from the 2013 Power Smart Plan.
* Savings include actual + persisting results, up to and including 2013/14.
Note: Figures may not add due to rounding.

Exhibit 4.2.1 - C

Annual m^3 Savings - Natural Gas DSM Support Programs & Cost-Recovery Programs

	2013/14 Actual	2013/14 Plan^	Total*	2027/28 Plan^
		millions of cubic metres		
RESIDENTIAL				
Power Smart Residential Loan	0.3	0.3	15.2	20.0
Residential Earth Power Loan	0.2	0.1	2.9	4.4
Power Smart Residential PAYS Program	(0.0)	0.1	(0.0)	0.7
	0.5	0.5	18.1	25.1
COMMERCIAL				
Power Smart for Business PAYS Program	-	0.0	-	0.1
	-	0.0	-	0.1
DISCONTINUED/COMPLETED PROGRAMS	-	-	2.7	2.7
	-	-	2.7	2.7
TOTAL	0.5	0.5	20.8	27.9

^ Plan estimates are from the 2013 Power Smart Plan.
* Savings include actual + persisting results, up to and including 2013/14.
Note: Figures may not add due to rounding.

4.3 Energy Efficiency Codes & Standards

In addition to DSM activities, some utilities, including Manitoba Hydro, are actively involved in a number of provincial and national committees. These committees work with governments and equipment manufacturers to gain acceptance of higher efficiency levels for various technologies, and to encourage adoption of energy efficiency standards and regulations.

Manitoba Hydro prepares an annual forecast of the expected influence of codes and standards, and since 1995, this forecast has been used to adjust Manitoba Hydro's system load forecast.

In many cases, legislation and regulations are the most effective and permanent form of market transformation, as it ensures customers do not revert to less efficient technologies/practices once the incentives and/or promotional activities are discontinued. Traditionally, changing legislation can be complex when faced with lack of market acceptance. These changes impact building design and construction, as well as industry manufacturing processes, and therefore do not always receive strong industry support without preceding market intervention (i.e. legislation and regulations).

4.3.1 National Activities

Manitoba Hydro is a key player on the CSA Strategic Steering Committee on Performance, Energy Efficiency and Renewables (SCOPEER). This committee is responsible for changes to national performance standards and legislation which have resulted in the improvement of energy utilization of numerous appliances and technologies. For example, as a result of SCOPEER working with Canadian manufacturers, refrigerator manufacturers now market products which exceed the current minimum efficiency standards for inter-provincial exporting.

Beginning in September 2005, Manitoba Hydro chaired the newly-created Manitoba Energy Code Advisory Committee which was tasked to provide recommendations for the adoption, development and implementation of energy efficiency requirements for all new commercial construction (i.e. new buildings, additions to existing buildings and major renovations of existing buildings) in Manitoba. In the report *"Building Energy, Building Leadership"*, the Committee recommended Manitoba adopt the Model National Energy Code for Buildings (MNECB) in the following three stages: (1) Adopt the MNECB (1997) as a regulation under The Buildings and Mobile Homes Act, (2) Develop and adopt Manitoba Amendments to the MNECB by January 1, 2009, and (3) Support and participate in a national initiative to update the MNECB.

The Committee recommended that Manitoba adopt the energy code as a regulation under The Buildings and Mobile Homes Act, rather than as a regulation under The Energy Act because The Buildings and Mobile Homes Act supersedes all other provincial legislation with respect to requirements for buildings.

Further supporting the development of energy codes for buildings, Manitoba Hydro is a former chair of the Building Energy Codes Collaborative (BECC). BECC is a federal/provincial/territorial committee supported by the Council of Energy Ministers, the Assistant Deputy Minister Steering Committee on Energy Efficiency (ASCEE) and Natural Resources Canada. It consists of representatives from both the code ministries and the energy ministries of provinces and territories working together to advance energy efficiency in building codes. In 2007, BECC was successful in securing the political and financial support necessary to convince the Canadian Commission on Building and Fire Codes to update the MNECB. In November 2011, after years of work with a nationally represented committee, the revised document entitled, *"2011 National Energy Code of Canada for Buildings"*, was published. Currently, Manitoba, Ontario, Quebec and British Columbia are recognized as the most active, and have made the most progress with respect to implementing energy efficiency requirements in buildings.

4.3.2 Provincial Activities

Initially, an energy code for residential homes was proposed by the federal government and was to be adopted by the Province of Manitoba in 1997 as part of the building code. Due to a decline in new house starts and the perceived impact on building costs of a proposed Model National Energy Code for Houses (MNECH), it was anticipated that members of the new home construction industry would be reluctant to support the proposed MNECH. Recognizing this, Manitoba Hydro initiated and sponsored amendments to the insulation tables for new houses in the Manitoba building code as an interim measure to improve upon eroding insulation practices throughout Manitoba. The interim measures improved insulation practices in new housing north of the 53rd parallel. As anticipated, the MNECH was not adopted; however, Manitoba Hydro's amendments were introduced in Manitoba in November 1998 with the support of the new home construction industry.

In July 2006, the requirements under insulation tables for new houses in the Manitoba Building Code were simplified. Manitoba Hydro played a key role in ensuring that efficiency requirements were not significantly diluted. As a result, Manitoba's minimum requirements for insulation in new homes are the highest in Canada.

In September 2007, Manitoba Hydro presented research on the life cycle benefits of improved basement insulation to homeowners, and successfully convinced the Building Standards Board of Manitoba to request R20 in foundation walls for all homes in Manitoba.

As of January, 2010, The Manitoba Energy Act regulations state that all natural gas furnaces sold in Manitoba must be at least 92% annual fuel utilization efficiency (AFUE). Meanwhile, federal regulations require a minimum efficiency of only 90%. As a result, Manitoba Hydro's Natural Gas Furnace Program had a direct impact on market transformation in Manitoba. For this reason, the additional 2% in energy savings relative to the federal regulations have been claimed from all furnaces sold in Manitoba's residential and commercial market from January, 2010 forward.

Manitoba Hydro's most recent involvement with provincial codes was with the Manitoba amendments made to Part 9 (Residential) of the Building Code that came into effect December 1, 2010. The amendments stipulated minimum performance requirements for newly-constructed homes in the areas of insulation, windows, heating systems and plumbing fixtures. Manitoba Hydro played a key role in developing the recommendations through technical review of proposed efficiency levels, and perhaps even more critically, through preparing the industry for accepting the code recommendations by offering the Power Smart New Home Program. With the final approved efficiency levels consisting largely of the technologies which made up the Power Smart Gold standard, testament can be given to the importance of voluntary incentive-based programs in accelerating market acceptance and penetration of energy efficient technologies, thereby making the transition to building codes more seamless. With enforcement occurring for all building permits issued after December, 2010, savings related to the code amendment have been realized since 2011/12.

4.3.3 Annual Energy & Demand Savings Resulting from Energy Efficiency Codes & Standards

The following section outlines the estimated energy and demand savings resulting from codes and standards improvements in the Manitoba marketplace.

Savings resulting from future codes and standards are included in targeted cost-effectiveness metrics. However, savings due to codes and standards are not included in the calculation of cost-effectiveness metrics based on actual activity (i.e. savings due to codes and standards are not included in the Power Smart Annual Review metrics).

Exhibit 4.3.3-A

Savings Resulting from Energy Efficiency Codes & Standards

CODE CATEGORY & COMPONENTS	CODE & MANITOBA HYDRO'S INFLUENCE	SAVINGS (AT METER) 2013/14		SAVINGS (AT METER) Cumulative	
Residential Insulation	-Manitoba Building Code Regulation 4/2008 (Oct. 2008) increased minimum required level of insulation from R12 to R20	6.6	GW.h	29.1	GW.h
		3.6	MW	14.0	MW
		303,239	m^3	1,706,970	m^3
Residential Appliances: Ranges, dishwashers, clothes washers, clothes dryers, refrigerators, freezers	-Member of Strategic Steering Committee on Performance, Energy Efficiency & Renewables (SCOPEER) -Savings based on Energy Star efficiency improvements	27.9	GW.h	365.2	GW.h
		4.9	MW	74.7	MW
		-	m^3	3,847,338	m^3
Other Residential Equipment: Central air conditioning, electric hot water tanks, furnaces, attic insulation, windows, HRVs, efficient shower heads	-CSA Standard C191-00 (July 2004) for electric hot water tanks -CSA Standard C656-05 (Nov. 2006) for central air conditioning -MB Energy Act (Dec. 2009) states furnaces must be ≥92% AFUE (≥94% AFUE for new homes, 2010) -Manitoba Building Code Regulation 142/2010 (Dec. 2010) increased attic insulation from R40 to R50, and specified level of windows, HRVs and efficient shower heads -Manitoba Plumbing Code Regulation 32/2011 (March 2011)	19.3	GW.h	71.9	GW.h
		7.0	MW	21.1	MW
		2,441,713	m^3	10,022,236	m^3
Commercial Lighting: T12 lamps, LED exit signs, fluorescent ballasts	-Member of Strategic Lighting Initiative Committee (SLIC), etc. -National Energy Efficiency Act (1996): Increased min. efficiency requirement of T12 lamps from 40 to 34 watts -National Energy Efficiency Act (Nov. 2004): Min. efficiency requirements only met by LED exit signs -National Energy Efficiency Act (Nov. 2006): Increased min. efficiency requirement of fluorescent ballasts (new construction) -National Energy Efficiency Act (April 2010): Increased min. efficiency requirement of fluorescent ballasts (renovation)	12.2	GW.h	135.1	GW.h
		3.4	MW	37.8	MW
		-	m^3	-	m^3
Other Commercial Equipment: Furnaces	-MB Energy Act (Dec. 2009) states furnaces must be ≥92% AFUE	-	GW.h	-	GW.h
		-	MW	-	MW
		63,966	m^3	461,544	m^3
Industrial Equipment: High Efficiency Motors	-Member of Coordinated Utilities Approach (CUA) -Oct. 1997 code change (min. efficiency increased to 82.5-95.0%) -Last year of claimed savings was 2006/07	-	GW.h	16.2	GW.h
		-	MW	2.8	MW
		-	m^3	-	m^3
TOTAL		66.0	GW.h	617.5	GW.h
		18.8	MW	150.4	MW
		2,808,918	m^3	16,038,088	m^3

In 2013/14 alone, as a result of efforts to achieve energy savings through energy efficient codes and standards, approximately 66 GW.h and 19 MW of electric savings (at meter), and 3 million cubic metres of natural gas savings were achieved. This resulted in nearly 56 thousand tonnes of greenhouse gas emissions reduction.

Cumulatively, it is estimated that 618 GW.h and 150 MW of electric savings (at meter), and 16 million cubic metres of natural gas savings were achieved, resulting in 505 thousand tonnes of greenhouse gas emissions reduction in 2013/14.

Exhibit 4.3.3 - B
Efficiency Codes & Standards
Cumulative GW.h Savings Achieved
(at Meter)

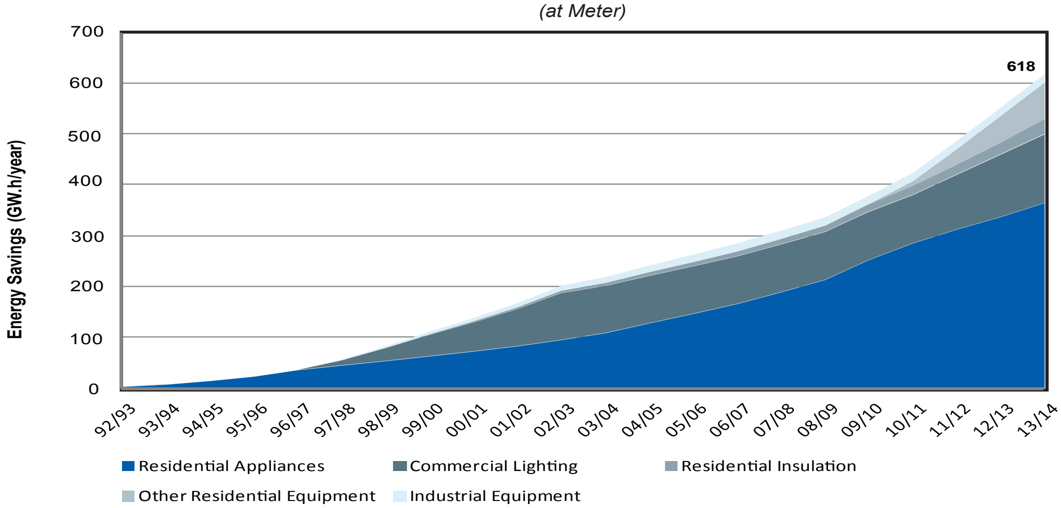


Exhibit 4.3.3 - C
Efficiency Codes & Standards
Cumulative MW Savings Achieved
(at Meter)

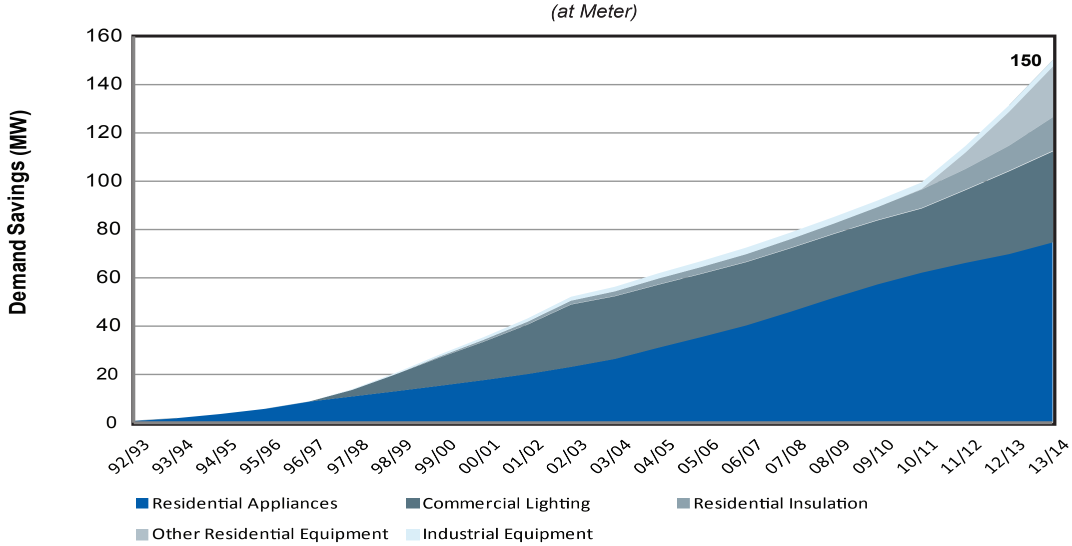
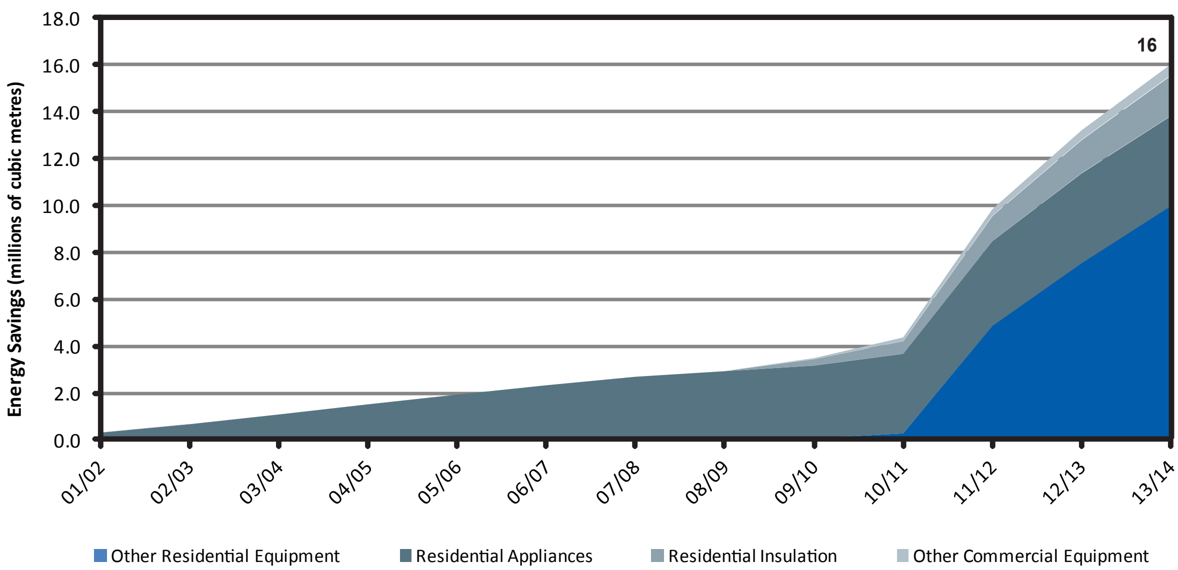


Exhibit 4.3.3 - D
Efficiency Codes & Standards
Cumulative Natural Gas Savings Achieved



Because there are many participants (utilities, governments, manufacturers, environmental groups, etc.) contributing to the formation of energy efficiency codes and standards, it is difficult to allocate specific credit for energy and demand savings among the various participants. For this reason, Manitoba Hydro only reports the estimated savings resulting from energy efficiency codes and standards. In the Power Smart Annual Review, the estimated savings from codes and standards are not included in the calculation of cost effectiveness metrics.

4.4 Incentive-Based Power Smart Programs

Power Smart incentive-based programs are designed to accelerate market awareness and acceptance of energy efficient technologies and practices.

4.4.1 Power Smart Electric Program Results

The following sections outline the Power Smart program results in terms of electric energy and demand savings and benefit/cost analyses.

4.4.1.1 Annual Energy Savings

Electric energy savings achieved by incentive-based Power Smart programs in 2013/14 is displayed by sector and program in Exhibits 4.4.1.1-A and B respectively.

Exhibit 4.4.1.1-B also provides cumulative electric energy savings achieved by incentive-based Power Smart programs.

Exhibit 4.4.1.1 - A
Percentage of Annual GW.h Savings
Electric Incentive Based Programs

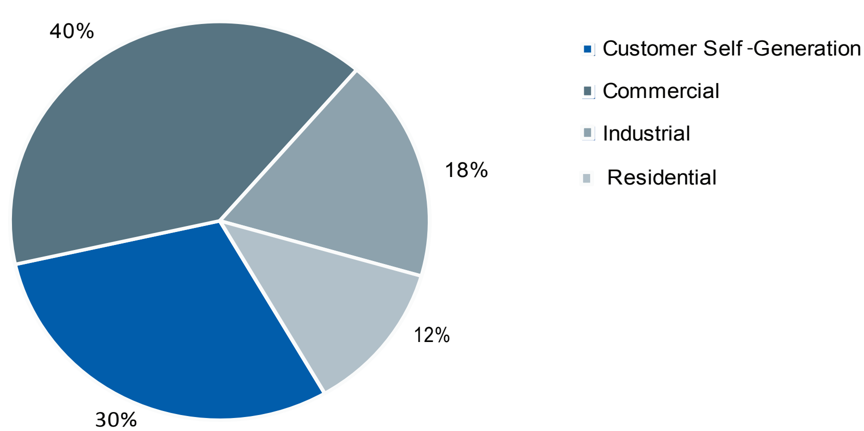


Exhibit 4.4.1.1 - B

Annual GW.h Savings - Electric Incentive-Based Programs

	2013/14 Actual	2013/14 Plan^	Total*	2027/28 Plan^
RESIDENTIAL				
Refrigerator Retirement	9.8	15.2	29.3	0.5
Home Insulation	4.5	3.1	49.4	55.4
Water & Energy Saver	3.1	2.9	15.7	18.4
Affordable Energy Program	2.5	2.4	11.8	14.6
Residential Discontinued/Completed Programs	-	-	172.6	155.0
	19.9	23.5	278.8	243.9
COMMERCIAL				
Commercial Lighting	32.7	22.3	341.7	485.4
Commercial Refrigeration	8.7	1.3	30.0	45.4
Commercial Building Envelope	8.6	3.5	38.1	52.1
Commercial Earth Power	4.9	1.6	34.8	55.3
Internal Retrofit	2.2	0.7	57.4	56.4
Commercial Building Optimization	1.9	0.7	2.9	14.2
Commercial New Buildings	1.6	11.7	8.1	88.2
Commercial HVAC - Chillers & CO2 Sensors	0.8	1.2	10.3	16.9
Commercial Network Energy Management	0.5	0.2	0.7	0.2
Commercial Custom Measures	0.4	0.9	21.3	35.3
Commercial Kitchen Appliances	0.0	0.6	0.8	1.1
LED Roadway Lighting Pilot	0.0	-	0.0	-
Commercial Discontinued/Completed Programs	2.6	1.7	130.9	134.9
	65.0	46.5	676.9	985.3
INDUSTRIAL				
Performance Optimization	29.6	12.9	471.4	635.3
Industrial Discontinued/Completed Programs	-	-	54.5	54.5
	29.6	12.9	525.9	689.8
EFFICIENCY PROGRAMS SUBTOTAL	114.5	82.9	1,481.6	1,919.1
CUSTOMER SELF-GENERATION PROGRAMS				
Bioenergy Optimization	48.7	13.0	99.3	114.1
	48.7	13.0	99.3	114.1
TOTAL (at customer meter)	163.2	95.9	1,581.0	2,033.1
TOTAL (at generation)	182.9	108.3	1,777.3	2,285.6

^ Plan estimates are from the 2013 Power Smart Plan.
* Savings include actual + persisting results, up to and including 2013/14.
Note: Figures may not add due to rounding.
Free driver participation is included in the above figures.

In 2013/14 alone, Power Smart electric incentive-based programs, including both efficiency-based programs and customer self-generation, surpassed plan by 67.3 GW.h. Efficiency-based programs were 31.6 GW.h and customer self-generation was 35.7 GW.h greater than planned.

The variances within Power Smart electric incentive-based programs in 2013/14 are highlighted below:

Residential:

The residential sector, which accounted for 12% of total GW.h savings in 2013/14, contributed 19.9 GW.h, falling short of its planned savings by 3.6 GW.h.

- The Refrigerator Retirement Program achieved 9.8 GW.h of savings, below target by 5.4 GW.h or 35%. This negative variance is the result of significantly lower participation than anticipated. As the program had been slated to end in 2013/14, a proposal was being developed to extend the program, increase the incentive and revise the marketing plan. Therefore, marketing efforts had been scaled back at the time, negativelty impacting participation.
- The Home Insulation Program saved 4.5 GW.h, 1.4 GW.h or 45% more than planned. This positive variance is the result of greater participation than anticipated, mainly resulting from electric free driver sales being 77% greater than planned. These are applicants who have applied to the program and completed their insulation upgrade; however, no rebate was provided to them as they did not meet the program's requirements.

Commercial:

The commercial sector, which accounted for 40% of savings in 2013/14, contributed 65.0 GW.h of savings, 18.5 GW.h more than planned.

- The Commercial Lighting Program achieved savings of 32.7 GW.h, or 46% more than anticipated. Several factors contributed to this positive variance including the installation of more efficient lighting than projected, completion of larger projects and participants with longer hours of operation.
- The Commercial Refrigeration Program achieved savings of 8.7 GW.h, exceeding planned savings by 7.4 GW.h. This positive variance was a result of a new vendor strongly promoting the program's technologies, as well as two large grocery chains with substantial participation in 2013/14.
- The Commercial New Buildings Program achieved 1.6 GW.h of savings, falling short of plan by 10.1 GW.h or 86%. The largest contributor to this variance (9.3 GW.h) was a building code that was to come into effect in 2013/14, but was ultimately rescheduled for December 2014.

Industrial:

- The industrial sector accounted for 18% of total GW.h savings in 2013/14, with 29.6 GW.h resulting from the Performance Optimization Program. Energy savings for the Performance Optimization Program were 16.7 GW.h more than planned due to greater per project savings than anticipated. In particular, one Performance Optimization Program participant upgraded their trim compressors, realizing over 11 GW.h in savings.

Customer Self-Generation:

- The Bioenergy Optimization Program accounted for 30% of total GW.h savings in 2013/14. The program achieved 48.7 GW.h of savings, 35.7 GW.h above plan due to a large unplanned participant.

4.4.1.2 Average Winter Peak Demand Savings

Demand savings achieved by electric incentive-based Power Smart programs in 2013/14 is displayed by sector and program in Exhibits 4.4.1.2-A and B respectively. Exhibit 4.4.1.2-B also provides cumulative demand savings achieved by electric incentive-based Power Smart programs. The demand savings are presented as an average of the winter AM and PM system peak savings.

Exhibit 4.4.1.2 - A
% of Average Winter MW Savings - Electric Incentive Based Programs

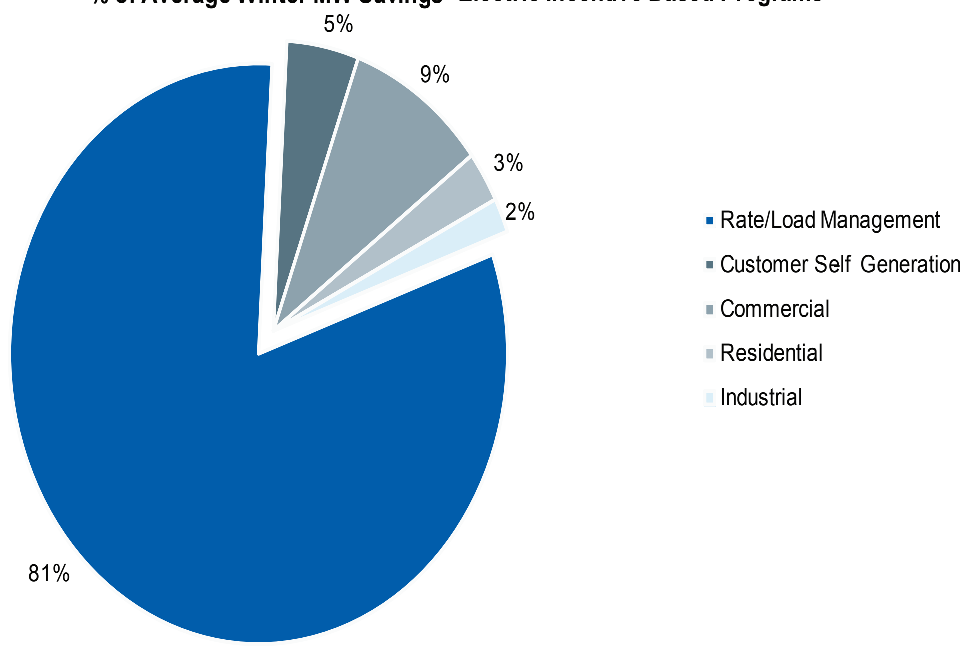


Exhibit 4.4.1.2 - B

Average Winter MW Savings - Electric Incentive-Based Programs

	2013/14 Actual	2013/14 Plan^	Total*	2027/28 Plan ^
RESIDENTIAL				
Home Insulation	2.4	1.7	24.5	27.7
Refrigerator Retirement	1.1	1.7	2.7	0.1
Affordable Energy Program	1.0	0.9	5.1	6.2
Water & Energy Saver	0.6	0.6	2.6	3.1
Residential Discontinued/Completed Programs	-	-	31.7	28.2
	5.1	4.9	66.7	65.4
COMMERCIAL				
Commercial Lighting	9.1	6.2	65.5	105.5
Commercial Building Envelope	3.4	1.4	16.4	22.0
Commercial Earth Power	1.2	0.4	13.6	18.5
Commercial Refrigeration	1.0	0.1	4.5	6.3
New Buildings Program	0.4	3.1	2.0	23.3
Commercial Building Optimization	0.4	0.1	0.4	2.9
Internal Retrofit	0.3	0.1	12.2	12.1
Commercial Network Energy Management	0.2	0.1	0.2	0.0
Commercial Custom Measures	0.1	0.2	1.8	5.5
Commercial Kitchen Appliances	0.0	0.6	0.2	0.3
Commercial HVAC - Chillers & CO2 Sensors	0.0	0.1	0.0	0.7
LED Roadway Lighting Pilot	0.0	-	0.0	-
Commercial Discontinued/ Completed Programs	0.4	0.2	18.8	19.4
	16.4	12.7	135.7	216.4
INDUSTRIAL				
Performance Optimization	3.4	2.0	91.0	117.9
Industrial Discontinued/Completed Programs	-	-	8.2	8.2
	3.4	2.0	99.2	126.1
EFFICIENCY PROGRAMS SUBTOTAL	25.0	19.6	301.5	407.8
CUSTOMER SELF-GENERATION PROGRAMS				
Bioenergy Optimization	8.4	1.5	14.2	13.1
	8.4	1.5	14.2	13.1
RATE/LOAD MANAGEMENT PROGRAMS				
Curtailable Rates	146.3	147.3	146.3	147.3
	146.3	147.3	146.3	147.3
TOTAL (at customer meter)	179.6	168.4	462.0	568.2
TOTAL (at generation)	198.5	186.0	516.3	636.3

^ Plan estimates are from the 2013 Power Smart Plan.

* Savings include actual + persisting results, up to and including 2013/14.

Note: Figures may not add due to rounding.

Free driver participation is included in the above figures.

For the Curtailable Rates Program, MW savings are assumed to be achieved when a customer signs a contract. Therefore, MW savings reported is the load available for curtailment.

In 2013/14 alone, Power Smart electric incentive-based programs, including both efficiency-based and customer self-generation programs, exceeded planned savings by 11.2 MW. By far, the greatest contributor of demand savings was the Curtailable Rates Program, which accounted for 81% of total MW savings.

The variances within Power Smart electric incentive-based programs in 2013/14 are highlighted below:

Residential:

The residential sector, which accounted for 3% of total demand savings in 2013/14, contributed 5.1 MW, exceeding its planned savings by 0.3 MW.

- The Home Insulation Program exceeded planned demand savings by 0.8 MW or 45%. The positive variance is the result of greater participation than anticipated, due to the previously mentioned increase in free driver sales.
- The Refrigerator Retirement Program fell short of planned demand savings by 0.6 MW or 35%. This negative variance is the result of significantly lower participation than anticipated. As the program has been slated to end in 2013/14, a proposal was being developed to extend the program, increase the incentive and revise the marketing plan. Therefore, marketing efforts has been scaled back at the time, negatively impacting participation.

Commercial:

The commercial sector, which accounted for 9% of total demand savings in 2013/14, contributed 16.4 MW of savings, 3.7 MW above target.

- The Commercial Lighting Program achieved 9.1 MW of demand savings, exceeding its planned demand savings of 6.2 MW. This positive variance was a result of participants installing more efficient lighting than projected, and the completion of larger projects than expected.
- The Commercial Refrigeration Program achieved demand savings of 1.0 MW, exceeding its target by 0.8 MW. The positive variance was a result of a new vendor strongly promoting the program's technologies, as well as two large grocery chains with substantial participation in 2013/14.

Industrial:

- The industrial sector accounted for 2% of total demand savings in 2013/14, with 3.4 MW resulting from the Performance Optimization Program. Demand savings for the Performance Optimization Program were 1.4 MW greater than planned due to greater per project savings than anticipated. In particular, on Performance Optimization Program participant upgraded their trim compressors, achieving significant demand savings.

Customer Self-Generation:

- The Bioenergy Optimization Program contributed 8.4 MW in demand savings, surpassing plan by 6.9 MW. Demand savings were greater than planned due to a large unplanned participant.

Rate/Load Management:

- The Curtailable Rates Program, which accounted for 81% of total demand savings in 2013/14, contributed 146.3 MW of savings, 1.0 MW less than planned. For further details, please see APPENDIX E - "Curtailable Rates Program Information & Methodology".

4.4.1.3 Electric Total Resource Cost - Benefit/Cost Analysis

Exhibits 4.4.1.3-A and B show the electric benefit/cost analysis results under the total resource cost (TRC) metric by program. The calculation of the benefit/cost ratio was based on a 30-year evaluation period. Refer to APPENDIX B - 'Explanation of Benefit/Cost Ratios used in DSM Economic Metrics' for formulas and criteria used to determine cost-effectiveness.

Exhibit 4.4.1.3 - A
2013/14 TRC - Electric Incentive-Based Programs

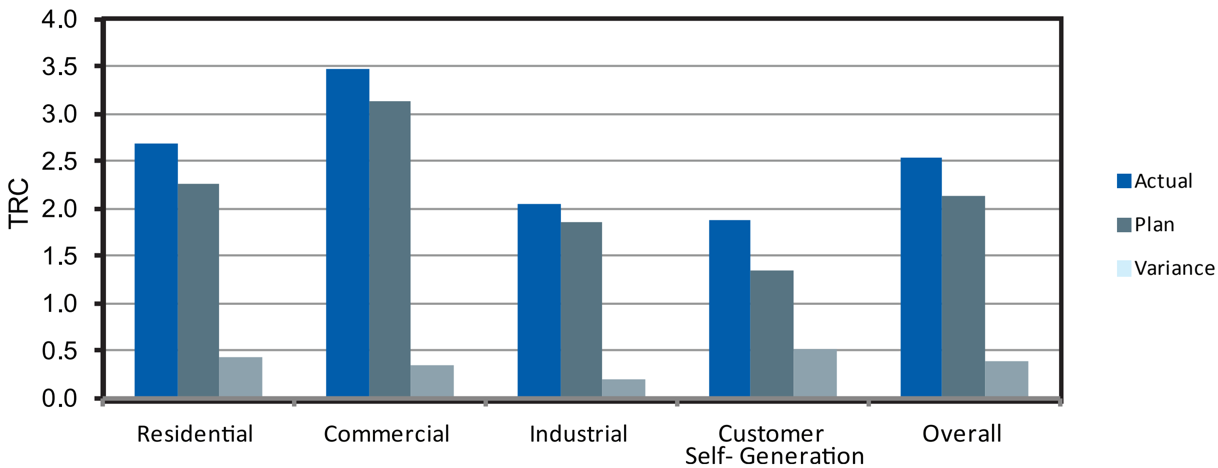


Exhibit 4.4.1.3 - B

Total Resource Cost Benefit/Cost Analysis - Electric Incentive-Based Programs

	2013/14 Actual	2013/14 Plan^^	Total**	2027/28 Plan^^
		TRC		
RESIDENTIAL				
Water & Energy Saver †	10.5	4.4	17.2	4.5
Home Insulation	5.1	4.3	5.0	4.3
Affordable Energy Program* †	3.2	1.4	1.8	1.5
Refrigerator Retirement	1.3	1.6	1.8	1.6
Community Geothermal	0.7	-	0.7	-
	2.7	2.3	3.9	2.6
COMMERCIAL				
Commercial Building Envelope	8.2	4.3	5.2	3.6
Commercial Building Optimization	5.9	2.9	1.4	4.0
Commercial Lighting	3.5	2.2	2.6	2.3
Commercial Refrigeration	2.9	1.6	3.7	2.2
Commercial Kitchen Appliances †	2.7	22.4	4.7	21.3
Internal Retrofit**	2.6	1.2	2.1	1.1
Commercial Network Energy Management	2.5	1.2	0.8	1.8
Commercial Earth Power	2.1	1.6	2.0	1.6
Commercial HVAC - Chillers & CO2 Sensors	1.9	3.1	2.3	3.8
Commercial New Buildings	1.8	10.7	4.4	7.8
Commercial Custom Measures	1.7	1.7	1.7	1.8
	3.5	3.1	2.6	2.9
INDUSTRIAL				
Performance Optimization	2.1	1.9	3.2	2.3
	2.1	1.9	3.2	2.3
DISCONTINUED/COMPLETED PROGRAMS †	6.5	-	2.6	-
	6.5	-	2.6	-
CUSTOMER SELF-GENERATION PROGRAMS				
Bioenergy Optimization	1.9	1.3	2.2	1.4
	1.9	1.3	2.2	1.4
OVERALL: PROGRAM COSTS	2.8	2.4	2.8	2.5
OVERALL: PROGRAM COSTS + SUPPORT COSTS^	2.5	2.1	2.4	2.0

* Includes all Affordable Energy Fund expenditures and external funding.
** "Total" values represent the results of the program/portfolio since its inception.
† Includes water savings benefits.
^ Support costs contain DSM support programs, basic information services and program support costs.
^^ Plan estimates are from the 2013 Power Smart Plan.
Note: Free driver participation is included in the above figures.

4.4.1.4 Electric Rate Impact Measure - Benefit/Cost Analysis

Exhibits 4.4.1.4-A and B identify the electric benefit/cost ratios under the rate impact measure (RIM) metric by program. The calculation of the benefit/cost ratio is based on a 30-year evaluation period. Refer to APPENDIX B - 'Explanation of Benefit/Cost Ratios used in DSM Economic Metrics' for formulas and criteria used to determine cost-effectiveness.

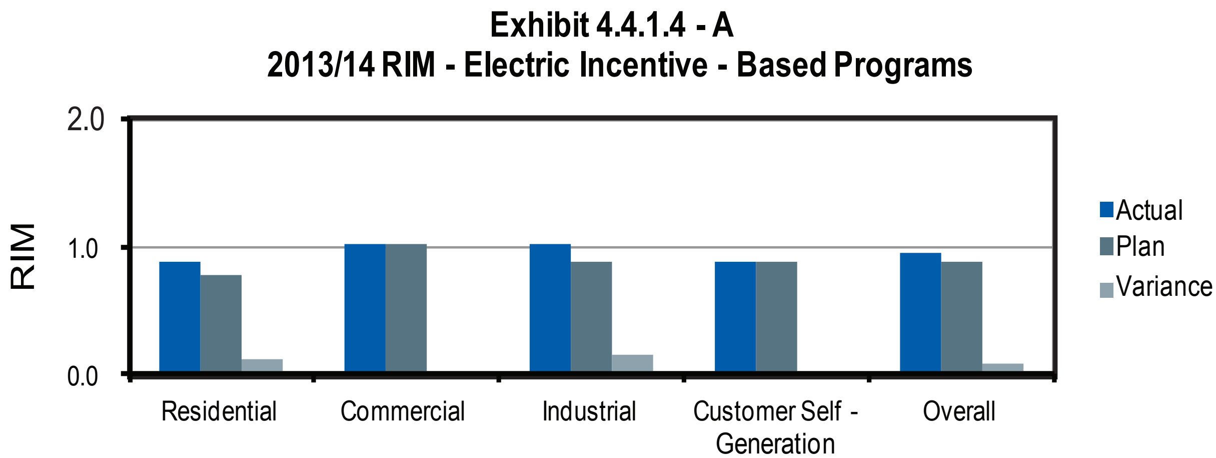


Exhibit 4.4.1.4 - B

Rate Impact Cost Benefit/Cost Analysis - Electric Incentive-Based Programs

	2013/14 Actual	2013/14 Plan^^	Total*	2027/28 Plan^^
		RIM		
RESIDENTIAL				
Home Insulation	1.3	1.2	1.5	1.2
Affordable Energy Program**	0.9	0.9	0.9	0.9
Water & Energy Saver	0.8	0.7	1.0	0.7
Community Geothermal	0.7	-	0.7	-
Refrigerator Retirement	0.6	0.6	0.7	0.6
	0.9	0.8	1.2	0.9
COMMERCIAL				
Internal Retrofit	2.6	1.2	2.1	1.1
Commercial Custom Measures	1.5	1.1	1.3	1.2
Commercial Building Envelope	1.4	1.2	1.5	1.1
Commercial Earth Power	1.3	1.1	1.6	1.1
Commercial New Buildings	1.3	1.4	1.4	1.4
Commercial Kitchen Appliances	1.0	1.6	1.0	1.4
Commercial Building Optimization	1.0	0.9	0.7	1.0
Commercial Lighting	0.9	0.8	1.0	0.8
Commercial Refrigeration	0.9	0.7	1.1	0.8
Commercial Network Energy Management	0.9	0.7	0.5	1.0
Commercial HVAC - Chillers & CO2 Sensors	0.5	0.6	1.0	0.7
	1.0	1.0	1.2	1.0
INDUSTRIAL				
Performance Optimization	1.0	0.9	1.3	1.0
	1.0	0.9	1.3	1.0
DISCONTINUED/COMPLETED PROGRAMS	1.0	-	0.9	-
	1.0	-	0.9	-
CUSTOMER SELF-GENERATION PROGRAMS				
Bioenergy Optimization	0.9	0.9	1.3	0.9
	0.9	0.9	1.3	0.9
OVERALL PROGRAM COSTS	1.0	0.9	1.2	1.0
OVERALL PROGRAM COSTS + SUPPORT COSTS^	0.9	0.9	1.1	0.9

* "Total" values represent the results of the program/portfolio since its inception.
** Includes all Affordable Energy Fund expenditures, excluding external funding.
^ Support costs contain DSM support programs, basic information services and program support costs.
^^ Plan estimates are from the 2013 Power Smart Plan.
Note: Benefit/Cost analysis is not calculated for rate/load management programs.
Free driver participation is included in the above figures.

4.4.1.5 Electric Average Levelized Utility Cost - ¢/kW.h Saved

Exhibits 4.4.1.5-A and B highlight the average levelized utility cost of 2013/14 electric incentive-based programs in ¢/kW.h saved. The calculation of ¢/kW.h saved is based upon current program kW.h savings at generation over a 30-year evaluation period. Refer to APPENDIX B - 'Explanation of Benefit/Cost Ratios used in DSM Economic Metrics' for formulas and criteria used to determine cost-effectiveness. The utility costs presented do not include costs associated with DSM support programs, standards activities or the customer costs of DSM measures.

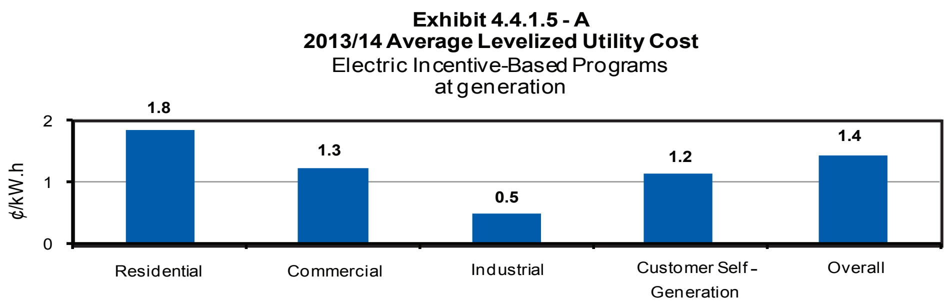


Exhibit 4.4.1.5 - B

Average Levelized Utility Cost at Generation - ¢/kW.h Saved by Power Smart Programs

	2013/14 Actual	2013/14 Total**	2027/28 Plan^^
		LUC (¢/kW.h)	
RESIDENTIAL			
Community Geothermal	3.5	3.5	-
Affordable Energy Program*	2.9	4.5	3.5
Refrigerator Retirement	1.7	1.7	1.5
Home Insulation	1.5	2.3	2.2
Water & Energy Saver	1.2	1.1	2.3
Discontinued/Completed Programs	-	-	-
	1.8	1.8	2.3
COMMERCIAL			
Commercial New Buildings**	2.3	1.4	0.5
Commercial Network Energy Management	2.2	8.8	1.6
Internal Retrofit	2.2	3.7	4.4
Commercial Kitchen Appliances	2.0	3.7	1.2
Commercial Lighting	1.8	1.7	2.5
Commercial HVAC - Chillers & CO2 Sensors	1.5	1.5	1.1
Commercial Building Envelope	1.0	2.0	2.4
Commercial Building Optimization	0.8	2.9	1.2
Commercial Refrigeration	0.6	0.9	1.4
Commercial Custom Measures	0.3	0.9	1.9
Commercial Earth Power	0.2	1.2	1.5
Discontinued/Completed Programs	0.2	1.8	-
	1.3	1.8	1.7
INDUSTRIAL			
Performance Optimization	0.5	0.5	1.5
Discontinued/Completed Programs	-	1.3	-
	0.5	0.7	1.5
CUSTOMER SELF-GENERATION PROGRAMS			
Bioenergy Optimization	1.2	1.0	1.5
	1.2	1.0	1.5
OVERALL: PROGRAM COSTS	1.1	1.3	1.7
OVERALL: PROGRAM COSTS + SUPPORT COSTS^	1.4	1.7	2.5

* Includes all Affordable Energy Fund expenditures, excluding external funding.
** "Total" values represent the results of the program/portfolio since its inception.
^ Support costs contain DSM support programs, basic information services and program support costs.
^^ Plan estimates are from the 2013 Power Smart Plan.
Note: Average levelized utility cost analysis is not provided for rate/load management programs.
Free driver participation is included in the above figures.

4.4.1.6 Electric Levelized Resource Cost- ¢/kW.h Saved

Exhibits 4.4.1.6-A and B highlight the average levelized resource cost of 2013/14 electric incentive-based programs in ¢/kW.h saved. The calculation of ¢/kW.h saved is based upon current program kW.h savings at generation over a 30-year evaluation period. Refer to APPENDIX B - 'Explanation of Benefit/Cost Ratios used in DSM Economic Metrics' for formulas and criteria used to determine cost-effectiveness. The resource costs presented do not include costs associated with DSM support programs or standards activities, however they do include DSM measures.

Exhibit 4.4.1.6 - A
2013/14 Average Levelized Resource Cost at generation

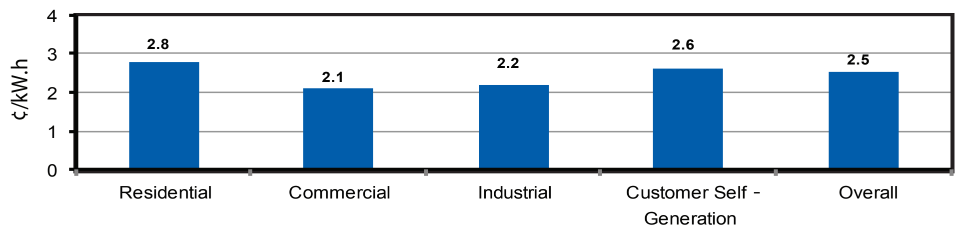


Exhibit 4.4.1.6 - B

Average Levelized Resource Cost at Generation - ¢/kW.h Saved by Power Smart Programs

	2013/14 Actual	2013/14 Total**	2027/28 Plan^^
		LRC(¢/kW.h)	
RESIDENTIAL			
Community Geothermal	11.0	11.0	-
Affordable Energy Program*	3.1	7.7	6.7
Refrigerator Retirement	2.8	2.8	3.0
Home Insulation	2.3	2.9	2.8
Water & Energy Saver	0.6	1.0	2.3
Discontinued/ Completed Programs	-	3.0	-
	2.8	3.1	3.6
COMMERCIAL			
Commercial Kitchen Appliances	5.7	4.8	1.8
Commercial New Buildings**	4.9	2.1	1.1
Commercial Custom Measures	4.8	3.5	4.9
Commercial Earth Power	3.5	5.5	5.5
Commercial Network Energy Management	3.0	9.4	4.8
Commercial Lighting	2.1	2.6	3.6
Commercial HVAC - Chillers & CO2 Sensors	2.1	2.7	1.4
Internal Retrofit***	1.9	3.7	4.4
Commercial Refrigeration	1.8	2.0	2.7
Commercial Building Envelope	1.2	2.6	2.9
Commercial Building Optimization	1.1	4.9	1.9
Discontinued/ Completed Programs	0.9	2.1	-
	2.1	2.8	2.9
INDUSTRIAL			
Performance Optimization	2.2	1.8	3.0
Discontinued/ Completed Programs	-	2.2	-
	2.2	1.9	3.0
CUSTOMER SELF-GENERATION PROGRAMS			
Bioenergy Optimization	2.6	3.2	4.2
	2.6	3.2	4.2
OVERALL: PROGRAM COSTS	2.3	2.5	3.1
OVERALL: PROGRAM COSTS + SUPPORT COSTS^	2.5	2.9	3.9

* Includes all Affordable Energy Fund expenditures, excluding external funding.
** “Total” values represent the results of the program/portfolio since its inception.
^ Support costs contain DSM support programs, basic information services and program support costs.
^^ Plan estimates are from the 2013 Power Smart Plan.
Note: Average levelized resource cost analysis is not provided for rate/load management programs.
Free driver participation is included in the above figures.

4.4.2 Power Smart Natural Gas Program Results

The following sections outline the Power Smart program results in terms of natural gas energy savings, and benefit/cost analyses.

4.4.2.1 Annual Natural Gas Energy Savings

Natural gas energy savings achieved by incentive-based Power Smart programs in 2013/14 is displayed by sector and program in Exhibits 4.4.2.1-A and B respectively.

Exhibit 4.4.2.1-B also provides cumulative natural gas energy savings achieved by incentive-based Power Smart programs.

Exhibit 4.4.2.1 - A
Percentage of Annual Natural Gas Savings
Incentive Based Programs

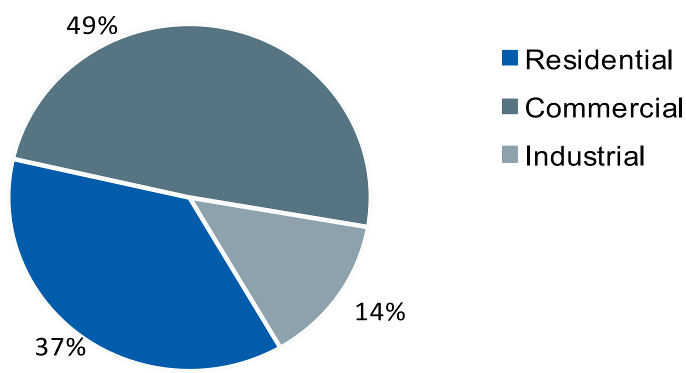


Exhibit 4.4.2.1 - B

Annual Natural Gas Savings - Incentive-Based Programs

	2013/14 Actual	2013/14 Plan^	Total*	2027/28 Plan^
		millions of cubic metres		
RESIDENTIAL				
Affordable Energy Program	1.1	1.2	5.8	6.9
Home Insulation	0.7	1.0	12.0	15.1
Water & Energy Saver	0.6	0.8	3.4	4.4
Residential Discontinued/Completed Programs	-	-	7.7	7.7
	2.5	3.0	28.8	34.1
COMMERCIAL				
Commercial Building Envelope	1.7	1.3	11.1	16.7
Commercial HVAC	1.2	0.4	9.7	12.0
Commercial Building Optimization	0.2	0.2	0.6	3.7
Commercial Custom Measures	0.1	0.1	1.5	3.5
Commercial New Buildings	0.1	0.8	2.9	8.5
Commercial Kitchen Appliances	0.0	0.2	0.1	0.2
Commercial Discontinued/Completed Programs	-	0.0	0.9	0.9
	3.3	3.0	26.6	45.4
INDUSTRIAL				
Natural Gas Optimization	0.9	1.6	13.4	18.9
Industrial Discontinued/Completed	-	-	-	-
	0.9	1.6	13.4	18.9
EFFICIENCY PROGRAMS SUBTOTAL	6.6	7.5	68.8	98.4
CUSTOMER SELF-GENERATION PROGRAMS				
Bioenergy Optimization	-	0.6	-	1.5
	-	0.6	-	1.5
INTERACTIVE EFFECTS SUBTOTAL	(0.9)	(1.1)	(13.0)	(12.1)
NET IMPACT OVERALL	5.8	7.1	55.9	87.8

^ Plan estimates are from the 2013 Power Smart Plan.

* Savings include actual + persisting results, up to and including 2013/14.

Note: Figures may not add due to rounding.
Free driver participation is included in the above figures.

In 2013/14, Power Smart natural gas incentive-based programs, including both efficiency-based and customer self-generation programs, fell below plan by 1.3 million cubic metres.

The variances within Power Smart natural gas incentive-based programs in 2013/14 are highlighted below:

Residential:

The residential sector, which contributed 2.5 million cubic metres in savings, accounted for 38% of total savings in 2013/14, falling below planned savings by 0.5 million cubic metres.

- The Home Insulation Program contributed 0.7 million cubic metres of savings, 30% below plan. This negative variance can be attributed in part to the ecoENERGY Program ending in June 2012. This resulted in a significant decrease in natural gas-based participation due to the elimination of the ecoENERGY grant. As the ecoENERGY Program was not as prevalent in rural/electric areas, the Home Insulation Program's electric participation was not negatively impacted.

- The Water and Energy Saver Program achieved 0.6 million cubic metres in savings, falling short of plan by 22%. This negative variance is due to lower than anticipated participation by customers with natural gas water heating.

Commercial:

The commercial sector, contributed 3.3 million cubic metres of savings. It accounted for 50% of total savings in 2013/14, surpassing planned savings by 0.3 million cubic metres.

- The Commercial HVAC Program achieved savings of 1.2 million cubic metres, surpassing plan by 0.9 million cubic metres. The variance is mainly due to boiler sales being 60% greater than projected for 2013/14.

- The Commercial Building Envelope Program (Windows and Insulation) achieved 1.7 million cubic metres of savings, exceeding plan by 0.4 million cubic metres or 32%. Annual energy savings were much higher than planned due to incremental program sales being 28% greater than plan. Also, higher energy savings per square foot were achieved. A greater number of insulation projects with lower starting insulation levels participated in the program, positively affecting energy savings. Projects are required to meet the program's minimum insulation levels; however, in many cases, projects went over and above the required levels, resulting in additional energy savings. As well, further energy savings were achieved as a result of projects including higher performance windows than anticipated.

Industrial:

- The Natural Gas Optimization Program contributed 0.9 million cubic metres of natural gas savings, 42% less than planned. This negative variance can be attributed to several projects whose completion was delayed past the end of the 2013/14 fiscal year.

Customer Self-Generation:

- Although in 2013/14, the Bioenergy Optimization Program planned for approximately 10% of its projects to be natural gas-based, none occurred. This is likely due to the fact that their participants are typically located within rural areas, and more commonly electric-based.

Some electric Power Smart programs result in an increase or decrease in natural gas consumption, referred to as interactive effects. For example, a more energy efficient lighting system emits less heat, requiring more energy to heat the space. In cases where the heat is produced through electric heating sources, interactive effects are taken into account when calculating the anticipated electricity savings that will result from the program. In cases where the heat is produced through natural gas heating systems, the interactive effects are taken into account when determining the natural gas savings. These interactive effects represent the increase in natural gas consumption in natural gas-heated homes resulting from the installation of energy efficient lighting systems.

In 2013/14, interactive effects increased consumption by 0.9 million cubic metres, reducing incentive-based natural gas savings to 5.8 million cubic metres. Interactive effects were lower than planned by 0.2 million cubic metres.

4.4.2.2 Natural Gas Total Resource Cost - Benefit/Cost Analysis

Exhibits 4.4.2.2-A and B show the natural gas benefit/cost analysis results under the total resource cost (TRC) metric by program. The calculation of the benefit/cost ratio was based on a 30-year evaluation period. Refer to APPENDIX B - 'Explanation of Benefit/Cost Ratios Used in DSM Economic Metrics' for formulas and criteria used to determine cost-effectiveness.

Exhibit 4.4.2.2 - A
2013/14 TRC - Natural Gas Incentive- Based Programs

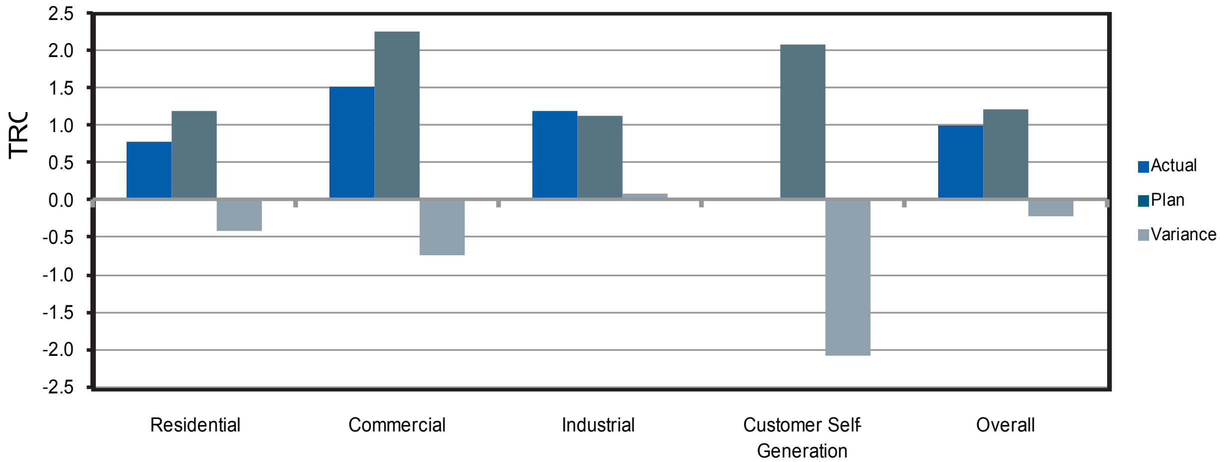


Exhibit 4.4.2.2 - B

Total Resource Cost Benefit/Cost Analysis - Natural Gas Incentive-Based Program

	2013/14 Actual	2013/14 Plan^^	Total**	2027/28 Plan^^
		TRC		
RESIDENTIAL				
Water & Energy Saver †	2.2	5.9	3.1	5.8
Home Insulation	1.1	1.4	1.7	1.4
Affordable Energy Program* †	0.5	0.5	0.6	0.6
	0.8	1.2	1.2	1.1
COMMERCIAL				
Commercial Building Optimization	1.9	1.1	1.0	1.5
Commercial Building Envelope	1.8	1.8	2.3	1.8
Commercial HVAC	1.4	1.2	2.8	1.8
Commercial Custom Measures	0.7	1.2	1.2	1.4
Commercial New Buildings	0.6	4.3	3.3	3.1
Commercial Kitchen Appliances †	0.4	15.3	1.1	6.5
	1.5	2.3	2.4	2.1
INDUSTRIAL				
Industrial Natural Gas Optimization	1.2	1.1	1.8	1.1
	1.2	1.1	1.9	1.1
DISCONTINUED/COMPLETED PROGRAMS †	-	-	1.6	-
	-	-	1.6	-
CUSTOMER SELF-GENERATION PROGRAMS				
Bioenergy Optimization	-	2.1	-	2.0
	-	2.1	-	2.0
OVERALL: PROGRAM COSTS	1.0	1.4	1.5	1.5
OVERALL: PROGRAM COSTS + SUPPORT COSTS^	1.0	1.2	1.4	1.1

* Includes all Affordable Energy Fund and Furnace Replacement Budget, as well as external funding.
** "Total" values represent the results of the program/portfolio since its inception.
† Water savings are included in the "2013/14 Plan" and "2027/28 Plan" values.
^ Support costs contain DSM support programs, basic information services and program support costs.
^^ Plan estimates are from the 2013 Power Smart Plan.
Note: Increased or decreased natural gas benefits resulting from electric incentive-based programs have been included in the overall calculation. Free driver participation is included in the above figures.

4.4.2.3 Natural Gas Rate Impact Measure - Benefit/Cost Analysis

Exhibits 4.4.2.3-A and B identify the benefit/cost ratios under the rate impact measure (RIM) metric. The calculation of the benefit/cost ratio is based on a 30-year evaluation period. Refer to APPENDIX B - 'Explanation of Benefit/Cost Ratios Used in DSM Economic Metrics' for formulas and criteria used to determine cost-effectiveness.

Exhibit 4.4.2.3 - A
2013/14 RIM - Natural Gas Incentive - Based Programs

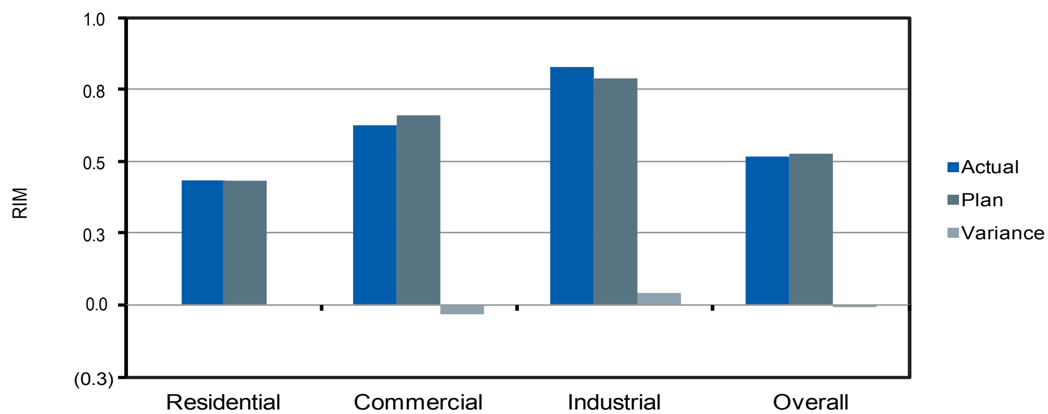


Exhibit 4.4.2.3 - B

Rate Impact Cost Benefit/Cost Analysis - Natural Gas Incentive-Based Programs

	2013/14 Actual	2013/14 Plan^^	Total*	2027/28 Plan^^
		RIM		
RESIDENTIAL				
Water & Energy Saver	0.6	0.6	0.6	0.6
Home Insulation	0.6	0.6	0.7	0.6
Affordable Energy Program**	0.3	0.3	0.4	0.3
	0.4	0.4	0.6	0.4
COMMERCIAL				
Commercial HVAC	0.7	0.6	0.8	0.8
Commercial Building Optimization	0.6	0.6	0.5	0.6
Commercial Building Envelope	0.6	0.6	0.7	0.6
Commercial Custom Measures	0.5	0.7	0.7	0.7
Commercial Kitchen Appliances	0.5	0.7	0.5	0.7
Commercial New Buildings	0.5	0.8	0.8	0.8
Internal Retrofit	-	-	-	-
	0.6	0.7	0.7	0.7
INDUSTRIAL				
Natural Gas Optimization	0.8	0.8	0.9	0.8
	0.8	0.8	0.9	0.8
DISCONTINUED/COMPLETED PROGRAMS	-	-	0.7	-
	-	-	0.7	-
CUSTOMER SELF-GENERATION				
Bioenergy Optimization	-	0.8	-	0.8
	-	0.8	-	0.8
OVERALL: PROGRAM COSTS	1.1	0.6	1.3	0.6
OVERALL: PROGRAM COSTS incl. INTERACTIVE EFFECTS	0.5	0.6	0.7	0.6
OVERALL: PROGRAM COSTS + SUPPORT COSTS incl. INTERACTIVE EFFECTS^	0.5	0.5	0.7	0.5

^ Support costs contain DSM support programs, basic information services and program support costs.

^^ Plan estimates are from the 2013 Power Smart Plan.

* "Total" values represent the results of the program/portfolio since its inception.

** Includes all apportioned Affordable Energy Fund and Furnace Replacement Program expenditures, excluding external funding. AEP's 'Actual' RIM, including apportioned Affordable Energy Fund without the Furnace Replacement Program was 0.36. AEP's "Actual' RIM, with the Furnace Replacement Program only was 0.18.

Note: Free driver participation is included in the above figures.

4.4.2.4 Natural Gas Average Levelized Utility Cost - ¢/m³ Saved

Exhibits 4.4.2.4-A and B highlight the average levelized utility cost of 2013/14 natural gas incentive-based programs in ¢/m³ saved. The calculation of ¢/m³ saved is based upon current program natural gas savings over a 30-year evaluation period. Refer to APPENDIX B - 'Explanation of Benefit/Cost Ratios used in DSM Economic Metrics' for formulas and criteria used to determine cost-effectiveness. The utility costs presented do not include costs associated with future Power Smart incentive-based programs, DSM support programs, standards activities or the customer costs of DSM measures.

Exhibit 4.4.2.4 - A
2013/14 Average Levelized Utility Cost (¢/m³)
Natural Gas Incentive-Based Programs

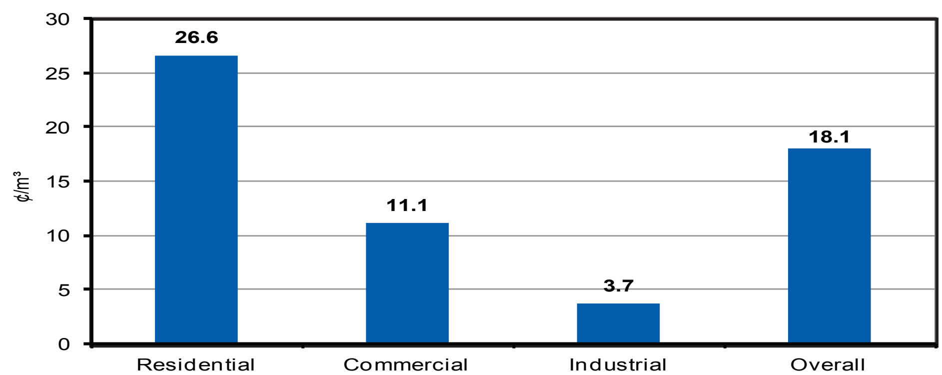


Exhibit 4.4.2.4 - B

Average Levelized Utility Cost - ¢/m³ Saved by Power Smart Programs

	2013/14 Actual	2013/14 Total**	2027/28 Plan^^
		LUC(¢/m³)	
RESIDENTIAL			
Affordable Energy Program*	50.0	45.2	55.3
Water & Energy Saver	12.3	10.6	10.1
Home Insulation	11.2	10.8	11.3
	26.6	17.5	26.9
COMMERCIAL			
Commercial New Buildings	22.6	5.1	5.0
Commercial Custom Measures	20.3	6.8	8.6
Commercial Kitchen Appliances	17.0	24.5	5.9
Commercial Building Envelope	12.4	11.1	11.9
Commercial Building Optimization	9.8	35.2	12.2
Commercial HVAC	8.0	6.7	4.0
Internal Retrofit Program	-	-	-
	11.1	8.8	8.2
INDUSTRIAL			
Natural Gas Optimization	3.7	2.7	5.1
	3.7	2.7	5.1
CUSTOMER SELF-GENERATION PROGRAMS			
Bioenergy Optimization	-	-	3.9
DISCONTINUED/COMPLETED PROGRAMS	-	8.5	-
OVERALL: PROGRAM COSTS	15.0	10.3	12.6
OVERALL: PROGRAM COSTS incl. INTERACTIVE EFFECTS†	16.7	11.5	13.1
OVERALL: PROGRAM COSTS + SUPPORT COSTS incl. INTERACTIVE EFFECTS^	18.1	14.2	19.0

* Includes all apportioned Affordable Energy Fund and Furnace Replacement Program expenditures, excluding external funding. AEP's 'Actual' levelized utility cost, including apportioned Affordable Energy Fund, without the Furnace Replacement Program was 37.9 ¢/m³. AEP's 'Actual' levelized utility cost with the Furnace Replacement Program only was 100.0 ¢/m³.

** "Total" values represent the results of the program/portfolio since its inception.

^ Support costs contain DSM support programs, basic information services and program support costs.

^^ Plan estimates are from the 2013 Power Smart Plan.

Note: Free driver participation is included in the above figures.

4.4.2.5 Natural Gas Levelized Resource Cost- ¢/m³ Saved

Exhibits 4.4.2.5-A and B highlight the average levelized resource cost of 2013/14 natural gas incentive-based programs in ¢/m^3. The calculation of ¢/m^3 saved was based upon current program natural gas savings over a 30-year evaluation period. Refer to APPENDIX B - 'Explanation of Benefit/Cost Ratios used in DSM Economic Metrics' for formulas and criteria used to determine cost-effectiveness. The resource costs presented do not include costs associated with future Power Smart incentive-based programs, DSM support programs or standards activities, however they do include the customer costs of DSM measures.

Exhibit 4.4.2.5 - A
2013/14 Levelized Resource Cost (¢/m³)
Natural Gas Incentive-Based Programs

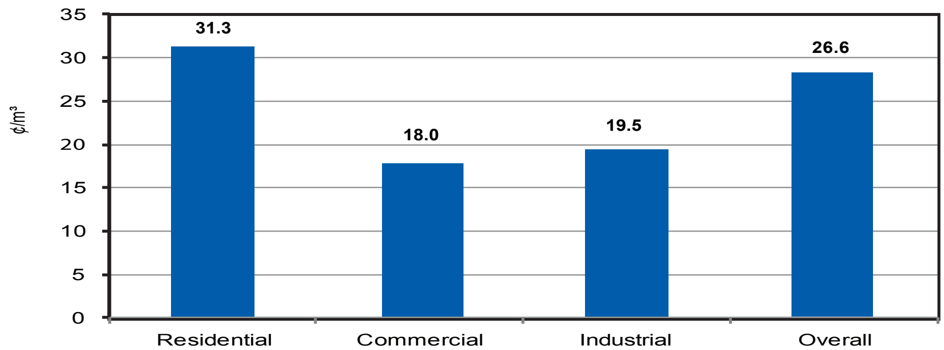


Exhibit 4.4.2.5 - B

Natural Gas Levelized Resource Cost - ¢/m³ Saved by Power Smart Programs

	2013/14 Actual	2013/14 Total**	2027/28 Plan^^
		LRC (¢/m³)	
RESIDENTIAL			
Affordable Energy Program*	52.5	56.4	53.9
Home Insulation	24.5	20.7	20.7
Water & Energy Saver	6.7	8.0	9.7
	31.3	26.2	31.0
COMMERCIAL			
Commercial Kitchen Appliances	69.4	29.7	10.4
Commercial New Buildings**	47.3	9.5	9.0
Commercial Custom Measures	36.6	24.8	21.4
Commercial HVAC	19.0	11.8	15.5
Commercial Building Envelope	14.9	14.8	15.4
Commercial Building Optimization	13.7	35.8	19.2
Internal Retrofit Program	-	-	-
	18.0	13.7	14.2
INDUSTRIAL			
Natural Gas Optimization	19.5	17.6	22.2
	19.5	17.6	22.2
CUSTOMER SELF-GENERATION PROGRAMS			
Bioenergy Optimization	-	-	13.5
	-	-	13.5
DISCONTINUED/COMPLETED PROGRAMS	-	20.9	-
OVERALL: PROGRAM COSTS	22.6	19.2	19.8
OVERALL: PROGRAM COSTS incl. INTERACTIVE EFFECTS	25.2	21.6	20.6
OVERALL: PROGRAM COSTS + SUPPORT COSTS incl. INTERACTIVE EFFECTS^	26.6	24.2	26.4

* Includes all Affordable Energy Fund and Furnace Replacement Program expenditures, excluding external funding.
** "Total" values represent the results of the program/portfolio since its inception.
^ Support costs contain DSM support programs, basic information services and program support costs.
^^ Plan estimates are from the 2013 Power Smart Plan.
Note: Average levelized resource cost analysis is not provided for rate/load management programs.
Free driver participation is included in the above figures.

4.4.3 Power Smart Combined Electric & Natural Gas Program Results

Total Resource Cost - Benefit/Cost Analysis

Exhibits 4.4.3-A and B show the combined electricity and natural gas benefit/cost analysis results under the total resource cost (TRC) metric by program. The calculation of the benefit/cost ratio was based on a 30-year evaluation period.

Exhibit 4.4.3 - A
2013-14 TRC - Combined Electric & Gas Incentive-Based Programs

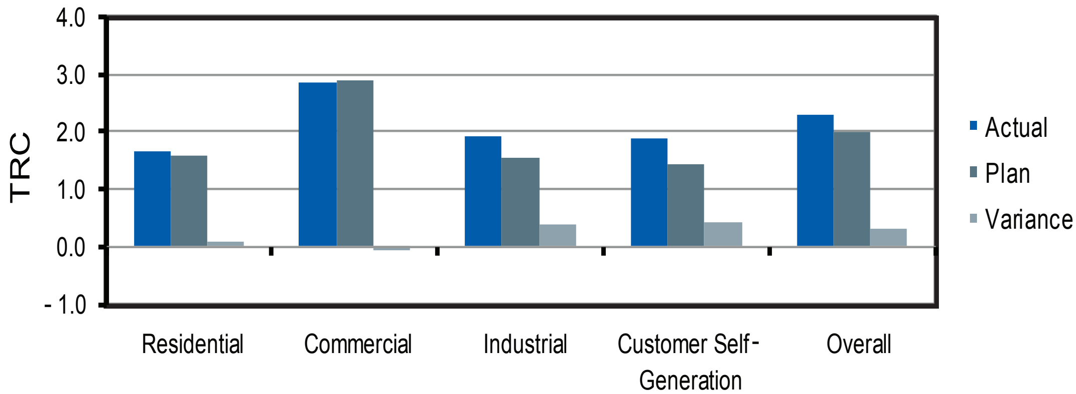


Exhibit 4.4.3 - B

Total Resource Cost Benefit Analysis - Combined Electric & Natural Gas Incentive-Based Programs

	2013/14 Actual	2013/14 Plan^^	Total**	2027/28 Plan^^
		TRC		
RESIDENTIAL				
Water & Energy Saver†	5.1	5.2	8.1	5.2
Home Insulation	2.7	2.3	2.9	2.3
Refrigerator Retirement	0.9	1.1	1.2	1.1
Affordable Energy Program*†	0.9	0.7	0.9	0.8
	1.7	1.6	2.2	1.5
COMMERCIAL				
Commercial Building Optimization	3.9	1.7	1.2	2.3
Commercial Building Envelope	3.8	2.6	3.4	2.5
Commercial Lighting	3.5	2.2	2.5	2.3
Commercial Refrigeration	3.0	1.8	4.0	2.4
Internal Retrofit	2.6	1.2	2.0	1.1
Commercial Network Energy Management	2.4	1.1	0.8	1.7
Commercial Earth Power	2.1	1.6	2.0	1.6
Commercial New Buildings	1.5	8.5	3.8	6.2
Commercial HVAC	1.5	1.6	2.7	2.3
Commercial Custom Measures	1.1	1.5	1.6	1.7
Commercial Kitchen Appliances†	0.7	18.0	3.2	11.5
	2.8	2.9	2.5	2.7
INDUSTRIAL				
Performance Optimization	2.1	1.9	3.2	2.3
Natural Gas Optimization	1.2	1.1	1.8	1.1
	1.9	1.5	2.9	2.1
DISCONTINUED/COMPLETED PROGRAMS†	6.5	-	2.1	-
	6.5	-	2.1	-
CUSTOMER SELF-GENERATION PROGRAMS				
Bioenergy Optimization	1.9	1.4	2.2	1.4
	1.9	1.4	2.2	1.4
OVERALL: PROGRAM COSTS	2.3	2.0	2.4	2.3
OVERALL: PROGRAM COSTS + SUPPORT COSTS^	2.1	1.8	2.1	1.8

* Includes all Affordable Energy Fund and Furnace Replacement Budget expenditures, as well as external funding.
** "Total" values represent the results of the program/portfolio since its inception.
† Includes water savings benefits.
^ Support costs contain DSM support programs, basic information services and program support costs.
^^ Plan estimates are from the 2013 Power Smart Plan.
Note: Increased or decreased natural gas benefits resulting from electric incentive-based programs have been included in the overall calculation.
Benefit/Cost analysis is not calculated for rate/load management programs.
Free driver participation is included in the above figures.

For 2013/14, the combined overall TRC benefit/cost ratio including support costs was 2.1, which surpassed the planned target. All evaluated Power Smart programs, with the exception of the Refrigerator Retirement Program, Affordable Energy Program and Commercial Kitchen Appliances Program, were cost-effective under the TRC metric in 2013/14.

4.5 Fuel Choice

As part of the provincial government's climate change plan, in 2011 they announced an upcoming tax and ban on heating with coal. In July 2013, they formally announced phasing in North America's first coal heating ban effective January 1, 2014, with a grace period up to July 1, 2017, if an approved conversion plan was filed by June 30, 2014.

To assist customers, Manitoba Hydro provided information of the fuel source options available to a number of impacted Hutterite Colonies. As a result of these efforts, nineteen colonies switched to biomass, with savings already accounted for under the Bioenergy Optimization Program. In addition, twenty-four colonies switched to natural gas.

The following table outlines the impacts of the Hutterite colonies that have switched to natural gas. It details the avoided electric impacts as well as the increased natural gas consumption.

The fuel choice impacts are included in the report for information purposes only, and have not been utilized in the tabulation of overall Power Smart program savings or metrics.

Exhibit 4.5
Fuel Choice Impacts

	Resulting from Avoided Electric Heat:					
	Annual Energy Savings (GW.h savings at meter)		Average Winter Demand Savings (MW savings at meter)		Increased Annual Natural Gas Consumption (millions of m^3)	
CONVERSION TO NATURAL GAS FROM:	2013/14	Total*	2013/14	Total*	2013/14	Total*
Lignite Coal	54.3	106.8	21.2	41.6	6.2	12.2
Sub-bituminous Coal	3.0	6.1	1.2	2.4	0.2	0.4
Bioenergy (Oat Pellets)	1.2	2.3	0.5	0.9	0.1	0.3
Propane	17.6	37.5	6.8	14.6	2.1	4.5
Total	76.1	152.7	29.6	59.5	8.7	17.5

Note: Figures may not add up due to rounding.
*Cumulative savings to the end of 2013/14

5.0 Total Power Smart Utility Costs

Total Power Smart utility costs include all costs incurred by the utility in the planning, development, design, implementation and evaluation of the Power Smart programs.

Program costs are attributed to a specific program and include program administration costs and incentive costs, while support costs are associated with activities supporting Power Smart programs which cannot be assigned to any one specific program. These costs include Power Smart promotions (general branding), promoting sustainability and standards, and DSM administration (overall planning and evaluation). Support costs also include costs attributed to running DSM support programs and the basic information portion of the efficiency programs.

5.1 Summary of Total Power Smart Utility Costs

Exhibit 5.1 summarizes the utility costs of the Power Smart programs cumulative to the end of 2013/14. The reported utility costs are presented in nominal dollars and detail actual accounting expenditures to 2013/14 for all Power Smart initiatives and activities.

Exhibit 5.1
Summary of Utility Costs Cumulative to 2013/14

UTILITY COSTS	Cumulative
	millions of nominal dollars
TOTAL UTILITY COSTS	
Program Cost	401.3
Support Cost	88.4
TOTAL UTILITY COSTS	489.7

Note: Support costs include both DSM support programs and support activity costs, but do not include Affordable Energy Fund or Furnace Replacement Program expenditures.
Figures may not add due to rounding.

As of March 31, 2014, Manitoba Hydro had invested approximately $490 million in the Power Smart initiative. The highest component of this expenditure was program utility costs of $401 million, which makes up 82% of total expenditures cumulative to 2013/14.

5.2 Utility Costs by Program

Exhibits 5.2-A and B outline the costs to the utility for Power Smart initiatives implemented between April 1, 1989 and March 31, 2014.

Exhibit 5.2 - A
Utility Costs for Support, DSM Support Programs & Standards

	Actual 2013$		Cumulative nominal $	
	thousands of dollars			
DSM SUPPORT PROGRAMS				
DSM Support Programs & Standards Electric Cost	*318*		*3,152*	
DSM Support Programs & Standards Natural Gas Cost	*-267*		*2,001*	
		50		5,152
BASIC INFORMATION SERVICES				
Basic Information Services Electric Cost	*1,305*		*22,059*	
Basic Information Services Natural Gas Cost	*24*		*5,216*	
		1,329		27,275
Discontinued/Completed Basic Information Services				
Discontinued/Completed Basic Information Services Electric Cost	*0*		*2,885*	
Discontinued/Completed Basic Information Services Natural Gas Cost	*0*		*20*	
		0		2,905
SUPPORT COSTS				
Integrated Plan/Targets				
Integrated Plan/Targets Electric Cost	*260*		*3,914*	
Integrated Plan/Targets Natural Gas Cost	*87*		*983*	
		346		4,898
DSM Market Potential Study				
DSM Market Potential Study Electric Cost	*121*		*364*	
DSM Market Potential Study Natural Gas Cost	*40*		*266*	
		161		631
DSM Administration				
DSM Administration Electric Cost	*360*		*4,463*	
DSM Administration Natural Gas Cost	*120*		*1,355*	
		479		5,817
DSM Tracking System				
DSM Tracking System Electric Cost	*14*		*633*	
DSM Tracking System Natural Gas Cost	*5*		*204*	
		18		838
AEP Review				
AEP Review Electric Cost	*1*		*1*	
AEP Review Gas Cost	*6*		*6*	
		7		7
Power Smart Communications				
Power Smart Communications Electric Cost	*754*		*16,325*	
Power Smart Communications Natural Gas Cost	*251*		*4,599*	
		1,005		20,923
Power Smart Residential Support				
Power Smart Residential Support Electric Cost	*141*		*463*	
Power Smart Residential Support Natural Gas Cost	*422*		*904*	
		562		1,366
Earth Energy & Emerging Technologies Residential Support				
Earth Energy & Emerging Technologies Residential Support Electric Cost	*61*		*61*	
Earth Energy & Emerging Technologies Residential Support Gas Cost	*26*		*26*	
		87		87
Power Smart for Business				
Power Smart for Business Electric Cost	*155*		*1,874*	
Power Smart for Business Natural Gas Cost	*103*		*1,034*	
		258		2,908
Earth Energy & Emerging Technologies Commercial Support				
Earth Energy & Emerging Technologies Commercial Support Electric Cost	*10*		*10*	
Earth Energy & Emerging Technologies Commercial Support Gas Cost	*0*		*0*	
		10		10
Retrofit Demonstrations				
Retrofit Demonstrations Electric Cost	*0*		*9,548*	
Retrofit Demonstrations Natural Gas Cost	*0*		*80*	
		0		9,628
Commercial Audits				
Commercial Audits Electric Cost	*5*		*154*	
Commercial Audits Natural Gas Cost	*3*		*69*	
		8		223
Efficiency Screening Studies				
Energy Efficiency Screening Studies Electric Cost	*64*		*190*	
Energy Efficiency Screening Studies Gas Cost	*43*		*155*	
		106		345
Sustainabilities & Standards				
Sustainabilities & Standards Electric Cost	*293*		*1,179*	
Sustainabilities & Standards Natural Gas Cost	*106*		*1,021*	
		399		2,200
Discontinued/Completed Support Costs				
Discontinued/Completed Support Costs Electric Cost	*0*		*3,157*	
Discontinued/Completed Support Costs Natural Gas Cost	*0*		*0*	
		0		3,157
Total Support Costs & DSM & Standards Electric Cost	*3,860*		*70,431*	
Total Support Costs & DSM & Standards Gas Cost	*968*		*17,940*	
TOTAL SUPPORT, DSM SUPPORT PROGRAMS & STANDARDS COSTS		4,827		88,371

Exhibit 5.2 - B

Utility Costs for Incentive-Based Programs

	Actual 2013$	Cumulative nominal $
	thousands of dollars	
EFFICIENCY PROGRAMS		
RESIDENTIAL		
Home Insulation Program		
Home Insulation Program Electric Cost	*1,109*	*14,661*
Home Insulation Program Natural Gas Cost	*1,117*	*17,715*
	2,227	32,377
Affordable Energy Program		
First Nations Program	*190*	*639*
Affordable Energy Program Electric Cost	*86*	*1,022*
Affordable Energy Program Natural Gas Cost	*562*	*3,961*
	838	5,622
Water & Energy Saver Program		
Water & Energy Saver Program Electric Cost	*410*	*2,238*
Water & Energy Saver Program Natural Gas Cost	*761*	*3,287*
	1,171	5,525
Community Geothermal Program	443	443
Fridge Recycling Program	1,620	4,931
Residential Exploratory Programs		
Residential Exploratory Programs Electric Cost	*1*	*55*
Residential Exploratory Programs Natural Gas Cost	*0*	*15*
	1	70
Discontinued/Completed Residential Programs		
Discontinued/Completed Residential Programs Electric Cost	*12*	*22,425*
Discontinued/Completed Residential Programs Natural Gas Cost	*0*	*9,618*
	51	32,044
Total Residential Programs Electric Cost	*3,872*	*46,414*
Total Residential Programs Natural Gas Cost	*2,440*	*34,597*
RESIDENTIAL EFFICIENCY PROGRAMS SUBTOTAL	6,312	81,012

Exhibit 5.2 - B (Continued)

Utility Costs for Incentive-Based Programs

	Actual 2013$		Cumulative nominal $
	thousands of dollars		
COMMERCIAL			
Commercial Custom Measures			
Commercial Custom Measures Electric Cost	14	2,756	
Commercial Custom Measures Natural Gas Cost	264	1,312	
	278		4,068
Commercial Insulation			
Commercial Insulation Electric Cost	517	2,670	
Commercial Insulation Natural Gas Cost	1,728	9,843	
	2,245		12,513
Commercial Windows			
Commercial Windows Electric Cost	813	6,549	
Commercial Windows Natural Gas Cost	964	5,666	
	1,777		12,215
Commercial Earth Power Program	168		4,654
Commercial HVAC			
Commercial HVAC Electric Cost	193	2,081	
Commercial HVAC Natural Gas Cost	1,276	9,294	
	1,469		11,376
CO2 Sensors			
CO2 Sensors Electric Cost	1	9	
CO2 Sensors Natural Gas Cost	11	151	
	12		160
Internal Retrofit	760		20,844
Commercial Lighting	6,642		82,283
LED Roadway Lighting Pilot	11		11
Commercial Refrigeration	651		2,907
Commercial Building Optimization Program			
Commercial Building Optimization Program Electric Cost	125	623	
Commercial Building Optimization Program Natural Gas Cost	125	1,435	
	250		2,058
New Buildings Program			
New Buildings Program Electric Cost	593	1,705	
New Buildings Program Natural Gas Cost	198	1,948	
	791		3,653
Commercial Kitchen Appliances			
Commercial Kitchen Appliances Electric Cost	4	263	
Commercial Kitchen Appliances Natural Gas Cost	15	231	
	19		494
Commercial Network Energy Management Program	55		257
Commercial Exploratory Programs			
Commercial Exploratory Programs Electric Cost	0	1	
Commercial Exploratory Programs Natural Gas Cost	2	84	
	2		85
Discontinued/Completed Commercial Programs			
Discontinued/Completed Commercial Programs Electric Cost	10	27,727	
Discontinued/Completed Commercial Programs Natural Gas Cost	2	947	
	12		28,674
Total Commercial Programs Electric Cost	10,605	155,829	
Total Commercial Programs Natural Gas Cost	4,585	30,911	
COMMERCIAL EFFICIENCY PROGRAMS SUBTOTAL	15,190		186,740

Exhibit 5.2 - B (Continued)

Utility Costs for Incentive-Based Programs

	Actual 2013$	Cumulative nominal $
	thousands of dollars	
INDUSTRIAL		
Performance Optimization Program	2,173	33,828
Natural Gas Optimization Program	480	4,037
Emergency Preparedness	0	159
	2,653	38,024
Discontinued/Completed Industrial Programs		
Discontinued/Completed Industrial Programs Electric Cost	*0*	*2,708*
Discontinued/Completed Industrial Programs Natural Gas Cost	*0*	*0*
	0	2,708
Total Industrial Programs Electric Cost	*2,173*	*36,694*
Total Industrial Programs Natural Gas Cost	*480*	*4,037*
INDUSTRIAL EFFICIENCY PROGRAMs SUBTOTAL	2,653	40,732
EFFICIENCY PROGRAMS COSTS		
Total Efficiency Programs Electric Cost	*16,650*	*238,938*
Total Efficiency Programs Natural Gas Cost	*7,505*	*69,545*
EFFICIENCY PROGRAMs SUBTOTAL	24,155	308,483
CUSTOMER SELF GENERATION		
Bioenergy Optimization Program		
Bioenergy Optimization Program Electric Cost	*698*	*10,898*
Bioenergy Optimization Program Natural Gas Cost	*0*	*112*
	698	11,010
RATE/LOAD MANAGEMENT PROGRAMS		
Curtailable Rates	*5,971*	*81,814*
	5,971	81,814
TOTAL PROGRAM COSTS		
Total Program Electric Cost	*23,320*	*331,650*
Total Program Natural Gas Cost	*7,505*	*69,657*
TOTAL PROGRAM COSTS	30,824	401,307

Note: Figures may not add due to rounding.

5.3 Utility Costs by Energy Source

Exhibit 5.3 provides a summary of electric and natural gas utility costs. Total Power Smart electric initiatives represented 76% of total Power Smart expenditures in 2013/14 and 82% of Power Smart expenditures to date.

Exhibit 5.3

Summary of Electricity & Natural Gas Utility Costs

	Actual 2013$	Cumulative nominal $
	millions of dollars	
ELECTRICITY		
Program Cost	23.3	331.7
Support Cost	3.9	70.4
	27.2	402.1
NATURAL GAS		
Program Cost	7.5	69.7
Support Cost	1.0	17.9
	8.5	87.6
TOTAL UTILITY COSTS (ELECTRICITY + NATURAL GAS)	35.7	489.7

Note: Support costs include both DSM support programs and support activity costs, but do not include Affordable Energy Fund or Furnace Replacement Program expenditures.
Figures may not add due to rounding.

5.4 The Affordable Energy Fund

The Affordable Energy Fund was established in 2006/07 through the Winter Heating Cost Control Act and it supports Manitoba Hydro's sustainable development initiatives. The purpose of the fund is to provide support for programs and services that encourage energy efficiency and conservation through programs and services for rural and northern Manitobans, lower income customers and seniors, as well as promoting the use of alternative energy sources such as renewable energy.

Exhibit 5.4 provides a summary of Affordable Energy Fund expenditures.

Exhibit 5.4

Summary of Affordable Energy Fund Expenditures

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative
					thousands of nominal dollars				
Affordable Energy Program	256	219	893	1,672	2,666	3,131	3,332	3,122	15,291
Geothermal Support									
Waverley West Demonstration Project*	619	252	5	0	-1	-1	-1	-1	872
Earth Power Loan Subsidy	0	19	69	105	108	108	91	0	500
Province of Manitoba Cooperative Advertising	0	0	18	0	0	0	0	28	46
Geothermal Support Total	619	270	92	104	108	107	91	27	1,419
Community Support & Outreach	0	0	35	130	133	139	114	123	674
Oil & Propane Heated Homes	0	75	85	31	32	24	0	4	250
Special Projects									
Res. Energy Assessment Services (ecoENERGY Audits)	0	61	241	85	119	39	0	0	545
Oil & Propane Furnace Replacement	0	0	6	36	42	17	10	23	135
Res. Solar Water Heating Program	0	0	89	119	56	11	10	0	285
Power Smart Residential Loan	0	0	0	130	312	354	510	365	1,671
Oil & Propane Heated Homes - Additional Funding	0	0	0	0	0	10	26	19	55
Special Projects Total	0	61	336	371	529	431	556	407	2,692
Community Energy Development									
ecoENERGY Program Funding - Additional Funding	0	0	0	0	0	2,817	1,241	0	4,059
Community Energy Development Total	0	0	0	0	0	2,817	1,241	0	4,059
DSM INITIATIVES SUBTOTAL	875	625	1,441	2,308	3,468	6,649	5,334	3,685	24,385
Manitoba Electric Bus	0	0	0	0	0	700	75	225	1,000
Energy & Resource Fund	0	0	0	750	0	0	0	0	750
Fort Whyte EcoVillage	0	0	0	0	0	120	0	0	120
Diesel Community Green Pilot Demonstration	0	0	0	0	0	3	-3	0	0
Métis Generation Fund	0	0	0	0	0	0	0	500	500
TOTAL EXPENDITURES	875	625	1,441	3,058	3,468	7,472	5,406	4,410	26,755

* Negative costs represent loop lease payments from customer to Manitoba Hydro.
** Reversal of an incorrect charge that took place in 2011/12 is indicated by the negative cost.

5.5 Furnace Replacement Budget

The Furnace Replacement Budget was established in 2007/08 as a result of Public Utility Board Order 99/07. The purpose of the budget is to support the implementation of a natural gas Furnace Replacement Program for lower income customers.

In 2013/14 alone, customers installed 605 furnaces and 18 boilers through the Furnace Replacement Program. Cumulatively, 3,130 furnaces and 75 boilers have been installed as a result of the program.

Exhibit 5.5 outlines Furnace Replacement Budget expenditures.

Exhibit 5.5

Summary of Furnace Replacement Expenditures

	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative
			thousands of nominal dollars				
Natural Gas Furnace Replacement	264	815	1,312	1,627	2,153	2,012	8,183
TOTAL EXPENDITURES	264	815	1,312	1,627	2,153	2,012	8,183

Appendix A

Sources of Evaluation & Planning Estimates

Many sources are used to estimate load savings and utility costs resulting from the Power Smart programs. These include:

Evaluation Estimate Sources

Impact Evaluation Reports:

Impact evaluation reports are prepared annually for the Power Smart programs to identify net program load savings and costs, as well as the cost-effectiveness of these savings. Net savings and costs differ from gross savings and costs as they take into consideration factors such as free riders, free drivers, heating/cooling interactive effects and persistence.

A number of variables potentially affect the cost-effectiveness of Power Smart programs. These variables include energy, demand and natural gas reduction; hours of operation; measure persistence; average measure life; measure reinvestment and changes in marginal cost values.

Life-to-Date Expenditure Report:

The utility costs cumulative to 2013/14 are tracked annually from the Annual DSM Expenditure Report.

Engineering Estimates:

Engineering expertise is used to quantify usage and savings data. Computer simulation and modeling may also be utilized.

Sales & Market Data:

In-depth market knowledge, product specifications and ratings, sales and replacement data, etc. are used to determine market acceptance and uptake.

Planning Estimate Sources

2013/14 Planning Estimates:

The 2013/14 electric and natural gas planning estimates were taken from the 2013 Power Smart Plan.

In all cases, the 2013 Power Smart Plan estimates were used regardless of delays in program launches or modifications. Consistent usage of the same plan helps reduce the probability of errors and provides a verifiable public target to compare against. Utilizing the same source information also helps ensure that a realistic and objective evaluation of the programs/portfolio is conducted, and improves the reliability and verifiability of the Power Smart Annual Review.

2027/28 Planning Estimates:

The 2027/28 electric planning targets for energy and demand savings are from the 2013 Power Smart Plan which includes forecasts for 2013/14 through 2027/28. The 1992/93 through 2013/14 planning estimates for energy and demand savings are from the respective Power Smart Resource Options reports or Power Smart Plan. Electric long range planning targets did not exist prior to 1992/93.

The 2027/28 natural gas planning targets are from the 2013 Power Smart Plan which includes forecasts for 2013/14 through 2027/28. Natural gas long range planning targets did not exist prior to 2005/06.

The 2013/14 through 2027/28 planning estimates for utility costs are included in the Integrated Financial Forecast report current during the evaluation year (IFF13).

The planning estimates for the years 1990/91 through 2013/14 are included in the following Integrated Financial Forecast reports: IFF90, IFF91, IFF92, IFF93, IFF94, IFF95, IFF96, IFF97, IFF98, IFF99, IFF00, IFF01, IFF02, IFF03, IFF04, IFF05, IFF06, IFF07, IFF08, IFF09, IFF10, IFF11, IFF12, IFF13.

Appendix B

Explanation of Benefit/Cost Ratios Used in DSM Metrics

Total Resource Cost (TRC) Metric

The Total Resource Cost (TRC) metric is used to assess the benefits of an energy efficiency program irrespective of who realizes the benefits and who pays the costs. Any economic transfers between Manitoba Hydro and the participating customer are excluded from the calculation.

The TRC is calculated based on the following formula:

$$\text{TRC} = \frac{\text{PV (Marginal Benefit)}}{\text{PV (Total Program Administration + Incremental Product Cost)}}$$

Where:

- For electricity, the marginal benefit includes the revenue realized by Manitoba Hydro from conserved electricity being sold in the export market, the avoided cost of new infrastructure (i.e. electric transmission facilities) and measurable non-energy benefits (i.e. water savings).
- For natural gas, the marginal benefit includes Manitoba Hydro's avoided cost of purchasing natural gas, avoided transportation costs, the value of reduced greenhouse gas emissions and measurable non-energy benefits (i.e. water savings).
- Total program administration costs include the administrative costs involved in program planning, design, marketing, implementation and evaluation. It includes all costs associated with offering the Power Smart program except for customer incentive costs.
    - o Note: The City of Winnipeg Power Smart Agreement evaluation treats commitment payments paid by Manitoba Hydro as administration costs.
- Incremental product costs include the total incremental costs associated with implementing a Power Smart measure. It is the difference in costs between the energy efficient technology and the standard technology that would have been installed in the absence of the energy efficient technology.

Levelized Utility Cost (LUC) / Rate Impact Measure (RIM) Metric

The Levelized Utility Cost (LUC) is used to provide an economic cost value for the energy saved by an energy efficiency program. The LUC provides the total cost of the conserved energy based upon the utility's investment on behalf of the ratepayer on a per unit basis levelized over a fixed time period. The cost value allows for a comparison to other supply options and other DSM programs occurring over different time frames.

The Rate Impact Measure (RIM) metric is used in conjunction with the LUC to provide an indication of the long term impact of an energy efficient program on energy rates. This metric is especially valuable in interpreting the LUC of electric energy efficiency programs due to the varying summer/winter values of Manitoba Hydro's marginal cost. This metric is a benefit/cost ratio that represents the economic impact of a program from the ratepayer's perspective. All program-related savings and costs incurred by the utility, including revenue loss and incentive payments, are taken into account in this assessment.

The LUC and RIM are calculated based on the following formulas:

$$\text{LUC} = \frac{\text{PV (Utility Program Administration Costs + Incentives)}}{\text{PV (Energy)}}$$

$$\text{RIM} = \frac{\text{PV (Utility Marginal Benefit)}}{\text{PV (Revenue Loss + Utility Program Administration Costs + Incentives)}}$$

Where:

- Utility program administration costs include the costs to Manitoba Hydro associated with program planning, design, marketing, implementation and evaluation. It includes all costs associated with offering the Power Smart program except for customer incentive costs.
- Incentives include the funds transferred from Manitoba Hydro to the participant associated with implementing the Power Smart measure.
- Energy includes the annual energy savings associated with the energy efficiency measure.
- For electricity, the utility marginal benefit includes the revenue realized by Manitoba Hydro from conserved electricity being sold in the export market and the avoided cost of new infrastructure (i.e. electric transmission facilities).
- For natural gas, the utility marginal benefit includes Manitoba Hydro's avoided cost of purchasing natural gas, avoided transportation costs and the value of reduced greenhouse gas emissions.
- Revenue loss includes Manitoba Hydro's lost revenue associated with the participants' reduced energy consumption (i.e. customer bill reductions)
- Incentives include the funds transferred from Manitoba Hydro to the participant associated with implementing the Power Smart measure.

Levelized Resource Cost (LRC)

The Levelized Resource Cost (LRC) is used to provide an economic cost value for the energy saved through an energy efficiency program. The LRC provides the total resource cost of the conserved energy on a per unit basis levelized over a fixed time period. The cost value allows for a comparison to other supply options and other DSM programs occurring over different time frames.

The LRC is calculated based on the following formula:

$$\text{LRC} = \frac{\text{PV (Total Program Administration + Incremental Product Cost)}}{\text{PV (Energy)}}$$

Where:

- Total program administration costs include the administrative costs involved in program planning, design, marketing, implementation and evaluation. It includes all costs associated with offering the Power Smart program except for customer incentive costs.
- Incremental product cost is the difference in cost between the energy efficient technology and the standard technology that would have been installed in the absence of the energy efficient technology.
- Energy includes the annual energy savings associated with the energy efficiency measure.

Appendix C

Total Power Smart Participation

Power Smart Participants Annual Increments*†	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	**2013/14**	*Cumulative*
Residential																										
Residential DSM Support Programs																										
Financing Programs																										
Power Smart Residential Loan	-	-	-	-	-	-	-	-	-	-	-	-	4,873	3,386	4,211	5,114	6,325	7,222	7,427	7,391	6,453	5,262	6,492	6,202	5,504	75,862
Power Smart Residential PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52	241	293
Residential Earth Power Loan	-	-	-	-	-	-	-	-	-	-	-	-														
Geothermal Loan	-	-	-	-	-	-	-	-	-	-	-	-	-	35	92	185	139	85	224	207	114	53	52	24	19	1,229
Solar Hot Water Heating Loan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	7	-	-	-	14
Financing Programs Subtotal	-	-	-	-	-	-	-	-	-	-	-	-	4,873	3,421	4,303	5,299	6,464	7,307	7,651	7,598	6,574	5,322	6,544	6,278	5,764	77,398
Mail-In/On-Line Energy Assessments	-	-	-	-	-	-	-	-	-	-	-	-	570	532	338	378	234	455	421	251	153	263	416	286	303	4,600
Residential DSM Support Programs SUBTOTAL	-	-	-	-	-	-	-	-	-	-	-	-	5,443	3,953	4,641	5,677	6,698	7,762	8,072	7,849	6,727	5,585	6,960	6,564	6,067	81,998
Residential DSM Support Programs Discontinued/Completed Programs																										
ecoENERGY[i]	-	-	-	-	-	-	-	-	-	-	-	-	411	1,094	4,085	5,298	6,939	5,001	3,171	4,967	7,009	3,428	11,683	1,186	-	54,272
WISE Home	-	-	-	-	-	-	-	-	-	-	-	-	297	506	570	900	859	612	312	425	450	460	-	-	-	5,391
Energy Saver Presentations	-	-	-	-	-	-	-	-	-	-	-	-	58	1,156	453	467	337	610	392	291	192	-	-	-	-	3,956
New Home Workshops	-	-	-	-	-	-	-	-	-	-	-	-	40	305	116	158	119	116	-	-	-	-	-	-	-	854
Residential Earth Power	-	-	-	-	-	-	-	-	-	-	-	-														
Earth Power Consumer Workshops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150	475	63	-	-	-	-	-	-	-	688
R-2000 Component of the 'New Home Program'[ii]	-	-	-	-	-	-	-	-	-	-	-	-	12	19	32	-	-	-	-	-	-	-	-	-	-	63
Solar Water Heating (Incentive Component)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	18	-	-	-	36
Residential DSM Support Programs Discontinued/Completed Programs	-	-	-	-	-	-	-	-	-	-	-	-	818	3,080	5,256	6,973	8,729	6,402	3,875	5,683	7,669	3,906	11,683	1,186	-	65,260
RESIDENTIAL DSM Support Programs TOTAL	-	-	-	-	-	-	-	-	-	-	-	-	6,261	7,033	9,897	12,650	15,427	14,164	11,947	13,532	14,396	9,491	18,643	7,750	6,067	147,258
Residential Incentive-Based Programs																										
Water & Energy Saver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38,448	33,411	27,338	19,659	118,856
Refrigerator Retirement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,437	8,298	8,982	25,717
Home Insulation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	459	1,433	5,211	4,551	4,578	5,093	3,923	3,682	2,894	2,273	34,097
Affordable Energy Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	139	143	716	2,056	1,908	1,653	1,847	8,462
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82	82
Residential Incentive-Based Programs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	459	1,433	5,211	4,690	4,721	5,809	44,427	47,438	40,183	32,843	187,214
Residential Incentive-Based Discontinued/Completed Programs																										
Compact Fluorescent Lighting[v]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21,663	26,623	17,296	28,933	73,228	99,817	75,821	-	-	-	343,381
Residential Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10,374	15,436	13,277	2,451	-	-	-	-	41,538
Outdoor Timer	6,169	8,954	8,134	4,812	4,160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32,229
High Efficiency Furnace/Boiler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,228	7,028	6,630	7,295	5,190	-	-	-	-	27,371
Seasonal LEDs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,900	10,880	8,144	4,956	-	-	-	-	-	25,880
Energy Efficient Light Fixtures	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,047	2,380	2,691	1,126	3,351	2,305	-	-	12,900
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,948	2,230	-	-	-	-	-	-	7,178
EE Water Tank/ Water Savings Measures of the 'No Worry Plan'	-	-	-	-	-	-	-	201	709	681	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,591
New Home	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	126	217	204	220	205	230	142	1	-	1,381
Refrigerator/Freezer Buy-Back Pilot	-	-	474	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	474
Residential Incentive-Based Discontinued/Completed Programs	6,169	8,954	8,608	4,812	4,160	-	-	201	709	681	-	-	-	-	-	21,699	29,877	51,790	63,957	101,667	108,789	79,402	2,447	1	-	493,923
Residential Incentive-Based TOTAL	6,169	8,954	8,608	4,812	4,160	-	-	201	709	681	-	-	-	-	-	22,158	31,310	57,001	68,647	106,388	114,598	123,829	49,885	40,184	32,843	681,137
Residential TOTAL	6,169	8,954	8,608	4,812	4,160	-	-	201	709	681	-	-	6,261	7,033	9,897	34,808	46,737	71,165	80,594	119,920	128,994	133,320	68,528	47,934	38,910	828,395
Commercial																										
Commercial DSM Support Programs																										
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	6
Religious Buildings Initiative	-	-	-	-	-	-	-	-	-	-	-	-	14	6	25	13	34	63	40	19	9	5	3	-	4	235
Power Smart Recreation Facility Survey	-	-	-	-	-	-	-	-	-	-	-	-	30	5	6	4	4	5	6	4	1	2	1	-	2	70
Commercial DSM Support Programs SUBTOTAL	-	-	-	-	-	-	-	-	-	-	-	-	44	11	31	17	38	68	46	23	10	7	4	-	12	311
Commercial DSM Support Programs Discontinued/Completed Programs																										
Power Smart Energy Manager[iii]	-	-	-	-	-	-	-	-	-	-	-	18	-	20	-	-	-	-	-	-	-	-	-	-	-	38
Commercial DSM Support Programs Discontinued/Completed Programs	-	-	-	-	-	-	-	-	-	-	-	18	-	20	-	-	-	-	-	-	-	-	-	-	-	38
Commercial DSM Support Programs TOTAL	-	-	-	-	-	-	-	-	-	-	-	18	44	31	31	17	38	68	46	23	10	7	4	-	12	349

Power Smart Participants Annual Increments*†	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative
Commercial Incentive-Based Programs																										
Commercial Lighting	-	-	-	129	634	556	488	264	235	384	178	122	152	184	373	742	871	999	1,116	1,292	1,111	991	788	748	779	13,136
Commercial Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	27	17	41	36	31	565	605	1,334
Commercial Building Envelope	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105	183	244	371	453	404	337	438	2,535
Commercial HVAC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38	72	74	78	96	73	92	90	613
Internal Retrofit	-	-	-	8	15	21	30	24	49	60	37	52	42	55	31	135	425	59	32	68	42	39	36	29	35	1,324
LED Roadway Lighting Pilot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	25
New Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	15	12	34
Commercial Earth Power	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	15	11	23	19	13	10	9	128
Commercial Custom Measures**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3	1	13	8	13	27	8	77
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	4	-	2	6	15
Network Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	2	-	-	3	11
Commercial Kitchen Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	27	16	11	6	2	83
Commercial Incentive-Based Programs SUBTOTAL	-	-	-	137	649	577	518	288	284	444	215	174	194	239	404	877	1,296	1,245	1,448	1,729	1,714	1,664	1,376	1,831	2,012	19,315
Commercial Incentive-Based Discontinued/Completed Programs																										
Commercial Rinse & Save	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	655	202	224	97	-	-	-	-	1,178
Parking Lot Controllers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	253	296	89	137	168	82	10	-	1,035
Infrared Heat Lamps	-	-	-	-	1,016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,016
Commercial Construction & Renovation	-	-	-	-	-	-	-	46	41	40	54	42	56	76	88	102	232	-	-	-	-	-	-	-	-	777
Power Smart Shops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	330	378	-	-	-	708
City of Winnipeg Power Smart Agreement	-	-	-	-	-	-	-	-	-	-	-	-	-	4	5	11	274	9	7	1	4	2	4	1	-	322
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	161	37	21	17	45	290
Livestock Waterer	-	-	-	-	129	96	57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	282
Sentinel Lighting	-	-	65	63	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	199
Roadway Lighting	-	-	-	73	71	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	199
Agricultural Heat Pads	-	-	-	-	-	-	-	-	-	16	22	7	10	13	10	12	8	5	6	4	10	7	-	-	-	130
Agricultural Demand Controller	-	-	-	-	24	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34
Power Smart Energy Manager[ø iii]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Commercial Incentive-Based Discontinued/Completed Programs SUBTOTAL	-	-	65	136	1,310	161	57	46	41	56	76	49	66	93	103	125	514	922	511	327	739	592	107	28	45	6,170
Commercial Incentive-Based TOTAL	-	-	65	273	1,959	738	575	334	325	500	291	223	260	332	507	1,002	1,810	2,167	1,959	2,056	2,453	2,256	1,483	1,859	2,057	25,485
Commercial TOTAL	-	-	65	273	1,959	738	575	334	325	500	291	241	304	363	538	1,019	1,848	2,235	2,005	2,079	2,463	2,263	1,487	1,859	2,069	25,834
Industrial																										
Industrial Incentive-Based Programs																										
Performance Optimization	-	-	-	-	3	1	4	4	4	8	2	7	15	22	28	44	46	44	66	84	97	72	55	71	44	721
Natural Gas Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	10	14	14	13	14	8	83
Industrial Incentive-Based Programs	-	-	-	-	3	1	4	4	4	8	2	7	15	22	28	44	46	44	76	94	111	86	68	85	52	804
Industrial Incentive-Based Discontinued/Completed Programs																										
High Efficiency Motors	-	-	24	157	199	228	181	178	191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,158
Industrial Incentive-Based Discontinued/Completed Programs	-	-	24	157	199	228	181	178	191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,158
Customer Self-Generation Programs																										
Bioenergy Optimization Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	2	22	2	24
Customer Self-Generation Programs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	2	22	2	24
Rate/Load Management Programs																										
Curtailable Rates[iv]	-	-	-	-	-	-	-	-	-	-	2	2	2	3	4	4	4	4	4	4	4	3	3	3	3	5
Rate/Load Management Programs	-	-	-	-	-	-	-	-	-	-	2	2	2	3	4	4	4	4	4	4	4	3	3	3	3	5
Industrial TOTAL	-	-	24	157	202	229	185	182	195	8	4	9	17	25	32	48	50	49	81	99	116	90	73	110	57	1,991
DSM SUPPORT PROGRAMS ACTIVE & DISCONTINUED/COMPLETED SUBTOTAL	-	-	-	-	-	-	-	-	-	-	-	18	6,305	7,064	9,928	12,667	15,465	14,232	11,993	13,555	14,406	9,498	18,647	7,750	6,079	147,607
INCENTIVE-BASED PROGRAMS ACTIVE & DISCONTINUED/COMPLETED SUBTOTAL	6,169	8,954	8,697	5,242	6,321	967	760	717	1,229	1,189	295	232	277	357	539	23,208	33,170	59,217	70,687	108,543	117,167	126,175	51,441	42,153	34,957	708,613
ALL PROGRAMS ACTIVE & DISCONTINUED/COMPLETED TOTAL	**6,169**	**8,954**	**8,697**	**5,242**	**6,321**	**967**	**760**	**717**	**1,229**	**1,189**	**295**	**250**	**6,582**	**7,421**	**10,467**	**35,875**	**48,635**	**73,449**	**82,680**	**122,098**	**131,573**	**135,673**	**70,088**	**49,903**	**41,036**	**856,220**

† Customers may participate in more than one Power Smart Program.
*Participation is measured by completed projects (includes free riders), and excludes free drivers and market transformation.
** A summation of annual participation columns will not necessarily correspond with the total participation to date. This is a result of Curtailable Rates Program participation (see footnote iv).
[i] The program offering in-home energy assessments prior to 2007/08 was known as the EnerGuide for Houses program. As Manitoba Hydro highly subsidized the evaluation cost of Amerispec and EnerGuy participants, they are included in the participation figures for 2011/12 and 2012/13.
[ii] Starting in 2004/05, the R-2000 Program was grouped into the Power Smart New Home Program.
[iii] Power Smart Energy Manager Program participation is measured by schools. Schools that joined the program in 2000/01 participated for 4 years, and schools that joined in 2002/03 participated for 2 years.
[iv] Annual participation represents the number of customers who participate each year. Since most customers participate year after year, the cumulative number represents the actual number of customers who have participated to date.
[v] Participation in the Residential Compact Fluorescent Lighting Program is defined as 1 household.

Appendix D

Synopsis of Discontinued Power Smart Incentive-Based Programs

Residential Programs

Outdoor Timer Program

Manitoba Hydro's first Power Smart Program, this program encouraged the use of outdoor timers to control block heaters and interior car warmers at existing homes.

Refrigerator/Freezer Buy-Back Pilot

This pilot program encouraged the removal of older, inefficient second refrigerators and freezers in existing homes.

Residential Shower Head Pilot

This pilot program encouraged the installation of energy efficient shower heads in existing homes.

Energy Efficient Water Saving Measures Component of the "No Worry Plan"

This program encouraged participants of the "No Worry Plan" hot water tank program to install energy saving devices (faucet aerators, heat traps, energy efficient shower heads and pipe wrap) as part of a bonus package when installing new hot water tanks.

Energy Efficient Water Tank Component of the "No Worry Plan"

This program encouraged residential customers with electric hot water heaters to purchase, finance or lease the most energy efficient water heater available when replacing or installing new electric water heaters.

New Home Program

This program provided customers in the residential new construction market with prescriptive Power Smart standards and incentives to implement energy saving features and construction techniques into the construction of new homes.

Compact Fluorescent Lighting Program

This program encouraged residential customers and property managers of multi-unit residential buildings to install energy efficient compact fluorescent light bulbs.

Seasonal LED Lighting Program

This program encouraged customers to replace their existing incandescent seasonal light strings with energy efficient LED light strings.

High Efficiency Furnace/Boiler Program

This program encouraged residential customers to replace their existing natural gas furnaces or boilers with ENERGY STAR-qualified high efficiency natural gas furnaces or boilers.

Residential Appliances Program

This program encouraged residential customers to purchase ENERGY STAR-qualified clothes washers and chest freezers.

Programmable Thermostat Pilot

This pilot program encouraged customers to replace non-programmable thermostats with ENERGY STAR programmable models.

Energy Efficient Light Fixtures Program

The Energy Efficient Light Fixtures Program provided financial incentives to residential customers and property managers of multi-unit residential buildings to encourage the installation of ENERGY STAR® qualified light fixtures, dimmer switches and LED night lights.

ecoENERGY Program

The federal government's ecoEnergy Retrofit Grants Program ran from June 2011 to March 2012. To qualify for a federal grant of up to $5,000, homeowners were required to have a pre-retrofit energy evaluation on their home, implement the energy efficiency upgrades and have a post retrofit energy evaluation complete within this time frame. Manitoba Hydro and the Province of Manitoba announced further enhancements for Manitobans including a subsidized price on the pre-retrofit energy evaluations, a top-up grant equating to 20% of the federal grant amount, and a reduction in the Power Smart Residential Loan interest rate. Funding for all subsidies were secured from the Affordable Energy Fund.

Incentive Component of the "Solar Water Heating Program"

In partnership with Natural Resources Canada, this program encouraged homeowners to purchase solar water heating systems.

Commercial Programs

Roadway Lighting Program

This program converted existing incandescent and mercury vapor street lighting to more energy efficient, high pressure sodium lighting.

Sentinel Lighting Program

This program encouraged the conversion of yard lighting and sentinel lighting from mercury vapor and incandescent lighting to the more energy efficient, high pressure sodium lighting.

Commercial Shower Head Pilot

This pilot program encouraged commercial operations to retrofit shower facilities with energy efficient shower heads.

Infrared Heat Lamps

This program encouraged swine farrowing operations to use energy efficient heat lamps in place of standard heat lamps.

Agricultural Demand Controller

This program encouraged large agricultural operations to install demand controllers to reduce peak demand consumption.

Livestock Waterer

This program encouraged dairy and cattle operations to install energy efficient waterers to reduce energy and demand consumption.

Air Barrier Component of the "Commercial Construction Program"

This program encouraged commercial customers to install greater efficiency air barriers when retrofitting their building's envelope.

Commercial Clothes Washers Program

This program encouraged customers to install energy efficient front-loading clothes washers at their business or facility.

Air Conditioning Component of the "Commercial Construction Program"

This program encouraged commercial customers to replace their existing air conditioning system with a more energy efficient system.

Commercial Parking Lot Controllers

This program encouraged customers to install the parking lot controller technology to effectively manage electricity usage in their parking lots.

Agricultural Heat Pads

This program encouraged owners of swine barns to replace the traditional heat lamps in their hog farrowing crates with energy efficient heat pads.

Commercial Rinse & Save

The program offered operators of restaurants or food services businesses the free installation of a low-flow pre-rinse spray valve.

Power Smart Energy Manger

This program provided information, training and support for Manitoba school divisions to hire dedicated energy managers.

Power Smart Shops

This program encouraged small independent commercial customers to fully convert their buildings to a Power Smart Shop level of efficiency.

City of Winnipeg Power Smart Agreement

The City of Winnipeg Power Smart Agreement was established as part of the Winnipeg Hydro purchase agreement. It's objective was to encourage and implement energy saving measures in city-owned facilities. The terms of the agreement ended in September 2012.

Industrial Programs

High Efficiency Motors

This program encouraged the installation of high efficiency motors in industrial and commercial operations.

Appendix E

Curtailable Rates Program Information & Methodology

- The Curtailable Rates Program provides incentives to large industrial customers who curtail their electrical load when called upon by Manitoba Hydro. Incentives are provided by way of a credit on the customer's monthly energy bill.

- 2013/14 reported demand savings for the Curtailable Rates Program are based on a methodology where curtailments throughout the year are analyzed to determine the amount of curtailable load that can be expected to be on the system at the time a curtailment is called. This methodology has been in place since 2000/01. For previous methodology details, refer to the appropriate Power Smart Annual Review.

- Curtailable Rates Program targets are from the 2013 Power Smart Plan.

- Curtailable Rate Program targets and savings are adjusted for efficiency. This adjustment is made to equate load available for curtailment to that of an actual generator. Curtailments are not as efficient since there is potential risk customers may not curtail at all or may not curtail in time for Manitoba Hydro's system peak. The efficiency factor is based on the curtailment option selected by the customer.

- Savings resulting from the Curtailable Rates Program are available as long as the service offering continues, whether or not actual curtailments are made at the time of system peak or at any other time. Curtailments may be made to:
  - Re-establish contingency reserves;
  - Maintain planning reserve obligations;
  - To protect firm load when reserves are insufficient to avoid curtailing firm load; and to
  - Meet Manitoba Hydro's non-spinning reserves to the extent necessary.

- The expected availability of this load and not the timing of its dispatch determine the future benefits of demand savings for this program.

- Under the 2013/14 Power Smart Annual Review, the Curtailable Rates Program has been treated as an incentive-based program. This is consistent with treatment in the 2013 Power Smart Plan. As a rate-load management program, cost-effectiveness metrics are not reported.

Appendix F

Energy Savings -Incentive-Based Programs

2013/14 Annual Energy Savings - GW.h
Electric Incentive-Based Programs

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL																	
Refrigerator Retirement	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	-	-	-	-	11.2	-
Home Insulation	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.1	5.1
Water & Energy Saver	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.5	3.5
Affordable Energy Program	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.9	2.9
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	10.1	10.1	10.1	10.1	22.7	11.5
DISCONTINUED/COMPLETED																	
Residential Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compact Fluorescent Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seasonal LED Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outdoor Timer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Residential Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Heater Rental	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Home	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficient Light Fixtures	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retrofit/Demonstration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigerator/Freezer Buy-Back	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High Efficiency Furnace & Boiler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RESIDENTIAL TOTAL	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	10.1	10.1	10.1	10.1	22.7	11.5
COMMERCIAL																	
Commercial Lighting	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	37.3	37.3
Commercial Refrigeration	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	10.0	10.0
Commercial Insulation*	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.9	7.9
Commercial Earth Power	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	5.6	5.6
Internal Retrofit	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.5	2.5
Commercial Building Optimization	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	0.0	0.0	0.0	0.0	0.0	2.2	0.0
Commercial Windows*	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.9	1.9
Commercial New Buildings	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.8	1.8
Commercial HVAC - Chillers	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9
Commercial Network Energy Manager	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6
Commercial Custom Measures	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Commercial Kitchen Appliances	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LED Roadway Lighting Pilot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial HVAC - CO2 Sensors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	60.5	60.5	60.5	60.5	60.5	71.1	68.9
DISCONTINUED/COMPLETED																	
Agricultural Heat Pads	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.9	2.9
Commercial Clothes Washers	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Commercial Showerhead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Infrared Heat Lamp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Livestock Waterer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roadway Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sentinel Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Barrier	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural Demand Controller	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parking Lot Controllers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spray Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Shops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
City of Winnipeg Power Smart Agreement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.9	2.9
COMMERCIAL TOTAL	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	63.1	63.1	63.1	63.1	63.1	74.1	71.9
INDUSTRIAL																	
Performance Optimization	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	32.6	32.6
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	32.6	32.6
DISCONTINUED/COMPLETED																	
Industrial (Basic)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retrofit/Demonstration GSL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High Efficiency Motors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INDUSTRIAL TOTAL	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	32.6	32.6
EFFICIENCY PROGRAMS SUBTOTAL	114.5	114.5	114.5	114.5	114.5	114.5	114.5	114.5	114.5	114.5	112.6	102.8	102.8	102.8	102.8	129.4	116.0
CUSTOMER SELF-GENERATION PROGRAMS																	
Bioenergy Optimization	48.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	53.5	0.7
	48.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	53.5	0.7
GW.h IMPACTS (at meter)	163.2	115.2	115.2	115.2	115.2	115.2	115.2	115.2	115.2	115.2	113.3	103.5	103.5	103.5	103.5	N/A	N/A
GW.h IMPACTS (at generation)	182.9	130.1	130.1	130.1	130.1	130.1	130.1	130.1	130.1	130.1	127.9	116.7	116.7	116.7	116.7	182.9	116.7

Note: Subtotals may not be exact due to rounding.
* Programs comprise the Commercial Building Envelope Program.

Persisting Energy Savings - GW.h
Electric Incentive-Based Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL																											
Home Insulation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	4.2	10.7	16.5	22.1	28.4	33.8	38.7	44.9	44.9	51.2	51.2
Refrigerator Retirement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.9	19.6	19.6	22.3	-
Water & Energy Saver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.5	12.6	12.6	14.4	14.4
Affordable Energy Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	1.1	2.0	4.2	6.4	9.3	9.3	10.6	10.6
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	4.2	10.7	17.0	23.2	30.4	38.0	65.6	86.3	86.3	98.4	76.1
DISCONTINUED/COMPLETED																											
Compact Fluorescent Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.1	15.4	20.6	28.1	49.9	85.8	107.5	107.5	107.5	107.5	122.5	122.5
Outdoor Timer	5.0	8.9	15.3	20.6	24.8	29.2	30.9	34.7	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	41.6	41.6
Residential Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.6	7.6	12.1	12.7	12.7	12.7	12.7	12.7	14.5	14.5
New Home	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.6	1.9	2.9	3.7	4.3	5.0	5.5	5.5	5.5	6.3	6.3
Energy Efficient Light Fixtures	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	1.0	2.1	2.6	3.7	4.5	4.5	4.5	5.1	5.1
Seasonal LED Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	1.3	2.3	3.1	3.2	3.2	3.2	3.2	3.2	3.7	3.7
High Efficiency Furnace & Boiler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.3	1.3	1.3	1.3	1.3	1.4	1.4
Residential Hot Water	-	-	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7
Water Heater Rental	-	-	-	-	-	-	-	0.1	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Retrofit/Demonstration	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigerator/Freezer Buy-Back	-	-	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5.0	8.9	15.7	21.0	25.1	29.6	31.3	35.1	37.2	37.5	37.6	37.6	37.6	37.6	37.6	45.8	53.7	65.4	79.8	108.8	147.9	171.3	172.6	172.6	172.6	196.8	196.8
RESIDENTIAL TOTAL	5.0	8.9	15.7	21.0	25.1	29.6	31.3	35.1	37.2	37.5	37.6	37.6	37.6	37.6	37.6	47.5	57.9	76.1	96.9	132.0	178.3	209.3	238.2	258.9	258.9	295.2	272.9
COMMERCIAL																											
Commercial Lighting	-	-	-	2.9	17.0	35.9	55.0	61.2	67.4	85.4	90.8	94.9	100.2	105.6	116.2	132.6	153.1	175.8	193.9	218.9	239.5	258.7	281.2	309.0	309.0	352.2	352.2
Internal Retrofit	-	-	-	0.2	1.2	2.7	3.3	3.8	4.3	4.9	5.4	5.9	6.1	6.9	9.4	12.2	14.4	17.0	18.0	19.8	29.5	41.4	53.6	55.2	55.2	62.9	62.9
Commercial Earth Power	-	-	-	-	-	-	-	0.3	1.1	1.8	2.9	3.2	4.0	5.1	7.8	8.8	11.1	15.3	18.6	20.2	23.6	26.0	27.8	29.9	29.9	34.0	34.0
Commercial Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.2	3.0	4.3	5.5	7.0	8.7	21.2	21.2	24.2	24.2
Commercial Custom Measures	-	-	-	-	-	-	-	0.4	0.4	2.6	10.0	10.8	11.7	12.2	12.8	12.8	12.9	13.1	15.4	15.9	17.4	18.8	20.2	21.0	21.0	23.9	23.9
Commercial Insulation*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	1.9	4.1	6.6	9.7	12.5	15.6	15.6	17.8	17.8
Commercial Windows*	-	-	-	-	-	-	-	0.1	0.4	0.6	0.7	0.9	1.0	1.4	1.8	2.3	3.2	3.9	4.5	5.2	7.3	9.7	11.7	13.9	13.9	15.8	15.8
Commercial HVAC - Chillers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	3.7	4.1	4.3	4.8	5.3	7.1	8.2	9.4	9.4	10.7	10.7
Commercial New Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.3	6.4	6.4	7.3	7.3
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.6	0.9	0.9	1.0	1.0	1.1	-
Commercial Kitchen Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.5	0.6	0.7	0.7	0.7	0.8	0.8
Commercial Network Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.2	0.2	0.2	0.2	0.2	0.2
Commercial HVAC - CO2 Sensors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.1	0.1	0.1	0.2	0.2
LED Roadway Lighting Pilot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	3.1	18.2	38.6	58.3	65.8	73.6	95.3	109.7	115.6	123.1	131.1	147.9	171.1	198.4	231.1	259.6	293.9	335.8	380.1	428.0	483.5	483.5	551.2	550.1
DISCONTINUED/COMPLETED																											
Parking Lot Controllers	-	-	-	-	-	-	-	0.8	1.6	3.7	4.1	4.4	5.9	6.8	8.8	11.5	20.0	27.9	30.5	32.4	34.9	38.1	39.4	39.4	39.4	44.9	44.9
Agricultural Heat Pads	-	-	-	-	-	-	-	-	-	3.5	5.5	6.7	9.2	11.6	12.9	15.4	16.4	17.0	21.8	24.3	25.4	28.4	30.2	32.0	32.0	36.5	36.5
Roadway Lighting	-	-	3.9	13.5	23.2	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	34.0	34.0
City of Winnipeg Power Smart Agreement	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.6	1.2	7.6	9.6	10.1	10.3	10.8	11.1	11.5	11.6	11.6	13.2	13.2
Sentinel Lighting	-	-	2.3	4.7	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8.5	8.5
Infrared Heat Lamp	-	-	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	4.2	4.2
Commercial Showerhead	-	-	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.6	1.6
Commercial Construction - Air Barrier	-	-	-	-	-	-	-	0.2	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9
Power Smart Shops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.7	0.7	0.7	0.7	0.8	0.8
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.3	0.4	0.5	0.6	0.6	0.7	0.7
Livestock Waterer	-	-	-	-	-	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-
Commercial Construction - Air Conditioning	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Spray Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.9	2.9	4.8	5.2	5.2	-	-	-	-	-
Agricultural Demand Controller	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	11.3	23.4	35.8	42.7	42.8	43.8	44.7	50.3	52.8	54.4	58.6	62.1	66.1	72.0	87.9	100.4	109.2	115.9	120.9	127.9	126.3	128.3	128.3	146.3	145.9
COMMERCIAL TOTAL	-	-	11.3	26.5	54.0	81.3	101.1	109.6	118.3	145.5	162.5	170.0	181.7	193.2	214.0	243.1	286.3	331.5	368.9	409.8	456.7	508.0	554.3	611.9	611.9	697.6	696.0
INDUSTRIAL																											
Performance Optimization	-	-	-	-	-	2.4	7.2	35.1	43.5	85.9	107.7	110.8	142.9	170.5	181.5	207.6	238.6	249.3	276.4	294.9	319.6	347.9	373.1	373.1	402.7	443.0	443.0
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	2.4	7.2	35.1	43.5	85.9	107.7	110.8	142.9	170.5	181.5	207.6	238.6	249.3	276.4	294.9	319.6	347.9	373.1	373.1	402.7	443.0	443.0
DISCONTINUED/COMPLETED																											
Retrofit/Demonstration GSL	-	-	-	0.1	0.7	9.7	32.7	32.7	32.7	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.0	33.0	33.0	33.0	33.0	33.0	33.0	36.3	36.3
High Efficiency Motors	-	-	0.4	4.8	7.7	10.3	13.3	17.9	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	23.6	23.6
Industrial (Basic)	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	0.4	4.9	8.3	20.0	46.0	50.6	54.2	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.5	54.5	54.5	54.5	54.5	54.5	54.5	59.9	59.9
INDUSTRIAL TOTAL	-	-	0.4	4.9	8.3	22.4	53.2	85.7	97.7	140.4	162.3	165.4	197.5	225.1	236.0	262.2	293.1	303.9	330.9	349.3	374.1	402.4	427.6	427.6	457.2	502.9	502.9
EFFICIENCY PROGRAMS SUBTOTAL	5.0	8.9	27.4	52.3	87.5	133.3	185.6	230.5	253.2	323.5	362.4	373.0	416.8	455.9	487.6	552.7	637.4	711.6	796.6	891.1	1,009.1	1,119.7	1,220.1	1,298.4	1,328.0	1,495.6	1,471.8
CUSTOMER SELF-GENERATION PROGRAMS																											
Bioenergy Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.3	120.1	84.2	94.0	80.1	86.6	70.3	82.5	50.7	55.7	55.7
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.3	120.1	84.2	94.0	80.1	86.6	70.3	82.5	50.7	55.7	55.7
GW.h IMPACTS (at meter)	5.0	8.9	27.4	52.3	87.5	133.3	185.6	230.5	253.2	323.5	362.4	373.0	416.8	455.9	487.6	552.7	647.6	831.6	880.8	985.1	1,089.2	1,206.2	1,290.3	1,380.9	1,378.7	N/A	N/A
GW.h IMPACTS (at generation)	5.7	10.2	31.2	59.4	99.4	151.1	209.5	259.3	284.7	363.1	406.6	418.6	467.2	510.7	546.5	619.6	726.2	931.1	987.5	1,105.3	1,223.5	1,355.6	1,451.1	1,553.8	1,551.4	1,551.4	1,527.5

Persisting Energy Savings - GW.h
Electric Incentive-Based Programs

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
RESIDENTIAL													
Home Insulation	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9
Refrigerator Retirement	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	8.6	-	-	-	-
Water & Energy Saver	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6
Affordable Energy Program	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-
	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	75.4	66.8	66.8	66.8	66.8
DISCONTINUED/COMPLETED													
Compact Fluorescent Lighting	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5
Outdoor Timer	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5
Residential Appliances	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
New Home	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Energy Efficient Light Fixtures	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Seasonal LED Lighting	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
High Efficiency Furnace & Boiler	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Residential Hot Water	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Water Heater Rental	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Programmable Thermostat	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Retrofit/Demonstration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigerator/Freezer Buy-Back	-	-	-	-	-	-	-	-	-	-	-	-	-
	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6
RESIDENTIAL TOTAL	258.9	258.9	258.9	258.9	258.9	258.9	258.9	258.9	248.0	239.4	239.4	239.4	239.4
COMMERCIAL													
Commercial Lighting	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0
Internal Retrofit	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2
Commercial Earth Power	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
Commercial Refrigeration	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2
Commercial Custom Measures	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Commercial Insulation*	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
Commercial Windows*	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9
Commercial HVAC - Chillers	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
Commercial New Buildings	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Commercial Building Optimization	1.0	1.0	1.0	1.0	1.0	1.0	0.1	0.1	-	-	-	-	-
Commercial Kitchen Appliances	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Commercial Network Energy Manager	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Commercial HVAC - CO2 Sensors	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
LED Roadway Lighting Pilot	-	-	-	-	-	-	-	-	-	-	-	-	-
	483.5	483.5	483.5	483.5	483.5	483.5	482.7	482.7	482.6	482.6	482.6	482.6	482.6
DISCONTINUED/COMPLETED													
Parking Lot Controllers	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4
Agricultural Heat Pads	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Roadway Lighting	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
City of Winnipeg Power Smart Agreement	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6
Sentinel Lighting	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Infrared Heat Lamp	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Commercial Showerhead	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Commercial Construction - Air Barrier	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Power Smart Shops	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Commercial Clothes Washers	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Livestock Waterer	0.2	0.1	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Spray Valves	-	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural Demand Controller	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-
	128.2	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0
COMMERCIAL TOTAL	611.7	611.6	611.5	611.5	611.5	611.5	610.6	610.6	610.5	610.5	610.5	610.5	610.5
INDUSTRIAL													
Performance Optimization	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-
	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7
DISCONTINUED/COMPLETED													
Retrofit/Demonstration GSL	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
High Efficiency Motors	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Industrial (Basic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-
	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5
INDUSTRIAL TOTAL	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2
EFFICIENCY PROGRAMS SUBTOTAL	1,327.8	1,327.7	1,327.6	1,327.6	1,327.6	1,327.6	1,326.8	1,326.8	1,315.7	1,307.1	1,307.1	1,307.1	1,307.1
CUSTOMER SELF-GENERATION PROGRAMS													
Bioenergy Optimization	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7
	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7
GW.h IMPACTS (at meter)	1,378.5	1,378.4	1,378.3	1,378.3	1,378.3	1,378.3	1,377.4	1,377.4	1,366.4	1,357.8	1,357.8	1,357.8	1,357.8
GW.h IMPACTS (at generation)	1,551.2	1,551.0	1,551.0	1,551.0	1,551.0	1,551.0	1,550.0	1,550.0	1,537.4	1,527.5	1,527.5	1,527.5	1,527.5

	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL														
Home Insulation	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9
Refrigerator Retirement	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water & Energy Saver	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6
Affordable Energy Program	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8
DISCONTINUED/COMPLETED														
Compact Fluorescent Lighting	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5
Outdoor Timer	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5
Residential Appliances	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
New Home	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Energy Efficient Light Fixtures	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Seasonal LED Lighting	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
High Efficiency Furnace & Boiler	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Residential Hot Water	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Water Heater Rental	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Programmable Thermostat	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Retrofit/Demonstration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigerator/Freezer Buy-Back	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6
RESIDENTIAL TOTAL	239.4	239.4	239.4	239.4	239.4	239.4	239.4	239.4	239.4	239.4	239.4	239.4	239.4	239.4
COMMERCIAL														
Commercial Lighting	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0	309.0
Internal Retrofit	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2
Commercial Earth Power	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
Commercial Refrigeration	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2
Commercial Custom Measures	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Commercial Insulation*	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
Commercial Windows*	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9
Commercial HVAC - Chillers	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
Commercial New Buildings	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Kitchen Appliances	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Commercial Network Energy Manager	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Commercial HVAC - CO2 Sensors	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
LED Roadway Lighting Pilot	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	482.6	482.6	482.6	482.6	482.6	482.6	482.6	482.6	482.6	482.6	482.6	482.6	482.6	482.6
DISCONTINUED/COMPLETED														
Parking Lot Controllers	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4
Agricultural Heat Pads	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Roadway Lighting	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
City of Winnipeg Power Smart Agreement	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6
Sentinel Lighting	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Infrared Heat Lamp	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Commercial Showerhead	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Commercial Construction - Air Barrier	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Power Smart Shops	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Commercial Clothes Washers	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Livestock Waterer	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Spray Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural Demand Controller	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0
COMMERCIAL TOTAL	610.5	610.5	610.5	610.5	610.5	610.5	610.5	610.5	610.5	610.5	610.5	610.5	610.5	610.5
INDUSTRIAL														
Performance Optimization	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7	402.7
DISCONTINUED/COMPLETED														
Retrofit/Demonstration GSL	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
High Efficiency Motors	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Industrial (Basic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5
INDUSTRIAL TOTAL	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2	457.2
EFFICIENCY PROGRAMS SUBTOTAL	1,307.1	1,307.1	1,307.1	1,307.1	1,307.1	1,307.1	1,307.1	1,307.1	1,307.1	1,307.1	1,307.1	1,307.1	1,307.1	1,307.1
CUSTOMER SELF-GENERATION PROGRAMS														
Bioenergy Optimization	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7
	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7
GW.h IMPACTS (at meter)	1,357.8	1,357.8	1,357.8	1,357.8	1,357.8	1,357.8	1,357.8	1,357.8	1,357.8	1,357.8	1,357.8	1,357.8	1,357.8	1,357.8
GW.h IMPACTS (at generation)	1,527.5	1,527.5	1,527.5	1,527.5	1,527.5	1,527.5	1,527.5	1,527.5	1,527.5	1,527.5	1,527.5	1,527.5	1,527.5	1,527.5

Note: Subtotals may not be exact due to rounding.
*Programs comprise the Commercial Building Envelope Program.

Total Annual Energy Savings - GW.h
Electric Incentive-Based Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL																											
Home Insulation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	4.2	10.7	16.5	22.1	28.4	33.8	38.7	44.9	49.4	56.3	56.3
Refrigerator Retirement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.9	19.6	29.3	33.5	-
Water & Energy Saver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.5	12.6	15.7	17.9	17.9
Affordable Energy Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	1.1	2.0	4.2	6.4	9.3	11.8	13.5	13.5
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	4.2	10.7	17.0	23.2	30.4	38.0	65.6	86.3	106.2	121.1	87.7
DISCONTINUED/COMPLETED																											
Compact Fluorescent Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.1	15.4	20.6	28.1	49.9	85.8	107.5	107.5	107.5	107.5	122.5	122.5
Outdoor Timer	5.0	8.9	15.3	20.6	24.8	29.2	30.9	34.7	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	41.6	41.6
Residential Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.6	7.6	12.1	12.7	12.7	12.7	12.7	12.7	14.5	14.5
New Home	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.6	1.9	2.9	3.7	4.3	5.0	5.5	5.5	5.5	6.3	6.3
Energy Efficient Light Fixtures	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	1.0	2.1	2.6	3.7	4.5	4.5	4.5	5.1	5.1
Seasonal LED Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	1.3	2.3	3.1	3.2	3.2	3.2	3.2	3.2	3.7	3.7
High Efficiency Furnace & Boiler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.3	1.3	1.3	1.3	1.3	1.4	1.4
Residential Hot Water	-	-	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7
Water Heater Rental	-	-	-	-	-	-	-	0.1	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Retrofit/Demonstration	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigerator/Freezer Buy-Back	-	-	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5.0	8.9	15.7	21.0	25.1	29.6	31.3	35.1	37.2	37.5	37.6	37.6	37.6	37.6	37.6	45.8	53.7	65.4	79.8	108.8	147.9	171.3	172.6	172.6	172.6	196.8	196.8
RESIDENTIAL TOTAL	5.0	8.9	15.7	21.0	25.1	29.6	31.3	35.1	37.2	37.5	37.6	37.6	37.6	37.6	37.6	47.5	57.9	76.1	96.9	132.0	178.3	209.3	238.2	258.9	278.8	317.9	284.4
COMMERCIAL																											
Commercial Lighting	-	-	-	2.9	17.0	35.9	55.0	61.2	67.4	85.4	90.8	94.9	100.2	105.6	116.2	132.6	153.1	175.8	193.9	218.9	239.5	258.7	281.2	309.0	341.7	389.5	389.5
Internal Retrofit	-	-	-	0.2	1.2	2.7	3.3	3.8	4.3	4.9	5.4	5.9	6.1	6.9	9.4	12.2	14.4	17.0	18.0	19.8	29.5	41.4	53.6	55.2	57.4	65.4	65.4
Commercial Earth Power	-	-	-	-	-	-	-	0.3	1.1	1.8	2.9	3.2	4.0	5.1	7.8	8.8	11.1	15.3	18.6	20.2	23.6	26.0	27.8	29.9	34.8	39.7	39.7
Commercial Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.2	3.0	4.3	5.5	7.0	8.7	21.2	30.0	34.2	34.2
Commercial Insulation*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	1.9	4.1	6.6	9.7	12.5	15.6	22.6	25.7	25.7
Commercial Custom Measures	-	-	-	-	-	-	-	0.4	0.4	2.6	10.0	10.8	11.7	12.2	12.8	12.8	12.9	13.1	15.4	15.9	17.4	18.8	20.2	21.0	21.3	24.3	24.3
Commercial Windows*	-	-	-	-	-	-	-	0.1	0.4	0.6	0.7	0.9	1.0	1.4	1.8	2.3	3.2	3.9	4.5	5.2	7.3	9.7	11.7	13.9	15.5	17.7	17.7
Commercial HVAC - Chillers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	3.7	4.1	4.3	4.8	5.3	7.1	8.2	9.4	10.2	11.6	11.6
Commercial New Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.3	6.4	8.1	9.2	9.2
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.6	0.9	0.9	1.0	2.9	3.3	-
Commercial Kitchen Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.5	0.6	0.7	0.7	0.8	0.9	0.9
Commercial Network Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.2	0.2	0.2	0.7	0.8	0.8
Commercial HVAC - CO2 Sensors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.1	0.1	0.1	0.2	0.2
LED Roadway Lighting Pilot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	-	-	-	3.1	18.2	38.6	58.3	65.8	73.6	95.3	109.7	115.6	123.1	131.1	147.9	171.1	198.4	231.1	259.6	293.9	335.8	380.1	428.0	483.5	545.9	622.4	619.1
DISCONTINUED/COMPLETED																											
Parking Lot Controllers	-	-	-	-	-	-	-	0.8	1.6	3.7	4.1	4.4	5.9	6.8	8.8	11.5	20.0	27.9	30.5	32.4	34.9	38.1	39.4	39.4	39.4	44.9	44.9
Agricultural Heat Pads	-	-	-	-	-	-	-	-	-	3.5	5.5	6.7	9.2	11.6	12.9	15.4	16.4	17.0	21.8	24.3	25.4	28.4	30.2	32.0	34.5	39.3	39.3
Roadway Lighting	-	-	3.9	13.5	23.2	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	34.0	34.0
City of Winnipeg Power Smart Agreement	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.6	1.2	7.6	9.6	10.1	10.3	10.8	11.1	11.5	11.6	11.6	13.2	13.2
Sentinel Lighting	-	-	2.3	4.7	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8.5	8.5
Infrared Heat Lamp	-	-	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	4.2	4.2
Commercial Showerhead	-	-	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.6	1.6
Commercial Construction - Air Barrier	-	-	-	-	-	-	-	0.2	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9
Power Smart Shops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.7	0.7	0.7	0.7	0.8	0.8
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.3	0.4	0.5	0.6	0.7	0.8	0.8
Livestock Waterer	-	-	-	-	-	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-
Commercial Construction - Air Conditioning	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Spray Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.9	2.9	4.8	5.2	5.2	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural Demand Controller	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	11.3	23.4	35.8	42.7	42.8	43.8	44.7	50.3	52.8	54.4	58.6	62.1	66.1	72.0	87.9	100.4	109.2	115.9	120.9	127.9	126.3	128.3	130.9	149.3	148.8
COMMERCIAL TOTAL	-	-	11.3	26.5	54.0	81.3	101.1	109.6	118.3	145.5	162.5	170.0	181.7	193.2	214.0	243.1	286.3	331.5	368.9	409.8	456.7	508.0	554.3	611.9	676.9	771.6	767.9
INDUSTRIAL																											
Performance Optimization	-	-	-	-	-	2.4	7.2	35.1	43.5	85.9	107.7	110.8	142.9	170.5	181.5	207.6	238.6	249.3	276.4	294.9	319.6	347.9	373.1	441.8	471.4	518.6	518.6
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	2.4	7.2	35.1	43.5	85.9	107.7	110.8	142.9	170.5	181.5	207.6	238.6	249.3	276.4	294.9	319.6	347.9	373.1	441.8	471.4	518.6	518.6
DISCONTINUED/COMPLETED																											
Retrofit/Demonstration GSL	-	-	-	0.1	0.7	9.7	32.7	32.7	32.7	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.0	33.0	33.0	33.0	33.0	33.0	33.0	36.3	36.3
High Efficiency Motors	-	-	0.4	4.8	7.7	10.3	13.3	17.9	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	23.6	23.6
Industrial (Basic)	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	0.4	4.9	8.3	20.0	46.0	50.6	54.2	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.5	54.5	54.5	54.5	54.5	54.5	54.5	59.9	59.9
INDUSTRIAL TOTAL	-	-	0.4	4.9	8.3	22.4	53.2	85.7	97.7	140.4	162.3	165.4	197.5	225.1	236.0	262.2	293.1	303.9	330.9	349.3	374.1	402.4	427.6	496.3	525.9	578.5	578.5
EFFICIENCY PROGRAMS SUBTOTAL	5.0	8.9	27.4	52.3	87.5	133.3	185.6	230.5	253.2	323.5	362.4	373.0	416.8	455.9	487.6	552.7	637.4	711.6	796.6	891.1	1,009.1	1,119.7	1,220.1	1,367.1	1,481.6	1,668.0	1,630.8
CUSTOMER SELF-GENERATION PROGRAMS																											
Bioenergy Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.3	120.1	84.2	94.0	80.1	86.6	70.3	82.5	99.3	109.3	56.5
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.3	120.1	84.2	94.0	80.1	86.6	70.3	82.5	99.3	109.3	56.5
GW.h IMPACTS (at meter)	5.0	8.9	27.4	52.3	87.5	133.3	185.6	230.5	253.2	323.5	362.4	373.0	416.8	455.9	487.6	552.7	647.6	831.6	880.8	985.1	1,089.2	1,206.2	1,290.3	1,449.6	1,581.0	N/A	N/A
GW.h IMPACTS (at generation)	5.7	10.2	31.2	59.4	99.4	151.1	209.5	259.3	284.7	363.1	406.6	418.6	467.2	510.7	546.5	619.6	726.2	931.1	987.5	1,105.3	1,223.5	1,355.6	1,451.1	1,629.4	1,777.3	1,777.3	1,687.3

Note: Subtotals may not be exact due to rounding.
* Programs comprise the Commercial Building Envelope Program.

Total Annual Energy Savings - GW.h
Electric Incentive-Based Programs

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
RESIDENTIAL														
Home Insulation	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Refrigerator Retirement	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3	18.4	9.8	-	-	-	-
Water & Energy Saver	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7
Affordable Energy Program	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	106.2	106.2	106.2	106.2	106.2	106.2	106.2	106.2	95.3	86.7	76.9	76.9	76.9	76.9
DISCONTINUED/COMPLETED														
Compact Fluorescent Lighting	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5
Outdoor Timer	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5
Residential Appliances	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
New Home	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Energy Efficient Light Fixtures	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Seasonal LED Lighting	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
High Efficiency Furnace & Boiler	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Residential Hot Water	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Water Heater Rental	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Programmable Thermostat	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Retrofit/Demonstration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigerator/Freezer Buy-Back	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6
RESIDENTIAL TOTAL	278.8	278.8	278.8	278.8	278.8	278.8	278.8	278.8	267.9	259.3	249.5	249.5	249.5	249.5
COMMERCIAL														
Commercial Lighting	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7
Internal Retrofit	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4
Commercial Earth Power	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8
Commercial Refrigeration	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Commercial Insulation*	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6
Commercial Custom Measures	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3
Commercial Windows*	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
Commercial HVAC - Chillers	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
Commercial New Buildings	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Commercial Building Optimization	2.9	2.9	2.9	2.9	2.9	2.9	2.0	2.0	1.9	-	-	-	-	-
Commercial Kitchen Appliances	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Commercial Network Energy Manager	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Commercial HVAC - CO2 Sensors	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
LED Roadway Lighting Pilot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	545.9	545.9	545.9	545.9	545.9	545.9	545.1	545.1	545.0	543.0	543.0	543.0	543.0	543.0
DISCONTINUED/COMPLETED														
Parking Lot Controllers	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4
Agricultural Heat Pads	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5
Roadway Lighting	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
City of Winnipeg Power Smart Agreement	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6
Sentinel Lighting	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Infrared Heat Lamp	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Commercial Showerhead	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Commercial Construction - Air Barrier	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Power Smart Shops	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Commercial Clothes Washers	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Livestock Waterer	0.2	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Spray Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural Demand Controller	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	130.8	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6
COMMERCIAL TOTAL	676.7	676.6	676.5	676.5	676.5	676.5	675.6	675.6	675.5	673.6	673.6	673.6	673.6	673.6
INDUSTRIAL														
Performance Optimization	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4
DISCONTINUED/COMPLETED														
Retrofit/Demonstration GSL	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
High Efficiency Motors	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Industrial (Basic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5
INDUSTRIAL TOTAL	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9
EFFICIENCY PROGRAMS SUBTOTAL	1,481.5	1,481.3	1,481.2	1,481.2	1,481.2	1,481.2	1,480.4	1,480.4	1,469.4	1,458.8	1,449.0	1,449.0	1,449.0	1,449.0
CUSTOMER SELF-GENERATION PROGRAMS														
Bioenergy Optimization	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3
	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3
GW.h IMPACTS (at meter)	1,532.8	1,532.7	1,532.6	1,532.6	1,532.6	1,532.6	1,531.7	1,531.7	1,520.7	1,510.1	1,500.3	1,500.3	1,500.3	1,500.3
GW.h IMPACTS (at generation)	1,724.3	1,724.1	1,724.1	1,724.1	1,724.1	1,724.1	1,723.1	1,723.1	1,710.5	1,698.5	1,687.3	1,687.3	1,687.3	1,687.3

	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL													
Home Insulation	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4	49.4
Refrigerator Retirement	-	-	-	-	-	-	-	-	-	-	-	-	-
Water & Energy Saver	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7
Affordable Energy Program	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-
	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9
DISCONTINUED/COMPLETED													
Compact Fluorescent Lighting	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5	107.5
Outdoor Timer	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5
Residential Appliances	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
New Home	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Energy Efficient Light Fixtures	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Seasonal LED Lighting	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
High Efficiency Furnace & Boiler	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Residential Hot Water	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Water Heater Rental	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Programmable Thermostat	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Retrofit/Demonstration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigerator/Freezer Buy-Back	-	-	-	-	-	-	-	-	-	-	-	-	-
	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6	172.6
RESIDENTIAL TOTAL	249.5	249.5	249.5	249.5	249.5	249.5	249.5	249.5	249.5	249.5	249.5	249.5	249.5
COMMERCIAL													
Commercial Lighting	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7	341.7
Internal Retrofit	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4
Commercial Earth Power	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8
Commercial Refrigeration	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Commercial Insulation*	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6
Commercial Custom Measures	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3
Commercial Windows*	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
Commercial HVAC - Chillers	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
Commercial New Buildings	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Kitchen Appliances	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Commercial Network Energy Manager	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Commercial HVAC - CO2 Sensors	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
LED Roadway Lighting Pilot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	543.0	543.0	543.0	543.0	543.0	543.0	543.0	543.0	543.0	543.0	543.0	543.0	543.0
DISCONTINUED/COMPLETED													
Parking Lot Controllers	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4
Agricultural Heat Pads	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5
Roadway Lighting	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
City of Winnipeg Power Smart Agreement	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6
Sentinel Lighting	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Infrared Heat Lamp	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Commercial Showerhead	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Commercial Construction - Air Barrier	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Power Smart Shops	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Commercial Clothes Washers	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Livestock Waterer	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Spray Valves	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural Demand Controller	-	-	-	-	-	-	-	-	-	-	-	-	-
	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6	130.6
COMMERCIAL TOTAL	673.6	673.6	673.6	673.6	673.6	673.6	673.6	673.6	673.6	673.6	673.6	673.6	673.6
INDUSTRIAL													
Performance Optimization	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-
	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4	471.4
DISCONTINUED/COMPLETED													
Retrofit/Demonstration GSL	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
High Efficiency Motors	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Industrial (Basic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-
	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5
INDUSTRIAL TOTAL	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9	525.9
EFFICIENCY PROGRAMS SUBTOTAL	1,449.0	1,449.0	1,449.0	1,449.0	1,449.0	1,449.0	1,449.0	1,449.0	1,449.0	1,449.0	1,449.0	1,449.0	1,449.0
CUSTOMER SELF-GENERATION PROGRAMS													
Bioenergy Optimization	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3
	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3
GW.h IMPACTS (at meter)	1,500.3	1,500.3	1,500.3	1,500.3	1,500.3	1,500.3	1,500.3	1,500.3	1,500.3	1,500.3	1,500.3	1,500.3	1,500.3
GW.h IMPACTS (at generation)	1,687.3	1,687.3	1,687.3	1,687.3	1,687.3	1,687.3	1,687.3	1,687.3	1,687.3	1,687.3	1,687.3	1,687.3	1,687.3

Note: Subtotals may not be exact due to rounding.
* Programs comprise the Commercial Building Envelope Program.

Appendix G

Average Winter Demand Savings - Incentive-Based Programs

2013/14 Average Winter MW
Electric Incentive-Based Programs

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL																	
Home Insulation	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.8	2.8
Refrigerator Retirement	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	-	-	-	-	1.2	-
Affordable Energy Program	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1
Water & Energy Saver	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.0	4.0	4.0	4.0	5.8	4.6
DISCONTINUED/COMPLETED																	
New Home	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seasonal LED Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outdoor Timer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Residential Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Heater Rental	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficient Light Fixtures	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compact Fluorescent Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retrofit/Demonstration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigerator/Freezer Buy-Back	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High Efficiency Furnace & Boiler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RESIDENTIAL TOTAL	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.0	4.0	4.0	4.0	5.9	4.6
COMMERCIAL																	
Commercial Lighting	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	10.4	10.4
Commercial Insulation*	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	3.1	3.1
Commercial Earth Power	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3
Commercial Refrigeration	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1
Commercial Windows*	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7
Commercial New Buildings	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5
Commercial Building Optimization	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	-	-	0.4	-
Internal Retrofit	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Commercial Network Energy Manager	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Commercial Custom Measures	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Commercial Kitchen Appliances	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LED Roadway Lighting Pilot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial HVAC - Chillers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial HVAC - CO2 Sensors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	15.6	15.6	15.6	15.6	15.6	18.3	17.8
DISCONTINUED/COMPLETED																	
Agricultural Heat Pads	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Commercial Clothes Washers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Showerhead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Infrared Heat Lamp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Livestock Waterer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roadway Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sentinel Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Barrier	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural Demand Controller	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
City of Winnipeg Power Smart Agreement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parking Lot Controllers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse and Save	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Shops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
COMMERCIAL TOTAL	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.0	16.0	16.0	16.0	16.0	18.7	18.3
INDUSTRIAL																	
Performance Optimization	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.8	3.8
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.8	3.8
DISCONTINUED/COMPLETED																	
Industrial (Basic)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retrofit/Demonstration GSL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High Efficiency Motors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INDUSTRIAL TOTAL	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.8	3.8
EFFICIENCY PROGRAMS SUBTOTAL	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	24.6	23.5	23.5	23.5	23.5	28.3	26.7
CUSTOMER SELF-GENERATION PROGRAMS																	
Bioenergy	8.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9.2	0.1
	8.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9.2	0.1
RATE/LOAD MANAGEMENT PROGRAMS																	
Curtailable Rates	146.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	160.9	-
	146.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	160.9	-
MW IMPACTS (at meter)	179.7	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	24.7	23.6	23.6	23.6	23.6	N/A	N/A
MW IMPACTS (at generation)	198.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.0	26.8	26.8	26.8	26.8	198.5	26.8

Note: Subtotals may not be exact due to rounding.
* Programs comprise the Commercial Building Envelope Program.

Persisting Average Winter MW
Electric Incentive-Based Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL																											
Home Insulation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	2.0	5.2	8.0	10.7	13.8	16.4	18.8	22.1	22.1	25.2	25.2
Affordable Energy Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.4	0.7	1.5	3.0	4.1	4.1	4.7	4.7
Water & Energy Saver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	1.3	2.0	2.0	2.2	2.2
Refrigerator Retirement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	1.7	1.7	1.9	-
Community Geothermal															-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	2.0	5.2	8.1	11.0	14.5	18.6	23.9	29.9	29.9	34.0	32.1
DISCONTINUED/COMPLETED																											
Compact Fluorescent Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	3.1	4.2	5.7	10.2	19.4	24.4	24.4	24.4	24.4	27.9	27.9
Outdoor Timer	0.3	0.5	0.9	1.2	1.5	1.9	2.0	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.7	2.7
Residential Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	1.0	1.6	1.7	1.7	1.7	1.7	1.7	1.9	1.9
New Home	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.2	0.4	0.7	1.0	1.2	1.5	1.6	1.6	1.6	1.9	1.9
Energy Efficient Light Fixtures	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.2	0.3	0.4	0.6	0.7	0.7	0.7	0.8	0.8
High Efficiency Furnace & Boiler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	0.4	0.4	0.4	0.4	0.5	0.5
Seasonal LED Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Residential Hot Water	-	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Retrofit/Demonstration	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Heater Rental	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigerator/Freezer Buy-Back	-	-	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Programmable Thermostat	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.3	0.5	1.0	1.3	1.6	1.9	2.1	2.4	2.5	2.5	2.6	2.6	2.6	2.6	2.5	4.2	5.9	7.8	10.3	15.8	25.8	31.4	31.7	31.7	31.7	36.1	36.1
RESIDENTIAL TOTAL	0.3	0.5	1.0	1.3	1.6	1.9	2.1	2.4	2.5	2.5	2.6	2.6	2.6	2.6	2.5	5.0	7.9	12.9	18.4	26.8	40.3	50.0	55.5	61.5	61.5	70.1	68.3
COMMERCIAL																											
Commercial Lighting	-	-	-	0.5	2.6	5.7	9.2	10.8	11.6	15.1	16.4	17.4	18.5	19.7	21.7	24.2	27.7	31.1	34.1	38.5	42.3	45.7	48.8	56.5	56.5	64.4	64.4
Commercial Earth Power	-	-	-	-	-	-	-	0.1	0.8	1.1	1.5	1.7	2.0	2.4	3.8	4.2	5.4	7.4	8.7	9.3	10.3	11.2	11.9	12.4	12.4	14.2	14.2
Internal Retrofit	-	-	-	0.0	0.3	0.6	0.6	0.7	0.9	1.0	1.1	1.2	1.3	1.4	1.7	2.2	2.4	2.8	3.0	3.2	5.4	8.3	11.7	11.9	11.9	13.6	13.6
Commercial Insulation*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.7	1.8	3.2	4.8	6.2	7.4	7.4	8.5	8.5
Commercial Windows*	-	-	-	-	-	-	-	0.1	0.2	0.3	0.3	0.4	0.5	0.6	0.8	1.1	1.5	1.7	1.8	2.1	3.0	4.0	4.8	5.6	5.6	6.4	6.4
Commercial Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.8	1.3	1.6	1.9	2.1	3.5	3.5	4.0	4.0
Commercial Custom Measures	-	-	-	-	-	-	-	0.0	0.0	0.1	0.4	0.5	0.5	0.5	0.9	0.9	0.9	1.0	1.1	1.2	1.2	1.4	1.7	1.7	1.7	1.9	1.9
Commercial New Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	1.5	1.5	1.7	1.7
Commercial Kitchen Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	-
HVAC - CO2 Sensors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0
Commercial Network Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LED Roadway Lighting Pilot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HVAC - Chillers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	0.5	2.9	6.3	9.8	11.8	13.5	17.6	19.7	21.1	22.7	24.6	28.8	32.5	37.8	44.3	50.2	57.6	67.1	77.6	87.8	100.8	100.8	115.0	114.9
DISCONTINUED/COMPLETED																											
Roadway Lighting	-	-	0.9	3.1	5.4	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.9	7.9
Agricultural Heat Pads	-	-	-	-	-	-	-	-	-	0.7	1.0	1.2	1.6	2.0	2.2	2.6	2.7	2.8	3.2	3.5	3.6	3.9	4.1	4.3	4.3	4.9	4.9
City of Winnipeg Power Smart Agreement	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.1	0.3	1.6	2.0	2.1	2.2	2.4	2.5	2.6	2.6	2.6	3.0	3.0
Sentinel Lighting	-	-	0.5	1.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.0	2.0
Agricultural Demand Controller	-	-	-	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1
Infrared Heat Lamp	-	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.2	0.3	0.4	0.4	0.4	0.5	0.5
Commercial Construction - Air Barrier	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Commercial Showerhead	-	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Power Smart Shops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Livestock Waterer	-	-	-	-	-	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parking Lot Controllers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse and Save	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.3	0.3	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	2.2	5.7	9.0	10.6	10.7	10.8	10.8	11.4	11.8	12.0	12.5	12.9	13.3	13.9	15.3	15.8	16.4	16.9	17.5	18.0	18.1	18.4	18.4	21.0	20.9
COMMERCIAL TOTAL	-	-	2.2	6.3	11.9	16.9	20.5	22.5	24.2	29.1	31.5	33.2	35.2	37.5	42.1	46.4	53.1	60.1	66.6	74.5	84.6	95.6	105.9	119.3	119.3	136.0	135.8
INDUSTRIAL																											
Performance Optimization	-	-	-	-	-	0.3	1.1	4.6	5.8	37.4	39.1	39.5	48.4	52.9	54.1	57.6	61.7	63.2	66.2	68.7	72.0	75.5	78.9	87.6	87.6	96.3	96.3
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	0.3	1.1	4.6	5.8	37.4	39.1	39.5	48.4	52.9	54.1	57.6	61.7	63.2	66.2	68.7	72.0	75.5	78.9	87.6	87.6	96.3	96.3
DISCONTINUED/COMPLETED																											
Retrofit/Demonstration GSL	-	-	-	0.3	0.4	1.6	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.8	4.8
High Efficiency Motors	-	-	0.1	0.7	1.3	1.8	2.3	3.0	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	4.2	4.2
Industrial (Basic)	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	0.1	1.0	1.7	3.4	6.6	7.4	8.1	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	9.0	9.0
INDUSTRIAL TOTAL	-	-	0.1	1.0	1.7	3.7	7.7	12.0	13.9	45.5	47.3	47.6	56.6	61.1	62.2	65.8	69.8	71.3	74.4	76.9	80.2	83.7	87.1	95.7	95.7	105.3	105.3
EFFICIENCY PROGRAMS SUBTOTAL	0.3	0.5	3.3	8.6	15.2	22.6	30.3	36.9	40.6	77.1	81.4	83.4	94.4	101.2	106.9	117.2	130.9	144.3	159.4	178.1	205.1	229.3	248.6	276.5	276.5	311.4	309.4
CUSTOMER SELF-GENERATION PROGRAMS																											
Bioenergy Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.3	14.3	14.3	14.3	14.3	14.3	14.4	9.4	5.8	6.4	6.4
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.3	14.3	14.3	14.3	14.3	14.3	14.4	9.4	5.8	6.4	6.4
RATE/LOAD MANAGEMENT PROGRAMS																											
Curtailable Rates	-	-	-	-	40.7	46.4	24.7	32.7	80.0	48.2	58.0	57.1	68.0	110.3	148.5	153.8	189.1	183.3	180.6	172.8	149.2	154.5	147.2	144.8	-	-	-
	-	-	-	-	40.7	46.4	24.7	32.7	80.0	48.2	58.0	57.1	68.0	110.3	148.5	153.8	189.1	183.3	180.6	172.8	149.2	154.5	147.2	144.8	-	-	-
MW IMPACTS (at meter)	0.3	0.5	3.3	8.6	55.9	69.0	55.0	69.6	120.6	125.3	139.4	140.5	162.4	211.4	255.4	270.9	334.2	341.9	354.3	365.2	368.5	398.1	410.2	430.7	282.3	N/A	N/A
MW IMPACTS (at generation)	0.3	0.6	3.7	9.8	62.1	76.6	61.4	77.5	133.8	139.1	154.6	155.9	180.1	234.2	282.7	300.1	370.1	379.1	393.2	405.8	410.4	443.7	457.7	481.0	317.8	317.8	315.8

Note: Subtotals may not be exact due to rounding.
* Programs comprise the Commercial Building Envelope Program.

Persisting Average Winter MW
Electric Incentive-Based Programs

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
RESIDENTIAL														
Home Insulation	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1
Affordable Energy Program	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Water & Energy Saver	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Refrigerator Retirement	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.0	-	-	-	-	-
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.2	28.2	28.2	28.2	28.2	28.2
DISCONTINUED/COMPLETED														
Compact Fluorescent Lighting	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4
Outdoor Timer	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Residential Appliances	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
New Home	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Energy Efficient Light Fixtures	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
High Efficiency Furnace & Boiler	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Seasonal LED Lighting	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Residential Hot Water	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Retrofit/Demonstration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Heater Rental	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigerator/Freezer Buy-Back	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7
RESIDENTIAL TOTAL	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5	60.8	59.9	59.9	59.9	59.9	59.9
COMMERCIAL														
Commercial Lighting	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5
Commercial Earth Power	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4
Internal Retrofit	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9
Commercial Insulation*	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Commercial Windows*	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
Commercial Refrigeration	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Commercial Custom Measures	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Commercial New Buildings	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Commercial Kitchen Appliances	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Commercial Building Optimization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-
HVAC - CO2 Sensors	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Network Energy Manager	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LED Roadway Lighting Pilot	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HVAC - Chillers	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8
DISCONTINUED/COMPLETED														
Roadway Lighting	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Agricultural Heat Pads	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
City of Winnipeg Power Smart Agreement	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Sentinel Lighting	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Agricultural Demand Controller	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Infrared Heat Lamp	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Commercial Clothes Washers	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Commercial Construction - Air Barrier	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Commercial Showerhead	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Power Smart Shops	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Livestock Waterer	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parking Lot Controllers	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse and Save	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	18.4	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3
COMMERCIAL TOTAL	119.2	119.2	119.2	119.2	119.2	119.2	119.1	119.1	119.1	119.1	119.1	119.1	119.1	119.1
INDUSTRIAL														
Performance Optimization	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6
DISCONTINUED/COMPLETED														
Retrofit/Demonstration GSL	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
High Efficiency Motors	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Industrial (Basic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
INDUSTRIAL TOTAL	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7
EFFICIENCY PROGRAMS SUBTOTAL	276.5	276.5	276.4	276.4	276.4	276.4	276.4	276.4	275.7	274.7	274.7	274.7	274.7	274.7
CUSTOMER SELF-GENERATION PROGRAMS														
Bioenergy Optimization	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
RATE/LOAD MANAGEMENT PROGRAMS														
Curtailable Rates	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW IMPACTS (at meter)	282.3	282.3	282.2	282.2	282.2	282.2	282.2	282.2	281.5	280.6	280.6	280.6	280.6	280.6
MW IMPACTS (at generation)	317.8	317.7	317.7	317.7	317.7	317.7	317.7	317.7	316.9	315.8	315.8	315.8	315.8	315.8

	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL													
Home Insulation	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1
Affordable Energy Program	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Water & Energy Saver	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Refrigerator Retirement	-	-	-	-	-	-	-	-	-	-	-	-	-
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-
	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2
DISCONTINUED/COMPLETED													
Compact Fluorescent Lighting	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4
Outdoor Timer	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Residential Appliances	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
New Home	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Energy Efficient Light Fixtures	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
High Efficiency Furnace & Boiler	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Seasonal LED Lighting	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Residential Hot Water	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Retrofit/Demonstration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Heater Rental	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigerator/Freezer Buy-Back	-	-	-	-	-	-	-	-	-	-	-	-	-
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-
	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7
RESIDENTIAL TOTAL	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9
COMMERCIAL													
Commercial Lighting	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5
Commercial Earth Power	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4
Internal Retrofit	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9
Commercial Insulation*	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Commercial Windows*	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
Commercial Refrigeration	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Commercial Custom Measures	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Commercial New Buildings	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Commercial Kitchen Appliances	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-
HVAC - CO2 Sensors	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Network Energy Manager	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LED Roadway Lighting Pilot	-	-	-	-	-	-	-	-	-	-	-	-	-
HVAC - Chillers	-	-	-	-	-	-	-	-	-	-	-	-	-
	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8
DISCONTINUED/COMPLETED													
Roadway Lighting	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Agricultural Heat Pads	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
City of Winnipeg Power Smart Agreement	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Sentinel Lighting	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Agricultural Demand Controller	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Infrared Heat Lamp	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Commercial Clothes Washers	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Commercial Construction - Air Barrier	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Commercial Showerhead	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Power Smart Shops	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Livestock Waterer	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-
Parking Lot Controllers	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse and Save	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-
	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3
COMMERCIAL TOTAL	119.1	119.1	119.1	119.1	119.1	119.1	119.1	119.1	119.1	119.1	119.1	119.1	119.1
INDUSTRIAL													
Performance Optimization	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-
	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6
DISCONTINUED/COMPLETED													
Retrofit/Demonstration GSL	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
High Efficiency Motors	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Industrial (Basic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
INDUSTRIAL TOTAL	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7	95.7
EFFICIENCY PROGRAMS SUBTOTAL	274.7	274.7	274.7	274.7	274.7	274.7	274.7	274.7	274.7	274.7	274.7	274.7	274.7
CUSTOMER SELF-GENERATION PROGRAMS													
Bioenergy Optimization	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
RATE/LOAD MANAGEMENT PROGRAMS													
Curtailable Rates	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
MW IMPACTS (at meter)	280.6	280.6	280.6	280.6	280.6	280.6	280.6	280.6	280.6	280.6	280.6	280.6	280.6
MW IMPACTS (at generation)	315.8	315.8	315.8	315.8	315.8	315.8	315.8	315.8	315.8	315.8	315.8	315.8	315.8

Note: Subtotals may not be exact due to rounding.
* Programs comprise the Commercial Building Envelope Program.

Total Average Winter MW
Electric Incentive-Based Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL																											
Home Insulation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	2.0	5.2	8.0	10.7	13.8	16.4	18.8	22.1	24.5	27.9	27.9
Affordable Energy Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.4	0.7	1.5	3.0	4.1	5.1	5.9	5.9
Refrigerator Retirement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	1.7	2.7	3.1	-
Water & Energy Saver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	1.3	2.0	2.6	2.9	2.9
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	2.0	5.2	8.1	11.0	14.5	18.6	23.9	29.9	35.0	39.9	36.7
DISCONTINUED/COMPLETED																											
Compact Fluorescent Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	3.1	4.2	5.7	10.2	19.4	24.4	24.4	24.4	24.4	27.9	27.9
Outdoor Timer	0.3	0.5	0.9	1.2	1.5	1.9	2.0	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.7	2.7
Residential Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	1.0	1.6	1.7	1.7	1.7	1.7	1.7	1.9	1.9
New Home	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.2	0.4	0.7	1.0	1.2	1.5	1.6	1.6	1.6	1.9	1.9
Energy Efficient Light Fixtures	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.2	0.3	0.4	0.6	0.7	0.7	0.7	0.8	0.8
High Efficiency Furnace & Boiler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	0.4	0.4	0.4	0.4	0.5	0.5
Seasonal LED Lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Residential Hot Water	-	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Water Heater Rental	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Retrofit/Demonstration	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Programmable Thermostat	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigerator/Freezer Buy-Back	-	-	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.3	0.5	1.0	1.3	1.6	1.9	2.1	2.4	2.5	2.5	2.6	2.6	2.6	2.6	2.5	4.2	5.9	7.8	10.3	15.8	25.8	31.4	31.7	31.7	31.7	36.1	36.1
RESIDENTIAL TOTAL	0.3	0.5	1.0	1.3	1.6	1.9	2.1	2.4	2.5	2.5	2.6	2.6	2.6	2.6	2.5	5.0	7.9	12.9	18.4	26.8	40.3	50.0	55.5	61.5	66.7	76.0	72.9
COMMERCIAL																											
Commercial Lighting	-	-	-	0.5	2.6	5.7	9.2	10.8	11.6	15.1	16.4	17.4	18.5	19.7	21.7	24.2	27.7	31.1	34.1	38.5	42.3	45.7	48.8	56.5	65.5	74.7	74.7
Commercial Earth Power	-	-	-	-	-	-	-	0.1	0.8	1.1	1.5	1.7	2.0	2.4	3.8	4.2	5.4	7.4	8.7	9.3	10.3	11.2	11.9	12.4	13.6	15.5	15.5
Internal Retrofit	-	-	-	0.0	0.3	0.6	0.6	0.7	0.9	1.0	1.1	1.2	1.3	1.4	1.7	2.2	2.4	2.8	3.0	3.2	5.4	8.3	11.7	11.9	12.2	13.9	13.9
Commercial Insulation*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.7	1.8	3.2	4.8	6.2	7.4	10.2	11.6	11.6
Commercial Windows*	-	-	-	-	-	-	-	0.1	0.2	0.3	0.3	0.4	0.5	0.6	0.8	1.1	1.5	1.7	1.8	2.1	3.0	4.0	4.8	5.6	6.3	7.2	7.2
Commercial Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.8	1.3	1.6	1.9	2.1	3.5	4.5	5.2	5.2
Commercial New Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	1.5	2.0	2.2	2.2
Commercial Custom Measures	-	-	-	-	-	-	-	0.0	0.0	0.1	0.4	0.5	0.5	0.5	0.9	0.9	0.9	1.0	1.1	1.2	1.2	1.4	1.7	1.7	1.8	2.0	2.0
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.4	0.5	-
Commercial Network Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.2	0.2	0.2
Commercial Kitchen Appliances	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Commercial HVAC - CO2 Sensors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0
LED Roadway Lighting Pilot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0
Commercial HVAC - Chillers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	0.5	2.9	6.3	9.8	11.8	13.5	17.6	19.7	21.1	22.7	24.6	28.8	32.5	37.8	44.3	50.2	57.6	67.1	77.6	87.8	100.8	116.9	133.2	132.7
DISCONTINUED/COMPLETED																											
Roadway Lighting	-	-	0.9	3.1	5.4	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.9	7.9
Agricultural Heat Pads	-	-	-	-	-	-	-	-	-	0.7	1.0	1.2	1.6	2.0	2.2	2.6	2.7	2.8	3.2	3.5	3.6	3.9	4.1	4.3	4.6	5.3	5.3
City of Winnipeg Power Smart Agreement	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.1	0.3	1.6	2.0	2.1	2.2	2.4	2.5	2.6	2.6	2.6	3.0	3.0
Sentinel Lighting	-	-	0.5	1.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.0	2.0
Agricultural Demand Controller	-	-	-	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1
Infrared Heat Lamp	-	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.2	0.3	0.4	0.4	0.5	0.5	0.5
Commercial Construction - Air Barrier	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Commercial Showerhead	-	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Power Smart Shops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Livestock Waterer	-	-	-	-	-	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-
Commercial Construction - Air Conditioning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parking Lot Controllers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse and Save	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.3	0.3	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	2.2	5.7	9.0	10.6	10.7	10.8	10.8	11.4	11.8	12.0	12.5	12.9	13.3	13.9	15.3	15.8	16.4	16.9	17.5	18.0	18.1	18.4	18.8	21.4	21.3
COMMERCIAL TOTAL	-	-	2.2	6.3	11.9	16.9	20.5	22.5	24.2	29.1	31.5	33.2	35.2	37.5	42.1	46.4	53.1	60.1	66.6	74.5	84.6	95.6	105.9	119.3	135.7	154.7	154.1
INDUSTRIAL																											
Performance Optimization	-	-	-	-	-	0.3	1.1	4.6	5.8	37.4	39.1	39.5	48.4	52.9	54.1	57.6	61.7	63.2	66.2	68.7	72.0	75.5	78.9	87.6	91.0	100.1	100.1
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	0.3	1.1	4.6	5.8	37.4	39.1	39.5	48.4	52.9	54.1	57.6	61.7	63.2	66.2	68.7	72.0	75.5	78.9	87.6	91.0	100.1	100.1
DISCONTINUED/COMPLETED																											
Retrofit/Demonstration GSL	-	-	-	0.3	0.4	1.6	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.8	4.8
High Efficiency Motors	-	-	0.1	0.7	1.3	1.8	2.3	3.0	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	4.2	4.2
Industrial (Basic)	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	0.1	1.0	1.7	3.4	6.6	7.4	8.1	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	9.0	9.0
INDUSTRIAL TOTAL	-	-	0.1	1.0	1.7	3.7	7.7	12.0	13.9	45.5	47.3	47.6	56.6	61.1	62.2	65.8	69.8	71.3	74.4	76.9	80.2	83.7	87.1	95.7	99.2	109.1	109.1
EFFICIENCY PROGRAMS SUBTOTAL	0.3	0.5	3.3	8.6	15.2	22.6	30.3	36.9	40.6	77.1	81.4	83.4	94.4	101.2	106.9	117.2	130.9	144.3	159.4	178.1	205.1	229.3	248.6	276.5	301.5	339.8	336.0
CUSTOMER SELF-GENERATION PROGRAMS																											
Bioenergy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.3	14.3	14.3	14.3	14.3	14.3	14.4	9.4	14.2	15.6	6.5
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.3	14.3	14.3	14.3	14.3	14.3	14.4	9.4	14.2	15.6	6.5
RATE/LOAD MANAGEMENT PROGRAMS																											
Curtailable Rates	-	-	-	-	40.7	46.4	24.7	32.7	80.0	48.2	58.0	57.1	68.0	110.3	148.5	153.8	189.1	183.3	180.6	172.8	149.2	154.5	147.2	144.8	146.3	160.9	-
	-	-	-	-	40.7	46.4	24.7	32.7	80.0	48.2	58.0	57.1	68.0	110.3	148.5	153.8	189.1	183.3	180.6	172.8	149.2	154.5	147.2	144.8	146.3	160.9	-
MW IMPACTS (at meter)	0.3	0.5	3.3	8.6	55.9	69.0	55.0	69.6	120.6	125.3	139.4	140.5	162.4	211.4	255.4	270.9	334.2	341.9	354.3	365.2	368.5	398.1	410.2	430.7	462.0	N/A	N/A
MW IMPACTS (at generation)	0.3	0.6	3.7	9.8	62.1	76.6	61.4	77.5	133.8	139.1	154.6	155.9	180.1	234.2	282.7	300.1	370.1	379.1	393.2	405.8	410.4	443.7	457.7	481.0	516.3	516.3	342.5

Note: Subtotals may not be exact due to rounding.
* Programs comprise the Commercial Building Envelope Program.

Total Average Winter MW
Electric Incentive-Based Programs

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
RESIDENTIAL														
Home Insulation	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5
Affordable Energy Program	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Refrigerator Retirement	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.0	1.1	-	-	-	-
Water & Energy Saver	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	34.3	33.3	32.2	32.2	32.2	32.2
DISCONTINUED/COMPLETED														
Compact Fluorescent Lighting	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4
Outdoor Timer	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Residential Appliances	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
New Home	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Energy Efficient Light Fixtures	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
High Efficiency Furnace & Boiler	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Seasonal LED Lighting	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Residential Hot Water	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Water Heater Rental	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Retrofit/Demonstration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigerator/Freezer Buy-Back	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7
RESIDENTIAL TOTAL	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.0	65.0	63.9	63.9	63.9	63.9
COMMERCIAL														
Commercial Lighting	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
Commercial Earth Power	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6
Internal Retrofit	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
Commercial Insulation*	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
Commercial Windows*	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Commercial Refrigeration	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Commercial New Buildings	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Commercial Custom Measures	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Commercial Building Optimization	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	-	-
Commercial Network Energy Manager	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Commercial Kitchen Appliances	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Commercial HVAC - CO2 Sensors	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LED Roadway Lighting Pilot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial HVAC - Chillers	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	116.9	116.9	116.9	116.9	116.9	116.9	116.8	116.8	116.8	116.4	116.4	116.4	116.4	116.4
DISCONTINUED/COMPLETED														
Roadway Lighting	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Agricultural Heat Pads	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
City of Winnipeg Power Smart Agreement	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Sentinel Lighting	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Agricultural Demand Controller	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Infrared Heat Lamp	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Commercial Clothes Washers	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Commercial Construction - Air Barrier	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Commercial Showerhead	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Power Smart Shops	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Livestock Waterer	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parking Lot Controllers	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse and Save	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7
COMMERCIAL TOTAL	135.6	135.6	135.6	135.6	135.6	135.6	135.5	135.5	135.5	135.1	135.1	135.1	135.1	135.1
INDUSTRIAL														
Performance Optimization	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0
DISCONTINUED/COMPLETED														
Retrofit/Demonstration GSL	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
High Efficiency Motors	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Industrial (Basic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
INDUSTRIAL TOTAL	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2
EFFICIENCY PROGRAMS SUBTOTAL	301.5	301.4	301.4	301.4	301.4	301.4	301.4	301.4	300.7	299.3	298.2	298.2	298.2	298.2
CUSTOMER SELF-GENERATION PROGRAMS														
Bioenergy	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
RATE/LOAD MANAGEMENT PROGRAMS														
Curtailable Rates	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW IMPACTS (at meter)	307.4	307.4	307.3	307.3	307.3	307.3	307.3	307.3	306.6	305.3	304.2	304.2	304.2	304.2
MW IMPACTS (at generation)	346.2	346.2	346.2	346.2	346.2	346.2	346.1	346.1	345.3	343.8	342.5	342.5	342.5	342.5

	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL													
Home Insulation	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5
Affordable Energy Program	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Refrigerator Retirement	-	-	-	-	-	-	-	-	-	-	-	-	-
Water & Energy Saver	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Community Geothermal	-	-	-	-	-	-	-	-	-	-	-	-	-
	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
DISCONTINUED/COMPLETED													
Compact Fluorescent Lighting	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4
Outdoor Timer	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Residential Appliances	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
New Home	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Energy Efficient Light Fixtures	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
High Efficiency Furnace & Boiler	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Seasonal LED Lighting	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Residential Hot Water	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Water Heater Rental	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Retrofit/Demonstration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigerator/Freezer Buy-Back	-	-	-	-	-	-	-	-	-	-	-	-	-
	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7
RESIDENTIAL TOTAL	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9
COMMERCIAL													
Commercial Lighting	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
Commercial Earth Power	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6
Internal Retrofit	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
Commercial Insulation*	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
Commercial Windows*	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Commercial Refrigeration	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Commercial New Buildings	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Commercial Custom Measures	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Network Energy Manager	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Commercial Kitchen Appliances	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Commercial HVAC - CO2 Sensors	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LED Roadway Lighting Pilot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial HVAC - Chillers	-	-	-	-	-	-	-	-	-	-	-	-	-
	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4
DISCONTINUED/COMPLETED													
Roadway Lighting	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Agricultural Heat Pads	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
City of Winnipeg Power Smart Agreement	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Sentinel Lighting	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Agricultural Demand Controller	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Infrared Heat Lamp	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Commercial Clothes Washers	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Commercial Construction - Air Barrier	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Commercial Showerhead	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Power Smart Shops	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Livestock Waterer	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Construction - Air Conditioning	-	-	-	-	-	-	-	-	-	-	-	-	-
Aboriginal Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-
Parking Lot Controllers	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse and Save	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-
	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7
COMMERCIAL TOTAL	135.1	135.1	135.1	135.1	135.1	135.1	135.1	135.1	135.1	135.1	135.1	135.1	135.1
INDUSTRIAL													
Performance Optimization	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0
Emergency Preparedness	-	-	-	-	-	-	-	-	-	-	-	-	-
	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0
DISCONTINUED/COMPLETED													
Retrofit/Demonstration GSL	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
High Efficiency Motors	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Industrial (Basic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Efficient Motors (QMR)	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
INDUSTRIAL TOTAL	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2	99.2
EFFICIENCY PROGRAMS SUBTOTAL	298.2	298.2	298.2	298.2	298.2	298.2	298.2	298.2	298.2	298.2	298.2	298.2	298.2
CUSTOMER SELF-GENERATION PROGRAMS													
Bioenergy	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	14.2
	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	14.2
RATE/LOAD MANAGEMENT PROGRAMS													
Curtailable Rates	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
MW IMPACTS (at meter)	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2	304.2	312.5
MW IMPACTS (at generation)	342.5	342.5	342.5	342.5	342.5	342.5	342.5	342.5	342.5	342.5	342.5	342.5	351.7

Note: Subtotals may not be exact due to rounding.
* Programs comprise the Commercial Building Envelope Program.

Appendix H

Natural Gas Savings (m^3) - Incentive-Based Programs

2013/14 Annual Energy Savings - million m^3
Natural Gas Incentive-Based Programs

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
RESIDENTIAL														
Affordable Energy Program	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Home Insulation	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Water & Energy Saver	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
DISCONTINUED/COMPLETED														
High Efficiency Furnace/Boiler	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Home	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RESIDENTIAL TOTAL	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
COMMERCIAL														
Commercial Insulation*	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Commercial HVAC	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Commercial Windows*	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Commercial Building Optimization	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-	-	-	-
Commercial Custom Measures	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Commercial New Buildings	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Commercial Kitchen Appliances	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.1	3.1	3.1	3.1
DISCONTINUED/COMPLETED														
Power Smart Shops	-	-	-	-	-	-	-	-	-	-	-	-	-	-
City of Winnipeg Power Smart Agreement	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse & Save	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COMMERCIAL TOTAL	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.1	3.1	3.1	3.1
INDUSTRIAL														
Natural Gas Optimization	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
INDUSTRIAL TOTAL	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
EFFICIENCY PROGRAMS SUBTOTAL	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.5	6.5	6.5	6.5
CUSTOMER SELF-GENERATION														
Bioenergy Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LESS: INTERACTIVE EFFECTS	(0.9)	(1.0)	(1.0)	(1.0)	(0.9)	(1.1)	(1.1)	(1.2)	(1.2)	(1.2)	(1.2)	(0.4)	(0.5)	(0.5)
NET IMPACT: OVERALL	5.8	5.7	5.6	5.6	5.7	5.5	5.5	5.5	5.5	5.5	5.3	6.0	6.0	6.0

	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL														
Affordable Energy Program	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Home Insulation	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Water & Energy Saver	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
DISCONTINUED/COMPLETED														
High Efficiency Furnace/Boiler	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Home	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Programmable Thermostat	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RESIDENTIAL TOTAL	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
COMMERCIAL														
Commercial Insulation*	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Commercial HVAC	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Commercial Windows*	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Custom Measures	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Commercial New Buildings	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Commercial Kitchen Appliances	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
DISCONTINUED/COMPLETED														
Power Smart Shops	-	-	-	-	-	-	-	-	-	-	-	-	-	-
City of Winnipeg Power Smart Agreement	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse & Save	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COMMERCIAL TOTAL	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
INDUSTRIAL														
Natural Gas Optimization	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
INDUSTRIAL TOTAL	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
EFFICIENCY PROGRAMS SUBTOTAL	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
CUSTOMER SELF-GENERATION														
Bioenergy Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LESS: INTERACTIVE EFFECTS	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)
NET IMPACT: OVERALL	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1

Note: Subtotals may not be exact due to rounding.
* Programs comprise Commercial Building Envelope Program.

Persisting Energy Savings - million m3
Natural Gas Incentive-Based Programs

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
RESIDENTIAL																											
Home Insulation	-	-	-	-	0.3	2.2	3.9	5.6	7.6	9.0	10.2	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3
Affordable Energy Program	-	-	-	-	-	-	0.0	0.1	0.7	2.3	3.5	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Water & Energy Saver	-	-	-	-	-	-	-	-	-	0.8	1.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	-	-	-	-	0.3	2.2	3.9	5.6	8.3	12.2	15.4	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7
DISCONTINUED/COMPLETED																											
High Efficiency Furnace/Boiler	-	-	-	-	0.6	2.6	4.0	5.8	6.9	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
New Home	-	-	-	0.0	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Programmable Thermostat	-	-	-	-	-	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	-	-	-	0.0	0.7	2.9	4.4	6.3	7.5	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
RESIDENTIAL TOTAL	-	-	-	0.0	1.0	5.0	8.3	11.9	15.8	19.8	23.1	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4
COMMERCIAL																											
Commercial HVAC	-	-	-	-	-	0.4	2.5	4.8	6.2	6.2	7.2	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Commercial Insulation*	-	-	-	-	-	0.3	1.1	2.1	3.2	5.4	6.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Commercial New Buildings	-	-	-	-	-	-	-	-	-	-	0.4	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Commercial Windows*	-	-	-	-	-	0.0	0.1	0.2	0.5	0.8	1.3	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Commercial Custom Measures	-	-	-	-	-	-	-	-	0.1	0.2	0.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Commercial Building Optimization	-	-	-	-	-	-	-	0.1	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.1	0.1	-	-	-	-	-	-
Commercial Kitchen Appliances	-	-	-	-	-	-	-	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	-	-	-	-	-	0.7	3.7	7.3	10.3	13.0	16.4	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1
DISCONTINUED/COMPLETED																											
City of Winnipeg Power Smart Agreement	-	0.1	0.1	0.2	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Power Smart Shops	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse & Save	-	-	-	-	-	0.8	1.1	2.1	2.4	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	0.1	0.1	0.2	0.6	1.5	1.8	2.8	3.1	3.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
COMMERCIAL TOTAL	-	0.1	0.1	0.2	0.6	2.2	5.5	10.1	13.4	16.2	17.2	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.0	23.0	22.9	22.9	22.9	22.9	22.9	22.9
INDUSTRIAL																											
Natural Gas Optimization	-	-	-	-	-	-	1.7	3.8	4.9	8.0	10.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
INDUSTRIAL TOTAL	-	-	-	-	-	-	1.7	3.8	4.9	8.0	10.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
EFFICIENCY PROGRAMS SUBTOTAL	-	0.1	0.1	0.2	1.6	7.3	15.5	25.9	34.1	44.0	50.9	62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8
CUSTOMER SELF-GENERATION																											
Bioenergy Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LESS: INTERACTIVE EFFECTS	-	(0.0)	(0.0)	(1.2)	(2.6)	(3.0)	(3.8)	(5.9)	(8.9)	(10.5)	(11.3)	(12.0)	(12.1)	(12.1)	(12.2)	(12.1)	(12.1)	(12.2)	(12.2)	(12.3)	(12.3)	(12.3)	(11.5)	(11.5)	(11.5)	(11.5)	(11.5)
NET IMPACT: OVERALL	-	0.1	0.1	(1.0)	(1.0)	4.3	11.7	20.0	25.3	33.5	39.6	50.1	50.1	50.1	50.0	50.1	50.1	50.0	50.0	49.6	49.6	49.5	50.3	50.2	50.2	50.3	50.3

Note: Subtotals may not be exact due to rounding.
* Programs comprise Commercial Building Envelope Program.

Persisting Energy Savings - million m3
Natural Gas Incentive-Based Programs

	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL													
Home Insulation	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3
Affordable Energy Program	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Water & Energy Saver	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7
DISCONTINUED/COMPLETED													
High Efficiency Furnace/Boiler	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
New Home	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Programmable Thermostat	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
RESIDENTIAL TOTAL	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4
COMMERCIAL													
Commercial HVAC	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Commercial Insulation*	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Commercial New Buildings	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Commercial Windows*	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Commercial Custom Measures	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Kitchen Appliances	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1
DISCONTINUED/COMPLETED													
City of Winnipeg Power Smart Agreement	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Power Smart Shops	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse & Save	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
COMMERCIAL TOTAL	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9
INDUSTRIAL													
Natural Gas Optimization	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
INDUSTRIAL TOTAL	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
EFFICIENCY PROGRAMS SUBTOTAL	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8
CUSTOMER SELF-GENERATION													
Bioenergy Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
LESS: INTERACTIVE EFFECTS	(11.5)	(11.5)	(11.5)	(11.5)	(11.5)	(11.5)	(11.6)	(11.6)	(11.6)	(11.6)	(11.6)	(11.6)	(11.6)
NET IMPACT: OVERALL	50.3	50.2	50.2	50.2	50.2	50.2	50.1	50.1	50.1	50.1	50.1	50.1	50.1

Note: Subtotals may not be exact due to rounding.
* Programs comprise Commercial Building Envelope Program.

Total Annual Energy Savings - million m^3
Natural Gas Incentive-Based Programs

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
ESIDENTIAL																											
Home Insulation	-	-	-	-	0.3	2.2	3.9	5.6	7.6	9.0	10.2	11.3	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Affordable Energy Program	-	-	-	-	-	-	0.0	0.1	0.7	2.3	3.5	4.6	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Water & Energy Saver	-	-	-	-	-	-	-	-	-	0.8	1.8	2.8	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
	-	-	-	-	0.3	2.2	3.9	5.6	8.3	12.2	15.4	18.7	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
DISCONTINUED/COMPLETED																											
High Efficiency Furnace/Boiler	-	-	-	-	0.6	2.6	4.0	5.8	6.9	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
New Home	-	-	-	0.0	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Programmable Thermostat	-	-	-	-	-	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	-	-	-	0.0	0.7	2.9	4.4	6.3	7.5	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
RESIDENTIAL TOTAL	-	-	-	0.0	1.0	5.0	8.3	11.9	15.8	19.8	23.1	26.4	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
OMMERCIAL																											
Commercial HVAC	-	-	-	-	-	0.4	2.5	4.8	6.2	6.2	7.2	8.4	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Commercial Insulation*	-	-	-	-	-	0.3	1.1	2.1	3.2	5.4	6.8	7.8	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Commercial New Buildings	-	-	-	-	-	-	-	-	-	-	0.4	2.8	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Commercial Windows*	-	-	-	-	-	0.0	0.1	0.2	0.5	0.8	1.3	1.6	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Commercial Custom Measures	-	-	-	-	-	-	-	-	0.1	0.2	0.3	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Commercial Building Optimization	-	-	-	-	-	-	-	0.1	0.2	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.2	0.2	0.2	-	-	-	-	-
Commercial Kitchen Appliances	-	-	-	-	-	-	-	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	-	-	-	-	-	0.7	3.7	7.3	10.3	13.0	16.4	22.5	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.4	25.4	25.3	25.1	25.1	25.1	25.1	25.1
ISCONTINUED/COMPLETED																											
City of Winnipeg Power Smart Agreement	-	0.1	0.1	0.2	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Power Smart Shops	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse & Save	-	-	-	-	-	0.8	1.1	2.1	2.4	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	0.1	0.1	0.2	0.6	1.5	1.8	2.8	3.1	3.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
COMMERCIAL TOTAL	-	0.1	0.1	0.2	0.6	2.2	5.5	10.1	13.4	16.2	17.2	23.4	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.3	26.3	26.2	26.0	26.0	26.0	26.0	26.0
IDUSTRIAL																											
Natural Gas Optimization	-	-	-	-	-	-	1.7	3.8	4.9	8.0	10.5	12.5	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4
INDUSTRIAL TOTAL	-	-	-	-	-	-	1.7	3.8	4.9	8.0	10.5	12.5	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4
FFICIENCY PROGRAMS SUBTOTAL	-	0.1	0.1	0.2	1.6	7.3	15.5	25.9	34.1	44.0	50.9	62.2	68.8	68.8	68.8	68.8	68.8	68.8	68.8	68.5	68.5	68.4	68.2	68.2	68.2	68.2	68.2
USTOMER SELF-GENERATION																											
Bioenergy Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LESS: INTERACTIVE EFFECTS	-	(0.0)	(0.0)	(1.2)	(2.6)	(3.0)	(3.8)	(5.9)	(8.9)	(10.5)	(11.3)	(12.0)	(13.0)	(13.1)	(13.2)	(13.1)	(13.0)	(13.4)	(13.4)	(13.4)	(13.4)	(13.4)	(12.7)	(11.9)	(12.0)	(12.0)	(11.8)
NET IMPACT: OVERALL	-	0.1	0.1	(1.0)	(1.0)	4.3	11.7	20.0	25.3	33.5	39.6	50.1	55.9	55.7	55.6	55.7	55.8	55.5	55.5	55.1	55.1	55.0	55.6	56.3	56.2	56.3	56.4

Note: Subtotals may not be exact due to rounding.
* Programs comprise Commercial Building Envelope Program.

Total Annual Energy Savings - million m^3
Natural Gas Incentive-Based Programs

	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL													
Home Insulation	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Affordable Energy Program	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Water & Energy Saver	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
DISCONTINUED/COMPLETED													
High Efficiency Furnace/Boiler	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
New Home	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Programmable Thermostat	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
RESIDENTIAL TOTAL	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
COMMERCIAL													
Commercial HVAC	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Commercial Insulation*	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Commercial New Buildings	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Commercial Windows*	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Commercial Custom Measures	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Commercial Building Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Kitchen Appliances	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1
DISCONTINUED/COMPLETED													
City of Winnipeg Power Smart Agreement	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Power Smart Shops	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Clothes Washers	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Rinse & Save	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
COMMERCIAL TOTAL	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
INDUSTRIAL													
Natural Gas Optimization	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4
INDUSTRIAL TOTAL	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4
EFFICIENCY PROGRAMS SUBTOTAL	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2
CUSTOMER SELF-GENERATION													
Bioenergy Optimization	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
LESS: INTERACTIVE EFFECTS	(11.8)	(11.8)	(11.9)	(11.9)	(11.9)	(11.9)	(11.9)	(11.9)	(11.9)	(11.9)	(11.9)	(12.0)	(12.0)
NET IMPACT: OVERALL	56.4	56.4	56.4	56.4	56.4	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3

Note: Subtotals may not be exact due to rounding.
* Programs comprise Commercial Building Envelope Program.

Appendix I

Energy Savings - DSM Support Programs

2013/14 Annual Energy Savings - GW.h
Electric DSM Support Programs

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
RESIDENTIAL															
Power Smart Residential PAYS	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Power Smart Residential Loan	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
Residential Earth Power Loan	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64
COMMERCIAL															
Power Smart for Business PAYS	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
DISCONTINUED/COMPLETED															
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-2000 Component of the New Home Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW.h IMPACTS (at meter)	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77
GW.h IMPACTS (at generation)	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

Note: Subtotals may not be exact due to rounding.

2013/14 Annual Energy Savings - GW.h
Electric DSM Support Programs

	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL															
Power Smart Residential PAYS	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.41
Power Smart Residential Loan	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.54	0.54
Residential Earth Power Loan	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.09)	(0.09)
	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.87	1.87
COMMERCIAL															
Power Smart for Business PAYS	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1.13	0.15	0.15
	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1.13	0.15	0.15
DISCONTINUED/COMPLETED															
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-2000 Component of the New Home Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GW.h IMPACTS (at meter)	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	N/A	N/A
GW.h IMPACTS (at generation)	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02

Note: Subtotals may not be exact due to rounding.

Persisting Energy Savings - GW.h
Electric DSM Support Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL																											
Residential Earth Power Loan	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	1.0	2.8	4.8	6.1	8.8	10.2	11.2	11.8	12.8	13.3	13.3	15.2	15.2
Power Smart Residential Loan	-	-	-	-	-	-	-	-	-	-	-	-	0.9	1.6	2.2	2.7	3.2	3.9	4.6	5.2	6.9	7.4	7.8	8.4	8.4	9.5	9.5
Power Smart Residential PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.1	0.1
	-	-	-	-	-	-	-	-	-	-	-	-	0.9	1.9	3.1	5.6	8.0	10.0	13.4	15.4	18.1	19.2	20.6	21.7	21.7	24.7	24.7
COMMERCIAL																											
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED																											
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	0.6	1.2	2.4	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	3.2	3.2
R-2000 Component of the New Home Program	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1	0.1
	-	-	-	-	-	-	-	-	-	-	-	-	0.7	1.5	2.9	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	4.3	4.3
GW.h IMPACTS (at meter)	-	-	-	-	-	-	-	-	-	-	-	-	1.6	3.4	6.0	9.3	11.7	13.8	17.2	19.1	21.9	23.0	24.4	25.5	25.5	N/A	N/A
GW.h IMPACTS (at generation)	-	-	-	-	-	-	-	-	-	-	-	-	1.9	3.9	6.8	10.6	13.4	15.7	19.6	21.8	24.9	26.2	27.8	29.1	29.1	29.1	29.1

Note: Subtotals may not be exact due to rounding.

Persisting Energy Savings - GW.h
Electric DSM Support Programs

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL																											
Residential Earth Power Loan	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Power Smart Residential Loan	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Power Smart Residential PAYS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7
COMMERCIAL																											
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED																											
ecoENERGY	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Power Smart Energy Manager	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
R-2000 Component of the New Home Program	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Solar Hot Water Heating	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
GW.h IMPACTS (at meter)	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5
GW.h IMPACTS (at generation)	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1

Note: Subtotals may not be exact due to rounding.

2013/14 Total Annual Energy Savings - GW.h
Electric DSM Support Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL																											
Residential Earth Power Loan	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	1.0	2.8	4.8	6.1	8.8	10.2	11.2	11.8	12.8	13.3	13.2	15.1	15.1
Power Smart Residential Loan	-	-	-	-	-	-	-	-	-	-	-	-	0.9	1.6	2.2	2.7	3.2	3.9	4.6	5.2	6.9	7.4	7.8	8.4	8.8	10.1	10.1
Power Smart Residential PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	1.3	1.5	1.5
	-	-	-	-	-	-	-	-	-	-	-	-	0.9	1.9	3.1	5.6	8.0	10.0	13.4	15.4	18.1	19.2	20.6	21.7	23.3	26.6	26.6
COMMERCIAL																											
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	0.2
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	0.2
DISCONTINUED/COMPLETED																											
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9
Power Smart Energy Manager		-	-	-	-	-	-	-	-	-	-	-	0.6	1.2	2.4	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	3.2	3.2
R-2000 Component of the New Home Program	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1	0.1
	-	-	-	-	-	-	-	-	-	-	-	-	0.7	1.5	2.9	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	4.3	4.3
GW.h IMPACTS (at meter)	-	-	-	-	-	-	-	-	-	-	-	-	1.6	3.4	6.0	9.3	11.7	13.8	17.2	19.1	21.9	23.0	24.4	25.5	27.3	N/A	N/A
GW.h IMPACTS (at generation)	-	-	-	-	-	-	-	-	-	-	-	-	1.9	3.9	6.8	10.6	13.4	15.7	19.6	21.8	24.9	26.2	27.8	29.1	31.1	31.1	31.1

Note: Subtotals may not be exact due to rounding.

2013/14 Total Annual Energy Savings - GW.h
Electric DSM Support Programs

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL																											
Residential Earth Power Loan	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
Power Smart Residential Loan	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
Power Smart Residential PAYS	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
COMMERCIAL																											
Power Smart for Business PAYS	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
DISCONTINUED/COMPLETED																											
ecoENERGY	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Power Smart Energy Manager	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
R-2000 Component of the New Home Program	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Solar Hot Water Heating	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
GW.h IMPACTS (at meter)	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3
GW.h IMPACTS (at generation)	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1

Note: Subtotals may not be exact due to rounding.

Appendix J

Average Winter Savings - DSM Support Programs

2013/14 Average Winter MW
Electric DSM Support Programs

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
RESIDENTIAL															
Power Smart Residential PAYS	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Power Smart Residential Loan	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Residential Earth Power Loan	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
COMMERCIAL															
Power Smart for Business PAYS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DISCONTINUED/COMPLETED															
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-2000 Component of the New Home Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW IMPACTS (at meter)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
MW IMPACTS (at generation)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7

Note: Subtotals may not be exact due to rounding.

2013/14 Average Winter MW
Electric DSM Support Programs

	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL															
Power Smart Residential PAYS	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Power Smart Residential Loan	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Residential Earth Power Loan	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
COMMERCIAL															
Power Smart for Business PAYS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DISCONTINUED/COMPLETED															
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-2000 Component of the New Home Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW IMPACTS (at meter)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	N/A	N/A
MW IMPACTS (at generation)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7

Note: Subtotals may not be exact due to rounding.

Persisting Average Winter MW
Electric DSM Support Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01
RESIDENTIAL												
Power Smart Residential Loan	-	-	-	-	-	-	-	-	-	-	-	-
Residential Earth Power Loan	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Residential PAYS	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
COMMERCIAL												
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED												
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-
R-2000 Component of the New Home Program	-	-	-	-	-	-	-	-	-	-	-	-
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
MW IMPACTS (at meter)	-	-	-	-	-	-	-	-	-	-	-	-
MW IMPACTS (at generation)	-	-	-	-	-	-	-	-	-	-	-	-

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL															
Power Smart Residential Loan	0.5	0.8	1.1	1.4	1.6	2.0	2.7	3.0	3.9	4.2	4.4	4.7	4.7	5.4	5.4
Residential Earth Power Loan	-	0.1	0.2	0.6	1.1	1.4	2.1	2.5	3.0	3.3	3.8	3.9	3.9	4.4	4.4
Power Smart Residential PAYS	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0
	0.5	0.9	1.3	2.0	2.7	3.4	4.8	5.5	6.9	7.5	8.2	8.6	8.6	9.8	9.8
COMMERCIAL															
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED															
Power Smart Energy Manager	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
R-2000 Component of the New Home Program	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
MW IMPACTS (at meter)	0.5	1.0	1.5	2.2	2.9	3.6	5.0	5.7	7.1	7.7	8.4	8.8	8.8	N/A	N/A
MW IMPACTS (at generation)	0.6	1.2	1.7	2.5	3.3	4.1	5.7	6.5	8.1	8.8	9.5	10.0	10.0	10.0	10.0

Note: Subtotals may not be exact due to rounding.

Persisting Average Winter MW
Electric DSM Support Programs

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
RESIDENTIAL														
Power Smart Residential Loan	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Residential Earth Power Loan	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Power Smart Residential PAYS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
COMMERCIAL														
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED														
Power Smart Energy Manager	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R-2000 Component of the New Home Program	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
MW IMPACTS (at meter)	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
MW IMPACTS (at generation)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0

	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL													
Power Smart Residential Loan	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Residential Earth Power Loan	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Power Smart Residential PAYS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
COMMERCIAL													
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED													
Power Smart Energy Manager	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R-2000 Component of the New Home Program	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
MW IMPACTS (at meter)	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
MW IMPACTS (at generation)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0

Note: Subtotals may not be exact due to rounding.

Total Average Winter MW
Electric DSM Support Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	At Generation 2013/14	At Generation 2027/28
RESIDENTIAL																											
Power Smart Residential Loan	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.8	1.1	1.4	1.6	2.0	2.7	3.0	3.9	4.2	4.4	4.7	5.0	5.6	5.6
Residential Earth Power Loan	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	0.6	1.1	1.4	2.1	2.5	3.0	3.3	3.8	3.9	3.9	4.4	4.4
Power Smart Residential PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.3	0.4	0.4
	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.9	1.3	2.0	2.7	3.4	4.8	5.5	6.9	7.5	8.2	8.6	9.2	10.4	10.4
COMMERCIAL																											
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0
DISCONTINUED/COMPLETED																											
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
R-2000 Component of the New Home Program	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
MW IMPACTS (at meter)	-	-	-	-	-	-	-	-	-	-	-	-	0.5	1.0	1.5	2.2	2.9	3.6	5.0	5.7	7.1	7.7	8.4	8.8	9.4	N/A	N/A
MW IMPACTS (at generation)	-	-	-	-	-	-	-	-	-	-	-	-	0.6	1.2	1.7	2.5	3.3	4.1	5.7	6.5	8.1	8.8	9.5	10.0	10.7	10.7	10.7

Note: Subtotals may not be exact due to rounding.

Total Average Winter MW
Electric DSM Support Programs

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL																											
Power Smart Residential Loan	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Residential Earth Power Loan	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Power Smart Residential PAYS	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
COMMERCIAL																											
Power Smart for Business PAYS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DISCONTINUED/COMPLETED																											
Power Smart Energy Manager	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
R-2000 Component of the New Home Program	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
MW IMPACTS (at meter)	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
MW IMPACTS (at generation)	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7

Note: Subtotals may not be exact due to rounding.

Appendix K

Natural Gas Savings (m^3) - DSM Support Programs

2013/14 Annual Energy Savings - million m^3
Natural Gas DSM Support Programs

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL																												
Power Smart Residential Loan	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Residential Earth Power Loan	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Power Smart Residential PAYS	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
COMMERCIAL																												
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED																												
ecoENERGY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Power Smart Energy Manager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R-2000 Component of the New Home Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Hot Water Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m3 IMPACTS	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Note: Subtotals may not be exact due to rounding.

Persisting Energy Savings - million m^3
Natural Gas DSM Support Programs

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
RESIDENTIAL													
Power Smart Residential Loan	1.2	2.1	3.5	5.6	7.8	9.6	11.3	12.3	13.9	14.3	14.6	14.9	14.9
Residential Earth Power Loan	-	0.1	0.1	0.5	0.8	1.0	1.3	1.4	1.7	2.1	2.4	2.7	2.7
Power Smart Residential PAYS	-	-	-	-	-	-	-	-	-	-	-	(0.0)	(0.0)
	1.2	2.2	3.7	6.1	8.6	10.5	12.6	13.7	15.6	16.4	17.0	17.6	17.6
COMMERCIAL													
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED													
ecoENERGY	-	0.1	0.4	1.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Power Smart Energy Manager	(0.0)	0.0	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
R-2000 Component of the New Home Program	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solar Hot Water Heating	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0
	(0.0)	0.2	0.6	1.6	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
m3 IMPACTS	1.2	2.4	4.3	7.7	11.3	13.2	15.3	16.4	18.3	19.0	19.7	20.3	20.3

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
RESIDENTIAL														
Power Smart Residential Loan	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
Residential Earth Power Loan	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Power Smart Residential PAYS	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6
COMMERCIAL														
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED														
ecoENERGY	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Power Smart Energy Manager	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
R-2000 Component of the New Home Program	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solar Hot Water Heating	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
m3 IMPACTS	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3

Note: Subtotals may not be exact due to rounding.

Persisting Energy Savings - million m^3
Natural Gas DSM Support Programs

	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL													
Power Smart Residential Loan	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
Residential Earth Power Loan	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Power Smart Residential PAYS	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6
COMMERCIAL													
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED													
ecoENERGY	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Power Smart Energy Manager	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
R-2000 Component of the New Home Program	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solar Hot Water Heating	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
m3 IMPACTS	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3

Note: Subtotals may not be exact due to rounding.

Total Annual Energy Savings - million m^3
Natural Gas DSM Support Programs

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
RESIDENTIAL													
Power Smart Residential Loan	1.2	2.1	3.5	5.6	7.8	9.6	11.3	12.3	13.9	14.3	14.6	14.9	15.2
Residential Earth Power Loan	-	0.1	0.1	0.5	0.8	1.0	1.3	1.4	1.7	2.1	2.4	2.7	2.9
Power Smart Residential PAYS	-	-	-	-	-	-	-	-	-	-	-	(0.0)	(0.0)
	1.2	2.2	3.7	6.1	8.6	10.5	12.6	13.7	15.6	16.4	17.0	17.6	18.1
COMMERCIAL													
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED													
ecoENERGY	-	0.1	0.4	1.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Power Smart Energy Manager	(0.0)	0.0	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
R-2000 Component of the New Home Program	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solar Hot Water Heating	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0
	(0.0)	0.2	0.6	1.6	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
m3 IMPACTS	1.2	2.4	4.3	7.7	11.3	13.2	15.3	16.4	18.3	19.0	19.7	20.3	20.8

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
RESIDENTIAL														
Power Smart Residential Loan	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2
Residential Earth Power Loan	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Power Smart Residential PAYS	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
COMMERCIAL														
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED														
ecoENERGY	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Power Smart Energy Manager	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
R-2000 Component of the New Home Program	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solar Hot Water Heating	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
m3 IMPACTS	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8

Note: Subtotals may not be exact due to rounding.

Total Annual Energy Savings - million m^3
Natural Gas DSM Support Programs

	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41
RESIDENTIAL													
Power Smart Residential Loan	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2
Residential Earth Power Loan	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Power Smart Residential PAYS	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
COMMERCIAL													
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCONTINUED/COMPLETED													
ecoENERGY	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Power Smart Energy Manager	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
R-2000 Component of the New Home Program	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solar Hot Water Heating	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
m3 IMPACTS	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8

Note: Subtotals may not be exact due to rounding.

Appendix L

Annual Energy Savings - Codes & Standards (GW.h, MW & m³)

Annual Energy Savings - GW.h
Codes & Standards

	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Residential Appliances:																						
Clothes Washers	-0.3	-0.3	0.1	0.1	0.1	0.2	0.6	0.8	0.8	0.8	0.7	0.9	3.0	3.1	3.9	3.6	3.8	0.2	0.2	0.1	0.0	11.5
Refrigerators	2.0	4.7	6.1	7.1	7.0	7.2	7.1	7.2	7.8	7.8	10.1	11.0	12.9	13.2	12.8	16.2	17.1	18.7	10.9	10.2	9.1	5.7
Dishwashers	0.0	0.1	0.2	0.4	0.7	0.8	0.7	0.7	0.7	0.8	0.8	1.3	2.0	2.0	2.5	3.4	3.5	0.2	0.2	0.1	0.1	4.0
Ranges	0.4	-0.2	-0.1	0.1	-0.3	-0.1	-0.1	-0.1	-0.3	0.2	0.2	0.0	0.0	0.1	-0.2	-0.2	-0.2	3.4	3.2	1.4	1.2	3.6
Freezers	-0.3	0.3	0.4	0.5	0.7	0.4	0.5	0.5	0.5	0.5	0.3	0.3	0.5	-0.8	-0.5	-0.7	-0.8	3.1	2.6	6.5	6.2	2.2
Clothes Dryers	0.1	0.1	0.4	0.4	4.6	0.5	0.1	0.1	0.1	0.2	0.2	0.2	1.0	1.0	1.0	0.9	0.9	13.9	15.8	9.0	8.0	0.8
Residential Insulation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.0	1.0	1.1	1.2	1.5	0.8	1.2	1.3	1.5	2.8	2.9	1.7	3.5	6.6
Other Residential Equipment[1]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	21.3	22.3	19.3
Commercial Lighting	0.0	0.0	0.0	0.0	0.0	9.7	15.4	16.5	14.9	16.3	19.2	0.5	0.4	0.3	0.3	0.3	0.3	0.4	0.4	12.8	15.2	12.2
Other Commercial Equipment[2]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial Equipment - High Efficiency Motors	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	1.9	4.6	7.1	8.6	12.8	20.3	26.0	28.6	27.2	29.2	34.2	16.9	22.9	21.4	22.5	24.8	26.1	42.5	45.1	63.1	65.6	66.0
GW.h IMPACTS (at meter)	1.9	4.6	7.1	8.6	12.8	20.3	26.0	28.6	27.2	29.2	34.2	16.9	22.9	21.4	22.5	24.8	26.1	42.5	45.1	63.1	65.6	66.0
GW.h IMPACTS (at generation)	2.2	5.3	8.1	9.8	14.6	23.1	29.6	32.5	30.9	33.3	39.0	19.2	26.1	24.3	25.6	28.3	29.8	48.5	51.4	71.9	74.8	75.3

Note: Subtotals may not be exact due to rounding.

[1]Category includes: central air conditioning, electric hot water tank, furnace, attic insulation, windows, heat recovery ventilator (HRV), efficient showerheads and electronic fireplace ignition.

[2]Category includes: commercial spray valves.

Annual Energy Savings - MW
Codes & Standards

	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Residential Appliances:																						
Ranges	-0.1	-0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.7	0.8	1.0	0.9	0.9	0.0	0.0	0.0	0.0	2.2
Dishwashers	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.5	0.5	0.6	0.8	0.9	0.0	0.0	0.0	0.0	0.8
Clothes Washers	0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	1.3	1.2	0.3	0.2	0.7
Clothes Dryers	0.5	1.1	1.5	1.7	1.7	1.8	1.7	1.8	1.9	1.9	2.5	2.7	3.1	3.2	3.1	4.0	4.2	2.1	1.2	1.3	1.1	0.7
Refrigerators	-0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-0.2	-0.1	-0.2	-0.2	0.3	0.3	0.8	0.7	0.3
Freezers	0.0	0.0	0.1	0.1	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	1.8	2.1	1.8	1.6	0.2
Residential Insulation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.4	0.5	0.3	0.4	0.5	0.5	1.2	2.2	0.9	1.9	3.6
Other Residential Equipment[1]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	6.6	7.3	7.0
Commercial Lighting	0.0	0.0	0.0	0.0	0.0	2.7	4.3	4.7	4.2	4.6	5.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	3.5	4.2	3.4
Other Commercial Equipment[2]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial Equipment - High Efficiency Motors	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	0.5	1.1	1.7	2.1	3.0	5.2	6.8	7.6	7.2	7.8	9.1	4.1	5.6	5.2	5.5	6.2	6.5	6.9	7.5	15.1	17.0	18.8
MW IMPACTS (at meter)	0.5	1.1	1.7	2.1	3.0	5.2	6.8	7.6	7.2	7.8	9.1	4.1	5.6	5.2	5.5	6.2	6.5	6.9	7.5	15.1	17.0	18.8
MW IMPACTS (at generation)	0.5	1.3	2.0	2.4	3.4	5.9	7.7	8.7	8.2	8.8	10.3	4.7	6.4	5.9	6.2	7.0	7.4	7.8	8.5	17.2	19.4	21.4

Note: Subtotals may not be exact due to rounding.

[1]Category includes: central air conditioning, electric hot water tank, furnace, attic insulation, windows, heat recovery ventilator (HRV), efficient showerheads and electronic fireplace ignition.

[2]Category includes: commercial spray valves.

Annual Energy Savings - millions m^3
Codes & Standards

	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Residential Appliances:																						
Clothes Washers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.2	0.1	0.1	0.0
Dishwashers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0
Furnaces:																						
Residential - Federal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1
Commercial - Federal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Residential - Provincial	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Commercial - Provincial	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential Insulation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.5	0.3	0.3
Other Residential Equipment[1]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	2.5	2.3
Other Commercial Equipment[2]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Millions m^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.5	0.9	5.5	3.4	2.8

Note: Subtotals may not be exact due to rounding.
[1]Category includes: furnace, attic insulation, windows, heat recovery ventilator (HRV) and electronic fireplace ignition.
[2]Category includes: commercial spray valves.

Appendix M

Electric Incentive-Based Utility, Administration & Incentive Costs

Total Power Smart Utility Costs - Including Affordable Energy Costs (1000s in 2013$)
Electric Incentive-Based Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative Total 2013/14
RESIDENTIAL																										
Refrigerator Retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	84	1,533	1,632	1,620	4,881
Home Insulation	0	0	0	0	264	403	252	235	423	47	5	47	75	74	144	794	1,183	2,017	1,627	1,799	1,787	1,442	1,301	1,290	1,109	16,318
Affordable Energy Program*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	108	224	1,222	2,040	713	829	945	746	6,875
Community Geothermal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	443	443
Water & Energy Saver	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	19	0	0	84	53	483	455	791	410	2,295
Lower Income First Nations Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	14	2	6	41	60	147	189	190	656
	0	0	0	0	264	403	252	235	423	47	5	47	75	74	145	795	1,253	2,140	1,854	3,111	3,933	2,782	4,266	4,847	4,518	31,467
DISCONTINUED/COMPLETED																										
New Home	0	0	0	41	159	100	226	128	66	35	1	19	138	306	234	319	640	957	687	682	613	222	258	46	12	5,889
Residential Appliances	0	0	0	0	0	0	0	0	0	0	0	0	0	21	15	11	101	1,633	2,077	1,846	423	12	1	1	0	6,143
Compact Fluorescent Lighting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	836	1,082	865	991	1,365	1,684	1,060	2	0	0	7,906
Energy Efficiency Light Fixtures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	165	527	408	197	257	322	0	0	1,876
Programmable Thermostats	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	4	8	75	37	11	0	0	0	0	0	144
Seasonal LED Lighting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	413	385	364	24	0	0	0	0	1,277
Residential Hot Water	0	0	182	0	0	0	2	64	26	16	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	295
Outdoor Timer	206	301	257	200	98	57	20	3	10	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,157
Retrofit/Demonstration	0	68	28	126	0	0	5	0	0	0	0	0	0	0	0	14	49	0	0	0	0	0	0	0	0	290
Refrigerator/Freezer Buy-Back	0	0	55	13	0	0	0	0	0	0	0	0	0	18	30	5	70	26	0	0	0	0	0	0	0	216
Water Heater Rental	0	0	0	0	0	0	19	415	411	78	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	929
High Efficiency Furnace/Boiler	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
Aboriginal Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	15	0	0	0	0	0	0	0	20
	206	368	522	381	257	157	272	611	513	133	11	19	138	345	309	1,190	2,048	4,150	4,704	4,677	2,941	1,551	583	47	12	26,144
RESIDENTIAL EXPLORATORY PROGRAMS																										
New Home Program (Re-design)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	1	28
LED Light Fixtures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Residential Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	4
Set Top Boxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	1	0	0	0	22
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	3	2	28	1	55
RESIDENTIAL TOTAL	206	368	522	381	521	560	524	846	936	180	16	67	213	418	454	1,985	3,301	6,290	6,557	7,788	6,895	4,335	4,851	4,922	4,531	57,666
COMMERCIAL																										
Commercial Lighting	0	0	113	1,207	2,588	3,053	2,996	1,245	1,059	2,096	935	685	1,062	1,258	2,840	5,596	6,748	7,738	7,996	8,295	7,736	7,022	6,566	7,912	6,642	93,385
Commercial Windows**	0	0	0	0	8	27	44	133	177	65	45	79	70	162	126	254	337	419	408	474	1,075	1,286	1,021	944	813	7,966
Internal Retrofit	0	0	122	290	484	583	169	219	181	239	118	304	143	295	649	740	631	5,126	4,695	2,819	2,277	1,969	771	827	760	24,412
Commercial Refrigeration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249	329	315	187	195	180	347	625	651	3,077
Commercial New Buildings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	149	102	172	306	309	118	593	1,752
Commercial Insulation**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	228	274	255	243	281	241	460	517	2,499
Commercial HVAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	187	216	76	227	171	331	217	152	193	1,770
Commercial Earth Power	0	0	0	0	15	51	82	69	233	121	139	115	176	298	672	289	540	669	378	238	408	314	301	270	168	5,546
Commercial Building Optimization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	192	62	42	30	28	38	41	94	125	652
Commercial Network Energy Manager	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	22	73	87	24	6	55	269
Commercial Custom Measures	0	0	0	0	20	69	111	82	0	227	551	137	154	85	165	12	8	127	201	256	224	243	246	57	14	2,989
LED Roadway Lighting Pilot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11
Commercial Kitchen Appliances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97	88	38	33	12	4	271
Commercial HVAC - CO2 Sensors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	3
	0	0	236	1,497	3,115	3,783	3,401	1,748	1,650	2,748	1,789	1,320	1,606	2,099	4,451	6,890	8,893	14,915	14,536	13,000	12,691	12,097	10,114	11,476	10,548	144,601
DISCONTINUED/COMPLETED																										
Commercial Clothes Washers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	46	145	68	65	60	48	491
Power Smart Shops	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	65	257	150	48	0	6	527
Agricultural Heat Pads	0	0	0	0	0	0	3	71	37	94	94	50	63	71	63	136	77	70	64	46	122	104	8	1	2	1,176
City of Winnipeg Power Smart Agreement	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2,999	2,056	4,916	1,945	214	67	48	84	-46	-123	1	12,167
Commercial Air Conditioners	0	0	0	0	1	2	3	84	79	0	0	0	7	56	0	144	11	0	0	0	0	0	0	1	1	388
Power Smart Energy Manager	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	85	124	92	115	23	0	0	440
Commercial Rinse & Save	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	30	23	10	5	0	0	0	109
Commercial Parking Lot Controllers	0	0	0	0	41	138	222	118	106	199	22	54	213	116	301	381	1,130	976	627	405	542	559	291	10	0	6,449
Commercial Air Barriers	0	0	0	0	9	29	47	102	81	3	11	35	23	18	20	7	4	0	6	0	0	0	0	0	0	394
Livestock Waterer	0	0	0	0	0	160	138	97	25	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	424
Roadway Lighting	0	117	1,554	2,192	2,002	1,521	18	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,453
Sentinel Lighting	0	33	1,370	1,148	1,178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,729
Agricultural Demand Controller	0	0	33	654	223	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	910
Commercial Showerheads	0	68	125	36	4	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	358
Infrared Heat Lamps	0	19	299	34	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	357
Aboriginal Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	0	237	3,381	4,065	3,461	1,975	431	471	376	300	127	139	306	266	3,384	2,724	6,139	3,032	1,086	777	1,217	1,085	389	-51	57	35,373
COMMERCIAL EXPLORATORY PROGRAMS																										
Heat Recovery Ventilation Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
COMMERCIAL TOTAL	0	237	3,616	5,561	6,576	5,758	3,833	2,219	2,025	3,048	1,916	1,459	1,911	2,365	7,835	9,614	15,031	17,947	15,623	13,777	13,908	13,182	10,504	11,425	10,605	179,975
INDUSTRIAL																										
Performance Optimization	0	0	91	195	249	514	520	469	683	414	275	425	1,073	3,389	1,274	1,727	1,800	1,155	3,453	2,689	3,104	2,923	3,039	2,795	2,173	34,428
Emergency Preparedness	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	87	74	7	1	0	0	170
	0	0	91	195	249	514	520	469	683	414	275	425	1,073	3,389	1,274	1,727	1,800	1,155	3,453	2,776	3,178	2,931	3,040	2,796	2,173	34,599
DISCONTINUED/COMPLETED																										
High Efficiency Motors	0	23	324	785	628	499	458	496	668	48	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,933
Industrial Retrofit/Demonstration	0	0	65	332	356	640	1,098	372	342	88	11	5	0	0	0	0	0	40	0	0	0	0	0	0	0	3,349
Efficient Motors (QMR)	0	0	0	23	54	20	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102
	0	23	389	1,141	1,038	1,159	1,560	868	1,010	136	15	5	0	0	0	0	0	40	0	0	0	0	0	0	0	7,385
INDUSTRIAL TOTAL	0	23	480	1,336	1,288	1,673	2,081	1,337	1,692	550	290	429	1,073	3,389	1,274	1,727	1,800	1,195	3,453	2,777	3,178	2,931	3,040	2,796	2,173	41,983
EFFICIENCY PROGRAMS SUBTOTAL	206	628	4,618	7,277	8,384	7,992	6,437	4,401	4,654	3,778	2,221	1,955	3,198	6,172	9,562	13,325	20,133	25,431	25,633	24,341	23,981	20,448	18,394	19,143	17,310	279,625
CUSTOMER SELF-GENERATION PROGRAMS																										
Bioenergy Optimization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	1,819	1,757	1,846	1,587	1,695	1,784	355	698	10,999
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	1,819	1,757	1,846	1,587	1,695	1,784	355	698	10,999
RATE/LOAD MANAGEMENT PROGRAMS																										
Curtailable Rates	0	0	0	90	661	1,624	1,461	1,432	1,239	1,584	1,958	2,511	3,309	4,990	6,535	6,551	7,303	7,145	7,084	6,855	6,151	6,063	5,998	5,866	5,971	92,382
	0	0	0	90	661	1,624	1,461	1,432	1,239	1,584	1,958	2,511	3,309	4,990	6,535	6,551	7,303	7,145	7,084	6,855	6,151	6,063	5,998	5,866	5,971	92,382
Support Costs***	0	373	3,591	4,315	3,066	1,706	2,026	1,627	1,296	1,681	2,392	3,279	2,948	3,731	3,812	4,253	4,520	7,342	7,322	6,468	5,619	4,191	7,308	5,329	4,299	92,493
UTILITY COST OF PROGRAMS	206	1,002	8,209	11,682	12,112	11,322	9,924	7,461	7,189	7,043	6,571	7,745	9,455	14,893	19,908	24,130	32,115	41,738	41,795	39,509	37,338	32,396	33,484	30,693	28,278	475,500

Note: Subtotals may not be exact due to rounding.
* Includes Affordable Energy Fund expenditures.
** Programs comprise the Commercial Building Envelope Program.
*** Support Costs include Affordable Energy Fund spending.

Administration Cost (1000s in 2013$)
Electric Incentive-Based Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative Total 2013/14
RESIDENTIAL																										
Refrigerator Retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	84	1,203	1,264	1,262	3,826
Affordable Energy Program*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	181	902	1,239	84	764	856	683	4,755
Home Insulation	0	0	0	0	264	403	252	235	423	47	5	47	75	74	144	288	453	304	227	226	200	226	250	449	422	5,012
Water & Energy Saver	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	19	0	0	84	53	89	264	366	291	1,166
Community Geothermal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	198	198
Lower Income First Nations Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	14	2	6	41	60	147	189	190	656
	0	0	0	0	264	403	252	235	423	47	5	47	75	74	145	288	524	318	410	1,219	1,545	543	2,628	3,124	3,046	15,613
DISCONTINUED/COMPLETED																										
New Home	0	0	0	41	159	100	226	128	66	35	1	19	138	306	234	308	570	822	567	573	493	95	211	34	12	5,137
Residential Appliances	0	0	0	0	0	0	0	0	0	0	0	0	0	21	15	11	101	596	648	434	114	12	1	0	0	1,954
Compact Fluorescent Lighting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	670	803	620	723	670	544	429	2	0	0	4,483
Energy Efficiency Light Fixtures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65	417	334	130	100	189	0	0	1,235
Programmable Thermostats	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	4	8	51	25	5	0	0	0	0	0	104
Seasonal LED Lighting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	246	265	293	2	0	0	0	0	862
Residential Hot Water	0	0	173	0	0	0	2	64	26	16	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	285
Outdoor Timer	155	230	195	164	68	57	20	3	10	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	907
Retrofit/Demonstration	0	68	28	126	0	0	0	0	0	0	0	0	0	0	0	14	49	0	0	0	0	0	0	0	0	285
Refrigerator/Freezer Buy-Back	0	0	28	13	0	0	0	0	0	0	0	0	0	18	30	5	70	0	0	0	0	0	0	0	0	163
Water Heater Rental	0	0	0	0	0	0	19	415	411	78	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	929
High Efficiency Furnace/Boiler	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
	155	298	424	344	226	157	267	611	513	133	11	19	138	345	309	1,013	1,661	2,400	2,645	2,309	1,284	636	403	34	12	16,348
RESIDENTIAL EXPLORATORY PROGRAMS																										
New Home Program (Re-design)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	1	28
LED Light Fixtures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Residential Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	4
Set Top Boxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	1	0	0	0	22
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	3	2	28	1	55
RESIDENTIAL TOTAL	155	298	424	344	490	560	519	845	936	180	16	67	213	418	454	1,300	2,184	2,719	3,055	3,528	2,850	1,181	3,033	3,186	3,059	32,016
												66														
COMMERCIAL																										
Commercial Lighting	0	0	113	890	991	821	663	454	589	440	324	347	424	860	1,173	1,987	1,935	2,290	2,180	1,963	2,018	1,967	1,909	1,799	1,858	27,996
Internal Retrofit	0	0	122	290	484	583	169	219	181	239	118	304	143	295	649	740	631	5,126	4,695	2,819	2,277	1,969	771	827	760	24,412
Commercial New Buildings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102	172	190	194	38	268	964
Commercial Insulation**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150	151	46	47	33	31	150	198	808
Commercial Windows**	0	0	0	0	8	27	44	82	79	9	1	25	14	44	33	64	56	164	171	107	123	125	120	172	184	1,650
Commercial Refrigeration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249	231	206	100	102	89	139	122	113	1,351
Commercial Earth Power	0	0	0	0	15	51	82	38	79	29	13	41	83	150	300	154	213	213	227	139	128	103	125	83	87	2,354
Commercial Building Optimization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	192	62	42	22	18	28	28	69	77	540
Commercial HVAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	22	15	14	18	17	18	10	16	204
LED Roadway Lighting Pilot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	10
Commercial Network Energy Manager	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	68	75	24	6	8	202
Commercial Custom Measures	0	0	0	0	20	69	111	51	0	94	92	83	100	62	67	9	1	83	36	220	92	94	143	11	7	1,446
Commercial Kitchen Appliances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	37	14	19	8	2	129
Commercial HVAC - CO2 Sensors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	4
	0	0	236	1,179	1,518	1,551	1,069	844	928	810	549	800	765	1,412	2,222	2,954	3,352	8,341	7,724	5,604	5,101	4,705	3,520	3,296	3,591	62,071
DISCONTINUED/COMPLETED																										
Commercial Clothes Washers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	41	43	36	30	22	208
Power Smart Shops	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	65	255	147	48	0	6	521
Agricultural Heat Pads	0	0	0	0	0	0	3	71	37	43	31	22	25	33	28	85	46	45	29	20	34	28	8	1	2	588
City of Winnipeg Power Smart Agreement	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2,174	1,070	1,028	460	58	67	48	-83	-120	7	1	4,715
Commercial Air Conditioners	0	0	0	0	1	2	3	82	79	0	0	0	3	20	0	12	2	0	0	0	0	0	0	0	1	205
Power Smart Energy Manager	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	121	92	115	23	0	0	352
Commercial Rinse & Save	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	16	5	6	1	0	0	0	43
Commercial Parking Lot Controllers	0	0	0	0	41	138	222	82	79	71	5	33	162	92	227	299	522	189	124	152	154	84	32	1	0	2,710
Commercial Air Barriers	0	0	0	0	9	29	47	82	79	1	1	18	11	10	10	5	1	0	1	0	0	0	0	0	0	303
Livestock Waterer	0	0	0	0	0	139	120	85	25	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	373
Roadway Lighting	0	117	1,554	2,192	2,002	1,521	18	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,453
Sentinel Lighting	0	33	1,370	1,148	1,178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,729
Agricultural Demand Controller	0	0	33	471	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	665
Aboriginal Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Commercial Showerheads	0	68	94	36	4	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	327
Infrared Heat Lamps	0	19	161	34	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	220
	0	237	3,213	3,881	3,399	1,954	413	403	346	119	37	73	201	160	2,439	1,470	1,599	709	229	467	630	335	27	38	31	22,410
COMMERCIAL EXPLORATORY PROGRAMS																										
Heat Recovery Ventilation Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
COMMERCIAL TOTAL	0	237	3,448	5,060	4,917	3,506	1,482	1,247	1,274	929	586	873	966	1,572	4,661	4,424	4,951	9,050	7,953	6,071	5,730	5,040	3,548	3,334	3,622	84,482
INDUSTRIAL																										
Performance Optimization	0	0	91	195	249	361	266	311	281	215	231	217	304	2,045	423	202	357	420	531	621	471	420	423	363	367	9,363
Emergency Preparedness	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	87	74	7	1	0	0	170
	0	0	91	195	249	361	266	311	281	215	231	217	304	2,045	423	202	357	420	531	708	545	428	424	363	367	9,533
DISCONTINUED/COMPLETED																										
High Efficiency Motors	0	23	285	360	278	244	261	283	358	48	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,145
Industrial Retrofit/Demonstration	0	0	65	294	299	220	411	372	342	48	11	5	0	0	0	0	0	40	0	0	0	0	0	0	0	2,108
Efficient Motors (QMR)	0	0	0	23	54	20	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102
	0	23	350	677	632	485	676	655	700	97	15	5	0	0	0	0	0	40	0	0	0	0	0	0	0	4,355
INDUSTRIAL TOTAL	0	23	441	872	882	846	942	966	980	312	245	221	304	2,045	423	202	357	460	531	709	545	428	424	363	367	13,888
EFFICIENCY PROGRAMS SUBTOTAL	155	557	4,313	6,276	6,289	4,912	2,943	3,058	3,191	1,421	847	1,161	1,484	4,036	5,537	5,926	7,492	12,228	11,539	10,307	9,126	6,649	7,005	6,884	7,048	130,386
												1,149														
CUSTOMER SELF-GENERATION PROGRAMS																										
Bioenergy Optimization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77	301	318	1,756	355	685	3,493
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77	301	318	1,756	355	685	3,493
RATE/LOAD MANAGEMENT PROGRAMS																										
Curtailable Rates	0	0	0	90	127	225	78	53	50	36	36	35	10	10	15	18	10	8	10	5	7	8	9	5	5	850
	0	0	0	90	127	225	78	53	50	36	36	35	10	10	15	18	10	8	10	5	7	8	9	5	5	850
Support Costs***	0	373	3,591	4,315	3,066	1,706	2,026	1,627	1,296	1,681	2,392	3,279	2,948	3,731	3,812	4,253	4,520	7,342	7,322	6,468	5,619	4,191	7,308	5,329	4,299	92,493
ADMINISTRATION COSTS OF PROGRAMS	155	931	7,904	10,681	9,482	6,843	5,047	4,739	4,536	3,137	3,276	4,475	4,442	7,777	9,364	10,197	12,022	19,579	18,871	16,858	15,052	11,166	16,078	12,574	12,037	227,222

Note: Subtotals may not be exact due to rounding.
* Includes Affordable Energy Fund expenditures.
** Programs comprise the Commercial Building Envelope Program.
*** Support Costs include Affordable Energy Fund spending.

Incentive Cost (1000s in 2013$)
Electric Incentive-Based Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative Total 2013/14
RESIDENTIAL																										
Home Insulation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	507	730	1,713	1,401	1,572	1,587	1,216	1,051	841	687	11,305
Refrigerator Retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	330	367	358	1,055
Community Geothermal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	245	245
Water & Energy Saver	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	394	191	425	119	1,129
Affordable Energy Program*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108	43	320	801	629	66	90	62	2,120
Lower Income First Nations Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	507	730	1,822	1,444	1,893	2,388	2,239	1,638	1,723	1,472	15,855
DISCONTINUED/COMPLETED																										
Residential Appliances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,017	1,401	1,384	303	0	0	1	0	4,107
Compact Fluorescent Lighting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166	279	245	268	695	1,139	631	0	0	0	3,423
Energy Efficiency Light Fixtures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	110	74	67	157	132	0	0	640
Programmable Thermostats	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	11	6	0	0	0	0	0	39
New Home	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	69	133	117	106	118	125	47	12	0	737
Seasonal LED Lighting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	164	118	70	22	0	0	0	0	406
Residential Hot Water	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
Outdoor Timer	50	69	61	36	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	246
Retrofit/Demonstration	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Refrigerator/Freezer Buy-Back	0	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	52
Water Heater Rental	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
High Efficiency Furnace/Boiler	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	50	69	96	36	30	0	4	0	0	0	0	0	0	0	0	177	380	1,707	2,026	2,336	1,648	912	179	13	0	9,664
RESIDENTIAL TOTAL	50	69	96	36	30	0	4	0	0	0	0	0	0	0	0	684	1,110	3,529	3,469	4,228	4,036	3,152	1,817	1,736	1,472	25,518
COMMERCIAL																										
Commercial Lighting	0	0	0	311	1,565	2,188	2,287	775	461	1,623	599	331	625	391	1,634	3,538	4,719	5,341	5,702	6,207	5,606	4,956	4,566	5,993	4,784	64,201
Commercial Windows**	0	0	0	0	0	0	0	50	96	55	43	53	56	116	91	186	276	250	232	359	934	1,139	883	757	629	6,204
Commercial Refrigeration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	96	106	85	91	89	204	493	538	1,703
Commercial New Buildings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	146	0	0	114	113	79	325	778
Commercial Insulation**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76	120	205	193	243	205	304	319	1,664
Commercial HVAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110	190	61	209	150	307	195	140	177	1,538
Commercial Earth Power	0	0	0	0	0	0	0	30	151	91	124	72	91	145	364	132	321	447	148	96	275	207	172	183	81	3,130
Commercial Building Optimization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	9	9	13	24	48	111
Commercial Network Energy Manager	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	5	12	0	0	47	67
Commercial Custom Measures	0	0	0	0	0	0	0	30	0	130	450	53	52	22	96	3	7	43	162	35	129	146	101	46	7	1,512
Commercial Kitchen Appliances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	50	24	14	3	2	139
Commercial HVAC - CO2 Sensors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-147	-148	-45	-46	-31	-31	-147	0	-596
LED Roadway Lighting Pilot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Internal Retrofit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	311	1,565	2,188	2,287	886	708	1,899	1,215	509	824	674	2,185	3,859	5,432	6,298	6,530	7,206	7,395	7,215	6,434	7,873	6,957	80,453
DISCONTINUED/COMPLETED																										
Commercial Clothes Washers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	9	103	24	28	30	26	278
Aboriginal Commercial	0	-18	-158	-33	-5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-215
Commercial Parking Lot Controllers	0	0	0	0	0	0	0	35	27	125	16	21	50	24	73	80	596	771	492	248	381	466	254	9	0	3,666
Power Smart Shops	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	6
Power Smart Energy Manager	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	83	3	0	0	0	0	0	86
Agricultural Heat Pads	0	0	0	0	0	0	0	0	0	51	62	28	38	37	35	50	31	25	34	25	87	74	0	0	0	577
Commercial Rinse & Save	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	14	18	3	5	0	0	0	65
Commercial Air Conditioners	0	0	0	0	0	0	0	1	0	0	0	0	4	35	0	129	9	0	0	0	0	0	0	1	0	179
Commercial Air Barriers	0	0	0	0	0	0	0	19	2	3	10	17	11	8	10	3	3	0	5	0	0	0	0	0	0	90
Livestock Waterer	0	0	0	0	0	21	18	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Roadway Lighting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sentinel Lighting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agricultural Demand Controller	0	0	0	179	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	241
City of Winnipeg Power Smart Agreeme	0	0	0	0	0	0	0	0	0	0	0	0	0	0	809	966	3,812	1,456	154	0	0	163	72	-127	0	7,306
Commercial Showerheads	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
Infrared Heat Lamps	0	0	135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	135
	0	-18	7	146	56	21	18	67	29	178	88	65	103	103	926	1,229	4,451	2,278	840	304	576	735	354	-87	26	12,494
COMMERCIAL TOTAL	0	-18	7	457	1,621	2,209	2,305	953	736	2,077	1,303	575	927	777	3,112	5,088	9,883	8,576	7,371	7,509	7,971	7,951	6,789	7,786	6,984	92,947
INDUSTRIAL																										
Performance Optimization	0	0	0	0	0	150	250	154	394	195	43	204	754	1,317	834	1,495	1,415	720	2,864	2,027	2,581	2,454	2,564	2,385	1,807	24,610
Emergency Preparedness	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	150	250	154	394	195	43	204	754	1,317	834	1,495	1,415	720	2,864	2,027	2,581	2,454	2,564	2,385	1,807	24,610
DISCONTINUED/COMPLETED																										
High Efficiency Motors	0	0	38	417	343	250	193	209	304	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,754
Industrial Retrofit/Demonstration	0	0	0	38	55	411	674	0	0	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,216
Efficient Motors (QMR)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	38	455	398	661	866	209	304	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,970
INDUSTRIAL TOTAL	0	0	38	455	398	811	1,116	363	698	234	43	204	754	1,317	834	1,495	1,415	720	2,864	2,027	2,581	2,454	2,564	2,385	1,807	27,580
EFFICIENCY PROGRAMS SUBTOTAL	50	51	141	948	2,049	3,019	3,425	1,316	1,435	2,311	1,347	778	1,681	2,095	3,946	7,267	12,408	12,825	13,705	13,765	14,589	13,556	11,170	11,906	10,262	146,046
CUSTOMER SELF-GENERATION PROGRAMS																										
Bioenergy Optimization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	154	1,783	1,723	1,732	1,256	1,344	0	0	13	8,005
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	154	1,783	1,723	1,732	1,256	1,344	0	0	13	8,005
RATE/LOAD MANAGEMENT PROGRAMS																										
Curtailable Rates	0	0	0	0	524	1,372	1,357	1,352	1,166	1,518	1,884	2,427	3,234	4,882	6,392	6,405	7,150	6,997	6,935	6,715	6,024	5,936	5,871	5,746	5,966	89,854
	0	0	0	0	524	1,372	1,357	1,352	1,166	1,518	1,884	2,427	3,234	4,882	6,392	6,405	7,150	6,997	6,935	6,715	6,024	5,936	5,871	5,746	5,966	89,854
Support Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCENTIVE COSTS OF PROGRAMS	50	51	141	948	2,573	4,391	4,782	2,669	2,601	3,829	3,231	3,206	4,915	6,977	10,338	13,672	19,713	21,605	22,362	22,212	21,869	20,837	17,041	17,652	16,241	243,905

Note: Subtotals may not be exact due to rounding.
* Includes Affordable Energy Fund expenditures.
** Programs comprise the Commercial Building Envelope Program.

Appendix N

Natural Gas Incentive-Based Utility, Administration and Incentive Costs

Total Power Smart Utility Costs - Including Affordable Energy Costs (1000s in 2013$)
Natural Gas Incentive-Based Programs

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative Total 2013/14
RESIDENTIAL														
Affordable Energy Program*	0	0	0	0	85	0	176	504	1,656	4,703	5,198	5,549	5,159	23,031
Home Insulation	0	0	0	0	410	1,998	3,201	2,954	3,141	2,355	2,180	1,439	1,117	18,795
Water & Energy Saver	0	0	0	0	0	0	0	0	43	724	1,061	791	761	3,381
	0	0	0	0	495	1,998	3,377	3,458	4,840	7,782	8,439	7,779	7,038	45,207
DISCONTINUED/COMPLETED														
Programmable Thermostat	0	0	0	0	0	209	141	41	1	0	0	0	0	392
New Home	0	13	81	100	67	101	149	0	92	115	66	5	0	790
High Efficiency Furnace/Boiler	0	0	0	0	633	1,432	2,279	3,400	1,633	32	0	0	0	9,410
	0	13	81	100	699	1,742	2,569	3,441	1,727	147	66	5	0	10,591
RESIDENTIAL EXPLORATORY PROGRAMS														
Residential Solar	0	0	0	0	0	0	0	0	0	8	8	0	0	16
	0	0	0	0	0	0	0	0	0	8	8	0	0	16
RESIDENTIAL TOTAL	0	13	81	100	1,194	3,740	5,946	6,899	6,567	7,937	8,514	7,784	7,038	55,814
COMMERCIAL														
Commercial Insulation**	0	0	0	0	0	455	887	1,085	1,325	2,329	1,815	1,130	1,728	10,754
Commercial HVAC	0	0	0	0	114	657	1,780	1,481	1,194	1,295	949	1,239	1,286	9,995
Commercial Windows**	0	0	0	0	0	139	302	496	831	1,053	1,133	812	964	5,729
Commercial Custom Measures	0	0	0	0	0	0	0	0	149	162	164	515	264	1,254
Commercial New Buildings	0	0	0	0	0	0	0	153	115	204	206	1,064	198	1,940
Commercial Building Optimization	0	0	0	0	83	248	170	169	250	216	122	94	125	1,476
Commercial Kitchen Appliances	0	0	0	0	0	0	0	17	59	31	49	28	15	198
	0	0	0	0	196	1,499	3,139	3,402	3,923	5,290	4,437	4,881	4,580	31,347
DISCONTINUED/COMPLETED														
Commercial Hot Water	0	0	0	0	0	0	0	0	24	32	15	0	2	73
Power Smart Shops	0	0	0	0	0	0	1	16	86	100	12	0	1	217
Power Smart Energy Manager	0	0	0	0	0	0	128	101	75	0	53	0	1	358
Spray Valves	0	0	0	0	0	139	59	131	29	22	1	0	0	381
City of Winnipeg Power Smart Agreement	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Clothes Washers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	139	188	248	213	154	81	1	4	1,025
COMMERCIAL EXPLORATORY PROGRAMS														
Heat Recovery Ventilation	0	0	0	0	0	0	0	0	0	5	11	0	0	15
	0	0	0	0	0	0	0	0	0	5	11	0	0	15
COMMERCIAL TOTAL	0	0	0	0	196	1,638	3,327	3,650	4,136	5,449	4,529	4,882	4,584	32,387
INDUSTRIAL														
Natural Gas Optimization	0	0	0	0	111	40	311	358	637	740	733	768	480	4,177
INDUSTRIAL TOTAL	0	0	0	0	111	40	311	358	637	740	733	768	480	4,177
EFFICIENCY PROGRAMS SUBTOTAL	0	13	81	100	1,501	5,418	9,584	10,908	11,340	14,125	13,776	13,434	12,102	92,379
CUSTOMER SELF-GENERATION														
Bioenergy Optimization	0	0	0	0	0	0	14	8	0	0	0	0	0	23
	0	0	0	0	0	0	14	8	0	0	0	0	0	23
PROGRAMS SUBTOTAL	0	13	81	100	1,501	5,418	9,598	10,916	11,340	14,125	13,776	13,434	12,102	92,402
Support Costs***	853	595	553	825	1,236	2,441	1,970	1,927	1,978	1,367	1,806	1,421	968	17,940
UTILITY COST OF PROGRAMS	853	608	635	925	2,737	7,859	11,569	12,843	13,318	15,492	15,582	14,855	13,070	110,341

Note: Subtotals may not be exact due to rounding.
* Includes Affordable Energy Fund and Furnace Replacement Budget expenditures.
** Programs comprise the Commercial Building Envelope Program.
*** Support Costs include Affordable Energy Fund spending.

Administration Cost (1000s in 2013$)
Natural Gas Incentive-Based Programs

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative Total 2013/14
RESIDENTIAL														
Affordable Energy Program*	0	0	0	0	85	0	152	139	195	4,355	4,655	5,125	4,809	19,515
Water & Energy Saver	0	0	0	0	0	0	0	0	43	133	616	743	540	2,075
Home Insulation	0	0	0	0	186	572	821	640	503	526	537	188	187	4,159
	0	0	0	0	271	572	972	779	741	5,014	5,809	6,056	5,536	25,750
DISCONTINUED/COMPLETED														
High Efficiency Furnace/Boiler	0	0	0	0	286	313	483	382	208	18	0	0	0	1,689
New Home	0	13	81	82	22	34	53	0	16	0	17	1	0	320
Programmable Thermostat	0	0	0	0	0	119	102	19	1	0	0	0	0	241
	0	13	81	82	308	466	638	401	225	18	17	1.446	0	2,251
RESIDENTIAL EXPLORATORY PROGRAMS														
Residential Solar	0	0	0	0	0	0	0	0	0	8	8	0	0	16
RESIDENTIAL TOTAL	0	13	81	82	579	1,038	1,610	1,180	966	5,040	5,834	6,057	5,536	28,016
COMMERCIAL														
Commercial HVAC	0	0	0	0	114	307	319	269	370	275	298	333	314	2,598
Commercial Custom Measures	0	0	0	0	0	0	0	0	61	63	95	96	139	454
Commercial Insulation**	0	0	0	0	0	81	82	186	187	232	279	117	93	1,256
Commercial New Buildings	0	0	0	0	0	0	0	153	115	127	129	343	89	956
Commercial Building Optimization	0	0	0	0	83	248	170	124	165	161	83	69	77	1,180
Commercial Windows**	0	0	0	0	0	88	92	131	150	178	180	100	69	988
Commercial Kitchen Appliances	0	0	0	0	0	0	0	9	25	11	28	20	9	101
	0	0	0	0	196	724	662	872	1,073	1,046	1,093	1,078	790	7,534
DISCONTINUED/COMPLETED														
Commercial Hot Water	0	0	0	0	0	0	0	0	24	32	15	0	2	73
Power Smart Shops	0	0	0	0	0	0	1	16	85	98	12	0	1	214
Power Smart Energy Manager	0	0	0	0	0	0	128	99	75	0	53	0	1	356
Spray Valves	0	0	0	0	0	57	33	27	19	3	1	0	0	140
City of Winnipeg Power Smart Agreement	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Clothes Washers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	57	162	143	203	133	81	0	4	782
COMMERCIAL EXPLORATORY PROGRAMS														
Heat Recovery Ventilation	0	0	0	0	0	0	0	0	0	0	11	0	0	11
	0	0	0	0	0	0	0	0	0	0	11	0	0	11
COMMERCIAL TOTAL	0	0	0	0	196	781	824	1,014	1,275	1,179	1,185	1,078	794	8,327
INDUSTRIAL														
Natural Gas Optimization	0	0	0	0	111	40	99	93	176	124	179	249	201	1,272
	0	0	0	0	111	40	99	93	176	124	179	249	201	1,272
EFFICIENCY PROGRAMS SUBTOTAL	0	13	81	82	886	1,859	2,533	2,288	2,418	6,343	7,198	7,383	6,531	37,616
CUSTOMER SELF-GENERATION														
Bioenergy Optimization	0	0	0	0	0	0	14	8	0	0	0	0	0	23
	0	0	0	0	0	0	14	8	0	0	0	0	0	23
PROGRAMS SUBTOTAL	0	13	81	82	886	1,859	2,548	2,296	2,418	6,343	7,198	7,383	6,531	37,638
Support Costs***	853	595	553	825	1,236	2,441	1,970	1,927	1,978	1,367	1,806	1,421	968	17,940
ADMINISTRATION COSTS OF PROGRAMS	853	608	635	907	2,122	4,300	4,518	4,223	4,396	7,710	9,004	8,804	7,499	55,578

Note: Subtotals may not be exact due to rounding.
* Includes Affordable Energy Fund and Furnace Replacement Budget expenditures.
** Programs comprise the Commercial Building Envelope Program.
*** Support Costs include Affordable Energy Fund spending.

Incentive Costs (1000s in 2013$)
Natural Gas Incentive-Based Programs

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative Total 2013/14
RESIDENTIAL														
Home Insulation	0	0	0	0	223.520	1,426	2,380	2,314	2,639	1,829	1,643	1,251	931	14,636
Affordable Energy Program*	0	0	0	0	0	0	25	365	1,461	349	542	424	350	3,516
Water & Energy Saver	0	0	0	0	0	0	0	0	0	591	445	48	222	1,306
	0	0	0	0	224	1,426	2,405	2,679	4,099	2,768	2,631	1,723	1,502	19,457
DISCONTINUED/COMPLETED														
High Efficiency Furnace/Boiler	0	0	0	0	347	1,118	1,797	3,018	1,425	15	0	0	0	7,720
New Home	0	0	0	18	44	68	95	0	76	115	49	4	0	469
Programmable Thermostat	0	0	0	0	0	90	39	22	0	0	0	0	0	151
	0	0	0	18	392	1,276	1,931	3,040	1,502	129	49	4	0	8,341
RESIDENTIAL EXPLORATORY PROGRAMS														
Residential Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RESIDENTIAL TOTAL	0	0	0	18	615	2,702	4,336	5,719	5,601	2,898	2,679	1,727	1,502	27,798
COMMERCIAL														
Commercial Insulation**	0	0	0	0	0	374	805	899	1,138	2,097	1,536	1,013	1,635	9,498
Commercial HVAC	0	0	0	0	0	350	1,461	1,212	824	1,020	651	906	971	7,395
Commercial Windows**	0	0	0	0	0	51	210	365	681	875	953	712	895	4,742
Commercial Custom Measures	0	0	0	0	0	0	0	0	88	99	68	419	125	800
Commercial New Buildings	0	0	0	0	0	0	0	0	0	77	77	721	108	983
Commercial Building Optimization	0	0	0	0	0	0	0	45	85	55	39	24	48	296
Commercial Kitchen Appliances	0	0	0	0	0	0	0	8	34	20	21	8	6	97
	0	0	0	0	0	775	2,476	2,530	2,850	4,243	3,345	3,804	3,788	23,811
DISCONTINUED/COMPLETED														
Spray Valves	0	0	0	0	0	82	26	103	10	19	0	0	0	241
Power Smart Shops	0	0	0	0	0	0	0	0	1	2	0	0	0	3
Power Smart Energy Manager	0	0	0	0	0	0	0	2	0	0	0	0	0	3
City of Winnipeg Power Smart Agreement	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Clothes Washers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Hot Water	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	82	26	106	11	22	0	0	0	247
COMMERCIAL EXPLORATORY PROGRAMS														
Heat Recovery Ventilation	0	0	0	0	0	0	0	0	0	5	0	0	0	5
	0	0	0	0	0	0	0	0	0	5	0	0	0	5
COMMERCIAL TOTAL	0	0	0	0	0	857	2,502	2,636	2,861	4,269	3,345	3,804	3,788	24,062
INDUSTRIAL														
Natural Gas Optimization	0	0	0	0	0	0	212	265	461	616	554	519	278	2,905
	0	0	0	0	0	0	212	265	461	616	554	519	278	2,905
EFFICIENCY PROGRAMS SUBTOTAL	0	0	0	18	615	3,559	7,051	8,620	8,923	7,783	6,578	6,051	5,569	54,765
CUSTOMER SELF-GENERATION														
Bioenergy Optimization	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROGRAMS SUBTOTAL	0	0	0	18	615	3,559	7,051	8,620	8,923	7,783	6,578	6,051	5,569	54,765
Support Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCENTIVE COSTS OF PROGRAMS	0	0	0	18	615	3,559	7,051	8,620	8,923	7,783	6,578	6,051	5,569	54,765

Note: Subtotals may not be exact due to rounding.
* Includes Affordable Energy Fund and Furnace Replacement Budget expenditures.
** Programs comprise the Commercial Building Envelope Program.

Appendix O

Electric DSM Support Programs - Utility Costs

Utility Costs (1000s in 2013$)
Electric DSM Support Programs

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative Total 2013/14
RESIDENTIAL															
Residential Earth Power Loan	-	2	50	103	366	930	(98)	75	221	171	108	88	127	261	2,405
Power Smart Residential PAYS	-	-	-	-	-	-	-	-	-	-	-	28	233	43	304
Solar Hot Water Heating	-	-	-	-	-	-	-	-	0	7	-	-	-	-	7
Power Smart Residential Loan	48	81	21	9	(0)	1	10	(1)	(6)	(78)	(39)	(30)	(73)	(63)	(119)
	48	84	71	112	366	931	(88)	74	215	100	69	86	287	242	2,596
DISCONTINUED/COMPLETED															
ecoENERGY	-	-	-	-	(11)	(45)	76	174	(20)	151	107	117	(30)	1	518
	-	-	-	-	(11)	(45)	76	174	(20)	151	107	117	(30)	1	518
RESIDENTIAL TOTAL	48	84	71	112	355	886	(13)	248	194	251	176	203	258	242	3,114
COMMERICAL															
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	-	126	76	201
DSM SUPPORT PROGRAMS SUBTOTAL	48	84	71	112	355	886	(13)	248	194	251	176	203	383	318	3,316

Note: Subtotals may not be exact due to rounding.

Utility Costs for Support, Basic Information Services, DSM Support Programs & Standards (1000s in 2013$)
Electric DSM Support Programs

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative Total 2013/14
DSM SUPPORT PROGRAMS																										
DSM Support Programs	-	-	-	-	-	-	-	-	-	-	-	48	83	71	112	355	886	(13)	248	194	251	176	203	383	318	3,315
BASIC INFORMATION SERVICES																										
Basic Information Services	-	-	14	6	98	58	12	14	167	504	595	1,377	1,400	1,392	1,778	1,688	1,705	1,386	1,383	1,809	1,884	1,500	1,568	1,369	1,305	23,013
Discontinued/Completed Basic Information Services	-	-	-	-	5	24	169	149	1	79	267	329	429	315	399	458	413	12	(5)	-	-	1	0	-	-	3,047
SUPPORT COSTS																										
Power Smart Communications	-	9	744	1,593	1,135	554	732	691	604	522	742	664	184	540	494	958	657	628	656	1,197	915	838	807	679	754	17,298
DSM Administration	-	220	224	190	138	101	124	197	77	42	107	139	198	323	222	252	222	222	169	263	219	232	296	181	360	4,717
Sustainability & Standards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52	89	51	59	202	175	136	167	293	1,224
Integrated Plans/Targets	-	21	506	250	228	219	222	68	33	87	172	102	37	384	284	74	24	99	96	184	271	175	217	129	260	4,144
Power Smart for Business	-	-	-	149	146	93	53	0	-	-	-	-	-	-	-	-	89	165	225	211	209	167	195	117	155	1,976
Power Smart Residential Support	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	56	68	144	141	438
DSM Market Potential Study	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	152	98	121	372
Energy Efficient Screening Studies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	36	51	31	64	195
Earth Energy & Emerging Tech - Residential	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61	61
DSM Tracking System	-	-	-	14	24	152	158	14	1	1	3	-	-	-	-	-	-	3	7	1	20	85	82	88	14	667
Earth Energy & Emerging Tech - Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	10
Commercial Audits	-	-	-	-	-	-	-	-	-	-	-	-	17	23	21	32	41	5	3	-	0	0	2	15	5	163
Affordable Energy Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Residential Retrofit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	46	35	132	78	88	54	62	0	-	509
Residential Earth Power Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	3	0	-	9
Alternative Geothermal Financing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	1	-	27
Retrofit Demonstrations	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43	-	6	2	1	-	-	-	-	51
Discontinued/Completed Support Costs	-	-	1,008	852	449	54	57	127	135	103	63	80	164	207	47	14	9	0	-	-	-	-	-	-	-	3,367
	-	250	2,482	3,048	2,120	1,174	1,347	1,095	850	756	1,086	985	600	1,478	1,068	1,343	1,182	1,247	1,345	1,993	1,969	1,825	2,097	1,651	2,237	35,229
TOTAL SUPPORT, DSPs & STANDARDS	-	250	2,496	3,055	2,223	1,256	1,528	1,258	1,018	1,339	1,949	2,738	2,513	3,256	3,358	3,845	4,186	2,632	2,971	3,996	4,104	3,502	3,868	3,403	3,860	64,604

Note: Subtotals may not be exact due to rounding.

Appendix P

Natural Gas DSM Support Programs - Utility Costs

Utility Costs (1000s in 2013$)
Natural Gas DSM Support Programs

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative Total 2013/14
RESIDENTIAL														
Residential Earth Power Loan	-	-	-	-	-	-	-	-	-	-	38	54	111	203
Power Smart Residential PAYS	-	-	-	-	-	-	-	-	-	-	18	433	90	542
ecoENERGY	264	306	308	369	(11)	680	522	(116)	603	403	487	(118)	2	3,700
Solar Hot Water Heating	-	-	-	-	-	-	-	0	2	-	-	-	-	2
Power Smart Residential Loan	460	119	53	(6)	16	191	(24)	(115)	(699)	(741)	(565)	(659)	(563)	(2,531)
	725	425	362	364	6	871	498	(231)	(94)	(338)	(22)	(289)	(360)	1,916
COMMERCIAL														
Power Smart for Business PAYS	-	-	-	-	-	-	-	-	-	-	-	154	92	246
DSM SUPPORT PROGRAMS SUBTOTAL	725	425	362	364	6	871	498	(231)	(94)	(338)	(22)	(135)	(267)	2,162

Note: Subtotals may not be exact due to rounding.

Utility Costs for Support, Basic Information Services, DSM Support Programs & Standards (1000s in 2013$)
Natural Gas DSM Support Programs

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	Cumulative Total 2013/14
DSM SUPPORT PROGRAMS														
DSM Support Programs	725	425	362	364	6	871	498	(231)	(94)	(338)	(22)	(135)	(267)	2,162
BASIC INFORMATION SERVICES														
Basic Information Services	185	209	228	516	546	710	489	546	515	383	330	21	24	4,703
Discontinued/Completed Basic Information Services	-	-	-	-	4	27	(11)	-	-	-	-	-	-	21
SUPPORT COSTS														
Power Smart Residential Support	-	-	-	-	-	-	-	-	45	84	102	268	422	920
Power Smart Communications	-	-	-	-	354	418	437	979	749	559	538	555	251	4,841
DSM Administration	-	-	-	-	148	148	113	215	179	155	197	148	120	1,423
Sustainability & Standards	-	-	-	-	88	164	95	109	165	117	91	138	106	1,072
Power Smart for Business	-	-	-	-	-	110	150	140	139	167	130	143	103	1,084
Integrated Plans/Targets	-	-	-	-	76	66	64	150	222	117	145	106	87	1,033
Energy Efficient Screening Studies	-	-	-	-	-	-	-	-	9	36	34	38	43	160
DSM Market Potential Study	-	-	-	-	-	-	-	-	-	-	152	80	40	273
Earth Energy & Emerging Technologies Review - Gas	-	-	-	-	-	-	-	-	-	-	-	-	26	26
Affordable Energy Program - Gas	-	-	-	-	-	-	-	-	-	-	-	-	6	6
DSM Tracking System	-	-	-	-	-	2	5	1	17	56	55	72	5	212
Commercial Audits	-	-	-	-	18	21	10	-	1	1	5	15	3	73
Residential Retrofit	-	-	-	-	-	66	246	144	163	101	115	0	-	836
Retrofit Demonstrations	-	-	-	-	80	-	5	-	-	-	-	-	-	85
Discontinued/Completed Support Costs	-	-	-	-	-	0	-	-	-	-	-	-	-	0
	-	-	-	-	763	995	1,125	1,739	1,689	1,393	1,564	1,564	1,211	12,043
TOTAL SUPPORT COSTS, DSPs & STANDARDS	909	634	590	880	1,319	2,603	2,102	2,055	2,110	1,438	1,872	1,449	968	18,929

Note: Subtotals may not be exact due to rounding.

Power Smart Annual Provincial Report

For the Year Ended March 31, 2014

March 2015

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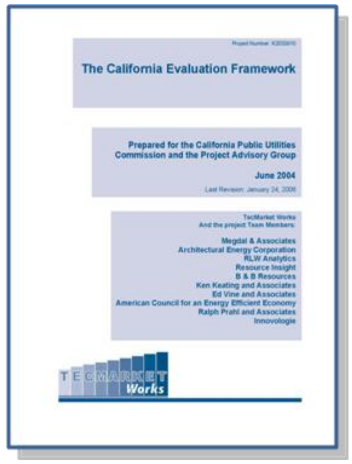
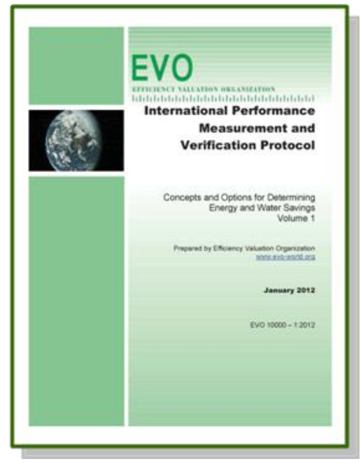
DEMAND SIDE MANAGEMENT EVALUATION

Manitoba Hydro evaluates its Demand Side Management (DSM) programs on an annual basis to validate electric and natural gas savings, and to provide feedback to program managers on program achievements and on improving data collection. Manitoba Hydro's DSM evaluation objectives are to provide timely, credible, actionable and cost-effective evaluations.

The California Evaluation Framework is used as a guide in Manitoba Hydro's DSM evaluations and related activities. This framework, which is widely used in the DSM evaluation industry, provides a consistent, systemized, cyclic approach for planning and conducting evaluations of energy efficiency programs. When verifying the energy and demand savings of its DSM programs, Manitoba Hydro uses the International Performance Measurement and Verification Protocol as a guide. This protocol provides an overview of current best practices for verifying the impacts of DSM activities in program impact evaluations.





Manitoba Hydro takes a comprehensive approach to evaluating its DSM programs. Impact evaluations are undertaken on an annual basis on all DSM programs to document Manitoba Hydro's DSM efforts and to determine the electric and natural gas savings and cost-effectiveness of the DSM programs.

The impact of Manitoba Hydro's DSM portfolio is determined using the following methodology. First, an evaluation plan is prepared for each program detailing the scope, methodology and data collection strategy of the evaluation. Second, an impact evaluation is conducted for each Power Smart program that compares the energy and demand savings and cost-effectiveness metrics to the planned values. Third, impact evaluation results for all programs are aggregated into an overall Power Smart portfolio report that outlines the energy and demand savings and cost-effectiveness for individual DSM programs and the overall portfolio. Finally, this report is reviewed by a cross-functional corporate committee and subsequently reviewed and approved by Manitoba Hydro's Executive Committee.

HIGHLIGHTS – 2013/14 ACHIEVEMENTS

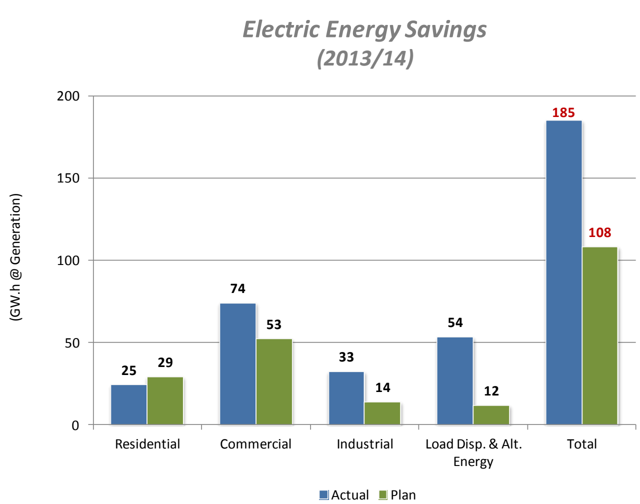
This report outlines the 2013/14 achievements of Manitoba Hydro's DSM program. Manitoba Hydro has a strong commitment to DSM, with a focus on pursuing all cost-effective energy efficiency opportunities. Each year the Power Smart portfolio is evaluated to determine its achievements during the year. This report outlines Manitoba Hydro's success in the 2013/14 year. Savings resulting from codes and standards efforts have been excluded, as they are attributable to past efforts.

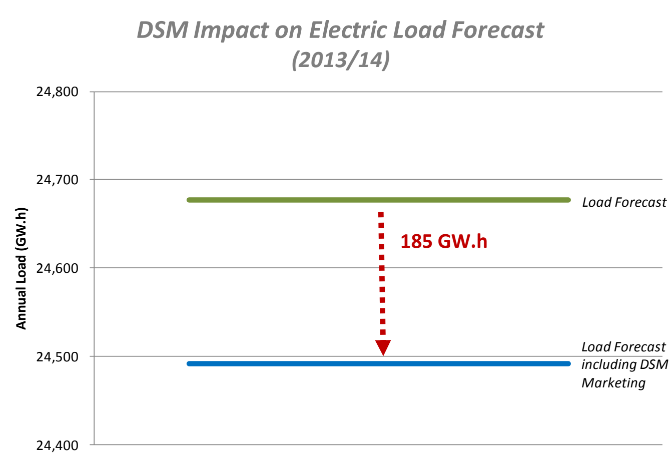
Electric Energy Savings

In 2013/14, Manitoba Hydro's Power Smart incentive-based and DSM support programs achieved 185 GW.h in electric energy savings, exceeding the planned level of savings by 71%. As displayed in the following chart, in 2013/14 the residential sector saved 25 GW.h, the commercial sector saved 74 GW.h, the industrial sector saved 33 GW.h and participants of load displacement & alternative energy programs saved 54 GW.h.

A few programs experienced more notable variances from their targeted electric energy savings. The Commercial Lighting Program achieved 46% more electric energy savings than planned due to the installation of more technologies than expected, completion of larger projects than planned and participants with longer hours of operation. The Performance Optimization Program achieved 136% more electric energy savings than expected due to greater per project savings than anticipated. As well, the Bioenergy Optimization Program achieved 350% more electric energy savings than targeted due to a large unplanned project.

Along with constructing new renewable hydroelectric generation, DSM is a key component of Manitoba Hydro's strategy for meeting the province's future energy needs. This level of energy savings represents 45% of Manitoba Hydro's expected annual load growth (20 year average) and 0.8% of electric load in 2013/14. In comparison, the planned level of energy savings represented 26% of the expected annual load growth (20 year average) and 0.4% of electric load in 2013/14.



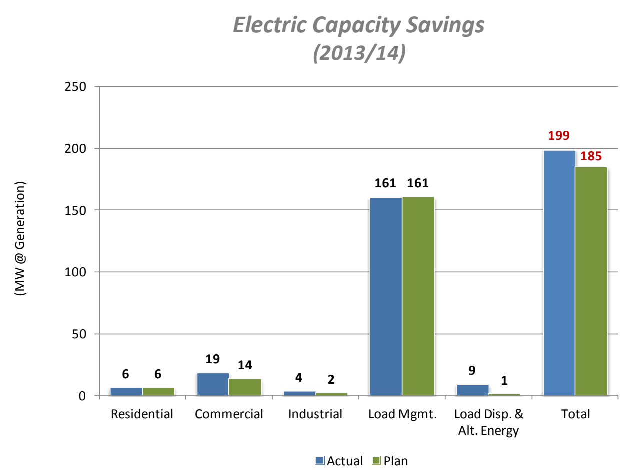


Electric Capacity Savings

Manitoba Hydro's Power Smart incentive-based and DSM support programs achieved 199 MW in electric capacity savings during 2013/14, exceeding the planned level of savings by 8%. As shown in the following chart, in 2013/14 the residential sector saved 6 MW, the commercial sector saved 19 MW, the industrial sector saved 4 MW, load management program participants saved 161 MW and participants of load displacement & alternative energy programs saved 9 MW.

More notable variances from electric capacity savings targets were experienced by a couple programs. The Commercial Lighting Program achieved 47% more electric capacity savings than planned due to the installation of more technologies than expected and the completion of larger projects than planned. As well, the Bioenergy Optimization Program achieved 800% more electric capacity savings than targeted due to a large unplanned project.

As displayed in the following graph, the largest contributor of electric capacity savings is the load management category from the Curtailable Rates Program. Due to the nature of the curtailment contracts in this program, these savings are assumed to persist for one year and are re-earned each year.

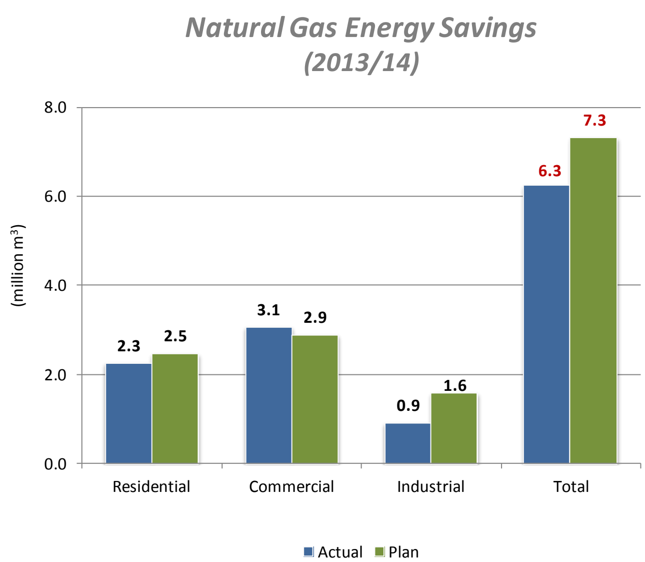


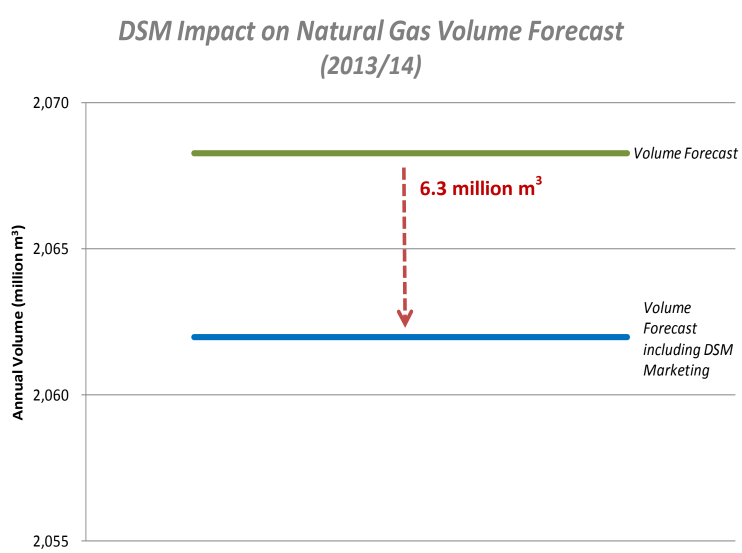
Natural Gas Energy Savings

Manitoba Hydro's Power Smart incentive-based and DSM support programs achieved 6.3 million cubic metres in natural gas energy savings in 2013/14, 14% below the planned level of savings. As displayed in the chart below, in 2013/14 the residential sector saved 2.3 million cubic metres, the commercial sector saved 3.1 million cubic metres and the industrial sector saved 0.9 million cubic metres.

The most notable variance from targeted natural gas energy savings was with the Natural Gas Optimization Program. The program achieved 44% less energy savings than planned due to several projects whose completion dates were delayed past the end of the 2013/14 fiscal year.

This level of energy savings represents 0.3% of natural gas load in 2013/14, further reducing natural gas consumption in Manitoba. Similarly, the planned level of energy savings also represented 0.3% of natural gas load in 2013/14.



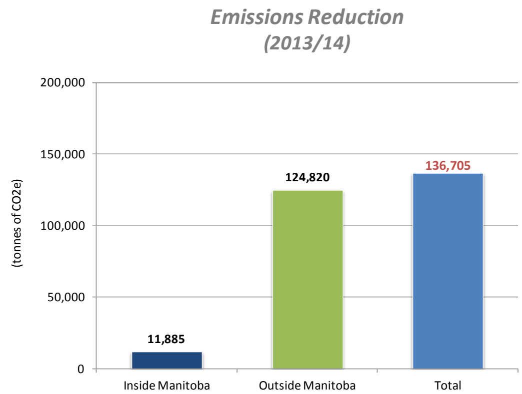


Greenhouse Gas Emissions Reduction

As Manitobans conserve electric energy through Power Smart programs, more hydroelectricity is available for export. These exports displace coal and natural gas fuelled generation outside of Manitoba, which results in significant global reduction of greenhouse gases and other emissions.

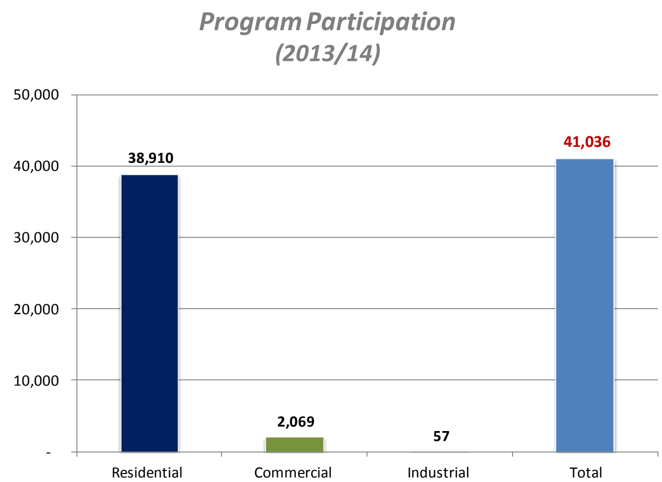
As well, by decreasing natural gas consumption within Manitoba, the Power Smart programs also contribute to emissions reduction within the province.

The energy savings achieved by Manitoba Hydro in 2013/14 resulted in a reduction of greenhouse gases and other air polluting emissions of nearly 137,000 tonnes of CO2e, comprised of 12,000 tonnes of CO2e reduced inside Manitoba and 125,000 tonnes of CO2e reduced outside the province. This emissions reduction is equivalent to removing over 27,000 cars off the road for one year.



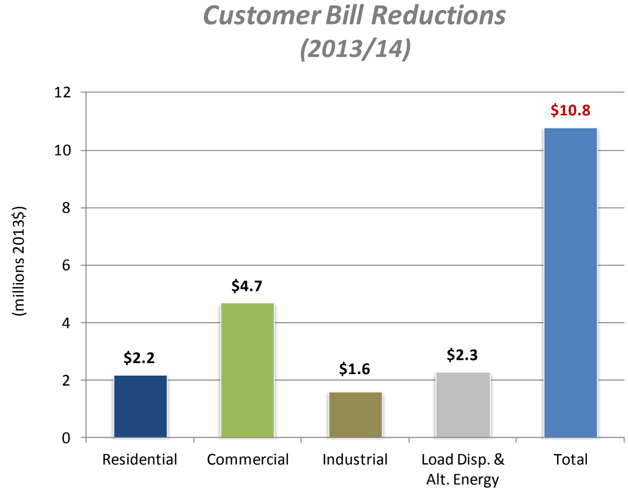
Participation

In 2013/14, over 41,000 customers participated in the incentive-based and DSM support programs. As displayed in the following chart, approximately 39,000 residential customers, 2,000 commercial customers and 57 industrial customers participated in at least one Power Smart program during the 2013/14 fiscal year.



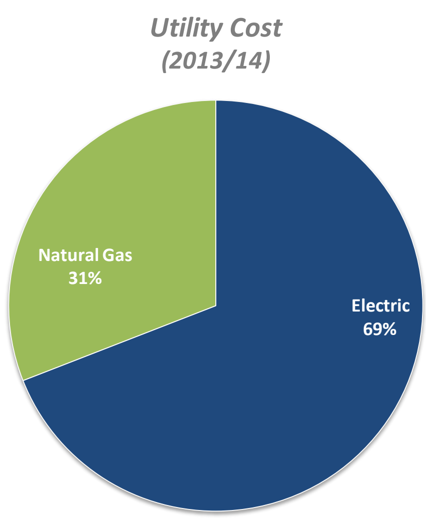
Customer Bill Reductions

Customers who participated in Manitoba Hydro's Power Smart programs in 2013/14 will enjoy savings of $11 million on their energy bills each year going forward. As displayed in the following chart, in 2013/14, approximately $2 million was saved by the residential sector, $5 million by the commercial sector, $2 million by the industrial sector and $2 million by participants of load displacement and alternative energy programs.



Power Smart Investment

Manitoba Hydro invested a total of $42 million in Power Smart initiatives in 2013/14. This investment is comprised of $27 million from the Power Smart electric budget, $9 million from the Power Smart natural gas budget, $4 million from the Affordable Energy Fund and $2 million from the Lower Income Natural Gas Furnace Replacement Budget. Approximately 70% of this investment went towards electric Power Smart programs, with the remaining 30% supporting natural gas Power Smart initiatives.



2013/14 SUCCESS STORIES

Water & Energy Saver Kits Reach over Twenty Thousand Households

Over 20,000 homes are reducing their energy and water bills thanks to the Power Smart Water and Energy Saver Program.

Customers are offered free, customized water and energy saver kits with program messaging focused on the energy and water saving benefits of energy efficient plumbing fixtures. The program offers three channels of participation: mail, targeted direct installation and a bulk mail or installation option for property managers of multi-unit residential facilities.

The Power Smart Water and Energy Saver Program launched in September 2010. Its primary objective is to reduce residential water heating energy consumption through the use of low flow, energy efficient plumbing fixtures.

Manitoba Hydro Continues Successful Partnership with Manitoba Housing Association with 140 Additional Retrofits

Insulation retrofits continue with this unique partnership between Manitoba Hydro and the Manitoba Housing Association to benefit lower income tenants. During the 2013/14 year, approximately 140 insulation retrofits were completed by BUILD, a social enterprise centre that provides employment to local residents and those facing barriers to employment. The insulation upgrades directly reduce tenants' utility bills and increase home comfort. This partnership continues to provide lower income tenants with energy efficiency upgrades with the use of social enterprise centres.

Manitoba Hydro Taking it to the Streets with the Neighbourhood Power Smart Project

Manitoba Hydro continued its aggressive marketing strategy through neighbourhood partnerships to further reach lower income customers. This approach proactively engages residents through door-to-door canvassing and provides residents with a resource in their community to assist with the Affordable Energy Program. Working with the North End Community Renewal Corporation and Brandon Neighbourhood Renewal Corporation, Manitoba Hydro's Neighbourhood Power Smart Project has proved to be another effective marketing channel for this hard to reach market. During the 2013/14 year, over 50 applications were received through this community-led initiative where community canvassers promote the Affordable Energy Program door-to-door. Residents receive a free in-home energy review, free basic energy saving measures such CFLs, pipe wrap, showerheads, faucet aerators, caulking and draft stoppers, along with free insulation. Employment is generated for local residents through community groups along with social enterprises such as Inner City Renovations, Building Urban Industries for Local Development (BUILD) and Brandon Energy Efficiency Program (BEEP).

First Nations Communities Explore Geothermal Heating Through Hands-on Installations

In June 2013, Manitoba Hydro launched the Power Smart Community Geothermal Program, with the conversion of 100 homes from electric furnaces to geothermal heat pump systems in Fisher River Cree Nation and Peguis First Nation. The program, which was led through a partnership with Aki Energy, an Aboriginal social enterprise, focuses on providing First Nations communities with the most efficient electric heating systems available thus, providing much needed bill reductions for families. The other key aspect of the program is the provision of real and transferable job training, and employment for local community members with a total of 27 receiving technical and hands-on geothermal installation training. Nine of those trained went on to receive full International Ground Source Heat Pump (IGSHPA) certification. The combination of a social, economic and culturally responsive approach to energy efficiency made this initiative the first of its kind in Canada.

Nearly 400 Homes in First Nations Communities Benefit from Manitoba Hydro Partnership

The First Nations Power Smart Program continued its successful partnership with First Nations communities in 2013/14. Over 370 homes were provided free basic energy saving measures such as CFLs, pipe wrap, showerheads, faucet aerators, caulking and draft stoppers, as well as free insulation. These energy efficient upgrades reduce utility bills and provide a more comfortable residence for household members. The energy efficiency upgrades are installed by community members, generating local employment opportunities as well as providing economic development. Through a dedicated First Nations Energy Advisor, efforts continue to pursue energy efficiency upgrades in all qualifying homes in First Nations communities.

Over Twenty Thousand Refrigerators Recycled

In July 2013, the Refrigerator Retirement Program hit a milestone, removing 20,000 refrigerator or freezer units from residential households, which translates to over 30 GW.h of electricity savings. Recycling these 20,000 units reduced the impact to Manitoba landfills by an astounding 1,675 metric tonnes of materials. Over 95% of each unit, including the metal, compressors, glass, plastic and foam, was recycled into other items such as new car parts, rebar for paving roads, light fixtures, patio furniture and other plastic household items.

Manitoba Hydro's Refrigerator Retirement Program has been assisting customers with removal of old working and often empty, refrigerators and freezers from their homes since 2011. The launch of the program was the sole catalyst in the creation of fifteen green-collar jobs in Manitoba through the service provider that picks up the units and processes them for recycling. All the ozone-depleting substances including CFCs, freon and oils are recovered, reused responsibly and never released into the atmosphere. Retiring 20,000 units reduced greenhouse gas emissions by nearly 52,000 tonnes of C02e, which is the same as taking 10,000 cars off the road in Manitoba for a year.

New PAYS Financing Creates an Additional Tool to Help Commercial Customers Pursue Energy Efficiency

The Power Smart for Business PAYS (Pay as You Save) Program for commercial customers was launched in September 2013. PAYS is an attractive financing tool, in addition to Manitoba Hydro's broad portfolio of Power Smart for Business incentive programs, to help mitigate the capital cost barrier often associated with upgrading to an energy efficient technology.

The program offers financing terms for energy efficient upgrades such as insulation, lighting (T5, T8 and LED), furnaces, boilers, geothermal heat pump systems, CO2 sensors and WaterSense® labeled toilets and urinals. The upgrades eligible for financing under the program are those energy efficiency opportunities where the monthly repayment is less than the estimated annual utility savings generated by the upgrade. The bill reductions are calculated on an average monthly basis over a year. Financing is available for extended terms with a ten to twenty-five year amortization period, depending on the upgrade, and a 5.9% interest rate fixed for the first five years.

POWER SMART PROGRAM 2013/14 ACHIEVEMENTS

Residential Sector

Manitoba Hydro invested $11.5 million towards programs and initiatives for residential customers in 2013/14. There were 4 residential DSM support programs and 5 residential incentive-based programs offered to customers in 2013/14, and nearly 39,000 customers participated in these programs. This activity resulted in electric savings of 24.6 GW.h and 6.5 MW, and natural gas savings of 2.9 million cubic metres.

The following table summarizes the achievements by program for the residential sector.

	2013/14 Achievements				
		Electric		Natural Gas	
RESIDENTIAL PROGRAMS	Customer Participation	GW.h	MW	Millions of m3	Utility Cost
Residential DSM Support Programs					
Power Smart Residential Loan	5,504	0.5	0.3	0.3	$ (625,161)
Mail-In/On-Line Energy Assessments	303	-	-	-	$ -
Power Smart Residential PAYS	241	1.4	0.4	(0.0)	$ 133,212
Residential Earth Power Loan	19	(0.1)	(0.0)	0.2	$ 371,930
Residential DSM Support Programs Subtotal	***6,067***	***1.9***	***0.6***	***0.5***	***$ (120,019)***
Residential Incentive-Based Programs					
Water & Energy Saver	19,659	3.5	0.7	0.6	$ 1,171,404
Refrigerator Retirement	8,982	11.2	1.2	-	$ 1,619,920
Home Insulation	2,273	5.1	2.8	0.7	$ 2,226,546
Affordable Energy Program	1,847	2.9	1.1	1.1	$ 6,095,569
Community Geothermal	82	-	-	-	$ 442,824
Residential Incentive-Based Programs Subtotal	***32,843***	***22.7***	***5.8***	***2.5***	***$ 11,556,265***
Residential Discontinued Programs	***-***	***-***	***-***	***-***	***$ 15,894***
Residential Programs Total	**38,910**	**24.6**	**6.5**	**2.9**	**$11,452,140**

Note: *The Power Smart Residential Loan Program is a cost recovery program; however at this stage of the program, it is earning revenue in order to cover costs incurred during earlier years of the program.*

Commercial Sector

Manitoba Hydro invested $15.4 million towards programs and initiatives for commercial customers in 2013/14. There were 3 commercial DSM support programs and 12 commercial incentive-based programs offered to customers in 2013/14, and over 2,000 customers participated in these programs. This activity resulted in electric savings of 74.2 GW.h and 18.7 MW, and natural gas savings of 3.3 million cubic metres.

The following table summarizes the achievements by program for the commercial sector.

		2013/14 Achievements			
		Electric		Natural Gas	
COMMERCIAL PROGRAMS	Customer Participation	GW.h	MW	Millions of m3	Utility Cost
Commercial DSM Support Programs					
Power Smart for Business PAYS	6	0.2	0.0	-	$ 167,806
Religious Buildings Initiative	4	-	-	-	$ -
Power Smart Recreation Facility Survey	2	-	-	-	$ -
Commercial DSM Support Programs Subtotal	***12***	***0.2***	***0.0***	-	***$ 167,806***
Commercial Incentive-Based Programs					
Commercial Lighting	779	37.3	10.4	-	$ 6,641,897
Commercial Refrigeration	605	10.0	1.1	-	$ 651,225
Commercial Building Envelope	438	9.8	3.8	1.7	$ 4,022,128
Commercial HVAC	90	0.9	-	1.2	$ 1,480,555
Internal Retrofit	35	2.5	0.3	-	$ 759,939
LED Roadway Lighting Pilot	25	0.0	0.0	-	$ 10,665
New Buildings	12	1.8	0.5	0.1	$ 791,085
Commercial Earth Power	9	5.6	1.3	-	$ 168,405
Commercial Custom Measures	8	0.4	0.1	0.1	$ 277,935
Commercial Building Optimization	6	2.2	0.4	0.2	$ 250,324
Network Energy Management	3	0.6	0.2	-	$ 55,276
Commercial Kitchen Appliances	2	0.0	0.0	0.0	$ 18,965
Commercial Incentive-Based Programs Subtotal	***2,012***	***71.1***	***18.3***	***3.3***	***$ 15,128,398***
Commercial Discontinued Programs	***45***	***2.9***	***0.4***	-	***$ 61,517***
Commercial Programs Total	**2,069**	**74.2**	**18.7**	**3.3**	**$ 15,357,721**

Industrial Sector

Manitoba Hydro invested $9.3 million towards programs and initiatives for industrial customers in 2013/14. There were 4 industrial incentive-based programs offered to customers in 2013/14, and nearly 60 customers participated. This activity resulted in electric savings of 86.1 GW.h and 173.9 MW, and natural gas savings of 0.9 million cubic metres.

The following table summarizes the achievements by program for the industrial sector.

	2013/14 Achievements				
		Electric		Natural Gas	
INDUSTRIAL PROGRAMS	Customer Participation	GW.h	MW	Millions of m3	Utility Cost
Industrial Incentive-Based Programs					
Performance Optimization	44	32.6	3.8	-	$ 2,173,319
Natural Gas Optimization	8	-	-	0.9	$ 479,673
Industrial Incentive-Based Programs Subtotal	***52***	***32.6***	***3.8***	***0.9***	***$ 2,652,992***
Industrial Discontinued Programs	***-***	***-***	***-***	***-***	***$ 114***
Customer Self-Generation Programs					
Bioenergy Optimization Program	2	53.5	9.2	-	$ 697,940
Rate/Load Management Programs					
Curtailable Rates	3	-	160.9	-	$ 5,971,171
Industrial Programs Total	**57**	**86.1**	**173.9**	**0.9**	**$ 9,322,217**

Power Smart Portfolio

Manitoba Hydro invested $42.0 million towards programs and initiatives for customers in 2013/14. There were 7 DSM support programs and 21 incentive-based programs offered to customers in 2013/14, and over 41,000 customers participated in these programs. This activity resulted in electric savings of 184.9 GW.h and 199.1 MW, and natural gas savings of 6.3 million cubic metres.

The following table summarizes the achievements by sector for the Power Smart portfolio.

	2013/14 Achievements				
		Electric		Natural Gas	
SUMMARY	Customer Participation	GW.h	MW	Millions of m3	Utility Cost
RESIDENTIAL					
Residential DSM Support Programs	6,067	1.9	0.6	0.5	$ (120,019)
Residential Incentive-Based Programs	32,843	22.7	5.8	2.5	$ 11,556,265
Residential Discontinued Programs	-	-	-	-	$ 15,894
Residential Total	***38,910***	***24.6***	***6.5***	***2.9***	***$ 11,452,140***
COMMERCIAL					
Commercial DSM Support Programs	12	0.2	0.0	-	$ 167,806
Commercial Incentive-Based Programs	2,012	71.1	18.3	3.3	$ 15,128,398
Commercial Discontinued Programs	45	3	0	-	$ 61,517
Commercial Total	***2,069***	***74.2***	***18.7***	***3.3***	***$ 15,357,721***
INDUSTRIAL					
Industrial Incentive-Based Programs	57	86	174	1	$ 9,322,103
Industrial Discontinued Programs	-	-	-	-	$ 114
Industrial Total	***57***	***86.1***	***173.9***	***0.9***	***$ 9,322,217***
INTERACTIVE EFFECTS	-	-	-	(0.9)	-
SUPPORT COSTS	-	-	-	-	$ 5,828,834
TOTAL	**41,036**	**184.9**	**199.1**	**6.3**	**$41,960,912**

Notes:

Some electric Power Smart programs have interactive effects which increase the consumption of natural gas. For example, a more energy efficient lighting system will emit less heat and therefore more energy will be required for space heating. The table above includes integrated natural gas results which have been adjusted for interactive effects.

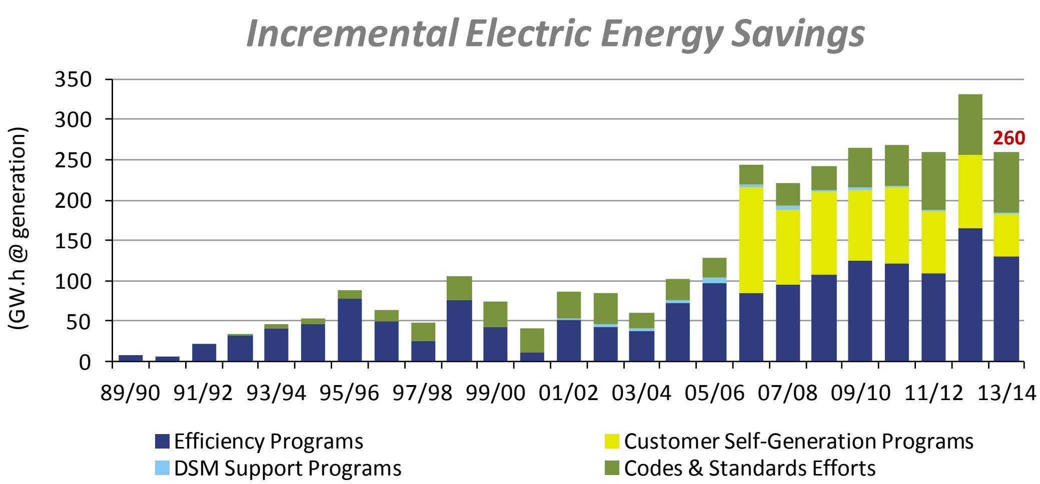
Support costs are related to providing overall support to the Power Smart portfolio. These costs include promoting and advertising the Power Smart brand, supporting sustainability and standards efforts and DSM planning and evaluation functions.

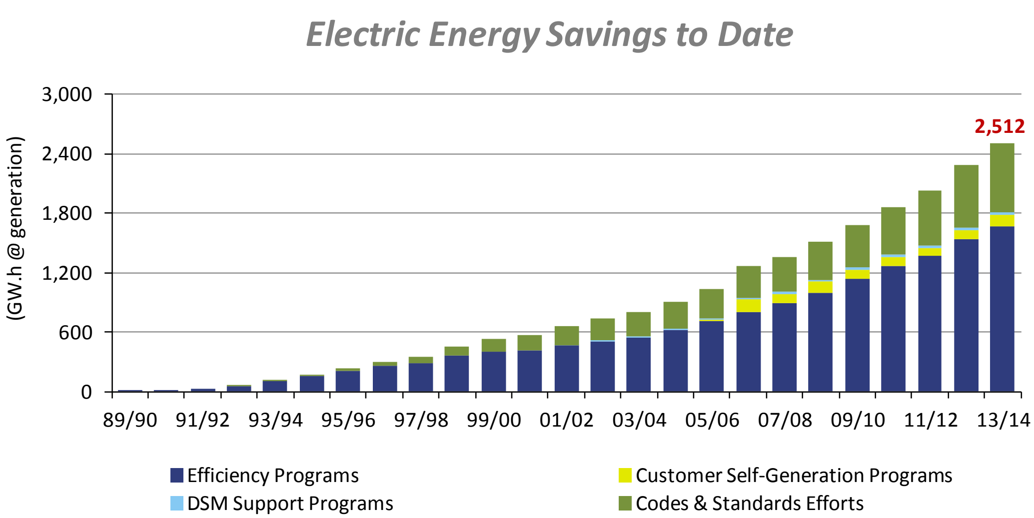
1989/90 – 2013/14 ACHIEVEMENTS

This section outlines Manitoba Hydro's Power Smart achievements since the inception of the program in 1989/90 through to the end of 2013/14.

Electric Energy Savings

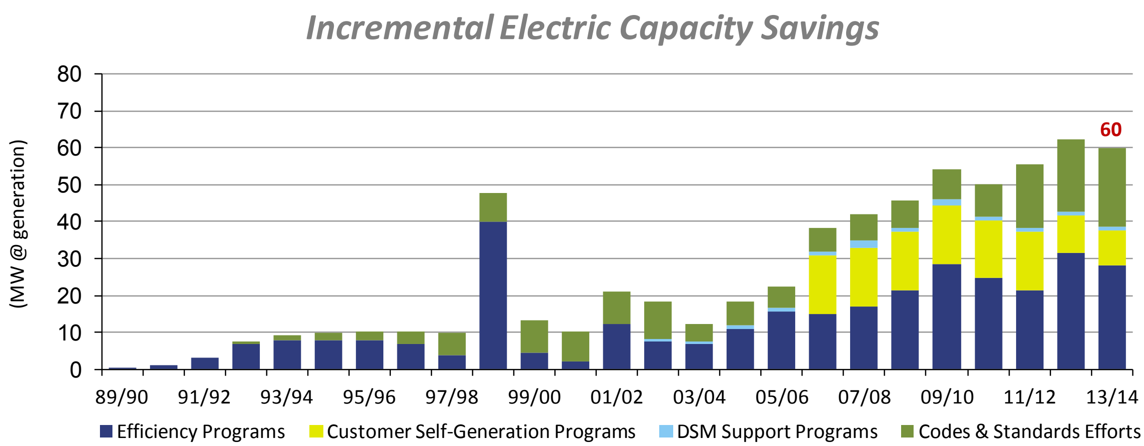
Cumulatively, the Power Smart portfolio has achieved a total of 2,512 GW.h in electric energy savings to the end of 2013/14. The following graphs display incremental and cumulative electric energy savings achieved.

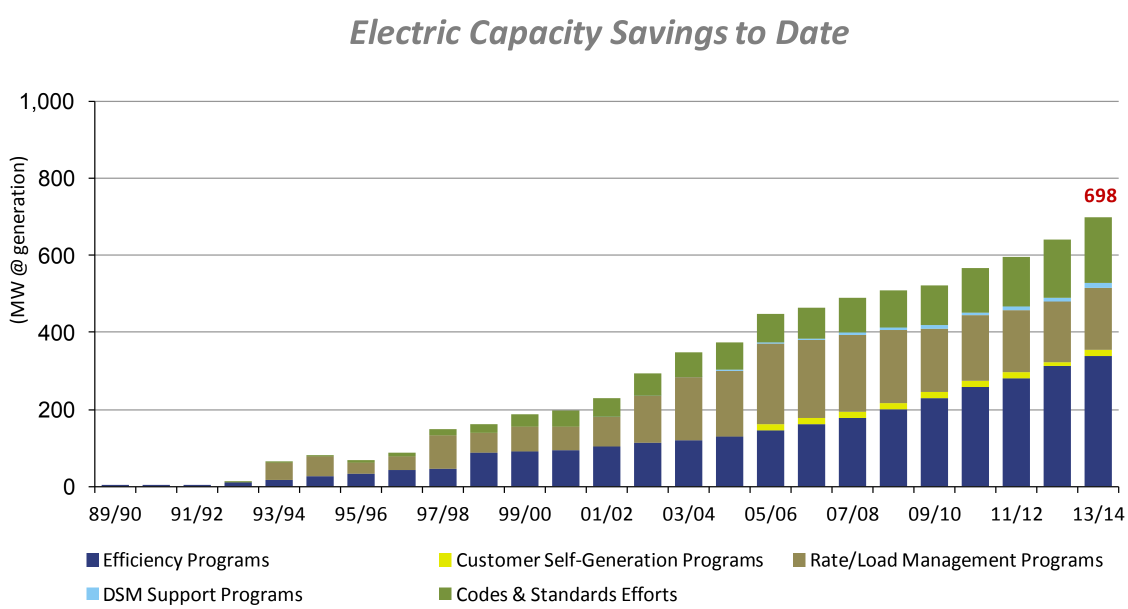




Electric Capacity Savings

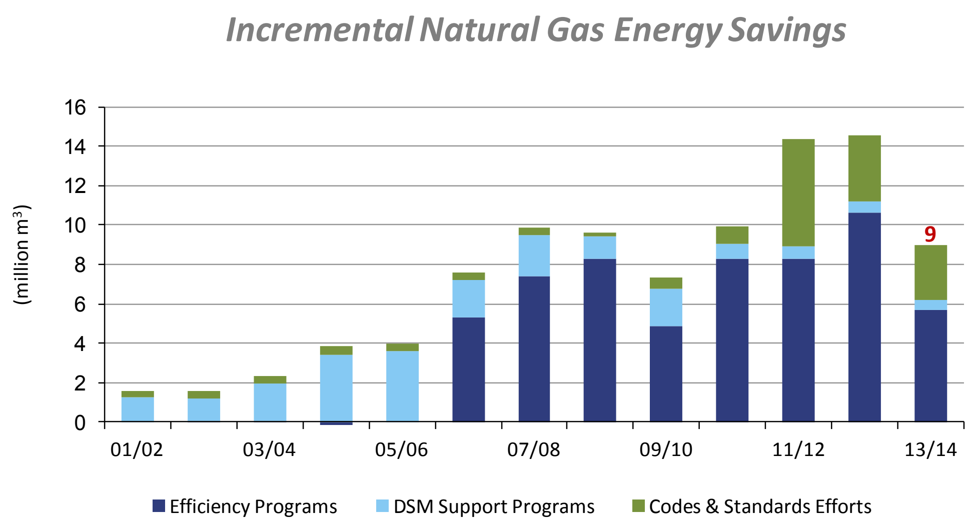
Since 1989/90, the Power Smart portfolio has achieved a total of 698 MW in electric capacity savings. The following graphs demonstrate incremental and cumulative electric capacity savings achieved. Electric capacity savings resulting from the Curtailable Rates Program have been excluded from the incremental savings graph to better represent incremental results. The high incremental capacity savings in 1998/99 were due to a large industrial project with substantial capacity savings.

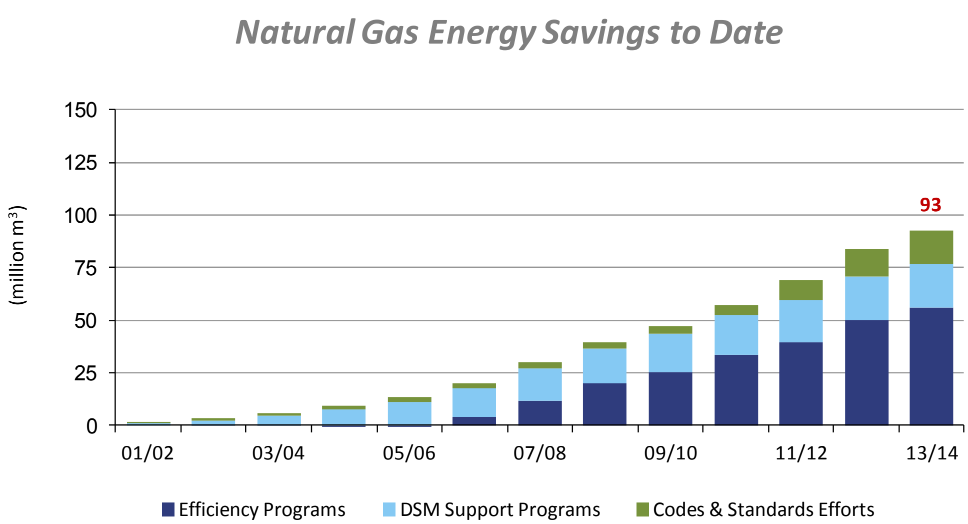




Natural Gas Energy Savings

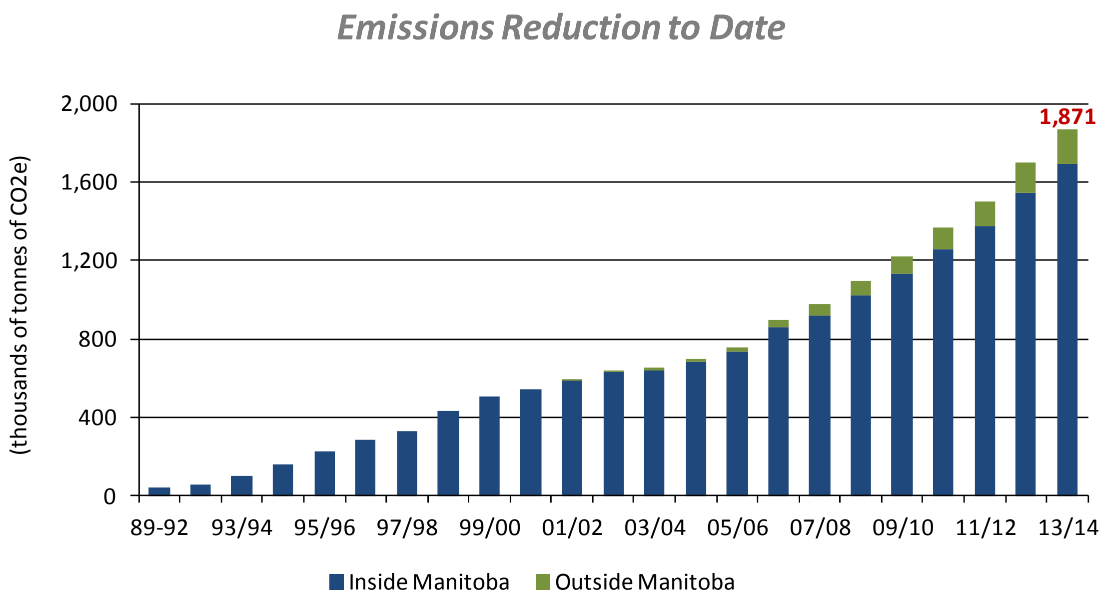
To date, Manitoba Hydro's Power Smart program has achieved a total of 93 million cubic metres in natural gas savings. The following graphs display incremental and cumulative natural gas savings achieved.





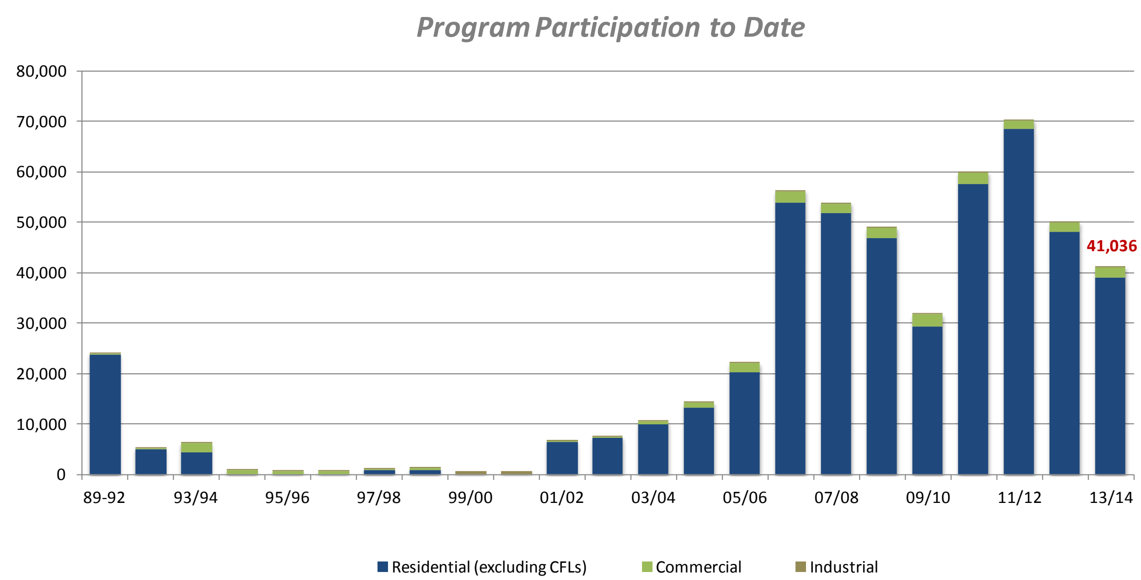
Greenhouse Gas Emissions Reduction

The 2,512 GW.h of electric energy savings and 93 million cubic metres of natural gas savings achieved to date by Manitoba Hydro's Power Smart program equates to a greenhouse gas emissions reduction of approximately 1,871,000 tonnes of CO2e. This is comparable to removing more than 374,000 cars off the road for one year. The following graph displays greenhouse gas emissions reduction achieved to the end of 2013/14.



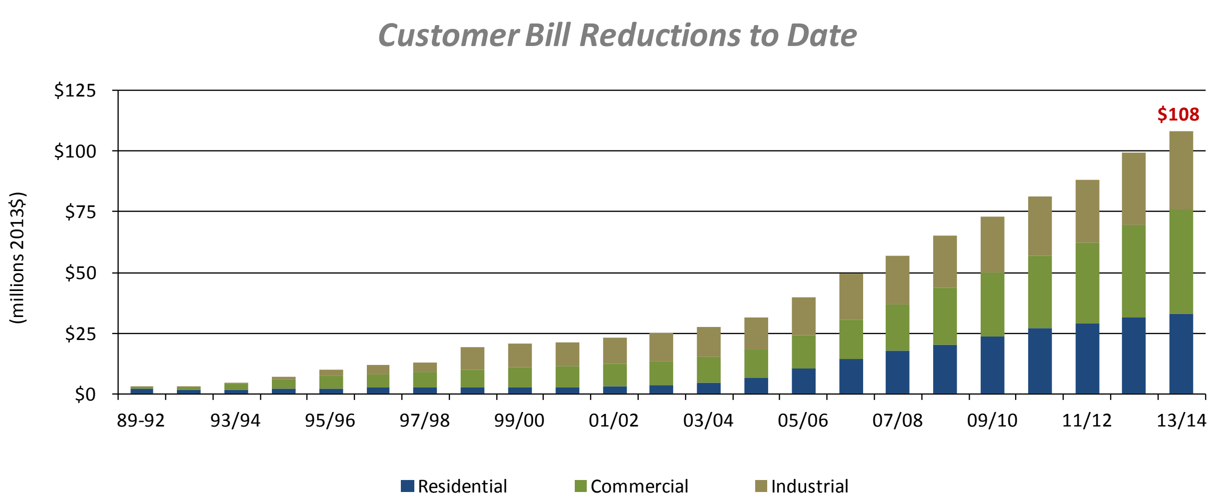
Customer Participation

There have been nearly 513,000 participants in Power Smart programs to date. Participants of the Residential Compact Fluorescent Lighting Program participation have been excluded from this total in order to better indicate participation trends.



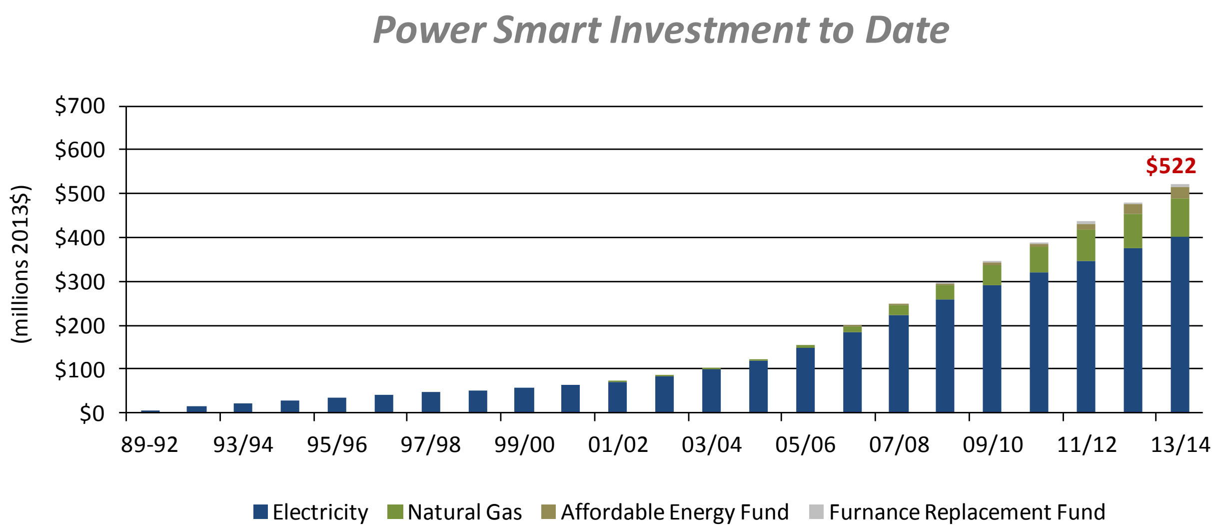
Customer Bill Reductions

As displayed in the following graph, customers who participated in Power Smart programs saved $108 million on their electric and natural gas bills in 2013/14. Cumulatively, over $882 million has been saved by participants on their electric and natural gas bills.



Power Smart Investment

Since 1989/90, Manitoba Hydro has invested $522 million in Power Smart initiatives. This investment is comprised of $402 million from the Power Smart electric budget, $88 million from the Power Smart natural gas budget, $24 million from the Affordable Energy Fund and $8 million from the Lower Income Natural Gas Furnace Replacement Budget.



Section:		Page No.:	
Topic:	2013-2014 Power Smart Results		
Subtopic:	2013-2014 Power Smart Annual Review		
Issue:	Expected date for finalized 2013/14 results		

PREAMBLE TO IR (IF ANY):

In response to GAC/MH I-29, MH provided the 2014 Residential Energy Use Survey instrument, but it did not provide the results of the survey.

QUESTION:

Please provide the results of the 2014 Residential Energy Use Survey.

RATIONALE FOR QUESTION:

This information is required in order to update the results provided in response to GAC/MH 1 – 46.

RESPONSE:

As noted in Manitoba Hydro's response to GAC/MH-I-66ci-vi, the data is currently being compiled, with the final analysis expected to be completed in the fall of 2015.